Former Nessen Lamps Site

3200 Jerome Avenue

BRONX, NEW YORK

Site Management Plan

NYSDEC Brownfield Cleanup Program Site Number: C203061

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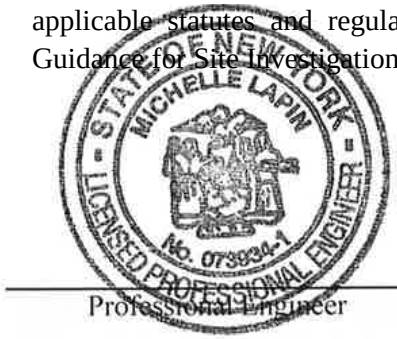
CERTIFICATION

I, Michelle Lapin, certify that I am currently a NYS registered Professional Engineer as defined in 6 NYCRR Part 375and 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).



Professional Engineer

12-18-14
Date

Signature

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

SITE MANAGEMENT PLAN

1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 Introduction

This document is required as an element of the remedial program at the Former Nessen Lamps Site located at 3200 Jerome Avenue, Bronx, New York (Tax Block 3323, Lot 36) (hereinafter referred to as the "Site") under the New York State (NYS) Brownfield Cleanup Program (BCP) administered by New York State Department of Environmental Conservation (NYSDEC). The Site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index #C203061-02-12, Site #C203061, which was executed on March 8, 2012.

1.1.1 General

The Rinzler Family Limited Partnership (RFLP) entered into a BCA as a volunteer with the NYSDEC to remediate a 0.264 acre property located in Bronx County, Bronx, New York. The BCA, required the Remedial Party, RFLP, to investigate and remediate contaminated media at the Site. The location and boundaries of this 0.264-acre Site are shown on Figure 1 and 2. The boundaries of the Site are more fully described in the Schedule "A" Property Description that is included as part of the Environmental Easement (Appendix A).

After completion of the remedial work described in the Remedial Action Work Plan, some contamination was left in the subsurface at this Site, which is hereafter referred to as "remaining contamination." This Site Management Plan (SMP) was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

This SMP was prepared by AKRF Engineering, P.C. (AKRF), on behalf of RFLP, in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010, and the guidelines provided by NYSDEC's Brownfield Cleanup Program (BCP). This SMP addresses the means for implementing the Institutional Controls (ICs) and Engineering Controls (ECs) that are required by the Environmental Easement for the Site.

1.1.2 Purpose

The Site contains contamination left after completion of the remedial action. Engineering Controls have been incorporated into the Site remedy to control exposure to remaining contamination during the use of the Site to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Bronx County Clerk, will require compliance with this SMP and all ECs and ICs placed on the Site. The ICs place restrictions on Site use, and mandate operation, maintenance, monitoring, and reporting measures for all ECs and ICs. This SMP specifies the methods necessary to ensure compliance with all ECs and ICs required by the

Environmental Easement for contamination that remains at the Site. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

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

To address these needs, this SMP includes three plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) and an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual for complex systems). This plan also includes a description of Periodic Review Reports for the periodic submittal of data, information, recommendations, and certifications to NYSDEC.

It is important to note 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) issued by NYSDEC; and
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA, (Index #C203061-02-12; Site #C203061) for the Site, and thereby subject to applicable penalties.

1.1.3 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. 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.

1.2 Site Background

1.2.1 Site Location and Description

The Site is located in the Bedford Park neighborhood of the Bronx, County of Bronx, New York and is identified as Block 3323 and Lot 36 on the Bronx County Tax Map. The Site is an approximately 0.264-acre lot bounded by a garage and other commercial uses to the north/northeast; residential buildings to the east along Van Cortlandt Avenue; commercial and residential buildings to the south across Van Cortlandt Avenue, and a New York City Department of Environmental Protection (NYCDEP) facility and NYC Transit authority train yard to the west beyond Jerome Avenue (see Figure 2). The boundaries of the site are more fully described in the Environmental Easement included in Appendix A.

The Site consists of a triangular-shaped, approximately 11,500-square foot (sf) property that is fully occupied by an approximately 18,200 sf, 2-story building. The Site is currently zoned C8-2 (commercial district).

1.2.2 Site History

Most recently, the building was occupied by PS 51X (The Bronx New School), an elementary school serving Kindergarten through 5th grade. It was leased by the New York City School Construction Authority (NYCSCA) for the school from 1993 to 2011.

The Site was historically used as a garage (approximately 1928 to 1956); a drug company (1956 to 1965); and by Nessen Lamps Inc. for lamp manufacturing (1971 through 1988). Four 550-gallon buried gasoline tanks were noted at the Site between 1945 and 1992 prior to its use as a school. Nessen Lamps is known to have generated hazardous waste (trichloroethene) at the Site between at least 1982 and 1987.

1.2.3 Geologic Conditions

Overburden material beneath the Site is characterized by fill material, consisting of sand, with silt, gravel, brick, glass, coal, and ash present to depths of approximately 4 to 9 feet below surface grade. The overburden material beneath the fill material was documented as a generally brown glacial till consisting of fine to medium sand with varying amounts of silt, clay, gravel, cobbles, and weathered rock. The till material is underlain by bedrock that slopes downward in elevation from a high point in the southwestern portion of the Site at approximately 16 feet below sidewalk grade (an elevation of approximately 120 feet above the Borough of the Bronx Topographical Bureau Datum, which is 2.6 feet above mean sea level) to a low point in the northeastern portion of the Site at approximately 32 feet below sidewalk grade (an elevation of approximately 104 feet). The topography of the Site slopes gently from the east to the west. The overburden groundwater aquifer is present at a depth of approximately 22 feet below the exterior sidewalk grade. Groundwater flow direction in the overburden groundwater aquifer is generally to the west and west-southwest.

A geologic cross-section layout is shown on Figure 3 and geologic sections of the Site are shown on Figures 4 and 5.

Groundwater elevation contour maps displaying groundwater flow direction prior to (December 2012), during (March 2014 through July 2014), and following (October 2014) the completion of remedial activities at the Site are included as Figures 6 through 10. No significant changes with respect to groundwater flow were observed during or following the completion of remedial activities at the Site.

1.3 Summary of Remedial Investigation Findings

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

Final Remedial Investigation Report & Remedial Action Work Plan dated June 2013, prepared by AKRF.

Generally, the RI determined that the areas of concern at the Site are based on the former use of the Site as a lamp manufacturer which was known to have stored and disposed of trichloroethene (TCE)-related waste and the prior use of the Site as an automotive garage which maintained underground gasoline storage tanks. Releases from the use, storage, or disposal of the chlorinated solvent TCE, and to a lesser extent, petroleum-related compounds, have contaminated soil, groundwater, and soil vapor beneath the Site. The identified location of the source of both of these contaminants has been identified in the central portion of the Site. The soil contaminated source area was determined to be confined within the extents of the Site and generally delineated within an approximately 1,500-square foot area from approximately 6 to 9 feet below the grade of the first floor based on soil sampling completed during the RI. The soil source had resulted in TCE and petroleum-related groundwater contamination, and predominantly TCE-contaminated soil vapor and related soil vapor intrusion concerns.

Based on the known geologic conditions (shallow bedrock and a west-southwesterly groundwater flow direction) and off-site investigation activities, the on-site contamination did not adversely affect nearby properties or sensitive receptors.

Below is a summary of Site conditions when the RI was performed between March 2012 and January 2013:

1.3.1 Soil

Soil contamination was identified during the Site Characterization and subsequently delineated during the RI in the central portion of the Site. Analytical results indicated that samples collected between 6 and 8 feet below the first floor grade were detected at concentrations exceeding the NYSDEC Part 375 Restricted Use-Protection of Groundwater Soil Cleanup Objectives (PGWSCOs) in five soil samples for TCE and/or petroleum-related compounds. One of these soil samples [NL-SB-7(6-7)] detected TCE at a concentration of 43 parts per million (ppm) also exceeding the NYSDEC Part 375 Restricted Residential Use Soil Cleanup Objective (RRSCO). The soil contamination identified at the Site was both vertically and horizontally delineated to the extent feasible based on accessible sampling locations and Site constraints.

Soil boring locations advanced during the RI are shown on Figure 11 and results indicating exceedances of the applicable NYSDEC SCOs are shown on Figure 12.

1.3.2 Site-Related Groundwater

TCE has been detected in each of the on-site monitor wells sampled, with six of the eight wells showing concentrations that exceed the NYSDEC Class GA Ambient Water Quality Standards (AWQS). The highest TCE concentrations [up to 6,400 parts per billion (ppb)] were detected in monitor well MW-3 located southwest and downgradient of the soil contaminant source area during the RI. TCE was also detected in each of the bedrock monitor wells (MW-3E-D and MW-5D) at concentrations slightly exceeding the AWQS of 5 ppb.

Chlorinated breakdown volatile organic compounds (VOCs) associated with TCE, including cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride, were detected at concentrations exceeding applicable AWQS in monitor wells MW-1, MW-3, MW-5-D, MW-2E, and MW-3E-D. Trans-1,2-dichloroethene (trans-1,2-DCE) was detected at concentrations exceeding the AWQS in monitor well MW-3, MW-5-D, MW-2E, and MW-3E-D.

The petroleum-related compounds benzene, toluene, ethylbenzene, and total xylenes (BTEX) all were detected at concentrations which exceeded applicable AWQS in monitor well MW-1. The petroleum-related semi-volatile organic compound (SVOC) naphthalene was also detected in monitor well MW-1 at a concentration exceeding its AWQS.

Benzene was also detected at concentrations slightly exceeding the AWQS in monitor wells MW-3, MW-5-D, MW-2E, and MW-3E-D during the RI. Isopropylbenzene was also detected in monitor wells MW-1 and MW-4 at concentrations exceeding the AWQS.

TCE, TCE breakdown products, and petroleum-contaminated groundwater concentrations have been detected above applicable AWQS in exterior overburden monitor wells, however, the concentrations are at least an order of magnitude lower than those which have been detected near and immediately downgradient of the soil source area in the central portion of the Site. The installation and sampling of bedrock monitor wells at the downgradient side of the Site also supports the premise that shallow bedrock has confined the vertical migration of the elevated TCE groundwater contamination, as contaminant concentrations in bedrock wells only slightly exceed the applicable AWQS. Furthermore, TCE breakdown products have been identified in overburden and bedrock well samples, indicating that existing conditions could support natural biodegradation of low-level contamination over time.

Analytical results of groundwater samples exceeding the AWQS during the RI are shown on Figure 13.

1.3.3 Site-Related Soil Vapor Intrusion

TCE was previously identified (prior to the RI) on-site in indoor air and sub-slab vapor at concentrations that exceeded the New York State Department of Health (NYSDOH) Air Guideline Value (AGV) outlined in the NYSDOH Vapor Intrusion Guidance Document. The maximum TCE concentration detected in sub-slab vapor samples beneath the building was 53,300 micrograms per cubic meter ($\mu g/m^3$) from a location in close proximity to the identified soil source. The concentration of TCE in soil vapor beneath the building was two to four orders of magnitude higher compared to the TCE concentrations detected in soil vapor below the sidewalk (5.8 $\mu g/m^3$ to 110 $\mu g/m^3$) adjacent to the Site building. Soil vapor contamination was not identified in the east-adjacent apartment building or in the sidewalk adjacent to the Toyota Automotive Garage warranting further investigation or mitigation during the completion of off-site investigations. Based on these results, the off-site migration of contaminated soil vapor was limited and did not adversely affect nearby properties to the south or west beyond Van Cortlandt Avenue East or Jerome Avenue.

Indoor air, sub-slab vapor, and ambient air analytical results for detections of TCE, PCE, and methylene chloride during previous on and off-site investigations as reported in the RI are shown on Figure 14.

1.3.4 Underground Storage Tanks

Four 550-gallon buried gasoline tanks were noted at the Site between 1945 and 1992 (as shown on Sanborn Fire Insurance Maps), prior to its designation as a school. No documentation regarding the registration, closure and/or removal of the tanks was identified during previous investigations or subsequent research

conducted as part of the RI. The approximate location of the suspected tanks based on the Sanborn Maps is shown on Figure 11.

1.3.5 Floor Drains

A floor drain investigation completed during the RI included the inspection and cleaning of floor drains in the partial basement and additional floor drains observed in the cafeteria. The discharge locations of all identifiable floor drains were confirmed to be the house trap in the basement of the Site building, which leads to the sanitary sewer piping located along Jerome Avenue in the northeastern portion of the Site. Snaking and flushing of each of the drains was conducted and television and video equipment confirmed that all the then currently operable floor drain piping reviewed was intact and appeared to be relatively new, compared to the age of the Site building.

1.4 Summary of Remedial Actions

The Site was remediated in accordance with AKRF's NYSDEC-approved Remedial Action Work Plan dated June 2013; Groundwater Treatment Remedial Design Work Plan dated February 2014; the Soil Vapor Mitigation Remedial Design Work Plan dated April 2014; and the NYSDEC's Decision Document dated June 2013.

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

1. Excavation of soil/fill exceeding NYSDEC Part 375 PGWSCOs listed in Table 1and shown on Figure 11, to the extent practicable based on Site constraints from immediately below the former first floor concrete slab to a depth of approximately 11 feet below first floor grade in the contaminant source area (central portion of the Site);
2. Removal of two 550-gallon underground gasoline tanks and out of service subsurface drainage piping and structures encountered within the contaminant source area (central portion of the Site) during soil removal, and the abandonment of one 550-gallon gasoline tank encountered in the western portion of the Site during soil removal/trenching associated with the construction of the sub-slab depressurization system (SSDS);
3. Construction and/or restoration of a soil cover system consisting of the existing concrete floor slab and newly poured concrete floor slab sections (associated with the soil removal area and the installation of remedial components including a vapor barrier across the soil removal area, SSDS pits and piping, and trenches for injection wells) to prevent human exposure to contaminated soil/fill remaining at the Site;
4. Execution and recording of an Environmental Easement (Appendix A) to restrict land use and prevent future exposure to any contamination remaining at the Site;
5. In-situ treatment of contaminated groundwater beneath the Site by injection of a chemical oxidant into the overburden aquifer located approximately 18 to 24 feet below first floor grade;
6. Construction, maintenance, and operation of an active SSDS to prevent migration of vapors into the building in conjunction with a soil vapor extraction (SVE) well to treat residual TCE-contaminated soil identified in a localized/inaccessible area of the Site during soil removal activities;
7. Development and implementation of this Site Management Plan (SMP) for long term management of remaining contamination as required by the Environmental Easement, which includes plans for: (1) Institutional and Engineering Controls, (2) Monitoring, (3) Operation and Maintenance, and (4) Reporting.

Remedial activities were completed at the Site between September 2013 and November 2014.

Table 1:
Site-Specific Soil Cleanup Objectives and Import Criteria

Volatile Organic Compounds	NYSDEC Part 375 Protection of Groundwater mg/Kg	NYSDEC Part 375 Restricted Residential mg/Kg
1,1,1-Trichloroethane	0.68	49
1,1-Dichloroethane	0.27	26
1,1-Dichloroethene	0.33	100
1,2,4-Trimethylbenzene	3.6	52
1,2-Dichlorobenzene	1.1	100
1,2-Dichloroethane	0.02	3
1,3,5-Trimethylbenzene	8.4	52
1,3-Dichlorobenzene	2.4	49
1,4-Dichlorobenzene	1.8	13
1,4-Dioxane	0.1	13
Acetone	0.05	100
Benzene*	0.06	5
Butylbenzene	12	100
Carbon tetrachloride	0.76	2
Chlorobenzene	1	100
Chloroform	0.37	49
cis-1,2-Dichloroethene*	0.25	100
Ethylbenzene*	1	41
Hexachlorobenzene	3.2	1
Isopropylbenzene**	2.3	NS
Methyl ethyl ketone	0.12	100
Methyl tert butyl ether	0.93	100
Methylene chloride	0.05	100
n-Propylbenzene	3.9	100
sec-Butylbenzene	11	100
tert-Butylbenzene	5.9	100
Tetrachloroethene	1.3	19
Toluene*	0.7	100
trans-1,2-Dichloroethene	0.19	100
Trichloroethene*	0.47	21
Vinyl chloride*	0.02	0.9
Xylene, mixed*	1.6	100

Semivolatile Organic Compounds		
Acenaphthene	98	100
Acenaphthylene	107	100
Anthracene	1,000	100
Benzo(a)anthracene	1	1
Benzo(a)pyrene	22	1
Benzo(b)fluoranthene	1.7	1
Benzo(g,h,i)perylene	1,000	100
Benzo(k)fluoranthene	1.7	3.9
Chrysene	1	3.9
Dibenz(a,h)anthracene	1,000	0.33
Fluoranthene	1,000	100
Fluorene	386	100
Indeno(1,2,3-cd)pyrene	8.2	0.5
m-Cresol	0.33	100
Naphthalene	12	100
o-Cresol	0.33	100
p-Cresol	0.33	100
Pentachlorophenol	0.8	6.7
Phenanthrene	1,000	100
Phenol	0.33	100
Pyrene	1,000	100

Metals	NYSDEC Part 375 Protection of Groundwater mg/kg	NYSDEC Part 375 Restricted Residential mg/kg
Arsenic	16	16
Barium	820	400
Beryllium	47	72
Cadmium	7.5	4.3
Chromium, hexavalent	19	110
Chromium, trivalent	NS	180
Copper	1,720	270
Cyanide, total	40	27
Lead	450	400
Manganese	2,000	2,000
Mercury, total	0.73	0.81
Nickel	130	310
Selenium	4	180
Silver	8.3	180
Zinc	2,480	10,000

PCB	mg/Kg	mg/Kg
Total PCB	3.2	1

Pesticides/Herbicides		
2,4,5-TP Acid	4	100
4,4'-DDD	14	13
4,4'-DDE	17	9
4,4'-DDT	136	8
Aldrin	0.19	0.097
Alpha-BHC	0.02	0.48
Beta-BHC	0.09	0.36
Chlordane	3	4.2
Delta-BHC	0.25	100
Dibenzofuran	210	59
Dieldrin	0.1	0.2
Endosulfan I	102	24
Endosulfan II	102	24
Endosulfan sulfate	1,000	24
Endrin	0.06	11
Heptachlor	0.38	2.1
Lindane	0.1	1.3

Notes:

* Site-Specific Contaminants of Concern utilize PGWSCOs as noted by gray shading

** Isopropylbenze PGWSCO utilizes the NYSDEC CP-51 SSCO

1. All other contaminants utilize RRSCOs for Remedial Action Objectives

2. For Import Criteria, the lower of the PGWSCO and the RRSCO must be met for each compound listed

1.4.1 Removal of Contaminated Materials from the Site

The NYSDEC PGWSCOs, as outlined in 6 NYCRR §375-6.8(b), were selected for this Site for the contaminants of concern, which include TCE and its degradation products, as well as the petroleum-related contaminants BTEX and isopropylbenzene. The NYSDEC PGWSCOs are relevant for these specific contaminants since they appear to be a source of groundwater contamination at the Site. A list of the NYSDEC PGWSCOs for the primary contaminants of concern for this Site is provided in Table 1 (above). The NYSDEC PGWSCOs are more stringent than the NYSDEC Restricted Residential Use Soil Cleanup Objectives (RRSCOs) for the contaminants of concern at the Site. For all other contaminants identified at the site the Restricted Residential SCOs are applicable.

Following the receipt of the formal approvals from the chosen waste disposal facilities, remedial activities began in early September 2013 in accordance with the NYSDEC-approved RAWP. Due to the discovery and necessary removal of underground storage tanks and subsurface piping, the completion of the proposed soil removal activities was delayed substantially. In early January 2014, the non-hazardous soil removal activities were completed, resulting in the off-site shipment of approximately 160 tons of soil classified as non-hazardous waste in a total of ten roll-off containers to Waste Management of PA's Grows North disposal facility. Immediately after non-hazardous soil removal activities were completed, hazardous (waste) soil removal was initiated. In accordance with facility approvals, hazardous soil was transported to CWM Chemical Services (in association with Waste Management) in Model City, New York for off-site disposal. Hazardous soil removal activities were completed at the end of January 2014, which resulted in the off-site shipment of approximately 225 tons of hazardous soil in a total of 15 roll-off containers.

End-point and investigatory sampling performed at the conclusion of the soil removal activities identified three soil sample locations within the proposed removal area (two samples collected at the base of the excavation and one sample collected beneath the concrete vault identified in the northwestern portion of the soil removal area) exhibiting TCE concentrations above the NYSDEC PGWSCO. As discussed with NYSDEC representatives during a Site meeting conducted on February 6, 2014, soil removal activities were completed to the extent practicable based on the physical and structural constraints inside of the Site building. All end-point soil sample locations collected within the excavation area were flagged, and subsequently surveyed by a NY-state licensed surveyor. The extents of and topographic features within the soil removal area were also surveyed (along with other pertinent Site features including the concrete vault and the soil sample location within the vault as described in Section 1.4.2) in accordance with the approved RAWP and DER-10 requirements.

Following the completion of the end-point soil sampling and surveying activities, boulders were removed from the bottom of the soil removal area to the extent feasible prior to backfilling the excavation with approximately 100 cubic yards of the approved mixture of flowable fill. The flowable fill was utilized to backfill the excavation to approximately five feet below the first floor grade. Following a one week curing period, approximately 100 cubic yards of an

approved clean sand source was imported to the Site and placed on top of the flowable fill within the soil excavation area to approximately two feet below the first floor grade.

The horizontal and vertical extent of the remedial soil excavation performed, a cross-section displaying the backfill detail, and the end-point sample locations exceeding NYSDEC PGWSCOs and RRSCOs (as further discussed in Section 1.4.4) are included on Figure 15.

1.4.2 Tank Closure and Subsurface Drainage Structure Removal

During the completion of soil removal activities in September 2013 in the central portion of the Site, two 550-gallon gasoline tanks were encountered and subsequently closed and removed from the Site in accordance with applicable NYSDEC and New York City Fire Department (FDNY) regulations. The tanks were encased in concrete, situated approximately 2 feet below the floor slab, and filled with concrete slurry. While these tanks were situated within the portion of the Site delineated as the TCE-contaminated soil area, no evidence of holes or structural damage were identified during their removal.

Following the removal of the tanks and during the continuation of the soil removal activities in the central portion of the Site, numerous subsurface piping runs (including current and former drain pipes) and former utility structures were encountered. Noteworthy findings include the uncovering of an approximately 3-inch steel pipe that connected to an unidentified brick drain structure/seepage pit (approximately 3 feet below grade) in the southeastern portion of the soil removal area which eventually led to a cylinder-shaped metal drum structure within a concrete vault in the northwestern portion of the soil removal area. Evidence of soil contamination was identified in the vicinity of the piping runs and brick drain structure/seepage pit, which was subsequently removed for off-site disposal as part of the hazardous waste soil excavation activities described in Section 1.4.1. An investigatory soil sample collected from the soil/debris remaining within the metal drum structure located within the concrete vault in the northwestern portion of the soil removal area identified a TCE concentration of 54 milligrams per kilogram (mg/kg) or parts per million (ppm). This material and, as a precautionary measure, all surrounding soil/debris encountered within the concrete vault was excavated and removed from the Site as hazardous waste. Several metallic piping runs and former suspected drainage and utility structures that were encountered within the soil removal area were also removed from the Site as scrap metal or construction and demolition (C&D) debris.

Following the removal of the metallic drum located within the concrete vault, the hammer attachment of the excavator was used to break through the floor of the concrete vault (located at approximately 9.5 feet below first floor grade). A strong solvent-like odor was detected in soil immediately beneath the six-inch concrete floor slab of the vault, and a hand auger was used to collect a soil sample for laboratory analysis of VOCs, which identified a TCE concentration of 57 ppm.

Removal of the contaminated soil beneath the concrete fault was determined to be infeasible due to the proximity of the vault to the exterior building wall and other load bearing supports within the building. Accordingly, as discussed and agreed upon with NYSDEC, residual TCE-contaminated soil beneath the

concrete vault and at the bottom of the soil removal area would be addressed through the installation of a soil vapor extraction (SVE) well in the vault.

During the completion of trenching and soil removal activities associated with the installation of the SSDS in the western portion of the Site, an additional 550-gallon gasoline tank was encountered and subsequently closed/abandoned in accordance with applicable NYSDEC and FDNY regulations. A confirmatory investigation (to supplement data collected in the vicinity of the tank during the RI) including the advancement of soil borings and the collection and analysis of soil samples for VOCs and SVOCs on each side of the tank was performed by AKRF prior to receiving NYSDEC approval to close the tank in place with concrete slurry.

The approximate locations of the former tanks, the abandoned tank, and the underground piping network and associated structures encountered at the Site are shown on Figure 16.

1.4.3 Site-Related Treatment Systems

1.4.3.1 In-Situ Groundwater Treatment

In-situ groundwater treatment performed in accordance with AKRF's NYSDEC-approved February 2014 Groundwater Treatment RDWP included chemical injection in an approximately 3,000-square foot (sf) area located in the central portion of the Site where elevated concentrations of TCE and residual petroleum-related compounds were detected. Following the completion of an initial round of baseline groundwater sampling activities from the remaining seven groundwater monitor wells, base activated sodium persulfate (BASP) was injected under pressure to the contaminated groundwater plume, permitting both initial and continued oxidation to break down contaminants of concern.

Two rounds of chemical injection were performed in the saturated zone at and within the overburden groundwater table at approximately 18 feet below the first floor grade to a depth of approximately 24 feet below first floor grade through twenty-four (24) 2-inch injection wells installed to the top of bedrock. During the first injection event completed in early April 2014, approximately 150 gallons of 10 percent BASP solution were delivered to each of the 24 injection wells at the Site.

Based on the review of the first round of post-injection analytical results of groundwater samples collected from the existing monitor wells (which showed modest TCE reductions in the monitor well in the vicinity of the former source area) and observations recorded during the initial round of injections, a 50 percent increase in the total amount of chemical delivery dosage was proposed for the second round of injections. The volume of the second injection was also proposed to be increased from 150 gallons of solution per injection well to 300 gallons of solution per injection well. This design change was discussed and subsequently approved in consultation with NYSDEC prior to implementation in May 2014.

Following the completion of the second round of chemical injections, each of the 24 injection wells was cut down to an elevation below the proposed concrete floor slab and retrofitted with a secure cap and connected to ¾-inch high strength polyethylene tubing. Each injection well tubing connection was pressure tested and led toward and through the gravel bedding of the soil removal area before

being bundled in groups of three and passing through the basement wall in eight steel sleeves that terminate at an access manifold to allow for potential future use, contingent on results associated with implementation of the groundwater monitoring program to be completed as part of this SMP. Following the determination (to be made in consultation with NYSDEC and NYSDOH) that chemical treatment of groundwater is no longer required to ensure protection of public health and the environment, the injection wells and associated tubing will be properly abandoned in accordance with applicable NYSDEC guidance.

Based on a review of the second round of post-injection analytical groundwater results, an increase in TCE concentrations was identified in the vicinity of the former source area. The increase in TCE concentrations in groundwater following the completion of the second round of chemical injections is likely due to the desorption of a non-aqueous soil source in the vicinity of the concrete vault in the northwestern portion of the Site, immediately upgradient from monitor well MW-3. Consistent and generally increasing concentrations of TCE breakdown compounds (especially in comparison to breakdown compounds detected during the RI) have also been detected during the post-injection sampling events. While an increase in TCE concentrations in monitor well MW-3 was identified between the first and second rounds of chemical injections at the Site (following the slight decrease identified after the first round of injections), desorption of non-aqueous soil sources is a necessary step to complete the remedy at the Site and ensure the continual oxidation and breakdown of chlorinated VOCs in subsurface soil and GW. Residual contamination in soil will be addressed by operation of a soil vapor extraction (SVE) well (see Section 1.4.3.3) and residual groundwater contamination will be addressed if necessary, following the completion of groundwater monitoring as discussed in Section 2.2.2.4 and outlined in the Site Monitoring Plan (Section 3) of this SMP.

The construction logs for each of the 24 injection wells are included in Appendix D. The surveyed locations of the injection well network that establishes the groundwater treatment area and the injection well access manifold are shown on Figure 17. Baseline and post-remediation groundwater analytical results are shown on Figure 18.

1.4.3.2 Sub-Slab Depressurization System

A sub-slab depressurization system (SSDS) has been installed at the Site to prevent the potential for vapor intrusion into the building in accordance with the April 2014 Soil Vapor Mitigation RDWP. The SSDS applies negative pressure beneath the entire first floor and basement concrete slabs, minimizing the potential for vapor intrusion into the Site building. A vapor barrier has also been installed in conjunction with the SSDS (and soil vapor extraction well) during restoration activities above the soil removal area.

Seven SSDS pit locations (six on the first floor and one in the basement) are connected to an operating blower in the basement of the Site building through dedicated solid PVC piping connections installed in underground trenches beneath the existing concrete floor slab to capture soil vapor. Within the soil removal area, soil vapor will be captured through slotted PVC piping bedded in clean stone, which will also be connected to the blower. VOC-contaminated soil vapor is treated with granular activated carbon (as described in Section 1.4.3.4) prior to being discharged to the atmosphere above the roof the Site building.

1.4.3.3 Soil Vapor Extraction Well

A SVE well was installed and will be operated to treat residual TCE-contaminated soil left in place at the Site (due to physical and structural constraints) while also (in combination with the SSDS) preventing potential adverse effects to indoor air quality. One SVE well point was installed at soil sample location NL-VF(10'-10.5') within the concrete vault in the northwestern portion of the soil removal area. The SVE well point was installed to 20 feet below first floor grade and will operate on the same blower as the SSDS (located in the basement of the Site building) and has been designed to include a radius of influence (ROI) that will encompass end-point soil samples NL-EP-WW-1(11-12) and NL-EP-BS-1(11-12), which identified residual concentrations of TCE-contaminated soil. Based on field observations conducted during the installation, a 10 foot section of slotted screen was installed from 10 to 20 feet below first floor grade (in the vicinity of the overburden groundwater table). VOC-contaminated soil vapor extracted from the SVE well is treated with granular activated carbon (as described in Section 1.4.3.4) prior to being discharged to the atmosphere above the roof of the Site building until discharge criteria is achieved and approval by NYSDEC is obtained indicating that treatment is no longer necessary.

1.4.3.4 Granular Activated Carbon Treatment of Effluent Vapor

All captured vapors from the seven SSDS pits, the slotted pipe within the soil removal area, and the SVE well point are manifolded to the basement and directed through two granular activated carbon (GAC) treatment units in series, thereafter traveling within an 8-inch steel riser pipe from the basement through the first and second floors, and are discharged to the atmosphere above the roof of the Site building. The GAC units absorb total VOCs collected in the effluent from the SSDS pits, slotted pipe, and SVE well, and will be changed out over time with spent carbon being sent to a regulated facility for proper off-site disposal.

The surveyed locations of the installed SSDS components and the SVE well, including the GAC units, are shown on Figure 19.

1.4.4 Remaining Contamination

Following the completion of the contaminated source removal in the central portion of the Site in January 2014, end-point soil sampling conducted at the bottom of the excavation (11 to 12 feet below first floor grade) confirmed the presence of TCE concentrations slightly exceeding the remedial cleanup goal (PGWSCO) of 0.47 ppm in two soil samples. TCE was detected in soil sample NL-EP-WW-1(11-12) collected in the northwestern base of the excavation at a concentration of 0.51 ppm, and in soil sample NL-EP-BS-1(11-12) in the north central base of the excavation at a concentration of 3.7 ppm. Both of these TCE concentrations are well below the RRSCO of 21 ppm. The petroleum-related compound total xylenes were detected in bottom endpoint soil sample NL-EP-SW-1(11-12) at a concentration of 4 ppm, and in bottom endpoint soil sample NL-EP-SW-2(11-12) at a concentration of 2 ppm, both of which exceed the PGWSCO of 1.6 ppm, but are well below the RRSCO of 100 ppm.

In conjunction with the completion of the contaminated materials removal within the soil excavation area, an investigatory soil sample [NL-VF(10'-10.5')]

collected at a depth of 10 to 10.5 feet below first floor grade and immediately beneath the concrete vault identified in the northwestern portion of the soil removal area, identified TCE at a concentration of 57 ppm. This concentration exceeds the PGWSCO of 0.47 ppm established as the remedial cleanup goal in addition to the RRSCO of 21 ppm for TCE.

As discussed with and agreed upon with NYSDEC representatives during a Site meeting conducted on February 6, 2014, soil removal activities were deemed to be completed to the extent practicable based on the physical and structural constraints inside of the Site building. Based on the physical and structural constraints within the Site building, additional soil removal activities could not be completed at any of these three locations.

The demarcation layer established within the soil removal area that encompasses soil samples NL-EP-WW-1(11-12), NL-EP-BS-1(11-12), NL-EP-SW-1(11-12), and NL-EP-SW-2(11-12) includes an approximately 6 foot layer of flowable fill from the bottom of the excavation (approximately 11 feet below first floor) grade to approximately 5 feet below first floor grade. Clean sand was placed and compacted on top of the flowable fill within the soil excavation area from approximately 5 feet below first floor grade to approximately 2 feet below the first floor grade. In conjunction with the construction of the SSDS, the backfilling and restoration process within the soil removal area was completed by placing geotextile fabric on top of the compacted clean sand prior to bedding (solid and slotted) SSDS piping in an approximately 1-foot clean stone layer.

Based on the analytical results of NL-VF(10'-10.5'), the proposed engineering control to mitigate soil vapor (as described in the June 2013 RAWP) was expanded to include an SVE well to address residual TCE contamination in soil (as described in Section 4.10.3).

During the installation of the SVE well, a Geoprobe drill rig was utilized to collect soil samples to approximately 24 feet below first floor grade to determine the screened interval for the SVE well. Evidence of residual contamination was identified at a depth of approximately 10 to 15 feet below first floor grade and immediately beneath the vault. Evidence of contamination dissipated within the 15 to 20 foot interval before encountering the groundwater table at approximately 20 feet below first floor grade during the drilling and sampling activities. A soil sample [NL-SVE-EP-1(19-20)] collected and analyzed for VOCs did not identify any exceedances of PGWSCOs for the contaminants of concern, confirming that the vertical extent of the remaining contamination in this location is confined to an approximately 4-5 foot interval immediately beneath the concrete vault. The remaining soil contamination beneath the vault is demarcated by the concrete floor of the vault located at approximately 10 feet below first floor grade, which remains largely intact with the exception of the location of the SVE well. The annulus between the SVE well screen and the borehole created during the installation (10 to 20 feet below first floor grade) was backfilled with clean silica sand, and the void space surrounding the SVE well riser (within the vault) was backfilled with flowable fill from the bottom of the vault to approximately two feet below first floor grade following installation.

The use of flowable fill as backfill within the vault and within the bottom of the soil removal area serves as a demarcation layer and further improves and increases the influence of the SVE well (by minimizing the potential for short

circuiting) on the targeted treatment area that encompasses all remaining TCE-contaminated soil documented at the Site.

Following the installation of the SVE well and the SSDS piping, the entire soil removal area was covered with StegoWrap® 15-mil vapor barrier (including the sealing of penetrations for the vapor monitoring point and the SVE well) prior to restoring the concrete floor slab on the first floor of the Site building.

Analytical results for all soil samples remaining at the Site after the completion of the Remedial Action that exceed the Site-Specific SCOs are identified in Table 2 below. The exceedances of PGWSCOs identified in Table 2 also account for all exceedances of Track 1 (Unrestricted) SCOs, with exception being given to the samples identifying exceedances for acetone that are related to laboratory contamination. Figure 15 shows the location of all soil samples remaining at the Site after the completion of the Remedial Action that exceed the Site-Specific SCOs and/or RRSCOs.

Figures 15 and 20 provide cross-sectional details and surveyed elevations of the soil removal area and associated demarcation layers utilized during restoration completed following Remedial Action.

Table 2:
Remaining Soil Contamination Summary

Client ID	NYSDEC	NYSDEC	NL-EP-SW-1 (11-12)	NL-EP-SW-2 (11-12)	NL-EP-WW-1 (11-12)	NL-EP-BS-1 (11-12)	NL-VF (10'-10.5')
Lab Sample ID	Part 375	Part 375	460-70347-1	460-70347-2	460-70544-7	460-70544-9	460-70235-1
Date Sampled	Groundwater	Restricted	01/28/2014	01/28/2014	01/31/2014	01/31/2014	01/24/2014
Dilution	SCO	Residential	50	50	1	50	100
		SCO					
mg/kg	mg/kg	mg/kg					
Tetrachloroethene (PCE)	1.3	19	0.011 U	0.0097 U	0.0013 J	0.013 U	**2.3**
Trichloroethene (TCE)	0.47	21	0.17	0.055 J	**0.51**	**3.7**	**57**
Xylenes, Total	1.6	100	**4**	**2**	0.16	0.6	0.08 U

Exceedences of Part 375 Groundwater Protection Soil Cleanup Objectives are highlighted in bold font.

Exceedences of Part 375 Restricted Residential Soil Cleanup Objectives are highlighted in gray.

mg/kg - milligrams per kilogram = parts per million (ppm) **U -** The analyte was not detected at the indicated concentration. **J -** The reported concentration is estimated.

2.0 ENGINEERING AND INSTITUTIONAL CONTROL PLAN

2.1 Introduction

2.1.1 General

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

2.1.2 Purpose

This plan provides:

- A description of all EC/ICs on the Site;
- The basic implementation and intended role of each EC/IC;
- A description of the key components of the ICs set forth in the 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 EC/ICs, 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 EC/ICs required by the Site remedy, as determined by the NYSDEC.

2.2 Engineering Controls

2.2.1 Engineering Control Systems

2.2.1.1 Site Cover System

Exposure to remaining contamination in soil/fill beneath the Site building is prevented by a cover system placed over the entire Site. The cover system installed at the Site is comprised of:

- The pre-existing 4-inch concrete floor slab in all areas of the first floor and basement outside of the soil removal area and the construction areas for the SSDS and SVE components and trenching for injection wells;
- The minimum 4-inch concrete slab over all SSDS pit locations that are underlain by geotextile fabric on the subgrade, and a minimum of 18 inches of 1.5-inch clean stone surrounding the installed SSDS pit structure;
- The minimum 4-inch concrete slab over all trenches associated with the SSDS piping runs that are underlain by geotextile fabric on the subgrade, and a minimum of 16 inches of clean 1.5-inch clean stone surrounding the installed SSDS piping;

- The minimum 4-inch concrete slab over all trenches associated with the injection well locations that are underlain by a minimum of 2 inches of 1.5-inch clean stone encompassing the installed injection well connections and tubing; and
- The minimum 4-inch concrete slab over the entire soil removal area that is underlain by approximately 6 feet of flowable fill from approximately 5 to 11 feet below grade, followed by approximately 3 feet of clean sand from approximately 2 to 5 feet below grade, followed by geotextile fabric, a minimum of 12 inches of 1.5-inch clean stone surrounding the installed SSDS piping, and the installed StegoWrap® 15-mil vapor barrier.

The integrity of the concrete floor slab and other underlying components of the site cover system will be maintained at all times. Cross-section details for the Site cover system are shown on Figure 20. The Excavation Work Plan included as Appendix B outlines the procedures required to be implemented in the event that any portion of the cover system is breached, penetrated, or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection and maintenance of this cover are provided in the Monitoring Plan included in Section 3 of this SMP.

2.2.1.2 Sub-Slab Depressurization System

Intrusion of contaminated soil vapor within the Site building is prevented by an active sub-slab depressurization system (SSDS) which applies negative pressure under the entire basement and first floor building slabs. The SSDS installed at the Site is comprised of the following components:

- Seven SSDS pits (P-1 through P-7) and associated solid 4-inch PVC piping in sub-slab trenches, including six throughout the first floor of the building and one in the basement;
- A connected section of slotted 4-inch PVC piping (SP-8) bedded in a gas permeable aggregate layer (clean 1.5-inch stone) above the soil removal area in the central portion of the Site;
- An appropriately sized piping connection manifold that also acts as a condensate collection header;
- One appropriately sized 15 HP blower to generate the necessary design vacuum and air flow located in the basement of the Site building;
- One back-up/reduced sized 10 HP blower to be stored or used in the basement of the Site building;
- Two appropriately sized GAC units located in the basement adjacent to the blower to treat contaminated soil vapor;
- Effluent stack consisting of an 8-inch steel riser pipe extending from the basement through the first and second floors and terminating a minimum of 10 feet from any air intakes/vents, and the east-adjacent garage or apartment buildings;
- An exhaust fan located in the basement extending from the basement through the first and second floors and terminating above the roof of the Site building;
- A 15-mil vapor barrier (StegoWrap®) installed over the soil removal area;

The active SSDS will operate continually, 24 hours a day, 7 days a week, 365 days a year with the 15 HP blower until monitoring (as outlined in Section 3 of this SMP) and appropriate consultation with NYSDEC and NYSDOH confirm that the carbon treatment units and connection to the SVE well are no longer required to treat soil vapor collected beneath the Site. The system would then be downsized to operate with the 10 HP blower, which would utilize less energy but would still maintain negative pressure across the entire Site. In the event of a power outage at the Site, the system is equipped with a battery operated by-pass valve that would initiate passive ventilation directly to the exhaust stack without the use/need of the blower. The location and components of the SSDS are shown on Figure 19.

Procedures for operating and maintaining the SSDS, including details pertaining to alarms and gauges are documented in the Operation and Maintenance Plan (Section 4 of this SMP). Procedures for monitoring the SSDS are included in the Monitoring Plan (Section 3 of this SMP). The Monitoring Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the Site, occurs.

2.2.1.3 Soil Vapor Extraction Well

The treatment of residual TCE-contaminated soil left in place at the Site (due to physical and structural constraints) is performed through the installation and operation of an SVE well. The SVE well, in combination with the SSDS, also prevents potential adverse effects to indoor air quality. The SVE well installed at the Site is comprised of:

- A ten-foot section of screened 4-inch PVC piping, which targets a treatment interval starting from the bottom of the concrete vault at approximately 10 feet below first floor grade and terminates at approximately 20 feet below first floor grade;
- A ten-foot section of solid 4-inch PVC riser piping with a 4-inch by 4-inch tee connector to a solid 4-inch PVC piping run connected to the SSDS/SVE blower located in the basement;
- A 4-inch fitted expansion plug; and
- An 8-inch flush-mounted access manhole installed into the restored concrete floor slab.

The SVE well will operate in conjunction with the SSDS on a continual basis, 24 hours a day, 7 days a week, and 365 days a year with the 15 HP blower until monitoring (as outlined in Section 3 of this SMP) and appropriate consultation with NYSDEC and NYSDOH confirm that the SVE well is no longer required to treat TCE-contaminated soil left in place at the Site. The location and components of the SVE well are shown on Figures 19 and 20.

Procedures for operating and maintaining the SVE well are documented in the Operation and Maintenance Plan (Section 4 of this SMP). Procedures for monitoring the SVE well are included in the Monitoring Plan (Section 3 of this SMP). The Monitoring Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the Site, occurs.

2.2.2 Criteria for Completion of Remediation/Termination of Remedial Systems

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

2.2.2.1 Site Cover System

The site cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity as outlined in Section 3 of this SMP.

2.2.2.2 Sub-Slab Depressurization System (SSDS)

The operation of the active SSDS will not be discontinued unless prior written approval is granted by the NYSDEC in consultation with NYSDOH. In the event that monitoring data collected under the Monitoring Plan (Section 3 of this SMP) indicates that the SSDS or one or more of its components is no longer required, a proposal to discontinue or reduce controls associated with the SSDS and/or the applicable components will be submitted by the property owner to the NYSDEC and NYSDOH.

2.2.2.3 Soil Vapor Extraction Well

The SVE well to be operated in conjunction with the SSDS will not be discontinued unless prior written approval is granted by the NYSDEC in consultation with NYSDOH. In the event that monitoring data collected under the Monitoring Plan (Section 3 of this SMP) indicates that the SVE well is no longer required, a proposal to discontinue the connection and operation of the SVE well with the blower will be submitted by the property owner. Conditions that warrant discontinuing the SVE well to be operated in conjunction with the SSDS include contaminant concentrations in soil vapor from the SVE well that: (1) reach levels that are consistently below NYSDOH Air Guidance Values, (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 SVE well component has reached the limit of its effectiveness. This assessment will be based in part on post-remediation contaminant levels in soil vapor collected from sampling ports installed on the SSDS and SVE manifold legs. The SVE well will remain in place and operational until permission to discontinue or reduce controls associated with its use is granted in writing by the NYSDEC.

2.2.2.4 Groundwater Monitoring and In-Situ Treatment

Groundwater monitoring activities to assess the effectiveness of the remedy will continue, as determined by the NYSDEC, until residual groundwater concentrations are found to be consistently below NYSDEC AWQS or have become asymptotic at an acceptable level over an extended period. Groundwater monitoring will continue (in accordance with Section 3 of this SMP) until permission to discontinue or reduce monitoring is granted in writing by the NYSDEC. If groundwater contaminant levels identified during the implementation of the Monitoring Plan become asymptotic at a level that is not acceptable to the NYSDEC, additional groundwater treatment through the injection well network and/or other control measures will be evaluated. Additional in-situ chemical oxidation (ISCO) injections may be required based

on the results of ongoing monitoring. See section 4.2.3 of this SMP for details on additional ISCO injections.

2.3 Institutional Controls

A series of Institutional Controls is required by the NYSDEC's June 2013 Decision Document for the Site to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the Site to Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv) uses only. Adherence to these Institutional Controls on the Site is required by the Environmental Easement and will be implemented under this Site Management Plan. These Institutional Controls are:

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

Institutional Controls identified in the 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 Controlled Property are:

- The property may only be used for Restricted Residential, Commercial, and Industrial use provided that the long-term Engineering and Institutional Controls included in this SMP are employed;
- The property may not be used for a higher level of use, such as unrestricted or residential use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC;
- All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- The use of the groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health rendering it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the NYSDEC;
- The potential for vapor intrusion must be evaluated for any future buildings developed on the Site, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the property are prohibited;

- The Site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with this SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow or will be deemed appropriate by an expert that the NYSDEC finds acceptable.

2.3.1 Excavation Work Plan

The Site has been remediated for Restricted Residential use. Any future intrusive work that will penetrate the site cover system, or encounter or disturb the remaining contamination, including any modifications or repairs to the existing cover system will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix B to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the Site. A Site specific HASP and CAMP are included as Appendix C to this SMP. These documents are in current compliance with DER-10, 29 CFR 1910, 29 CFR 1926, and all other applicable State, Federal, 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 B-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the periodic inspection and certification reports submitted under the Site Management Reporting Plan (See Section 5).

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

2.3.2 Soil Vapor Intrusion Evaluation

As part of the completed remedy, intrusion of contaminated soil vapor within the Site building (covering the entire footprint of the property) is prevented by an active SSDS which applies negative pressure under the entire partial basement and first floor building slabs. Therefore, a soil vapor intrusion (SVI) evaluation is not required for the current building.

Prior to any demolition/redevelopment of the existing structure located within the Site boundary, a SVI evaluation will be performed to determine whether any mitigation measures are necessary to eliminate potential exposure to vapors in the proposed location of the structure. Alternatively, the existing components of the installed SSDS may be modified to be included as an element of the newly

developed building foundation without first conducting an investigation. This updated mitigation system, at a minimum, would include a vapor barrier and passive SSDS piping capable of being connected to the existing active system.

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

In the event that an SVI evaluation is performed, preliminary (unvalidated) SVI sampling data will be forwarded to the NYSDEC and NYSDOH for initial review and interpretation. Upon validation, the final data will be transmitted to the agencies, along with a recommendation for the applicable follow-up action. If any indoor air test results associated with the SVI evaluation conducted as a result of desired redevelopment exceed NYSDOH guidelines, relevant NYSDOH fact sheets will be provided to all tenants and occupants of the property within 15 days of receipt of validated data.

In the event that an SVI evaluation is performed, SVI sampling results, evaluations, and follow-up actions will also be summarized in the next Periodic Review Report.

2.4 Inspections and Notifications

2.4.1 Inspections

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

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

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

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the Site will be conducted within 5 days of the

event to verify the effectiveness of the EC/ICs implemented at the Site by a qualified environmental professional as determined by NYSDEC.

2.4.2 Notifications

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

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

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

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

2.5 Contingency Plan

Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions.

The appropriate action for on-site emergencies are detailed in the attached HASP, provided as Appendix G.

2.5.1 Emergency Telephone Numbers

In the event of any environmentally related situation or unplanned occurrence requiring assistance, the Owner or Owner's representative(s) should contact the appropriate party from the contact list below. For emergencies, appropriate emergency response personnel should be contacted. Prompt contact should also

be made to AKRF's Project Principal or Project Manager or the current property manager/owner's representative for the Site. These emergency contact lists must be maintained in an easily accessible location at the Site.

Table 3: Emergency Contact Numbers

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

Table 4: Contact Numbers

Company/Regulator	Contact Name	Contact Title	Contact Number
AKRF	Marc Godick	Project Principal/QEP	914-922-2356 (office)
AKRF	Michelle Lapin	Remedial Engineer	646-388-9520 (office)
AKRF	Dustin Kapson	Project Manager	646-388-9767 (office)
AKRF	Eric Park	Asst. Project Manager	646-388-9532 (office)
NYSDEC	Dana Mecomber	Project Manager	718-482-7541 (office)
NYSDOH	Dawn Hettrick	Public Health Engineer	518-402-7880 (office)
Rinzler Family Limited Partnership	James Rinzler	Owners Representative	212-685-6500 (office)

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

QEP – Qualified Environmental Professional

2.5.2 Map and Directions to Nearest Health Facility

Site Location: 3200 Jerome Avenue, Bronx, New York

Nearest Hospital Name: North Central Bronx Hospital

Hospital Location: 3424 Kossuth Avenue, Bronx, New York

Hospital Telephone: 718-519-5000

Directions to the Hospital:

1. Head northeast on Jerome Avenue toward W. Mosholu Parkway South for 0.3 miles.

2. Turn right onto East 208th Street and drive 0.2 miles

3. Take sharp left onto Steuben Avenue and drive 0.1 miles

4. Turn left onto East 210th Street and drive 256 feet

5 Take first right onto Kossuth Avenue

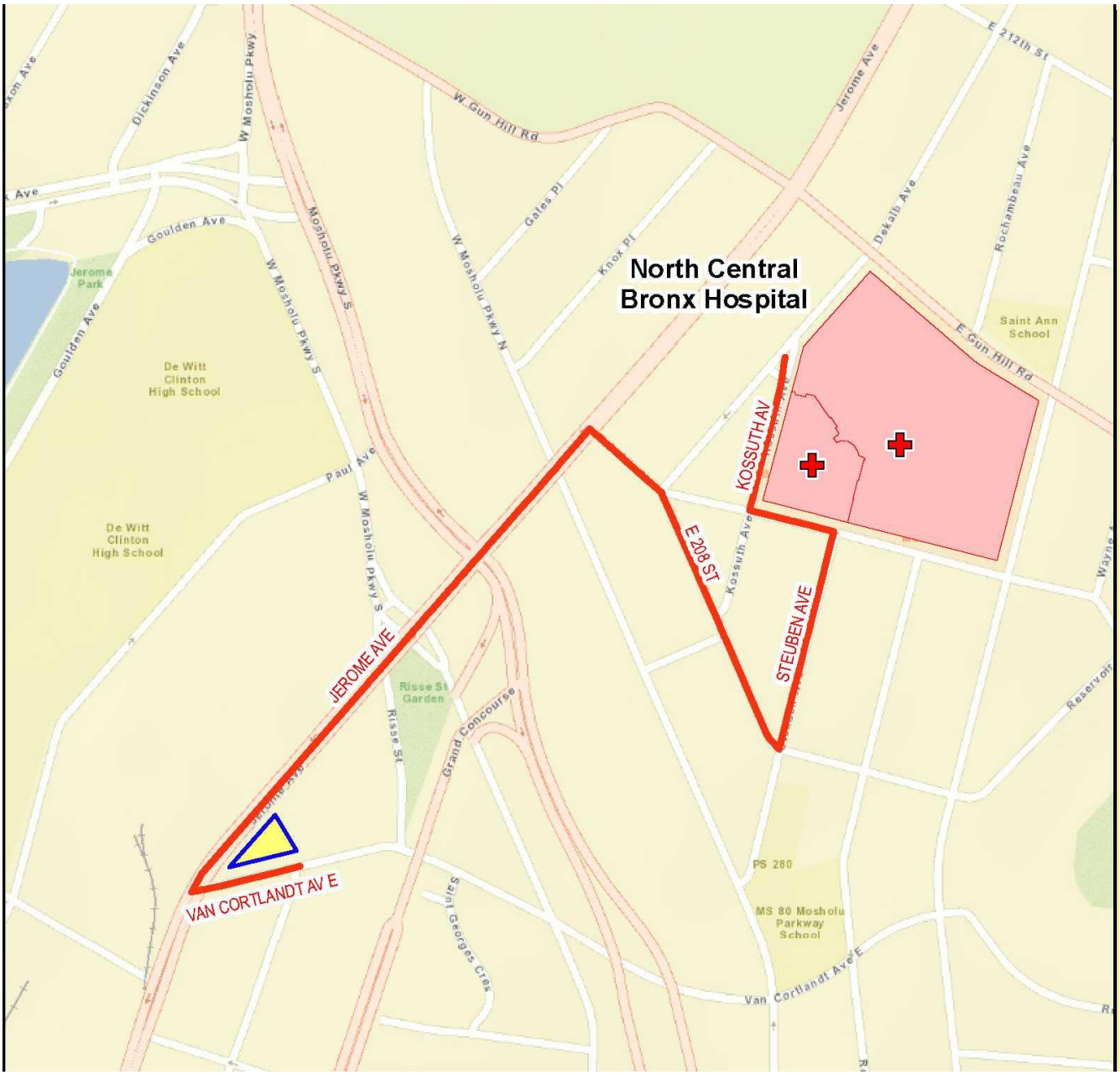
6. Destination will be on the right

Total Distance: 0.7 Miles

Total Estimated Time: 3 Minutes (Driving)

9 Minutes (Walking)

Map Showing Route from the Site to the North Central Bronx Hospital:



2.5.3 Response Procedures

As appropriate, the fire department and other emergency response groups will be notified immediately by telephone of the emergency. The emergency telephone number list is found at the beginning of this Contingency Plan (Table 2). The list will also be posted prominently at the Site and made readily available to all personnel at all times.

2.5.3.1 Procedure for Disturbance of Site Cover System

Prior to any planned disturbance of the site cover system, the location of existing monitoring points, groundwater monitor wells, and ECs located within or beneath the concrete floor slab including SSDS pits, SSDS piping, the SVE well and associated piping, and the injection well network will be identified using Figures 15, 17 and 20. The following procedures will be required if the site cover system is accidentally disturbed, is required as part of a planned building improvement/repair, or if damage to the site cover system is discovered during a monitoring/inspection event:

- Notification of NYSDEC in accordance with applicable guidance outlined in Section 2.4.2 and the Excavation Work Plan (Appendix B) of this SMP;
- Submittal of a written plan detailing the disturbance location and proposed repair or replacement activities to return the cover system or associated underlying components to the appropriate operating condition;
- Performance of the planned disturbance in accordance with the Excavation Work Plan included as Appendix B; and
- Scheduling of a follow-up inspection to be performed under the direct oversight of a qualified environmental professional.

The appropriate actions for other on-Site emergencies are detailed in the attached HASP, provided in Appendix C. The HASP may require revisions as necessitated by changes to Site conditions and project personnel. The plan will be updated as necessary or at a minimum of once every five years to ensure accuracy. Procedures associated with alarm systems established to monitor the operation of the SSDS and SVE well are described in Section 3 and 3 of this SMP.

3.0 SITE MONITORING PLAN

3.1 Introduction

3.1.1 General

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

3.1.2 Purpose and Schedule

This Monitoring Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, and soil vapor);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly NYSDEC Ambient Groundwater Quality Standards (AWQS) and NYSDOH Air Guideline Values (AGVs);
- Assessing achievement of the remedial performance criteria;
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring activities.

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

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

Monitoring of the performance of the remedy and overall reduction in contamination on-site will be conducted for the periods specified for each matrix listed in Table 5. The frequency thereafter will be determined in consultation with NYSDEC and based on reports submitted showing contaminant trends. Trends in contaminant levels in air, soil vapor, 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 5 and outlined in detail in Sections 3.2 and 3.3 below.

Table 5: Monitoring/Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
Site Cover System	Annually. First Inspection no more than 18 months after COC, then at least Annually Thereafter	Cover System Integrity	Visual Inspection of Conditions
Groundwater Monitoring and Sampling	Quarterly Basis for 24 months after COC, and as Necessary/Determined in Consultation with NYSDEC Thereafter	Groundwater	VOCs by EPA Method 8260
SSDS/SVE Routine Operations Inspections	Monthly Basis for first 6 months of operation, Quarterly Thereafter for 12 months, and at least Annually Thereafter	SSDS/SVE System Operations	Visual Inspection, Field Screening (PID) for Influent/Effluent Vapor
SSDS/SVE Detailed Operations Inspections	Quarterly Basis for 1 Year, and at least Annually Thereafter	SSDS/SVE System Operations	Visual Inspection, Field Screening (PID) for Influent/Effluent Vapor and recording system readings (vacuum/flow) and vacuum at vapor monitoring points
Confirmatory Influent/Effluent Vapor Sampling	Every 6 months following system startup for 24 months, and at least Annually Thereafter	Extracted Soil Vapor Before and After Carbon Treatment	EPA Method TO-15
Contingency Indoor Air Sampling**	System Failure for > 48 Hours	Indoor Air at 5 Sampling Locations	EPA Method TO-15
SSDS/SVE System Status	Continuous with Remote Telemetry and Email/Text Notification	SSDS Status (on/off) and other Alarm Conditions	Alarm Limits for Vacuum, Temperature, and Condensate Collection

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

** Confirmatory indoor air sampling was performed during the heating season immediately following system startup in November 2014. Indoor air sampling will only be performed in the event of a system failure or disturbance as outlined in this SMP.

COC – Certificate of Completion issued by NYSDEC

VOCs – Volatile Organic Compounds

PID – Photoionization Detector

3.2 Cover System Monitoring

Exposure to residual contaminated soil remaining at the Site is being prevented by an engineered site cover system that is made up of the pre-existing concrete floor slab and the newly constructed concrete floor slab overlying the soil removal area and the installation areas for the SSDS and SVE components and trenching for injection wells at the Site. The location and details of the site cover system are shown on Figure 20.

The site cover system will remain intact 24-hours a day, 7 days a week, for 365 days a year. Disturbance of the site cover system or EC components is prohibited by the Environmental Easement. In the unlikely event of an unanticipated accidental or required disturbance of the site cover system, the response procedure is outlined in Section 2.5.3.1.

Monitoring of the site cover system will occur on an annual basis as long as the Environmental Easement is in effect to ensure the system's integrity. Monitoring will consist of visual inspection, which shall evaluate the structural integrity of the concrete floor slab of the partial basement and first floors, support columns into the floors and the wall joints. If any cracks or openings are identified, they shall be screened for organic vapors with a PID and any readings shall be noted. In addition, any cracks or openings in the floor shall then be properly sealed. The results of the inspection will be included in the Periodic Review Report. In addition, the site cover system must be inspected and certified any time a disturbance in the system occurs. The 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 site cover system has been reported or an emergency occurs that is deemed likely to affect the operation of the system.

3.3 Media Monitoring Program

3.3.1 Groundwater Monitoring

Groundwater monitoring will be performed on a quarterly basis for two years after issuance of the COC to assess the performance of the remedy.

The network of groundwater monitoring wells has been installed to monitor both up-gradient and down-gradient overburden groundwater conditions at the Site. Two down-gradient bedrock groundwater monitor wells have also been installed to monitor the potential for vertical migration of chlorinated VOCs. The network of on-site wells within the Site building and off-site wells located within the sidewalk along Jerome Avenue has been designed based on the following criteria:

- Findings associated with the Remedial Investigation including horizontal locations relative to the identified source area in the central portion of the Site and a west-southwesterly inferred groundwater flow direction in the overburden groundwater aquifer located immediately above bedrock;
- Vertical delineation and comparison of overburden and bedrock groundwater aquifers based on the chlorinated VOC contamination identified at the Site;
- Physical constraints including the presence of an underground subway tunnel located beneath the sidewalk south of the Site along Van Cortlandt Avenue prohibiting installation of monitoring wells in these locations; and
- Completion of the soil removal, restoration, and SSDS installation in the central portion of the Site necessitating the removal and prohibiting the re-installation of former monitor well MW-1.

Monitoring well boring and construction logs are included in Appendix D and the locations of the five overburden groundwater monitoring wells (MW-2, MW-3, MW-4, MW-1E, and MW-2E) and two bedrock groundwater monitoring wells (MW-3E-D and MW-5D) are shown on Figure 17.

Each of the seven monitoring wells will be sampled on a quarterly basis to assess chlorinated VOC concentrations for a two year period following the issuance of the Certificate of Completion and during the operation of the SSDS and SVE well. After the initial one year period, monitoring will continue as determined in consultation with NYSDEC and NYSDOH, until residual groundwater concentrations are found to be below NYSDEC standards or have become asymptotic over an extended period. This SMP will be modified to reflect changes in sampling plans approved by NYSDEC. Deliverables for the groundwater monitoring program are specified below.

3.3.1.1 Quarterly Groundwater Sampling Protocol

All monitoring well sampling activities will be recorded by taking applicable notes in a field book and by collecting the readings listed on the groundwater sampling field log presented in Appendix E. Pertinent observations or Site conditions at the time of the sampling (e.g., well integrity, etc.) will also be noted on the well sampling log. One well sampling log will be filled out for each of the seven wells and serve as the inspection form associated with the groundwater monitoring well network.

Groundwater samples will be collected using low flow sampling techniques as described in U.S. EPA's Ground-Water Sampling Guidelines for the collection of groundwater samples from monitoring wells. Sampling will be conducted according to the following procedure during evening or weekend hours, or when the building is not fully occupied, and as detailed in the Quality Assurance Project Plan (QAPP) included as Appendix F:

- Slowly remove the access manhole and locking cap and immediately measure the vapor concentrations in the well with a PID calibrated to the manufacturer's specifications;
- Measure the depth to water and total well depth of all seven wells prior to conducting any purging, and check for the presence of NAPL using an oil/water interface probe. Measure the thickness of NAPL, if any, and record in field book and the well sampling field log. Collect a sample of NAPL (if present) using a disposable plastic weighted bailer or similar collection device. Groundwater samples will not be collected from wells containing measurable NAPL;
- Use the water level and total well depth measurements to calculate the length of the mid-point of the water column within the screened interval. For example, for a well where the total depth is 30 feet, screened interval is 20 to 30 feet, and depth to water is 24 feet, the mid-point of the water column within the screened interval would be 27 feet.
- For the 1-inch well (MW-2), lower dedicated tubing into the well such that the intake of the tubing is set at the mid-point of the water column within the screened interval. Connect the discharge end of the tubing to a peristaltic pump, and connect a dedicated discharge line to the flow-through cell of a Horiba Quanta multi-parameter (or equivalent) meter. Connect tubing to the

output of the cell and place the discharge end of the tubing in a five-gallon bucket.

- For all 2-inch wells, connect dedicated tubing to either a submersible or bladder pump and lower the pump such that the intake of the pump is set at the mid-point of the water column within the screened interval of the well. Connect the discharge end of the tubing to the flow-through cell of a Horiba Quanta multi-parameter (or equivalent) meter. Connect tubing to the output of the cell and place the discharge end of the tubing into a five-gallon bucket.
- Activate the applicable pump at the lowest flow rate setting of the pump.
- Measure the depth to water within the well. The pump flow rate may be increased such that the water level measurements do not change by more than 0.3 feet as compared to the initial static reading. The well-purging rate should be adjusted so as to produce a smooth, constant (laminar) flow rate and so as not to produce excessive turbulence in the well. The expected targeted purge rate will be approximately 100 milliliters/minute and will be no greater than 300 milliliters/minute.
- Transfer discharged water from the 5-gallon buckets to 55-gallon drums designated for well-purge water.
- During purging, collect periodic samples and analyze for water quality indicators (e.g., turbidity, pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue purging the well until turbidity is less than 50 NTU and water quality indicators have stabilized to the extent practicable. The criteria for stabilization will be three successive readings for the following parameters and criteria:

Parameter	Stabilization Criteria
PH	+/- 0.1 pH units
Specific Conductance	+/- 3% mS/cm
ORP/Eh	+/- 10mV
Turbidity	<50 NTU
Dissolved Oxygen	+/- 0.3 mg/l

Notes: mS/cm = millisievert per centimeter
mV = millivolts
NTU = nephthalometric turbidity units
mg/l = milligrams per liter

- If the water quality parameters do not stabilize and/or turbidity is greater than 50 NTU within two hours, purging may be discontinued. Efforts to stabilize the water quality for the well must be recorded in the field book, and samples may then be collected as described herein.
- After purging, disconnect the tubing to the inlet of the flow-through cell. Collect groundwater samples directly from the discharge end of the tubing and place into the required sample containers as described in Section 4.7 of

the QAPP. Label the containers as described in Section 4.7 of the QAPP and place in a chilled cooler. Samples should be collected for VOCs.

- Collect one final field sample and analyze for turbidity and water quality parameters (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity).
- Once sampling is complete, remove the pump and tubing from the well. Dispose of the sample tubing and any associated PPE used for sampling in a 55-gallon drum designated for disposable sampling materials and PPE. The purge water will be managed as described in Section 3.6 of the QAPP included as Appendix F.
- Decontaminate the pump, oil/water interface probe, and flow-through cell, as described in Section 3.4 of the QAPP included as Appendix F.
- Record all measurements (depth to water, depth to NAPL, water quality parameters, turbidity), calculations (well volume), and observations in the project field book and the well sampling field log included as Appendix E.

3.3.1.2 Monitoring Well Repairs, Replacement And Decommissioning

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped in accordance with the details outlined in Section 3.2 of the QAPP included as Appendix F. Additionally, monitoring wells will be properly decommissioned and replaced (as per the requirements of this Monitoring Plan), if an event renders the wells unusable.

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

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. Well abandonment will be performed in accordance with NYSDEC's CP-43: Groundwater Monitoring Well Decommissioning Policy. 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.

3.3.2 SSDS/SVE Operations Inspections and Sampling

The operation of the SSDS and SVE well components will be confirmed by two different levels of inspections identified as "routine" or "detailed" to be performed by appropriate personnel. An RFLP or current owner representative trained by an environmental consultant under the direction of the Remedial Engineer will conduct routine system checks on a monthly basis for the first six months following start-up, with weekly checks during the first month of operation after start-up. The routine check will consist of confirming the blower is operating properly in all areas of the Site with individual flow rate and vacuum readings for each of the SSDS pits, slotted piping, and the SVE well within designated ranges. The routine check will also note any unusual conditions (e.g., unusual odors, spills, leaks, blower noise, etc.).

Detailed SSDS/SVE operations checks will be performed by an environmental consultant to RFLP or current owner on a quarterly basis for the first year after issuance of the COC. The detailed inspections will consist of individual SSDS pit, SSDS slotted pipe, and SVE well gauge readings, blower inspections, alarm checks, and field screening the influent, intermediate, and effluent ports of each of the carbon treatment units for total VOC concentrations using a PID. The four sub-slab vacuum monitoring points (MP-1 through MP-4) installed at the Site will also be checked during each of these detailed inspections to ensure that key indicator locations remain under vacuum. Monitoring associated with the performance of the SSDS and SVE well is an integral portion of EC performance monitoring as described in further detail in Section 4.3 of this SMP.

As an added measure in addition to this schedule of inspections and sampling events, the alarm system associated with the SSDS/SVE system is equipped with an internet connection and cellular service which will send an automatic notification to a designated contact list in the event of a power outage or blower/system failure at the Site.

The monitoring frequency outlined above and listed in Table 5 may be modified based on field screening and associated laboratory analytical results with the approval of NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

3.3.2.1 SSDS/SVE Routine Operations Inspection Protocol

The routine check will consist of a visual inspection noting the individual flow rate and vacuum readings for each of the SSDS pits, slotted piping, and the SVE well. The routine check will also note any unusual conditions (e.g., unusual odors, spills, leaks, blower noise etc.).

The monthly inspection will be documented on the Routine System Monitoring Inspection Form provided in Appendix G. If the system is not functioning properly (i.e., the blower is not operating within the designated pressure and vacuum ranges), the owner's representative will inspect and clean out the moisture tank as detailed in Section 4.3 of this SMP. If readings are still outside of range or damage is noted, the owner's representative will immediately notify a Site contact (see Table 3 of Section 2 of this SMP). If damage requiring repair is identified during the inspections, repairs will be made promptly.

3.3.2.2 SSDS/SVE Detailed Operations Inspection and Sampling Protocol

Instantaneous PID readings will be collected at the influent, intermediate, and effluent sample ports on the GAC units. SSDS and SVE effluent sampling locations and details associated with indications of vacuum, temperature, air flow, and the collection of condensate are further discussed in Section 4.3.7. Each of the four vacuum monitoring points will be checked with a manometer capable of reading down to 0.0001 inches of H_2O to confirm negative pressure is being extended beneath the entire first floor slab.

All sampling activities will be recorded in a field book and the SSDS/SVE System Operations and Sampling Log presented in Appendix G. Field observations (e.g., potential VOC sources, ambient air conditions, etc.) will be noted on the sampling/inspection logs, which will be subject to the reporting requirements and system checks as discussed in Section 3.6 and 5.0. Complete vapor sampling procedures are detailed in the QAPP.

3.3.2.3 SVE Well Repair, Replacement And Decommissioning

The SVE well will be properly decommissioned and replaced (as per the requirements of this Monitoring Plan), if an event renders the well unusable. Repairs and/or replacement of the SVE well will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of the SVE well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. The decommissioning of the SVE well without replacement will be done only with the prior approval of NYSDEC. The SVE well abandonment will be performed in accordance with NYSDEC's CP-43: Groundwater Monitoring Well Decommissioning Policy. If the SVE well is decommissioned because it has been rendered unusable, a replacement SVE well will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.3.3 Indoor Air Sampling

To confirm indoor air quality during the operation of the SSDS and SVE system, one round of indoor air samples was collected from within the Site building during the heating season following system startup and operation in November 2014 in accordance with the NYSDOH Vapor Intrusion Guidance Document. A review of the indoor air analytical results indicated that none of the applicable compounds were detected at concentrations greater than the corresponding Air Guideline Values (AGVs) established in the NYSDOH Guidance Document in any of the five indoor air samples collected as part of the confirmatory sampling event.

As confirmed following system startup in November 2014 (reported as part of the Final Engineering Report), described in Section 3.3.2 above (and further detailed in Section 4.2), detailed operations inspections consisting of checks to system gauges and sub-slab vacuum monitoring points installed at the Site will ensure that key indicator locations remain under vacuum and indoor air remains unaffected from soil vapor intrusion. The need to perform additional rounds of indoor air sampling will be determined based on field screening, system failure, or the request to decommission or terminate components of the SSDS or the SVE well with the approval of NYSDEC. This SMP will be modified to reflect any changes in sampling plans approved by NYSDEC.

3.3.3.1 Indoor Air Sampling Protocol

Following the completion of a pre-sampling inspection and chemical inventory of the Site building, indoor air sampling was performed during the operation of the building's heating system throughout five locations on the first floor of the Site building. Indoor air sampling would be performed at the Site in the future in the event of SSDS failure (for a period of greater than 48 hours), or to confirm the discontinuation of SSDS use. During any future indoor air sampling event, two locations will be established within the vicinity of the former soil removal area and adjacent groundwater treatment area, and three locations will be established throughout rooms and/or hallways located throughout the southern and eastern portions of the Site building. The samples will be collected in 6-liter Summa canisters set approximately 3 to 5 feet above the first floor slab in accordance with NYSDOH guidance and the sampling procedure detailed in the

QAPP. All samples will be submitted to a NYSDOH ELAP-certified laboratory for analysis of VOCs by EPA Method TO-15.

All sampling activities will be recorded in a field book and the Indoor Air Sampling Log included in Appendix G. Field observations (e.g., potential VOC sources, etc.) will be noted on the sampling log, which will be subject to the reporting requirements and system checks as discussed in Section 3.6 and 5.0. Complete indoor air sampling procedures are detailed in the QAPP.

3.3.4 Influent/Effluent Vapor Sampling

Samples of the SSDS and SVE influent/effluent will be collected following initial startup and 6 months of operation for laboratory analysis to more accurately assess the VOC concentrations in extracted soil vapor from the entire Site, and the condition and lifespan of the GAC units. Sampling of extracted soil vapor from the individual SSDS and SVE piping lines, the influent, intermediate, and effluent ports of each of the carbon treatment units will be sampled as necessary and as determined based on previous results and in consultation with NYSDEC.

The sampling frequency outlined above and listed in Table 5 may be modified based on field screening and associated laboratory analytical results with the approval of NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

3.3.4.1 Influent/Effluent Vapor and Indoor Air Sampling Protocol

System influent and effluent vapor samples will be collected as grab samples from individual SSDS pits, the slotted piping section, and the SVE well (all sampled from the basement control manifold) and combined influent, intermediate, and effluent samples by filling Tedlar bags with a peristaltic pump, in accordance with the sampling procedure detailed in the QAPP included as Appendix F. Indoor air samples would be collected from 6 liter Summa canisters. All samples will be submitted to a NYSDOH ELAP-certified laboratory for analysis of VOCs by EPA Method TO-15.

All sampling activities will be recorded in a field book and the Effluent Vapor Sampling Log presented in Appendix G. Field observations (e.g., potential VOC sources, etc.) will be noted on the sampling log, which will be subject to the reporting requirements and system checks as discussed in Section 3.6 and 5.0. Complete effluent vapor sampling procedures are detailed in the QAPP.

3.3.4.2 Carbon Change Out and Disposal Protocol

Based on previous investigations, a conservative design estimate of 20,000 $\mu g/m^3$ total VOCs from each of the nine extraction points at a proposed air flow rate of 575 CFM, it is conservatively estimated that the system will utilize approximately 465 pounds of carbon per month during initial operation. However, GAC replacement frequency will be based on analytical results from influent/effluent vapor sampling and confirmatory field screening using a PID during routine and detailed system operations inspections.

All spent carbon will be disposed of or recycled off-site in accordance with all applicable local and federal regulations. Based on requirements of the disposal/recycling facility and waste disposal contractor, a carbon sample may need to be collected for facility acceptance purposes. If so, a representative grab

sample of the spent carbon will be collected and submitted for laboratory analysis as detailed in the QAPP, provided as Appendix H. Documentation associated with carbon disposal and replacement will be subject to the reporting requirements and system checks as discussed in Section 3.6 and 5.0.

3.4 Site Wide Inspections

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

- Compliance with all ICs, including Site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General Site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection;
- Compliance with permits and schedules included in the Operation and Maintenance Plan; and
- Confirm that Site records are up to date.

3.5 Monitoring Quality Assurance/Quality Control

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

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

assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

- Internal QC and Checks;
- QA Performance and System Audits;
- Preventative Maintenance Procedures and Schedules;
- Corrective Action Measures.

3.6 Monitoring Reporting Requirements

Forms and any other information generated during regular monitoring events and inspections will be kept on file on-site. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be (1) subject to approval by NYSDEC and (2) submitted at the time of the Periodic Review Report, as specified in the Reporting Plan (Section 5) of this SMP.

All monitoring results will be reported to NYSDEC on a periodic basis in the Periodic Review Report. Based on the scope or the type of site monitoring performed, a letter report or an email summary with attachments will be prepared, subsequent to each sampling event. The document submittal will include, at a minimum:

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

Data will be reported in digital format sent to the attention of the current NYSDEC Project Manager. A summary of the monitoring program deliverables are summarized in Table 6 below.

Table 6: Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Email Summary with Attachments (Routine Checks)	Monthly Following SSDS/SVE System Startup
Letter Report with Figures and Attachments (Detailed Checks and Associated Sampling Events)	Quarterly or Semi-annually as Performed
Period Review Report (Inclusive of all Checks and Sampling Events)	Annually beginning 18 months after issuance of COC until termination of Environmental Easement

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC
COC – Certificate of Completion issued by NYSDEC

4.0 OPERATION AND MAINTENANCE PLAN

4.1 Introduction

This Operation and Maintenance Plan describes the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the Site. This Operation and Maintenance Plan:

- Includes the steps necessary to allow individuals unfamiliar with the Site to operate and maintain the sub-slab depressurization system (SSDS),the soil vapor extraction (SVE) well, and the ISCO injection wells;
- Includes an operation and maintenance contingency plan; and,
- Will be updated periodically to reflect changes in Site conditions or the manner in which the SSDS, SVE well and the ISCO injection wells are operated and maintained.

Information on non-mechanical Engineering Controls (the site cover system) is provided in Section 2 - Engineering and Institutional Control Plan and Section 3.2 of this SMP. Information on the use of the contingency injection well network constructed for use during any future potential groundwater treatment is described herein; however, the associated groundwater monitoring plan that will determine the need for additional injections is included in Section 3.3.1 of this SMP. A copy of this Operation and Maintenance Plan, along with the complete SMP, will be kept at the Site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of the SMP.

4.2 Engineering Control System Operation and Maintenance

4.2.1 Sub-Slab Depressurization System (SSDS)

Intrusion of contaminated soil vapor within the Site building is prevented by an active SSDS which applies negative pressure under the entire basement and first floor building slabs, collects and treats contaminated vapor, and subsequently discharges the vapor to the atmosphere above the roof the Site building. The Site-specific design for the SSDS was developed during communication testing performed in July 2013 as part of the remedial action. Design of the granular activated carbon (GAC) treatment units was performed based on a conservative estimate of total VOCs detected during previous soil vapor sampling events completed as part of the RI.

The major components of the SSDS include:

- Seven SSDS pits (P-1 through P-7) and associated solid 4-inch PVC piping in sub-slab trenches, including six throughout the first floor of the building and one in the basement;
- A connected section of slotted 4-inch PVC piping (SP-8) bedded in a gas permeable aggregate layer (clean 1 and ½-inch stone) above the soil removal area in the central portion of the Site;
- An appropriately sized piping connection manifold that also acts as a condensate collection tank;

- One appropriately sized 15 HP blower (Model FPZ, Inc. K11-MS-15) with a variable-frequency drive (VFD) to generate the necessary design vacuum and air flow located in the basement of the Site building;
- One back-up/reduced sized 10 HP blower (Model FPZ, Inc. K11-MS-10) to be stored or used in the basement of the Site building;
- Two appropriately sized GAC units (Model Tetrasolv VR-400) located in the basement adjacent to the blower to treat contaminated soil vapor;
- Effluent stack consisting of an 8-inch steel riser pipe extending from the basement through the first and second floors and terminating a minimum of 10 feet from any air intakes/vents and the east-adjacent garage or apartment buildings;
- An exhaust fan (Model S&P PV100) located in the basement extending from the basement through the first and second floors and terminating above the roof of the Site building; and
- A 15-mil vapor barrier (StegoWrap®) installed over the soil removal area.

The SSDS pits, associated piping, and the vapor barrier were installed at the Site between May and August 2014. The SSDS blower, GAC units, exhaust stack, and exhaust fan were installed at the Site between August 2014 and September 2014. The SSDS began operating on November 5, 2014. As-built drawings for the SSDS are included in Appendix I and SSDS component manuals are included in Appendix J.

4.2.1.1 SSDS Scope

The SSDS is designed to operate continuously, 24 hours a day, 7 days a week, 365 days a year, without any required adjustments or repairs, beyond routine maintenance items discussed in Section 4.2.1.4. Manufacturer's specifications for each of the SSDS components are included in Appendix J, and the troubleshooting guide, included as Appendix K, should be consulted prior to any repairs or adjustments that may become necessary. Regular system inspections, operation parameter documentation and performance assessment guidelines are detailed in Section 4.3 of this SMP.

4.2.1.2 System Start-Up and Testing

The SSDS is already in operation at the Site. After any future event that requires SSDS start-up, the following inspections and testing will be performed to ensure the system is balanced:

- Confirmation of acceptable air flow rate (50 to 100 cfm) from each of the SSDS pits and the slotted piping by a visual inspection of gauges affixed to each of the manifold legs;
- Confirmation of acceptable vacuum readings from each of the SSDS pits (.5 to 5 inches of H_2O) and the slotted piping (.1 to .5 inch of H_2O) by a visual inspection of gauges affixed to each of the manifold legs and use of an appropriate manometer or portable vacuum gauging device;
- Confirmation of acceptable negative pressure (a minimum of 0.005 inches of H_2O) beneath the entire first floor/basement slab from monitoring points MP-1 through MP-4 through the manual access of each point and use of an appropriate manometer or portable vacuum gauging device; and

- As applicable, following the initial startup and any prolonged period of time that the system is down (greater than 48 hours) and requires a re-start, confirmatory indoor air and extracted vapor sampling will be performed in consultation with NYSDEC and NYSDOH in accordance with Sections 3.3.3 and 3.3.4 of this SMP.

4.2.1.3 System Operation: Routine Operation Procedures

Operation of the SSDS will be monitored in accordance with the frequency and detail set forth in Sections 3.3, 4.3, and Table 5 of this SMP. Monitoring of the SSDS will consist of a visual inspection of the complete system including checking to confirm that the SSDS blower is operating properly, observing all associated air flow and vacuum gauges and alarms to confirm system diagnostics, and identification and repair of any system malfunctions or problems (i.e. leaks, cracks, collection of condensation, etc.).

The SSDS will operate continuously at the Site and not be discontinued without written approval by NYSDEC and NYSDOH. A proposal to discontinue the SSDS will be submitted by the property owner based on confirmatory data that justifies the request. The SSDS will remain in place and operational until permission to discontinue use is granted in writing by NYSDEC and NYSDOH. Details pertaining to performance monitoring are included in Section 4.3 of this SMP.

4.2.1.4 System Operation: Routine Equipment Maintenance

A tentative schedule for SSDS routine equipment maintenance work is provided in the following table, and will be completed as needed during the appropriate routine or detailed inspection as cross-referenced with Table 5 and Section 3 of this SMP:

Table 7
SSDS Routine Maintenance Details

Monitoring Inspection or Sampling Type	Frequency	Maintenance Task
SSDS Routine Operations Inspection	Monthly Basis for first 6 months of operation, Quarterly Thereafter for 12 months, and at least Annually Thereafter	System Inspections
SSDS Detailed Operation Inspection	Quarterly Basis for 1 Year, and at least Annually Thereafter	System Components

System Inspections:

The routine check will consist of a visual inspection noting the individual flow rate and vacuum readings for each of the SSDS pits and the slotted piping from the gauges in the basement. The routine check will also note any alarms or

unusual conditions (e.g., unusual odors, spills, leaks, blower noise etc.). Typical routine maintenance items that should be addressed during these inspections include:

- Confirmation that the blower is operating and air is discharging through the exhaust piping to the roof;
- Confirmation that the gauges on each manifold leg are clean and within normal ranges;
- Confirmation that the exterior of the SSDS control panel is clean; and
- Confirmation of the level of moisture/condensate collected in the manifold/collection header.

In the event that the moisture/condensate level is approaching alarm level, or any other alarm or unusual condition is identified, consult Appendix J for SSDS component manuals and the troubleshooting guide in Appendix K, and notify a key contact listed in Table 3 of this SMP. Any maintenance completed for the SSDS should be documented in the Maintenance Log included in Appendix L.

System Component Maintenance:

The detailed operations check will be performed to identify/rectify operations-based maintenance items, such as malfunctioning SSDS pits, piping runs, and/or other system components. Typical detailed maintenance items that should be addressed during these inspections include:

- Confirm/assess blower performance and integrity;
- Assess inlet particulate on blower and determine need for replacement;
- Confirm/assess the need to transfer moisture/condensate to the on-site collection drum and associated off-site disposal of moisture/condensate collection drum;
- Confirm/assess the operation of GAC units and the need for GAC replacement;
- Confirm/assess the operating condition of vacuum monitoring points MP-1 though MP-4; and
- Confirm/assess the structural integrity of concrete floor slabs overlying constructed SSDS pits and piping runs.

In the event that a condition warranting system component maintenance is identified, the appropriate reporting and maintenance should be conducted immediately. Procedures for sampling drummed purge water prior to off-site disposal are provided in the QAPP. Manufacturer's recommendations for system component maintenance are included in the component manuals in Appendix J and the troubleshooting guide is included in Appendix K. Any maintenance completed for the SSDS should be documented in the Maintenance Log included in Appendix L.

4.2.1.5 System Operation: Non-Routine Equipment Maintenance

In most instances, non-routine maintenance will be required due to operating conditions that are governed by the SSDS alarms and system telemetry which will operate on a dedicated internet connection. The primary objective of system

telemetry is to notify personnel when operating conditions are likely to reduce or otherwise compromise efficiency, which could lead to the uncontrolled intrusion contaminated soil vapor into the Site building.

The system telemetry will also notify AKRF personnel when operating conditions could cause damage to the SSDS equipment. The SSDS includes the alarm systems as noted in Section 4.3.3 and Table 7 (also in Section 4.3.3).

Most damage or problems associated with SSDS components will trigger one of the alarms listed in Table 8. In the event of a power outage at the Site, the system is equipped with a battery operated by-pass valve that would initiate passive ventilation directly to the exhaust stack without the use/need of the blower. Damage to any SSDS components will be noted in the routine and detailed system inspections and remedied upon identification.

Accumulated condensate will be containerized in a 55-gallon drum for future off-Site disposal. Procedures for sampling drummed purge water are provided in the QAPP. Manufacturer's recommendations for system component maintenance are included in the component manuals in Appendix J and the troubleshooting guide is included in Appendix K. Any maintenance completed for the SSDS should be documented in the Maintenance Log included in Appendix L.

In the event that low SSDS air flow rates or vacuum are observed anywhere in the system, further system balancing may be necessary following moisture removal, to ensure that the combined air flow rates and vacuum in a given area of the Site achieve the minimum design requirements. Throttling valves for individual SSDS lines are located on the manifold legs as shown on Figure 18 and in Appendix I.

4.2.2 Soil Vapor Extraction (SVE) Well

The treatment of residual TCE-contaminated soil left in place at the Site (due to physical and structural constraints) is performed through the operation of a SVE well. The Site-specific design for the SVE well was developed based on the location of residual TCE-contaminated soil and field observations during its installation in March 2014. The SVE well is connected to the SSDS blower, collects and treats contaminated vapor encompassing remaining TCE-contaminated soil, and subsequently discharges the vapor through the same exhaust stack as the SSDS. The major components of the SVE well include:

- A ten-foot section of screened 4-inch PVC piping, which targets a treatment interval starting from the bottom of the concrete vault at approximately 10 feet below first floor grade and terminates at approximately 20 feet below first floor grade;
- A ten-foot section of solid 4-inch PVC riser piping with a 4-inch by 4-inch tee connector to a solid 4-inch PVC piping run connected to the SSDS/SVE blower located in the basement;
- A 4-inch fitted expansion plug; and
- An 8-inch flush-mounted access manhole installed into the restored concrete slab.

The SVE well was installed at the Site in March 2014. The SSDS began operating with inclusion of the SVE well on November 5, 2014. As-built

drawings for the SVE well are included in Appendix I and SSDS/SVE component manuals are included in Appendix J.

4.2.2.1 SVE Well Scope

The SVE well is designed to operate continuously with the SSDS, 24 hours a day, 7 days a week, 365 days a year, without any required adjustments or repairs, beyond routine maintenance items discussed in Section 4.2.2.4. Manufacturer's specifications for each of the SVE components are included in Appendix J, and these specifications and the troubleshooting guide, included as Appendix K, should be consulted prior to any repairs or adjustments that may become necessary. Regular system inspections, operation parameter documentation, and performance assessment guidelines are detailed in Section 4.3 of this SMP.

4.2.2.2 SVE Well Monitoring

The SVE well is already in operation at the Site. After any future event that requires SSDS/SVE well start-up, the following inspections and testing will be performed to ensure the SVE well is balanced with the rest of the system:

- Confirmation of an acceptable air flow rate (10 to 30 cfm) from the SVE well by a visual inspection of the gauges affixed to the SVE manifold leg;
- Confirmation of acceptable vacuum readings (15 to 25 inches of H_2O) from the SVE well by a visual inspection of the gauges affixed to the SVE manifold leg; and
- Confirmation of integrity and seal of the SVE well manhole and expansion plug/manual access point of through visual inspection.

4.2.2.3 SVE Well Operation: Routine Operation Procedures

Operation of the SVE well will be monitored in accordance with the frequency and detail set forth in Section 3.3 and Table 5 of this SMP. Monitoring of the SVE well will consist of a visual inspection of the associated air flow and vacuum gauges, and alarms to confirm system diagnostics, and identification and repair of any system malfunctions or problems (i.e. leaks, cracks, collection of condensation, etc.).

The SVE well will operate continuously with the SSDS at the Site and not be discontinued without written approval by NYSDEC. A proposal to discontinue the SVE well will be submitted by the property owner based on confirmatory data that justifies the request. The SVE well will remain in place and operational until permission to discontinue use is granted in writing by NYSDEC. Details pertaining to equipment monitoring are included in Section 4.3 of this SMP.

4.2.2.4 SVE Well Operation: Routine Equipment Maintenance

The tentative schedule for the routine equipment maintenance work for the SVE well will be conducted in accordance with Table 6, and will be completed as needed during the appropriate routine or detailed inspection as cross-referenced with Table 5 and Section 3 of this SMP.

In the event that a condition warranting SVE well component maintenance is identified, the appropriate reporting and maintenance will be conducted immediately. Generally, any routine maintenance that would be performed for the SSDS would cover the operation of the SVE well. The troubleshooting guide

is included in Appendix K. Any maintenance completed for the SVE well should be documented in the Maintenance Log included in Appendix L.

4.2.2.5 SVE Well Operation: Non-Routine Equipment Maintenance

In most instances, non-routine maintenance will be required due to operating conditions that are governed by the SSDS/SVE alarms and system telemetry. The primary objective of system telemetry is to notify personnel when operating conditions are likely to reduce or otherwise compromise efficiency, which could lead to the uncontrolled intrusion contaminated soil vapor into the Site building.

The system telemetry will also notify AKRF personnel when operating conditions could cause damage to the SSDS/SVE equipment. The SSDS/SVE includes the following alarm systems as noted in Table 7 in Section 4.3.3.

The SVE well may need to be reinstalled based on performance monitoring and Site inspection findings. If required, the SVE well will be replaced according to the specifications detailed in the QAPP. Any maintenance completed for the SVE well will be documented in the Maintenance Log included in Appendix L.

The NYSDEC will be notified prior to the decommissioning of the SVE well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Period Review Report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. If the SVE well is decommissioned because it has been rendered unusable, a replacement well will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

4.2.3 ISCO Groundwater Treatment

In the event that groundwater monitoring completed as part of this SMP indicates the need for additional groundwater treatment, injection activities would be performed through the injection well access manifold installed in the Site building basement. The manifold provides access to tubing connected to each of the existing 24 injection wells located beneath the Site building, as shown on Figure 17.

If required, in-situ treatment would utilize chemical oxidation to further reduce the contaminant mass in the overburden groundwater aquifer in the central portion of the Site where groundwater concentrations of TCE and BTEX compounds remain. The type of oxidant used during any potential future event may be altered from the type of oxidant used during the initial rounds of groundwater treatment depending on results of the groundwater monitoring program. The type of oxidant and proposed dosage amounts will be submitted for NYSDEC approval prior to implementation at the Site. Any additional groundwater treatment activity would be performed from the Site building basement and while the building is unoccupied. Injection pressure and flow rates would be monitored to ensure the successful delivery of the treatment chemicals, and visual inspections of the first floor of the Site building would be performed to confirm that daylighting of the chemical through the building's cover system does not occur. The SSDS would remain operational during the completion of any groundwater treatment activities; however, the applied vacuum to the SVE well would be reduced or temporarily discontinued during the completion of the injections to prevent the collection of treatment chemical into the condensate collection header (and allow for proper dosing/treatment in that area of the Site).

With the exception of dosage types and amounts (or otherwise noted herein), the ISCO injections would be performed in accordance with the NYSDEC-approved Groundwater Treatment RDWP and all associated quality assurance/quality control measures (which also include the QAPP, HASP, and CAMP).

4.3 SSDS and SVE Performance Monitoring

An active SSDS has been installed at the Site to prevent the potential for vapor intrusion into the building and will operate continuously in conjunction with a SVE well to treat residual TCE-contaminated soil left in place at the Site. The SSDS and SVE well began operating at the Site on November 5, 2014. As-built drawings for the SSDS and SVE well are included in Appendix I and the SSDS/SVE component manuals are included in Appendix J. Details pertaining to the performance monitoring of these ECs are outlined below.

4.3.1 SSDS and SVE Monitoring Schedule

The operation of the SSDS and SVE well components will be confirmed by two different levels of inspections identified as "routine" or "detailed" to be performed by appropriate personnel. An RFLP or current owner representative trained by an environmental consultant under the direction of the Remedial Engineer will conduct routine system checks on a monthly basis for the first six months after operation, with weekly checks during the first month of operation. The routine check will consist of confirming the blower is operating properly in all areas of the Site with individual flow rate and vacuum readings for each of the SSDS pits, slotted piping, and the SVE well within accepted ranges. The routine check will also note any unusual conditions (e.g., unusual odors, spills, leaks, blower noise etc.).

Detailed SSDS/SVE operations checks will be performed by an environmental consultant to RFLP or current owner on a quarterly basis for the first year after operation. The detailed inspections will consist of individual SSDS pit, SSDS slotted pipe, and SVE well gauge readings, blower inspections, alarm checks, and field screening the influent, intermediate, and effluent ports of each of the carbon treatment units for total VOC concentrations using a PID. The four sub-slab vacuum monitoring points (MP-1 through MP-4) installed at the Site will also be checked during each of these detailed inspections to ensure that key indicator locations remain under vacuum. The monitoring schedule is included as Table 5 in Section 3 of this SMP. SSDS and SVE monitoring forms to be used during the inspections are included in Appendix G.

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 SSDS or SVE well has been reported or an emergency occurs that is deemed likely to affect the operation of the system. Monitoring deliverables for the SSDS and SVE system are specified later in this Plan.

4.3.2 SSDS and SVE Equipment Monitoring

4.3.2.1 Routine Monitoring Inspections

The following list of items will be noted and inspected during Routine Monitoring Inspections performed on a Monthly Basis:

- Note if the blower is running and if there are any alarm conditions present;

- Identify any unusual odors, spills, or leaks in the basement or first floor of the Site building;
- Note that the air flow rate in cubic feet per minute (cfm) from each of the SSDS and SVE lines falls into the accepted range by a visual inspection and conversion of pitot tubes/magnehelic gauges affixed to each of the manifold legs;
- Note that the measured vacuum pressure readings in inches of H_2O from each of the SSDS and SVE lines falls into the accepted range by a visual inspection of magnehelic gauges affixed to each of the manifold legs; and
- Note structural integrity of exhaust piping within the Site building.

4.3.2.2 *Detailed Monitoring Inspections*

The following list of items will be noted and inspected during Detailed Monitoring Inspections performed on a Quarterly Basis:

- Note measured air flow rate in cubic feet per minute (cfm) from each of the SSDS and SVE lines by a visual inspection and conversion of pitot tubes/magnehelic gauges affixed to each of the manifold legs;
- Note measured vacuum pressure readings in inches of H_2O from each of the SSDS and SVE lines by a visual inspection of magnehelic gauges affixed to each of the manifold legs and use of an appropriate manometer or portable vacuum gauging device;
- Note vacuum pressure reading in inches of H_2O from monitoring points MP-1 through MP-4 through the manual access of each point and use of an appropriate manometer or portable vacuum gauging device;
- Note pre- and post-blower temperature of effluent vapor;
- Note temperature of blower enclosure;
- Note PID readings of ambient outdoor air, ambient air in basement and PID readings of influent, intermediate, and effluent sample ports on each of the two GAC units;
- Note level of condensate collected in manifold/collection tank during operation (perform transfer of condensate to 55-gallon drum as necessary);
- Note approximate level of total condensate collected in on-site 55-gallon drum;
- Inspect and note structural integrity of exhaust stack on the roof of the Site building; and
- As applicable, following any event that requires re-start of the system, confirmatory indoor air and extracted vapor sampling will be performed in consultation with NYSDEC and NYSDOH in accordance with Sections 3.3.3 and 3.3.4 of this SMP.

A visual inspection of the complete SSDS and SVE system will be conducted during each respective monitoring event. . SSDS and SVE Operations and Sampling Log forms to be utilized during the respective monitoring events that include a complete list of components to be checked are included in Appendix G. If any equipment readings are not within their typical range, any equipment is

observed to be malfunctioning, or the system is not performing within specifications, maintenance and repair as per the Operation and Maintenance Plan are required immediately, and the SSDS and SVE system restarted.

4.3.3 System Monitoring Devices and Alarms

In addition to this schedule of inspections and sampling events, the alarm system associated with the SSDS/SVE system is equipped with an internet connection and cellular service which will send an automatic notification to a designated contact list in the event of a power outage or blower/system failure at the Site. The SSDS/SVE system includes the following alarm systems:

Table 8

SSDS/SVE Alarm Types

Alarm	Equipment/Media Monitored	Parameters
Alarm 1	Inlet manifold collection chamber (header)	High Level Switch is triggered upon the collection of too much moisture
Alarm 2	Blower	Low Influent Vacuum alarm is triggered upon the identification of less than 4 inches of H_20
Alarm 3	Effluent Vapor	High Discharge Temperature alarm is triggered at temperatures greater than 125 °F
Alarm 4	Blower Enclosure	High Internal Temperature alarm within Sound Enclosure is triggered at temperatures greater than 104 °F

The SSDS and SVE system has a warning device to indicate that the system is not operating properly. In the event of a power outage at the Site, the system is equipped with a battery operated by-pass valve that would initiate passive ventilation directly to the exhaust stack without the use/need of the blower. In the event that the warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SSDS and SVE system will be restarted. Operational problems will be noted in the subsequent Periodic Review Report.

4.3.4 Sampling Event Protocol

4.3.4.1 Indoor Air Sampling

To confirm indoor air quality during the operation of the SSDS and SVE system, one round of indoor air samples will be collected from within the Site building during the first heating season following system startup and operation (November 15, 2014 to March 31, 2015) in accordance with the NYSDOH Vapor Intrusion Guidance Document.

The need to perform additional rounds of indoor air sampling will be determined based on field screening, associated laboratory analytical results, or the request to decommission or terminate components of the SSDS or the SVE well with the

approval of NYSDEC. This SMP will be modified to reflect any changes in sampling plans approved by NYSDEC.

Additional details pertaining to the sample collection and methodology for indoor air sampling are included in Section 3.3.3 of this SMP and the QAPP.

4.3.4.2 Effluent Vapor Sampling

Samples of the SSDS and SVE effluent will be collected twice during the first year of operation: following initial startup and then 6 months of operation for laboratory analysis to more accurately assess the VOC concentrations in extracted soil vapor from the entire Site, and the condition and lifespan of the GAC units. Sampling of extracted soil vapor from the individual SSDS and SVE piping lines, the influent, intermediate, and effluent ports of each of the carbon treatment units will be sampled as necessary and as determined based on previous results and in consultation with NYSDEC.

The sampling frequency outlined above and listed in Table 5 may be modified based on field screening and associated laboratory analytical results with the approval of NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

Additional details pertaining to the sample collection and methodology for effluent vapor sampling are included in Section 3.3.4 of this SMP and the QAPP.

4.3.4.3 Carbon Sampling

All spent carbon will be disposed of or recycled off-site in accordance with all applicable local and federal regulations on an as-needed basis. Based on requirements of the disposal/recycling facility and waste disposal contractor, a carbon sample may need to be collected for facility acceptance purposes. If so, a representative grab sample of the spent carbon will be collected and submitted for laboratory analysis as detailed in the QAPP, provided as Appendix H. Documentation associated with carbon disposal and replacement will be subject to the reporting requirements and system checks as discussed in Section 3.6 and 5.0.

4.3.4.4 Condensate Water Sampling

All condensate water collected from the manifold header and transferred to 55-gallon drums will be disposed of off-site in accordance with all applicable local and federal regulations on an as-needed basis. Based on requirements of the disposal/recycling facility and waste disposal contractor, a condensate water sample will be collected for facility acceptance purposes. A representative condensate water sample will be collected from each 55-gallon drum to be disposed of and submitted for laboratory analysis as detailed in the QAPP, provided as Appendix H. Documentation associated with condensate water disposal will be subject to the reporting requirements and system checks as discussed in Section 3.6 and 5.0.

4.4 Maintenance and Performance Monitoring Reporting Requirements

Maintenance reports and any other information generated during regular operations at the Site will be kept on-file on-site. All reports, forms, and other relevant information generated will be available upon request to the NYSDEC and submitted as part of the Periodic Review Report, as specified in the Section 5 of this SMP.

4.4.1 Routine Maintenance Reports

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

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

4.4.2 Non-Routine Maintenance Reports

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

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

5.0 INSPECTIONS, REPORTING, AND CERTIFICATIONS

5.1 Site Inspections

5.1.1 Inspection Frequency

All inspections will be conducted at the frequency specified in the schedules provided in Section 3 Monitoring Plan and Section 4 Operation and Maintenance Plan of this SMP. At a minimum, a site-wide inspection will be conducted annually. Inspections of remedial components will also be conducted when a breakdown of any treatment system component has occurred or whenever a severe condition has taken place, such as an erosion or flooding event that may affect the ECs.

5.1.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on the appropriate forms for the SSDS and SVE system and for the ISCO treatment system which are contained in Appendix G and Appendix H. A checklist developed to guide the completion of each of the respective forms during Operation and Maintenance Monitoring is incorporated in these forms. A general site-wide inspection form will be completed during the site-wide inspection (see Appendix H). These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including all media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format in the Periodic Review Report.

5.1.3 Evaluation of Records and Reporting

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

- EC/ICs are in place, are performing properly, and remain effective;
- The Monitoring Plan is being implemented;
- Operation and maintenance activities are being conducted properly; and, based on the above items,
- The Site remedy continues to be protective of public health and the environment and is performing as designed in the RAWP and FER.

5.2 Certification of Engineering and Institutional Controls

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

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

- The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;
- The institutional control and engineering controls employed at this Site are unchanged from the date the controls were put in place, or last approved by the NYSDEC;

- 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 NYSDEC to evaluate the remedy, including access to evaluate the continued maintenance of the engineering controls;
- If a financial assurance mechanism is required under the oversight document for the Site, the mechanism remains valid and sufficient for the intended purpose under the document;
- Use of the Site is compliant with the environmental easement;
- The engineering control systems are performing as designed and are effective;
- No new information has come to my attention, including groundwater monitoring data from wells located at the Site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid; and
- 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.
- I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Designated Site Representative] and [I have been authorized and designated by all site owners to sign this certification] for the Site.

  Every five years the following certification will be added:

  - The assumptions made in the qualitative exposure assessment remain valid.

The signed certification will be included in the Periodic Review Report described in Section 5.3 below.

5.3 Periodic Review Report

A Periodic Review Report will be submitted to the Department every year, beginning 18 months after the Certificate of Completion is issued by NYSDEC. 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 Environmental Easement included as Appendix A (Schedule A). The report will be prepared in accordance with NYSDEC DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site;
- Results of the required annual site inspections and severe condition inspections, if applicable;

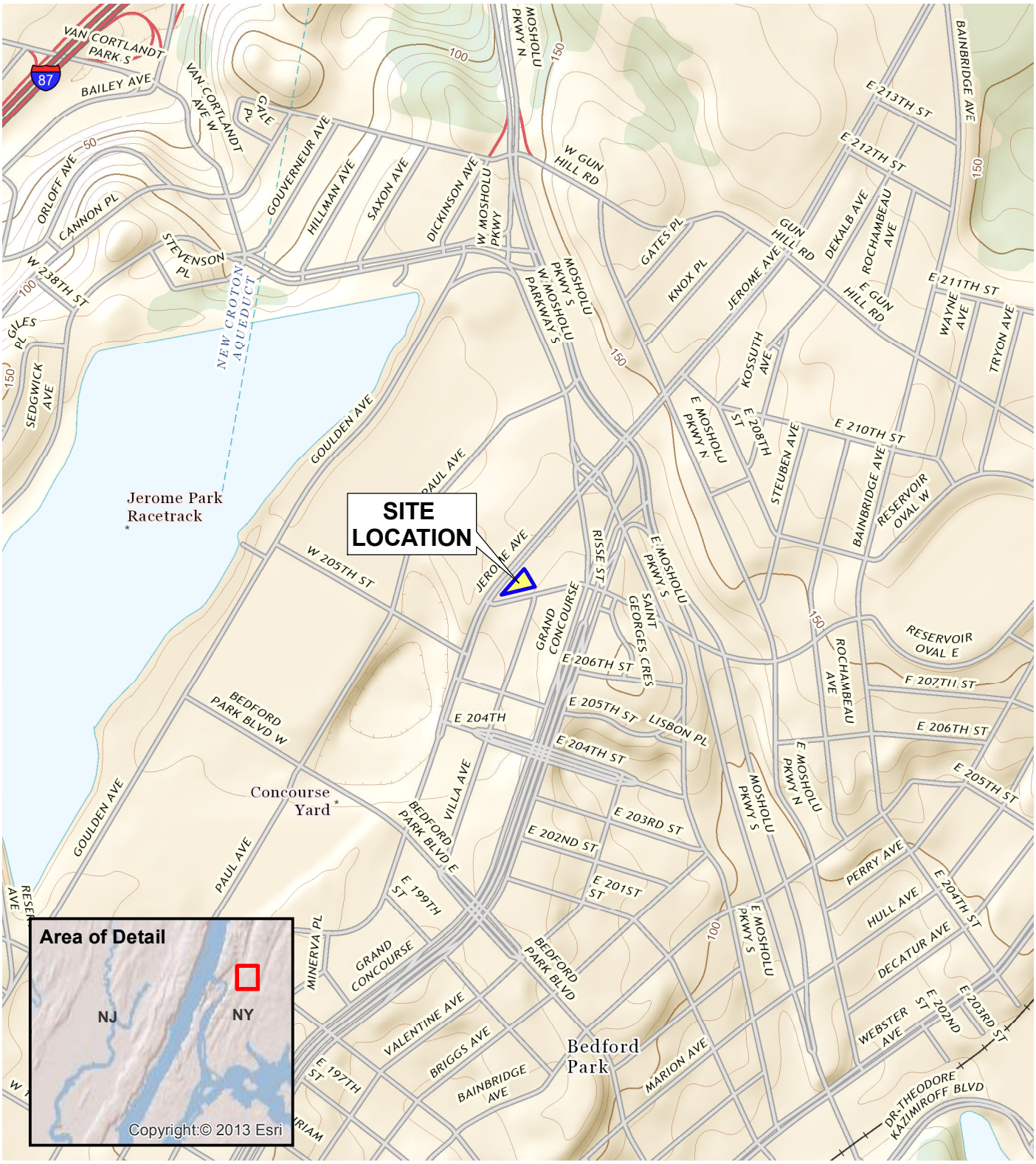
- All applicable inspection forms and other records generated for the site during the reporting period in electronic format;
- A summary of any discharge monitoring data and/or information generated during the reporting period with comments and conclusions;
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends;
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format;
- A site evaluation, which includes the following:
    - The compliance of the remedy with the requirements of the site-specific RAWP or Decision Document;
    - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
    - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring Plan for the media being monitored;
    - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; 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, in hard-copy format, to the NYSDEC Central Office and Regional Office in which the Site is located, and in electronic format to NYSDEC Central Office, Regional Office and the NYSDOH Bureau of Environmental Exposure Investigation.

5.4 Corrective Measures Plan

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

FIGURES



SOURCE
USGS 7.5 Minute Topographic Map
Yonkers Quad 2011

0 1,000 2,000 Feet

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

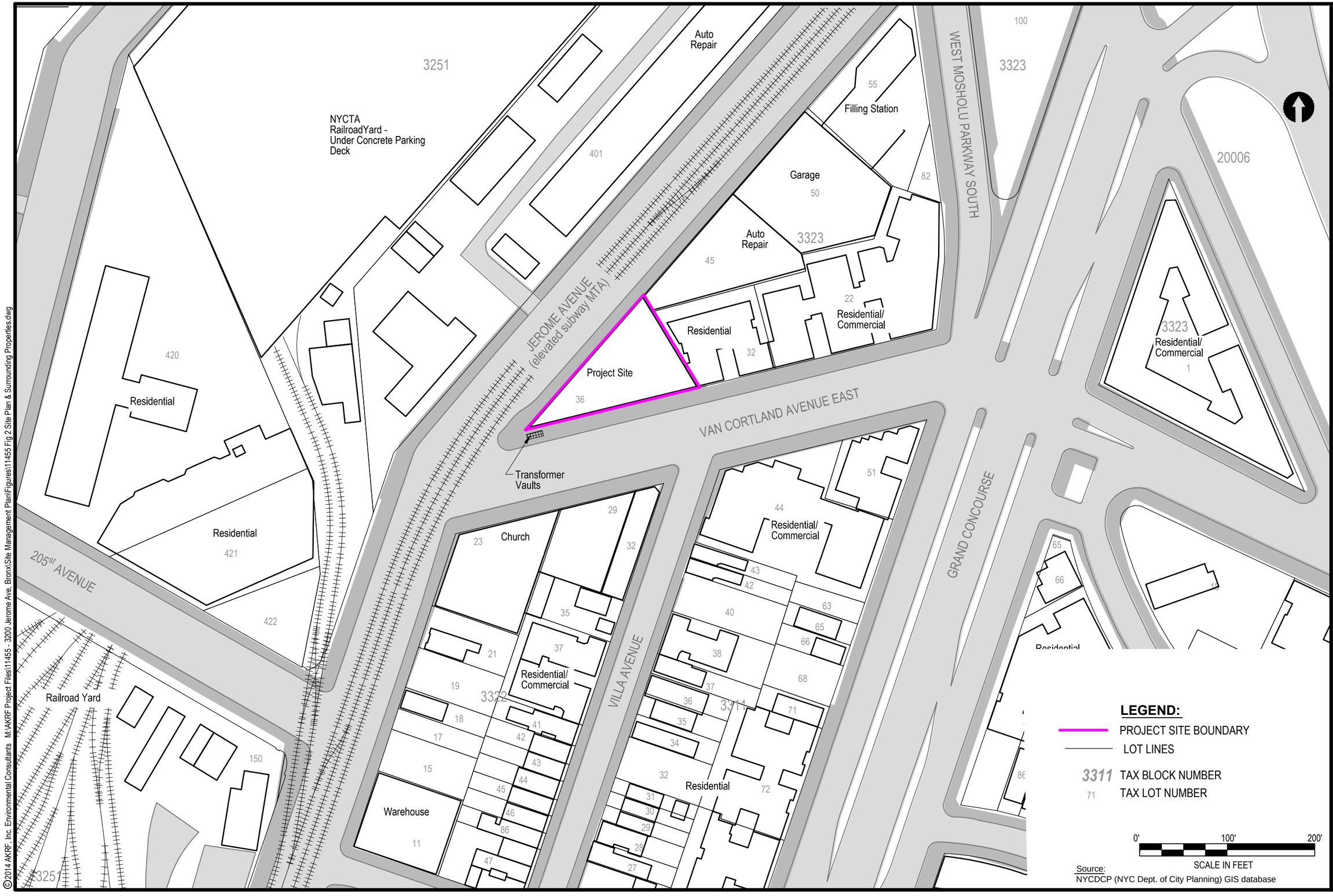
SITE LOCATION

AKRF Engineering, P.C.
440 Park Avenue South, New York, N.Y. 10016

DATE 8/1/2014
PROJECT No. 11455
FIGURE 1

©2013 AKRF, Inc. Environmental Consultants O:\Projects\11455 - 3200 JEROME AVE\11455 Fig 1 loc map SMP.mxd

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 2 Site Plan & Surrounding Properties.dwg



LEGEND:

- PROJECT SITE BOUNDARY
- LOT LINES
- 3311 TAX BLOCK NUMBER
- 71 TAX LOT NUMBER

0' 100' 200'

SCALE IN FEET

Source:
NYCDCP (NYC Dept. of City Planning) GIS database

AKRF Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMP SITE
3200 JEROME AVENUE
BRONX, NEW YORK

SITE LOCATION AND SURROUNDING PROPERTIES

DATE
8.1.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
2

JEROME AVENUE
(elevated subway MTA)

sidewalk

Boiler Room in
Partial Basement
Beneath Kitchen

Toyota Automotive
Storage Garage

SED-1 (sample included rusted metal
shavings from floor drain in basement)

Approximate Extent of Partial Basement

Apartment Building

Janitor's
Closet

SB-1E/
MW-1E

SB-3

SV-3/
TRC-SV3
(in basement)

TRC-IA3/IA-3V

SB-10

SB-11

SV-1/
TRC-SV1

SB-1

SB-12

SB-8

SB-17

SB-16

SB-1A

IA-1/TRC-IA1/
IA-IV

SB-7

SB-19/
MW-1

SB-9

SB-13

SB-20/
MW-3

SB-14

SB-15

SB-6

AA-1/TRC-AMB
AA-IV (on roof)

SB-18

IA-2/TRC-
IA2/IA-2V

SV-2/
TRC-SV2

SB-4

SB-2E

MW-3E-D

SB-2/
MW-2

SB-5

36

SB-22/
MW-5-D

SB-21/MW-4

AA-1 (3/27/11)

A

A'

B

B'

sidewalk

VAN CORTLAND AVENUE EAST

LEGEND

- MW-3E-S — BEDROCK MONITOR WELL LOCATION
- SB-1 — SOIL BORING LOCATION
- SB-2/MW-2 — SOIL BORING/ MONITORING WELL LOCATION
- SED-1 — SEDIMENT SAMPLE LOCATION
- PROJECT SITE BOUNDARY
- SV-1/ TRC-SV1 — SUB-SLAB VAPOR SAMPLING LOCATION
- AA-1/TRC-AMB AA-IV (on roof) — AMBIENT AIR SAMPLING LOCATION
- IA-1/TRC-IA/ IA-IV — INDOOR AIR SAMPLING LOCATION

0' 20' 40'
SCALE IN FEET

AKRF Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GEOLOGICAL CROSS SECTION LAYOUT

DATE
7.29.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
3

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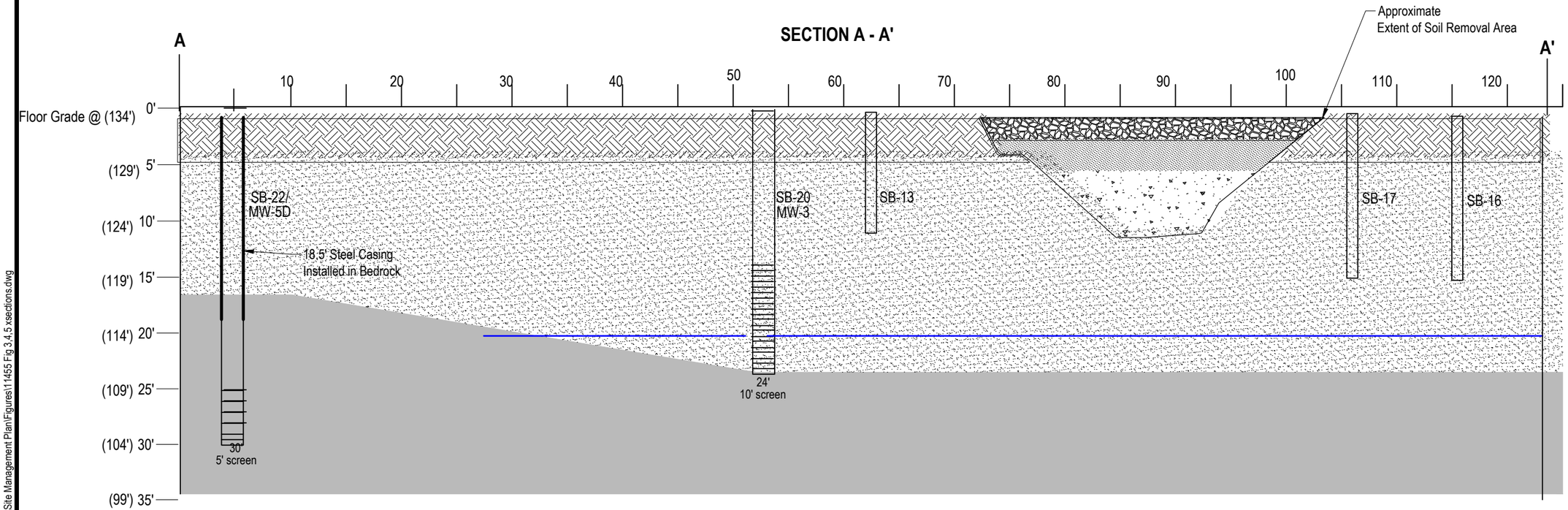
SECTION A - A'



NOTES:

1. INCLUDES SELECT SITE MONITORING WELLS AND BORINGS ALIGNED ON SECTION B-B' AS DISPLAYED ON FIGURE 3.

2. EXTENT OF SOIL REMOVAL AND RESTORATION AREA IS APPROXIMATE. SOIL BORING AND MONITOR WELL LOCATIONS WITHIN THE SOIL REMOVAL AREA HAVE BEEN REMOVED AND REPLACED WITH CONDITIONS ASSOCIATED WITH RESTORATION ACTIVITIES. SEE FIGURES 14 AND 19 FOR SURVEYED DETAILS.

3. APPROXIMATE DEPTH TO OVERBURDEN GROUNDWATER TABLE IS 20 FEET BELOW FIRST FLOOR GRADE.

4. LOCATIONS AND ELEVATIONS OF THE ON-SITE MONITOR WELLS ARE BASED UPON A JANUARY 8, 2013 MONITOR WELL LOCATION SURVEY COMPLETED BY MONTROSE SURVEYING CO., LLP.

LEGEND:

- CLEAN STONE (0-2 FEET)
- CLEAN SAND (2-5 FEET)
- FLOWABLE FILL (CONCRETE) (5-11 FEET)
- FILL 0 < 4 FEET
- GLACIAL TILL 4 < 17 - 24 FEET
- BEDROCK >17 - 24 FEET
- APPROXIMATE OVERBURDEN GROUNDWATER TABLE

AKRF
Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GEOLOGICAL CROSS SECTION A - A'

DATE 8.1.2014

PROJECT NO. 11455

SCALE nts

FIGURE 4

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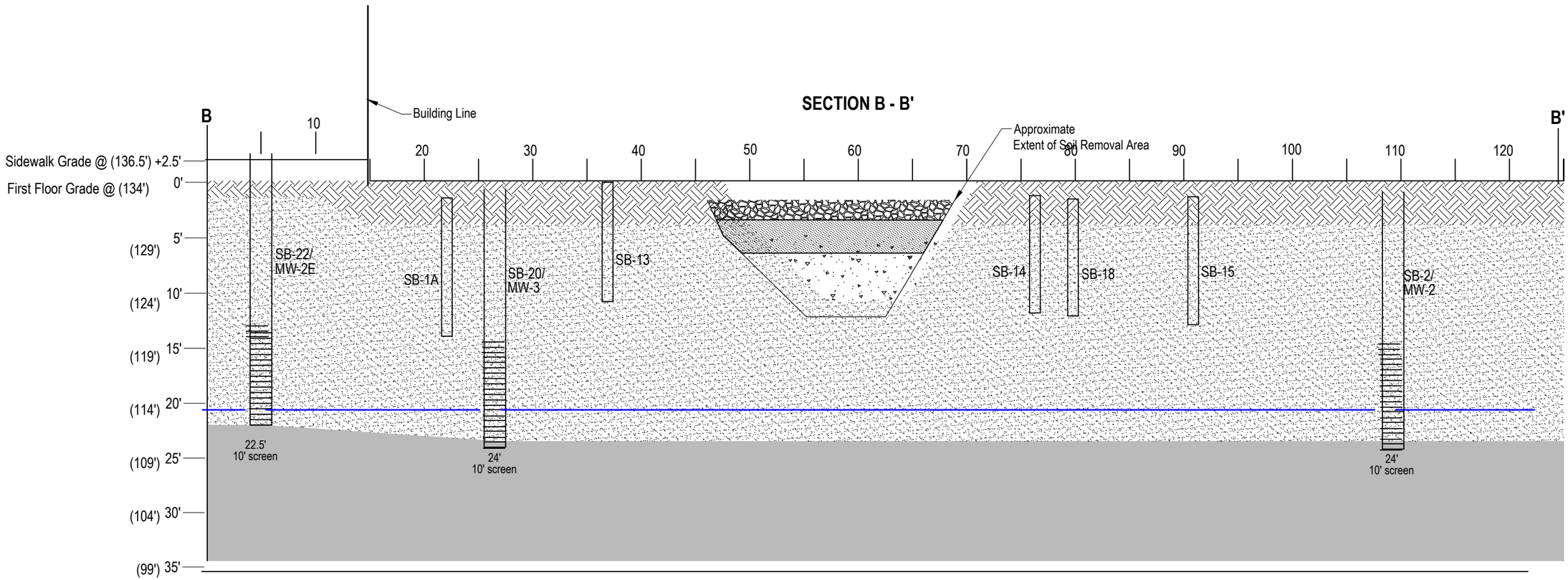
SECTION B - B'



NOTES:

1. INCLUDES SELECT SITE MONITORING WELLS AND BORINGS ALIGNED ON SECTION B-B' AS DISPLAYED ON FIGURE 3.

2. EXTENT OF SOIL REMOVAL AND RESTORATION AREA IS APPROXIMATE. SOIL BORING AND MONITOR WELL LOCATIONS WITHIN THE SOIL REMOVAL AREA HAVE BEEN REMOVED AND REPLACED WITH CONDITIONS ASSOCIATED WITH RESTORATION ACTIVITIES. SEE FIGURES 14 AND 19 FOR SURVEYED DETAILS.

3. APPROXIMATE DEPTH TO OVERBURDEN GROUNDWATER TABLE IS 20 FEET BELOW FIRST FLOOR GRADE.

4. LOCATIONS AND ELEVATIONS OF THE ON-SITE MONITOR WELLS ARE BASED UPON A JANUARY 8, 2013 MONITOR WELL LOCATION SURVEY COMPLETED BY MONTROSE SURVEYING CO., LLP.

LEGEND:

- CLEAN STONE (0-2 FEET)
- CLEAN SAND (2-5 FEET)
- FLOWABLE FILL (CONCRETE) (5-11 FEET)
- FILL 0 < 4 FEET
- GLACIAL TILL 4 < 17 - 24 FEET
- BEDROCK >17 - 24 FEET
- APPROXIMATE OVERBURDEN GROUNDWATER TABLE

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440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GEOLOGICAL CROSS SECTION B - B'

DATE 8.1.2014
PROJECT NO. 11455
SCALE nts
FIGURE 5

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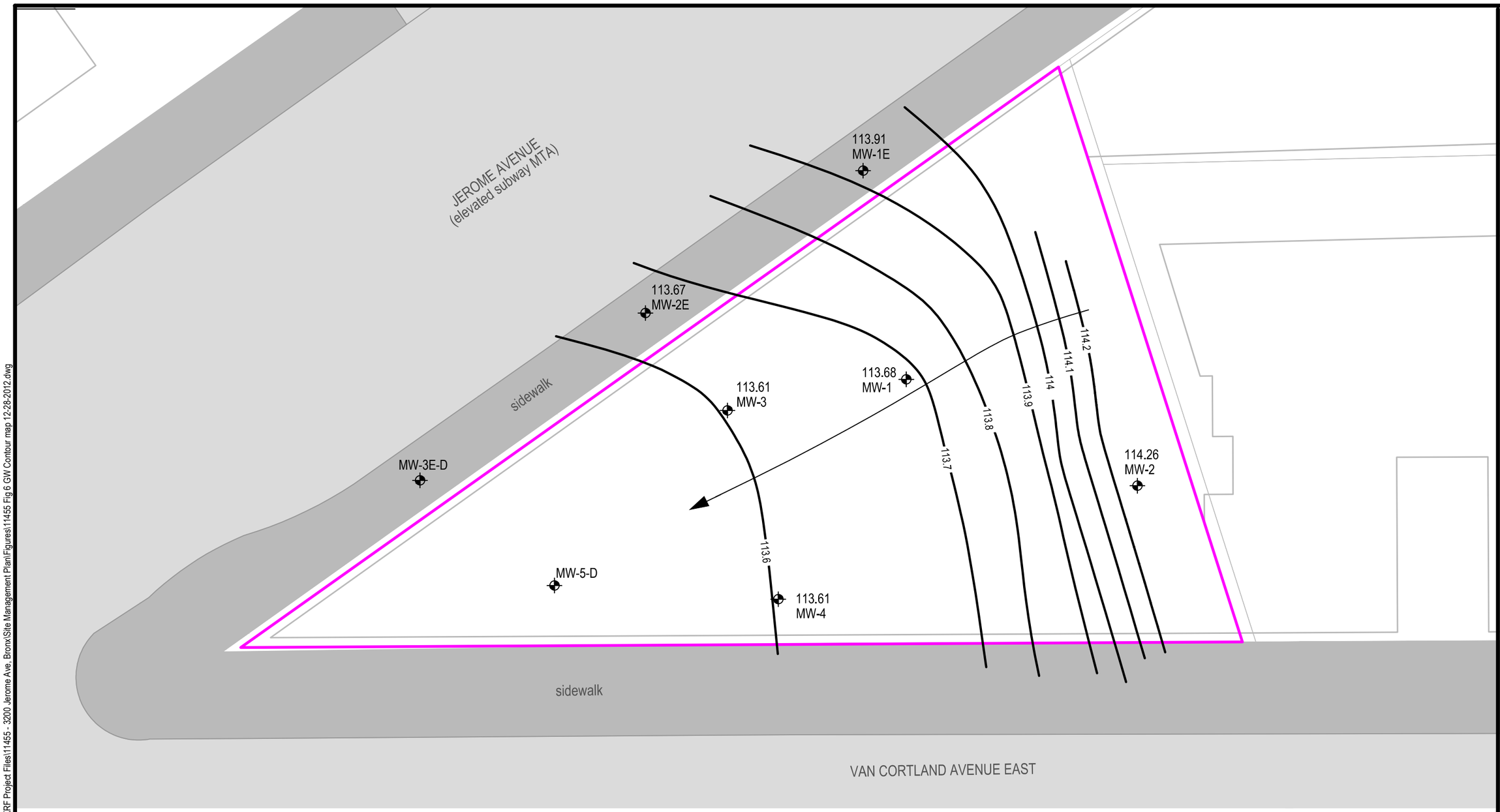

Note:
1. Elevations refer to the borough of the bronx topographical bureau datum which is 2.608 feet above mean sea level.

2. Locations and Elevations of the on-site monitor wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP.

3. Groundwater Elevation Contours shown are based on measurements taken from the Overburden Groundwater Aquifer. Measurements from bedrock wells (MW-3E-D and MW-5-D) were not used.

0' 20' 40'
SCALE IN FEET

LEGEND:

- PROJECT SITE BOUNDARY
- 113.91 MW-1E — EXISTING MONITORING WELL LOCATION WITH WATER TABLE ELEVATION IN FEET
- 114 — GROUNDWATER ELEVATION CONTOUR IN FEET
- INFERRED GROUNDWATER FLOW DIRECTION

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440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GROUNDWATER CONTOUR MAP 12/28/2012

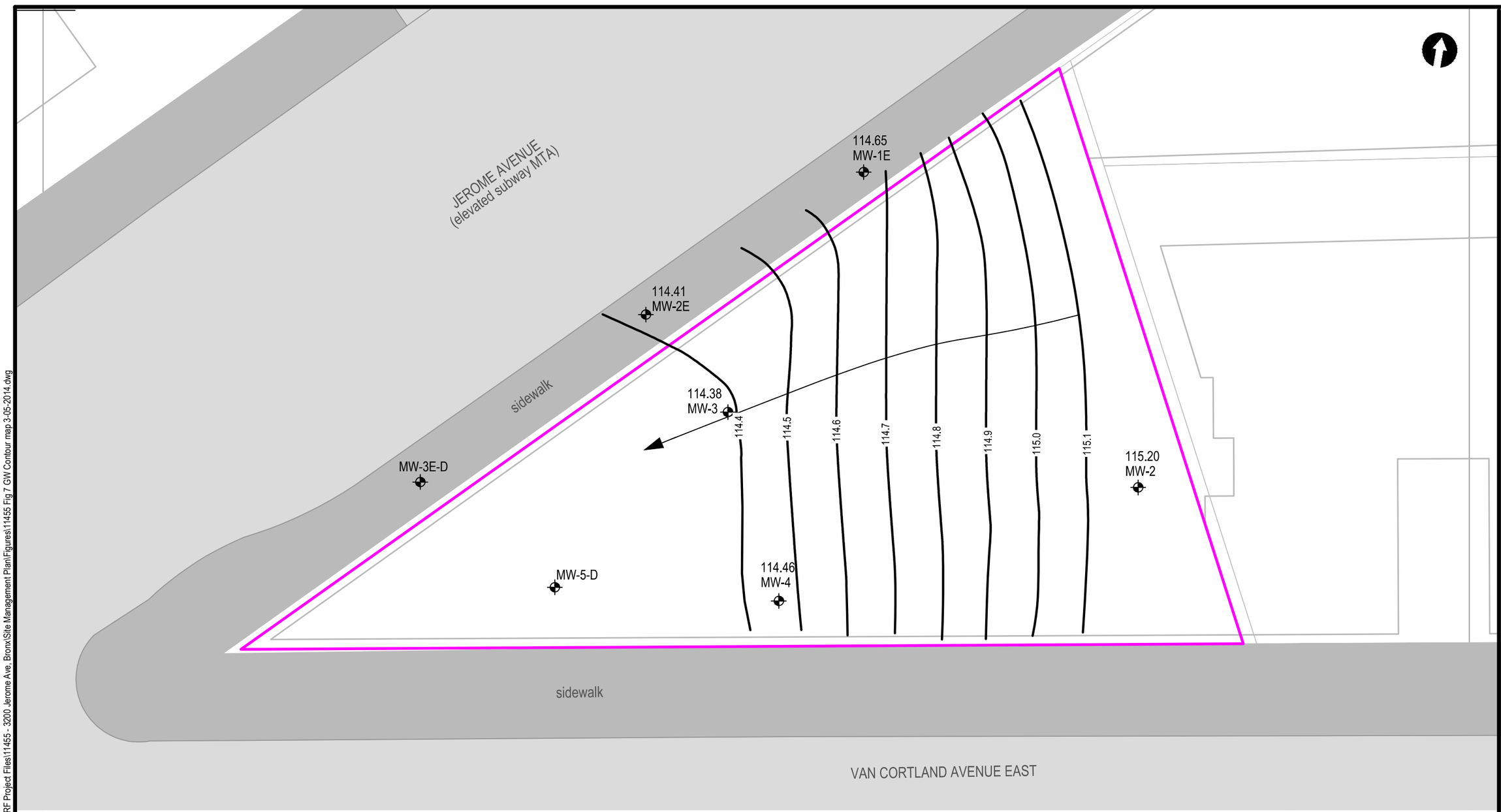
DATE
4.9.2013

PROJECT NO.
11455

SCALE
as shown

FIGURE
6

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 6 GW Contour map 12-28-2012.dwg



Note:
1. Elevations refer to the borough of the bronx topographical bureau datum which is 2.608 feet above mean sea level.

2. Locations and Elevations of the on-site monitor wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP., and subsequent surveying activities completed by DPK Consulting, LLC (revision dated May 13, 2014)

3. Groundwater Elevation Contours shown are based on measurements taken from the Overburden Groundwater Aquifer. Measurements from bedrock wells (MW-3E-D and MW-5-D) were not used.

0' 20' 40'
SCALE IN FEET

LEGEND:

- PROJECT SITE BOUNDARY
- 114.65 MW-1E — EXISTING MONITORING WELL LOCATION WITH WATER TABLE ELEVATION IN FEET
- 114 — GROUNDWATER ELEVATION CONTOUR IN FEET
- INFERRED GROUNDWATER FLOW DIRECTION

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440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GROUNDWATER CONTOUR MAP 3/05/2014

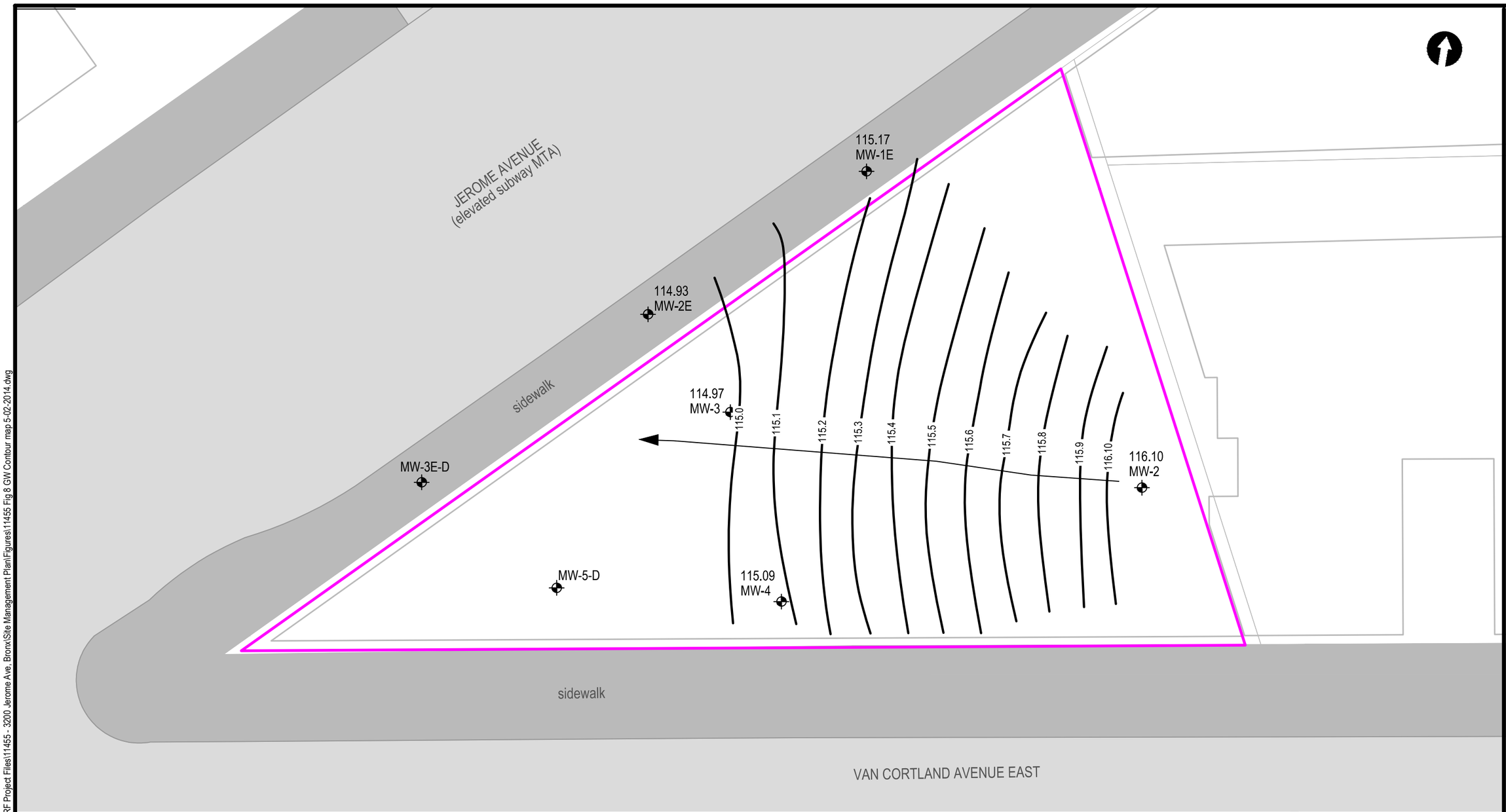
DATE
8.1.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
7

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave. Bronx\Site Management Plan\Figures\11455 Fig 7 GW Contour map 3-05-2014.dwg



Note:
1. Elevations refer to the borough of the bronx topographical bureau datum which is 2.608 feet above mean sea level.

2. Locations and Elevations of the on-site monitor wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP., and subsequent surveying activities completed by DPK Consulting, LLC (revision dated May 13, 2014)

3. Groundwater Elevation Contours shown are based on measurements taken from the Overburden Groundwater Aquifer. Measurements from bedrock wells (MW-3E-D and MW-5-D) were not used.

0' 20' 40'
SCALE IN FEET

LEGEND:

- PROJECT SITE BOUNDARY
- 115.17 MW-1E — EXISTING MONITORING WELL LOCATION WITH WATER TABLE ELEVATION IN FEET
- 114 — GROUNDWATER ELEVATION CONTOUR IN FEET
- INFERRED GROUNDWATER FLOW DIRECTION

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440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GROUNDWATER CONTOUR MAP 5/02/2014

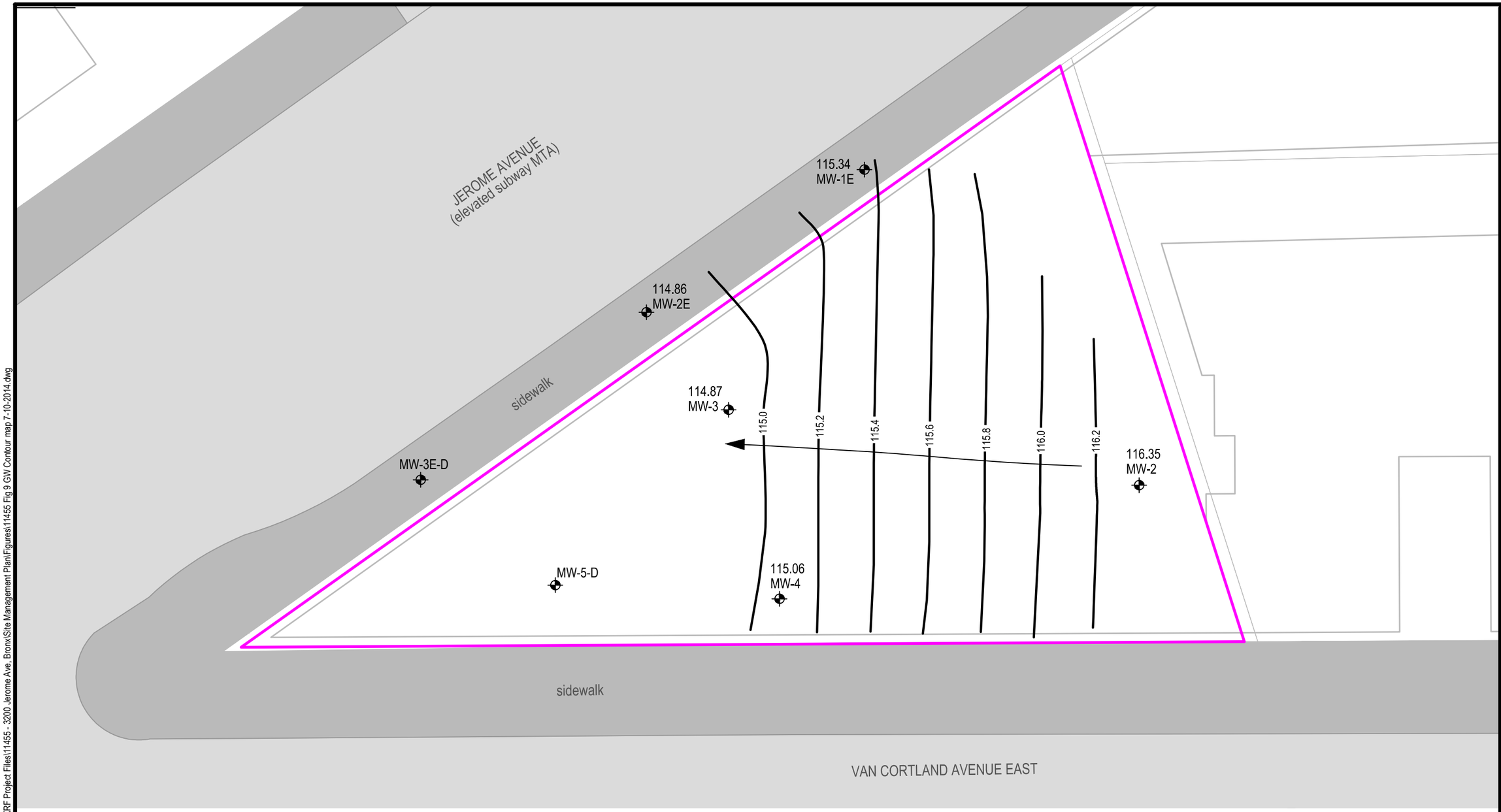
DATE
8.1.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
8

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 8 GW Contour map 5-02-2014.dwg



Note:
1. Elevations refer to the borough of the bronx topographical bureau datum which is 2.608 feet above mean sea level.

2. Locations and Elevations of the on-site monitor wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP., and subsequent surveying activities completed by DPK Consulting, LLC (revision dated May 13, 2014)

3. Groundwater Elevation Contours shown are based on measurements taken from the Overburden Groundwater Aquifer. Measurements from bedrock wells (MW-3E-D and MW-5-D) were not used.

0' 20' 40'
SCALE IN FEET

LEGEND:

- PROJECT SITE BOUNDARY
- 115.34 MW-1E — EXISTING MONITORING WELL LOCATION WITH WATER TABLE ELEVATION IN FEET
- 116 — GROUNDWATER ELEVATION CONTOUR IN FEET
- INFERRED GROUNDWATER FLOW DIRECTION

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440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GROUNDWATER CONTOUR MAP 7/10/2014

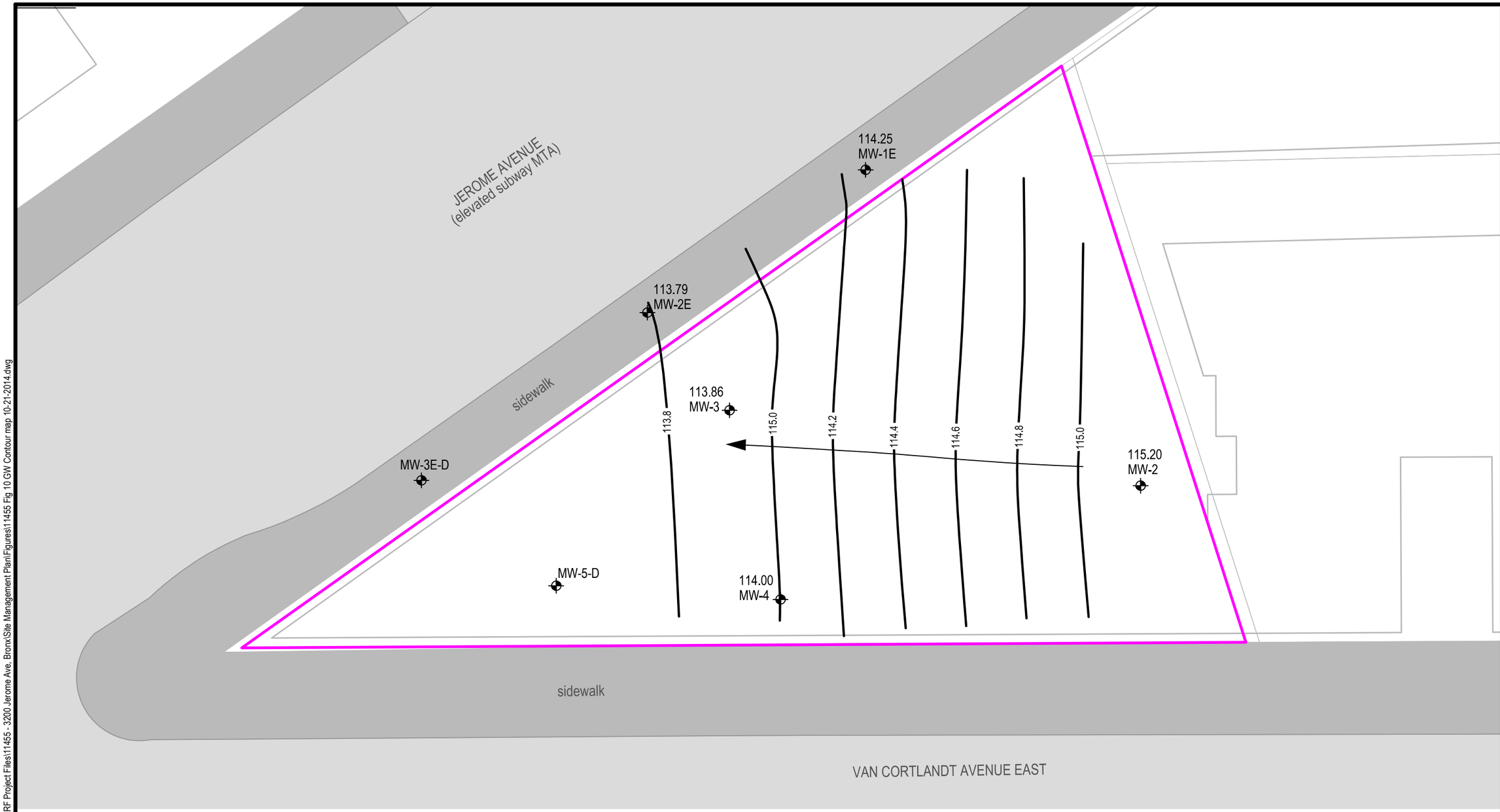
DATE
7.31.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
9

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 9 GW Contour map 7-10-2014.dwg



Note:
1. Elevations refer to the borough of the Bronx topographical bureau datum, which is 2.608 feet above mean sea level.

2. Locations and Elevations of the on-site monitor wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP., and subsequent surveying activities completed by DPK Consulting, LLC (revision dated May 13, 2014).

3. Groundwater Elevation Contours shown are based on measurements taken from the Overburden Groundwater Aquifer. Measurements from bedrock wells (MW-3E-D and MW-5-D) were not used.

0' 20' 40'
SCALE IN FEET

LEGEND:

- PROJECT SITE BOUNDARY
- 114.25 MW-1E — EXISTING MONITORING WELL LOCATION WITH WATER TABLE ELEVATION IN FEET
- 115 — GROUNDWATER ELEVATION CONTOUR IN FEET
- INFERRED GROUNDWATER FLOW DIRECTION

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440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GROUNDWATER ELEVATION CONTOUR MAP 10/21/2014

DATE
12.9.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
10

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 10 GW Contour map 10-21-2014.dwg

JEROME AVENUE
(elevated subway MTA)

sidewalk

Floor Drains

Suspected Concrete Pad Anomaly

Approximate Location of Access Ramp

Suspected Excavation Anomaly

Boiler Room in Partial Basement Beneath Kitchen

Toyota Automotive Storage Garage

SED-1 (sample included rusted metal shavings from floor drain in basement)

Approximate Extent of Partial Basement

Janitor's Closet

Apartment Building

Approximate Location of Former Gasoline tanks based on 1945-1992 Sanborn Maps

OS-AA-1
OS-ESV-1
ESV-1
ESV-2
ESV-3
ESV-4
MW-2E
MW-3E-D
SB-1E/MW-1E
SB-1
SB-1A
SB-2E
SB-2/MW-2
SB-3
SB-4
SB-5
SB-6
SB-7
SB-9
SB-10
SB-11
SB-12
SB-13
SB-14
SB-15
SB-16
SB-17
SB-18
SB-19/MW-1
SB-20/MW-3
SB-21/MW-4
SB-22/MW-5-D
SV-1/TRC-SV1
SV-2/TRC-SV2
SV-3/TRC-SV3 (in basement)
TRC-IA3/IA-3V
IA-1/TRC-IA1/IA-IV
IA-2/TRC-IA2/IA-2V
AA-1/TRC-AMB
AA-IV (on roof)
OAA-1
OSG/OIA-1
OSG/OIA-2
AA-1 (3/27/11)
36
5

VAN CORTLANDT AVENUE EAST

LEGEND

- OS-ESV-1 — EXTERIOR SOIL VAPOR SAMPLING LOCATION
- MW-3E-S — BEDROCK MONITOR WELL LOCATION
- OSG/OIA-1 — OFF-SITE SUB-SLAB VAPOR AND INDOOR AIR SAMPLING LOCATION
- OAA-1 — OFF-SITE AMBIENT AIR SAMPLING LOCATION
- SB-1 — SOIL BORING LOCATION
- SB-2/MW-2 — SOIL BORING/MONITORING WELL LOCATION
- SED-1 — SEDIMENT SAMPLE LOCATION
- PROJECT SITE BOUNDARY
- SV-1/TRC-SV1 — SUB-SLAB VAPOR SAMPLING LOCATION
- AA-1/TRC-AMB AA-IV (on roof) — AMBIENT AIR SAMPLING LOCATION
- IA-1/TRC-IA/IA-IV — INDOOR AIR SAMPLING LOCATION

0' 20' 40'
SCALE IN FEET

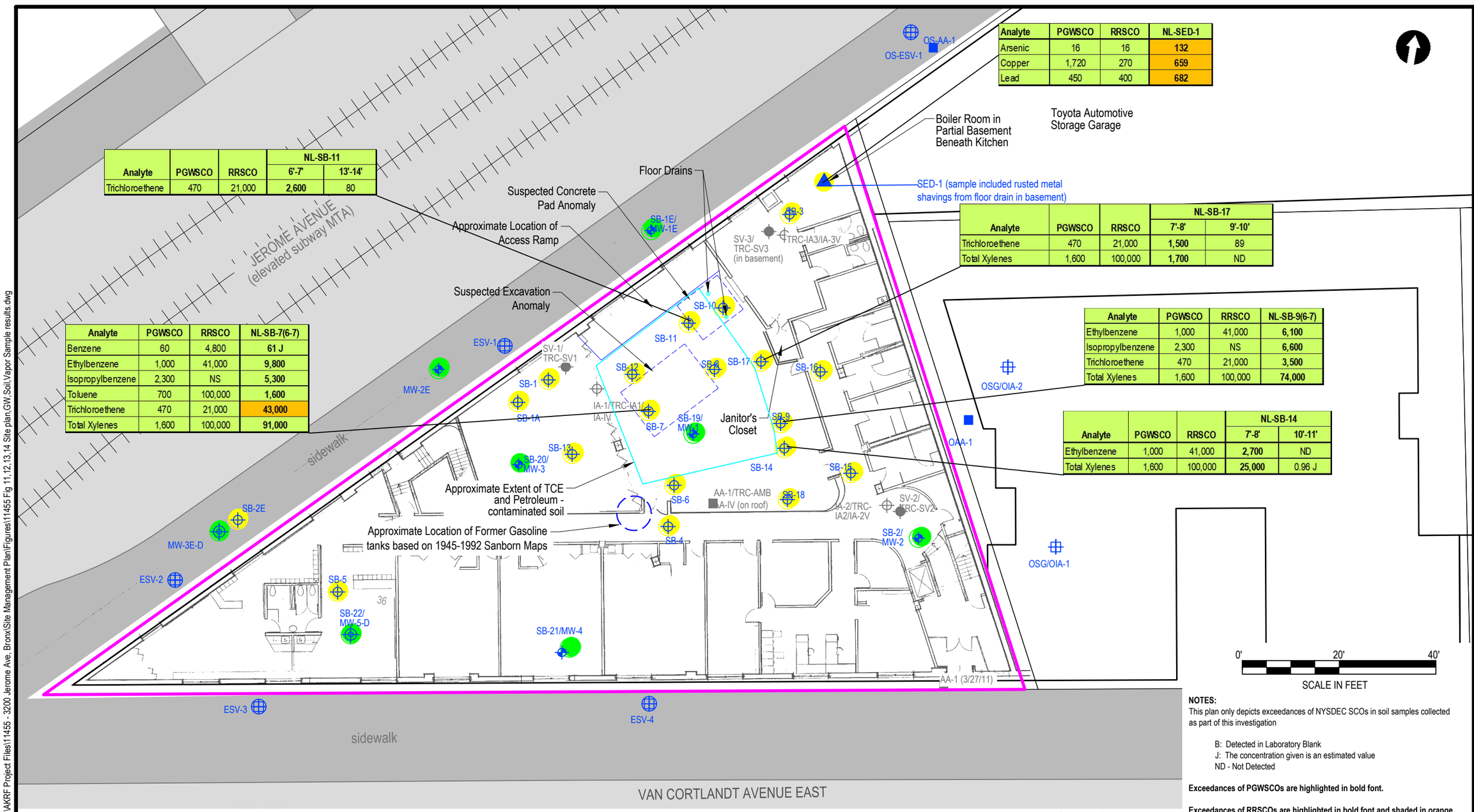
AKRF Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

RI SITE AND SAMPLE LOCATION PLAN

DATE 12.9.2014
PROJECT NO. 11455
SCALE as shown
FIGURE 11

©2013 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 11,12,13,14 Site plan,GW,Soil,Vapor Sample results.dwg



Analyte	PGWSCO	RRSCO	NL-SB-11	
			6'-7'	13'-14'
Trichloroethene	470	21,000	**2,600**	80

Analyte	PGWSCO	RRSCO	NL-SB-7(6-7)
Benzene	60	4,800	**61 J**
Ethylbenzene	1,000	41,000	**9,800**
Isopropylbenzene	2,300	NS	**5,300**
Toluene	700	100,000	**1,600**
Trichloroethene	470	21,000	**43,000**
Total Xylenes	1,600	100,000	**91,000**

Analyte	PGWSCO	RRSCO	NL-SED-1
Arsenic	16	16	**132**
Copper	1,720	270	**659**
Lead	450	400	**682**

Analyte	PGWSCO	RRSCO	NL-SB-17	
			7'-8'	9'-10'
Trichloroethene	470	21,000	**1,500**	89
Total Xylenes	1,600	100,000	**1,700**	ND

Analyte	PGWSCO	RRSCO	NL-SB-9(6-7)
Ethylbenzene	1,000	41,000	**6,100**
Isopropylbenzene	2,300	NS	**6,600**
Trichloroethene	470	21,000	**3,500**
Total Xylenes	1,600	100,000	**74,000**

Analyte	PGWSCO	RRSCO	NL-SB-14	
			7'-8'	10'-11'
Ethylbenzene	1,000	41,000	**2,700**	ND
Total Xylenes	1,600	100,000	**25,000**	0.96 J

0' 20' 40'

SCALE IN FEET

LEGEND

- EXTERIOR SOIL VAPOR SAMPLING LOCATION (OS-ESV-1)
- BEDROCK MONITOR WELL LOCATION (MW-3E-S)
- OFF-SITE SUB-SLAB VAPOR AND INDOOR AIR SAMPLING LOCATION (OSG/OIA-1)
- OFF-SITE AMBIENT AIR SAMPLING LOCATION (OAA-1)
- SOIL BORING LOCATION (SB-1)
- SOIL BORING/MONITORING WELL LOCATION (SB-2/MW-2)
- SEDIMENT SAMPLE LOCATION (SED-1)
- PROJECT SITE BOUNDARY
- SUB-SLAB VAPOR SAMPLING LOCATION (SV-1/ TRC-SV1)
- AMBIENT AIR SAMPLING LOCATION (AA-1/TRC-AMB AA-IV (on roof))
- INDOOR AIR SAMPLING LOCATION (IA-1/TRC-IA/ IA-IV)

Sample ID number

Analyte	PGWSCO	RRSCO	NL-SED-1
Arsenic	16	16	**132**
Copper	1,720	270	**659**
Lead	450	400	**682**

Concentrations reported in micrograms per Kilogram (µg/kg) or parts per billion (ppb)

NOTES:

This plan only depicts exceedances of NYSDEC SCOs in soil samples collected as part of this investigation

B: Detected in Laboratory Blank
J: The concentration given is an estimated value
ND - Not Detected

Exceedances of PGWSCOs are highlighted in bold font.

Exceedances of RRSCOs are highlighted in bold font and shaded in orange.

SOIL
Part 375 Soil Cleanup Objectives:
Soil Clean-up Objectives listed in NYSDEC (New York State Department of Environmental Conservation) "Part 375" Regulations (6 NYCRR Part 375).

PGWSCO-NYSDEC Part 375 Protection of Groundwater Soil Cleanup objective.
RRSCO-NYSDEC Part 375 Restricted Residential Soil Cleanup objective.

Concentrations reported in micrograms per kilogram (µg/kg) or parts per billion (ppb)

Acetone detections in Soil Samples SB-3(8-9) and SB-6(16-17) are associated with lab contamination and are not shown.

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FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

REMEDIAL INVESTIGATION SOIL
ANALYTICAL RESULTS EXCEEDING SCOs

DATE
12.9.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
12

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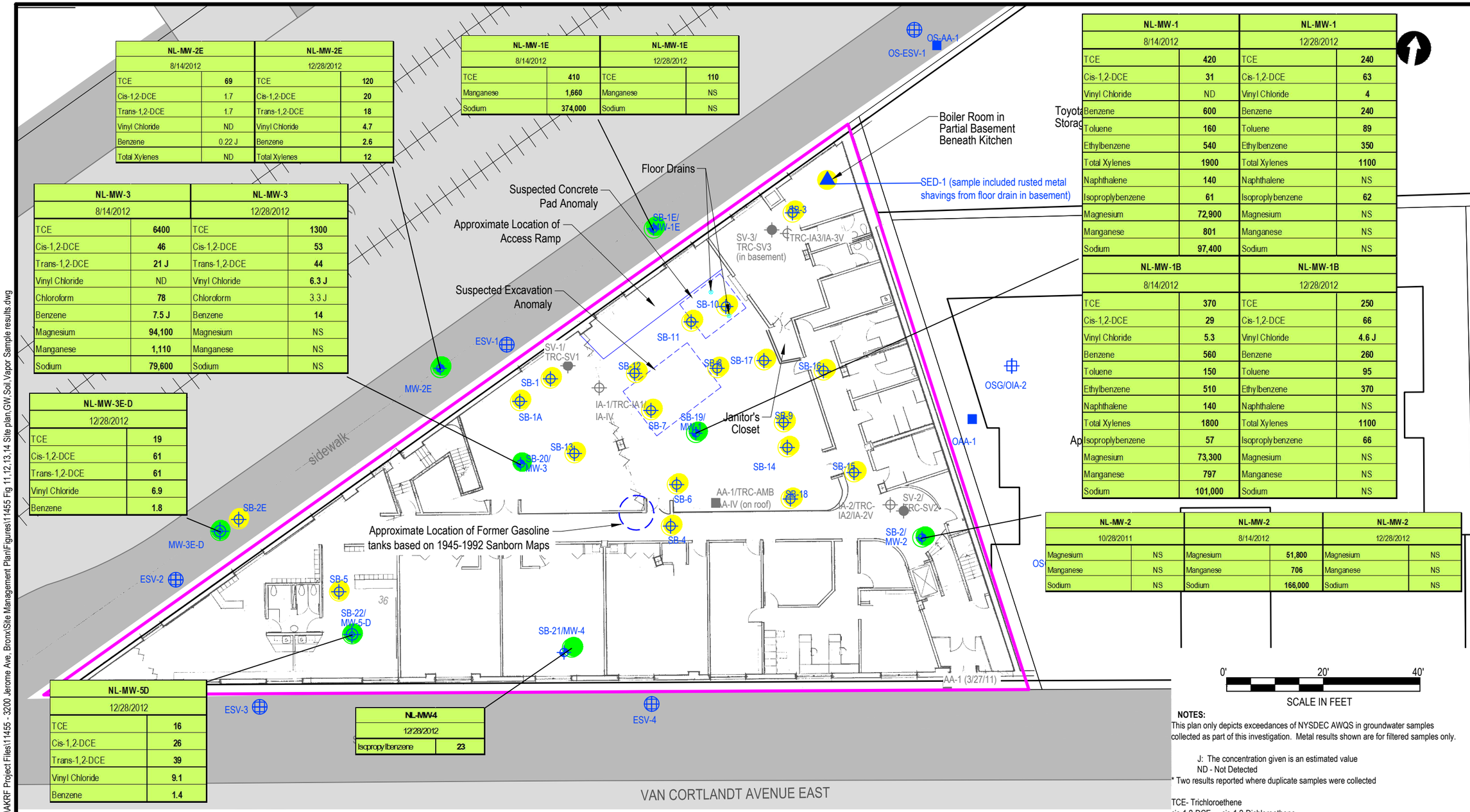

NOTES:

This plan only depicts exceedances of NYSDEC AWQS in groundwater samples collected as part of this investigation. Metal results shown are for filtered samples only.

J: The concentration given is an estimated value
ND - Not Detected
* Two results reported where duplicate samples were collected

TCE- Trichloroethene
cis-1,2-DCE - cis-1,2-Dichloroethene,
Trans-1,2-DCE - Trans-1,2-Dichloroethene

Exceedances are highlighted in bold font.

NS - Not sampled for the analyte

GROUNDWATER

NYSDEC Class GA Ambient Water Quality Standards
NYSDEC Water Quality Standards listed in Technical And Operational Guidance Series 1.1.1

Concentrations reported in micrograms per liter (µg/l) or parts per billion (ppb)

LEGEND

- OS-ESV-1 — EXTERIOR SOIL VAPOR SAMPLING LOCATION
- MW-3E-S — BEDROCK MONITOR WELL LOCATION
- OSG/OIA-1 — OFF-SITE SUB-SLAB VAPOR AND INDOOR AIR SAMPLING LOCATION
- OAA-1 — OFF-SITE AMBIENT AIR SAMPLING LOCATION
- SB-1 — SOIL BORING LOCATION
- SB-2/MW-2 — SOIL BORING/MONITORING WELL LOCATION
- SED-1 — SEDIMENT SAMPLE LOCATION
- PROJECT SITE BOUNDARY
- SV-1/TRC-SV1 — SUB-SLAB VAPOR SAMPLING LOCATION
- AA-1/TRC-AMB AA-IV (on roof) — AMBIENT AIR SAMPLING LOCATION
- IA-1/TRC-IA/IA-IV — INDOOR AIR SAMPLING LOCATION

Sample ID number

NL-MW-4	
12/28/2012	
Isopropylbenzene	23

Sample Date

Concentrations reported in micrograms per Liter (µg/L) or parts per billion (ppb)

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FORMER NESSEN LAMPS SITE
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REMEDIAL INVESTIGATION GROUNDWATER ANALYTICAL RESULTS EXCEEDING AWQS

DATE 12.9.2014
PROJECT NO. 11455
SCALE as shown
FIGURE 13

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FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

SOIL VAPOR AND INDOOR AIR ANALYTICAL RESULTS

AKRF

Engineering, P.C.
440 Park Avenue South, New York, NY 10016

DATE
12.9.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
14

TRC-IA3	4/22/11	IA-3V	05/14/11	IA-3V_DL	05/14/11
TCE	310		580 E		670 D
PCE	1		1.6		ND
Methylene Chloride	8.6		13		14 D

SV-3	03/27/11	TRC-SV3	04/22/11
TCE	34,900		31,100
PCE	112		160
Methylene Chloride	ND		2.4

SV-1	03/27/11	TRC-SV1	04/22/11
TCE	53,300		21,000
PCE	291		62
Methylene Chloride	ND		3.4

NL-ESV-1	11/19/12
TCE	35
PCE	1.5
Methylene Chloride	ND

IA-1	1/22/11	TRC-IA1	04/22/11	IA-1V	05/14/11
TCE	53		22		2.4
PCE	ND		0.42		0.34
Methylene Chloride	4.4		4.1		ND

NL-ESV-2	11/19/12
TCE	110
PCE	3.7
Methylene Chloride	1.8

NL-ESV-3	11/19/12
TCE	5.8
PCE	3.7
Methylene Chloride	ND

NL-ESV-4	11/19/12
TCE	32
PCE	26
Methylene Chloride	ND

NL-OS-ESV-1	1/7/13
TCE	ND
PCE	4.8
Methylene Chloride	ND

NL-OS-AA-1	1/7/13
TCE	ND
PCE	ND
Methylene Chloride	ND

NL-OAA-1	9/25/12
TCE	ND
PCE	0.32 J
Methylene Chloride	1.2 JB

NL-OIA-2	9/25/12
TCE	ND
PCE	1.1 J
Methylene Chloride	11 B

NL-OSG-2	9/25/12
TCE	0.59 J
PCE	5.4
Methylene Chloride	2.1 B

NL-OSG-1	9/25/12
TCE	3
PCE	1.9
Methylene Chloride	10 B

NL-OIA-1	9/25/12
TCE	0.4 J
PCE	0.47 J
Methylene Chloride	79 B

SV-2	03/27/11	TRC-SV2	04/22/11
TCE	706		730
PCE	68.4		26
Methylene Chloride	9.82		5.3

AA-1	1/22/11	AA-1V	05/14/11	TRC-AMB	4/22/11
TCE	4.4		ND		0.43
PCE	ND		ND		0.27
Methylene Chloride	ND		0.28		3.6
			2.3		

IA-2	1/22/11	TRC-IA2	04/22/11	IA-2V	05/14/11
TCE	49		10		1.7
PCE	ND		0.35		ND
Methylene Chloride	2.7		0.92		ND

Boiler Room in Partial Basement Beneath Kitchen

Toyota Automotive Storage Garage

Ambient Air

SED-1 (sample included rusted metal shavings from floor drain in basement)

Suspected Concrete Pad Anomaly

Approximate Location of Access Ramp

Suspected Excavation Anomaly

Approximate Location of Former Gasoline tanks based on 1945-1992 Sanborn Maps

Apartment Building

Janitor's Closet

sidewalk

AA-1 (3/27/11)

0' 20' 40'

SCALE IN FEET

NOTES:
This plan only depicts the applicable results of volatile organic compounds (VOCs) in Soil Vapor, Indoor, and Ambient Air samples collected as part of this investigation.

E: Result exceeds instrument calibration range
D: Sample run at a secondary dilution.
J: The concentration given is an estimated value
B: The analyte was found in an associated blank, as well as in the sample.
ND - Non detected

Exceedances are highlighted in bold font.

SOIL VAPOR/INDOOR AIR
NYSDOH Air Guidelines Values presented in the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

Concentrations reported in micrograms per cubic meter (µg/m³) of air.

LEGEND

- EXTERIOR SOIL VAPOR SAMPLING LOCATION (OS-ESV-1)
- BEDROCK MONITOR WELL LOCATION (MW-3E-S)
- OFF-SITE SUB-SLAB VAPOR AND INDOOR AIR SAMPLING LOCATION (OSG/OIA-1)
- OFF-SITE AMBIENT AIR SAMPLING LOCATION (OAA-1)
- SOIL BORING LOCATION (SB-1)
- SOIL BORING/MONITORING WELL LOCATION (SB-2/MW-2)
- SEDIMENT SAMPLE LOCATION (SED-1)
- PROJECT SITE BOUNDARY
- SUB-SLAB VAPOR SAMPLING LOCATION (SV-1/TRC-SV1)
- AMBIENT AIR SAMPLING LOCATION (AA-1/TRC-AMB, AA-IV (on roof))
- INDOOR AIR SAMPLING LOCATION (IA-1/TRC-IA/IA-IV)

Data collected prior to NYSDEC oversight

Soil Vapor	SV-3	TRC-SV3
	03/27/11	04/22/11
TCE	34,900	31,100
PCE	112	160
Methylene Chloride	ND	2.4

Sample ID number; Sample date; Concentrations reported in micrograms per cubic meter (µg/m³)

Data Collected and validated under NYSDEC oversight

Soil Vapor	NL-ESV-4	11/19/12
TCE		32
PCE		26
Methylene Chloride		ND

Sample ID number; Sample date; Concentrations reported in micrograms per cubic meter (µg/m³)

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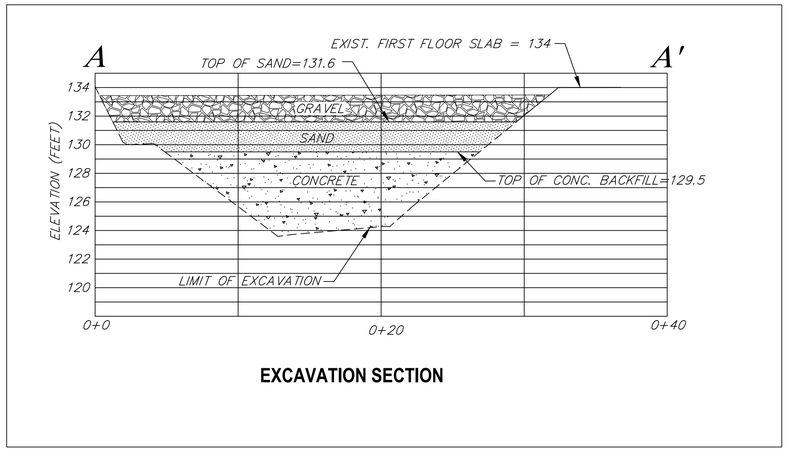


EXCAVATION SECTION

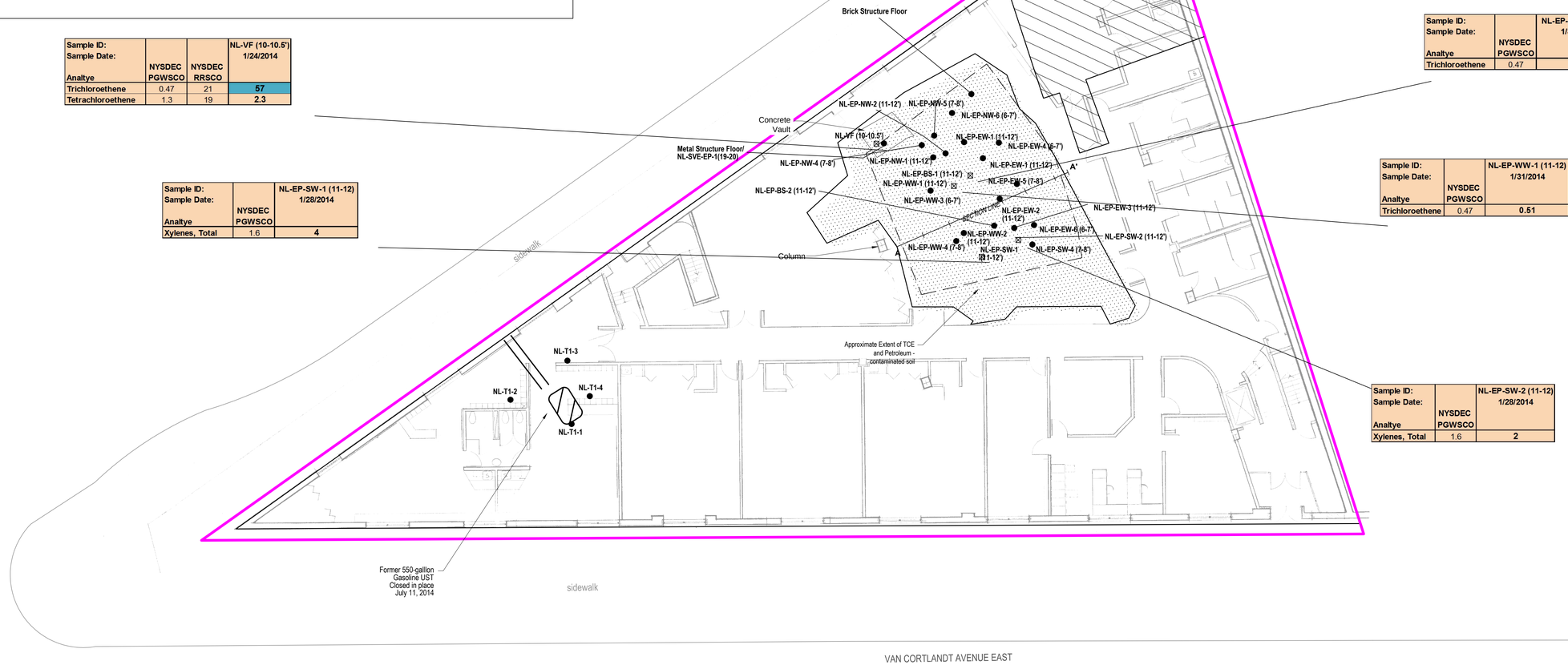
Sample ID:		NL-VF (10-10.5')
Sample Date:		1/24/2014
Analtye	NYSDEC PGWSCO / NYSDEC RRSCO	
Trichloroethene	0.47 / 21	**57**
Tetrachloroethene	1.3 / 19	**2.3**

Sample ID:		NL-EP-SW-1 (11-12)
Sample Date:		1/28/2014
Analtye	NYSDEC PGWSCO	
Xylenes, Total	1.6	**4**

Sample ID:		NL-EP-BS-1 (11-12)
Sample Date:		1/31/2014
Analtye	NYSDEC PGWSCO	
Trichloroethene	0.47	**3.7**

Sample ID:		NL-EP-WW-1 (11-12)
Sample Date:		1/31/2014
Analtye	NYSDEC PGWSCO	
Trichloroethene	0.47	**0.51**

Sample ID:		NL-EP-SW-2 (11-12)
Sample Date:		1/28/2014
Analtye	NYSDEC PGWSCO	
Xylenes, Total	1.6	**2**



NOTES:
This plan only depicts exceedances of NYSDEC SCOs in Post-Excavation soil samples collected during remedial activities.

Exceedances of PGWSCOs are highlighted in bold font.

Exceedances of RRSCOs are highlighted in bold font and shaded in blue.

SOIL
Part 375 Soil Cleanup Objectives:
Soil Clean-up Objectives listed in NYSDEC (New York State Department of Environmental Conservation) "Part 375" Regulations (6 NYCRR Part 375).

PGWSCO-NYSDEC Part 375 Protection of Groundwater Soil Cleanup objective.
RRSCO-NYSDEC Part 375 Restricted Residential Soil Cleanup objective.

Concentrations reported in miligrams per kilogram (mg/kg) or parts per million (ppm)

Source Notes:

1. BASEMAP taken from A15 (Lower Floor Plan)Dated 9.20.90 AND.
2. SOIL SAMPLE LOCATIONS AND EXTENT OF SOIL EXCAVATION TAKEN FROM DPK CONSULTING, LLC SURVEY DATED 5.13.14.
3. ELEVATIONS SHOWN IN EXCAVATION SECTION ARE BASED ON THE BRONX BOROUGH DATUM.

Sample ID:		NL-EP-SW-2 (11-12)
Sample Date:		1/28/2014
Analtye	NYSDEC PGWSCO	
Xylenes, Total	1.6	**2**

Sample ID number
Sample Date
Concentrations reported in miligrams per kilogram (mg/kg) or parts per million (ppm)

LEGEND:

- PROJECT SITE BOUNDARY
- BUILDING LINE
- EXTENT OF SOIL EXCAVATION FOLLOWED BY VAPOR BARRIER, GAS PERMEABLE AGGREGATE, AND CONCRETE SLAB RESTORATION
- EXTENT OF BASEMENT
- NL-EP-SW-4 (7-8') / NL-T1-2 — POST-EXCAVATION OR INVESTIGATORY SOIL SAMPLE LOCATION
- NL-EP-SW-2 (11-12') — SOIL SAMPLE LOCATION OF REMAINING SOIL CONTAMINATION EXCEEDING NYSDEC PART 375 SOIL CLEANUP OBJECTIVES.

0' 5' 10' 20'
SCALE IN FEET

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Engineering, P.C.
440 Park Avenue South, New York, N.Y. 10016

FORMER NESSEN LAMPS SITE 3200 JEROME AVENUE
NEW YORK, NEW YORK, NEW YORK

EXTENT OF REMEDIAL SOIL EXCAVATION AND REMAINING SOIL CONTAMINATION

DATE
12.9.2014

SCALE
as shown

PROJECT No.
11455

FIGURE
15

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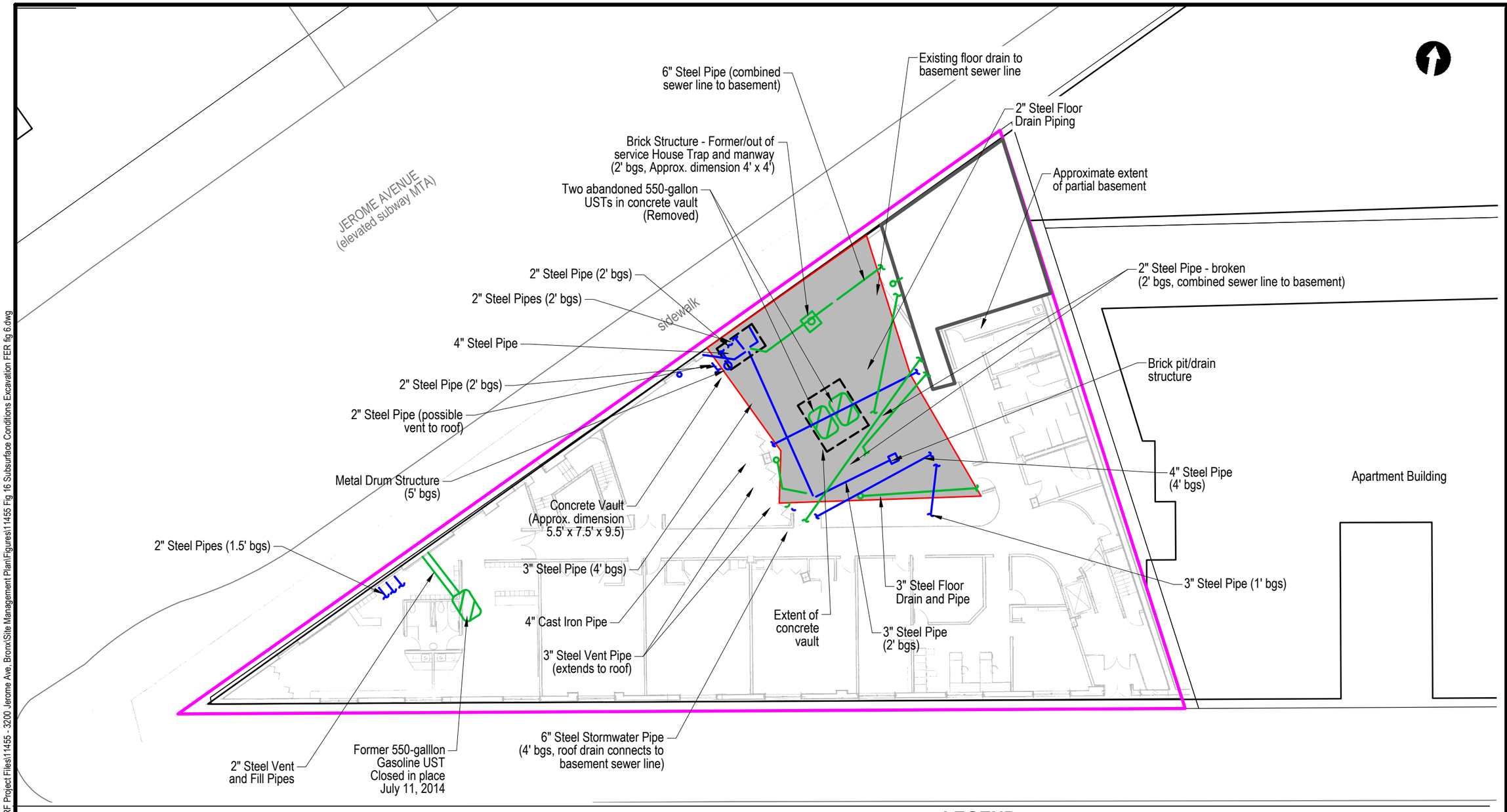
M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 15 Extent of remedial excavation & remaining soil contamination FER&g 5.dwg



LEGEND:

- PROJECT SITE BOUNDARY
- LOT LINE
- BUILDING LINE
- **UST** UNDERGROUND STORAGE TANK
- **(bgs)** APPROXIMATE DEPTH OF STRUCTURE ENCOUNTERED IN FEET BELOW GRADE
- PIPING/STRUCTURE IDENTIFIED WITH UNKNOWN USE
- PIPING/STRUCTURE IDENTIFIED WITH KNOWN USE
- CONCRETE STRUCTURE
- APPROXIMATE EXTENT OF CONTAMINANT REMOVAL AREA

0' 20' 40'
SCALE IN FEET

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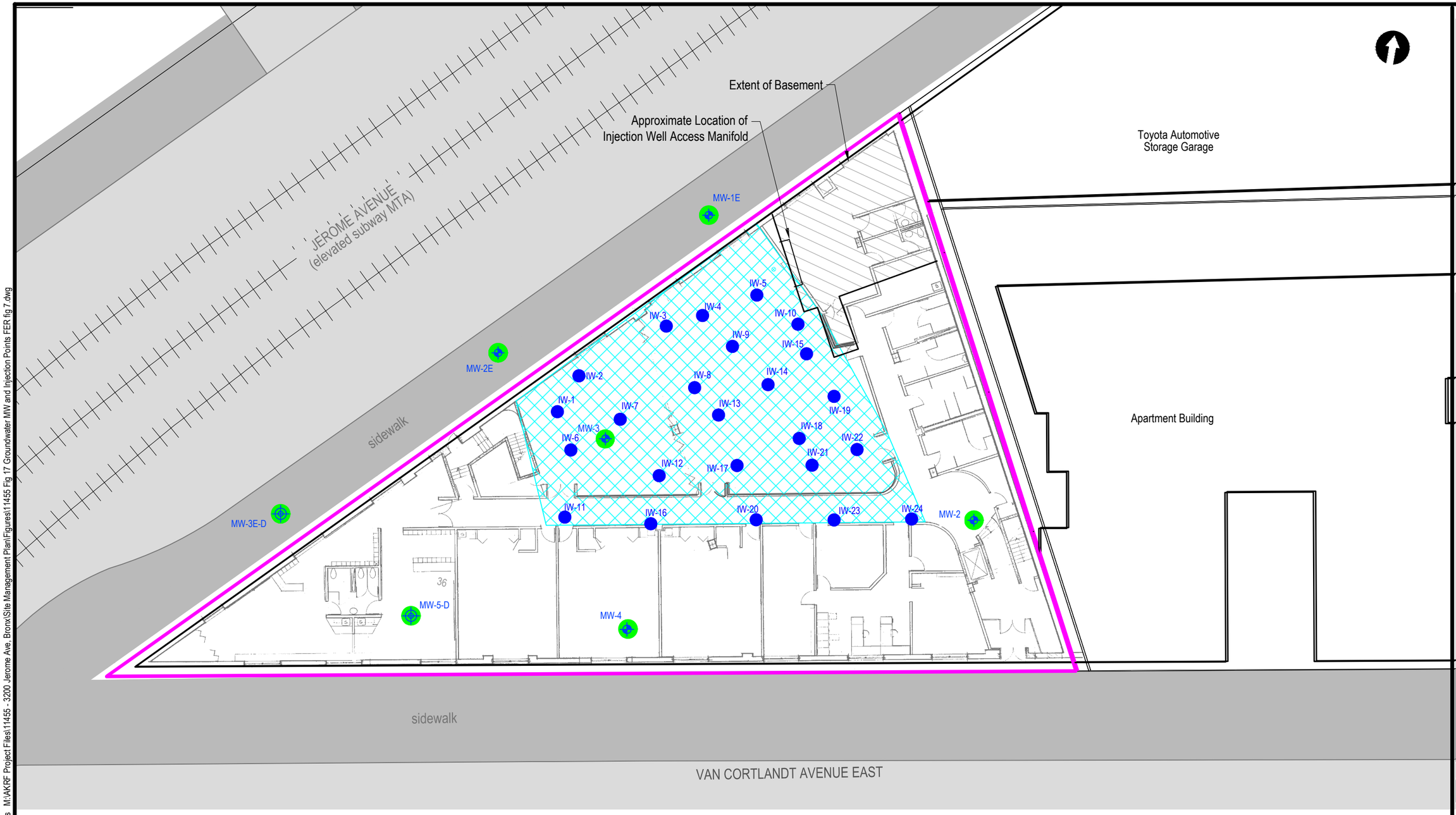
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

SUBSURFACE STRUCTURES ENCOUNTERED DURING SOIL REMOVAL ACTIVITIES

DATE 12/9/2014
PROJECT NO. 11455
SCALE as shown
FIGURE 16

©2010 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave. Bronx\Site Management Plan\Figures\11455 Fig 16 Subsurface Conditions Excavation FER fig 6.dwg



Note:
1. Elevations refer to the borough of the Bronx topographical bureau datum, which is 2.608 feet above mean sea level.

2. Locations and Elevations of the on-site monitor wells and injection wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP., and subsequent surveying activities completed by DPK Consulting, LLC (revision dated July 9, 2014).

LEGEND

- MW-3E-D — BEDROCK MONITOR WELL LOCATION
- MW-2 — MONITORING WELL LOCATION
- IW-1 — INJECTION WELL LOCATION
- PROJECT SITE BOUNDARY
- GROUNDWATER TREATMENT AREA

0' 20' 40'
SCALE IN FEET

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Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

GROUNDWATER MONITORING WELL AND INJECTION POINT NETWORK

DATE
12.9.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
17

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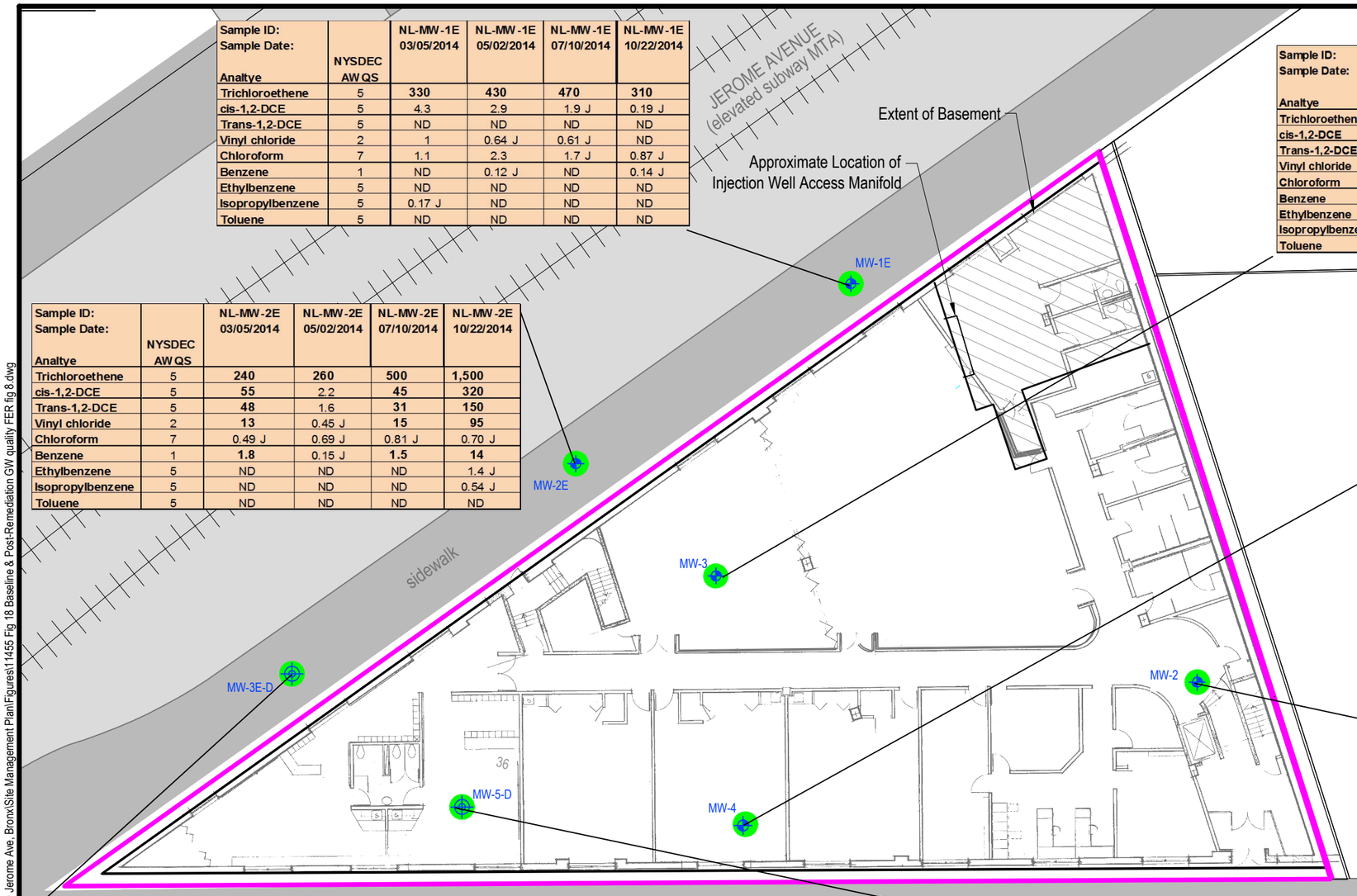


Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-1E 03/05/2014	NL-MW-1E 05/02/2014	NL-MW-1E 07/10/2014	NL-MW-1E 10/22/2014
Trichloroethene	5	**330**	**430**	**470**	**310**
cis-1,2-DCE	5	4.3	2.9	1.9 J	0.19 J
Trans-1,2-DCE	5	ND	ND	ND	ND
Vinyl chloride	2	1	0.64 J	0.61 J	ND
Chloroform	7	1.1	2.3	1.7 J	0.87 J
Benzene	1	ND	0.12 J	ND	0.14 J
Ethylbenzene	5	ND	ND	ND	ND
Isopropylbenzene	5	0.17 J	ND	ND	ND
Toluene	5	ND	ND	ND	ND

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-2E 03/05/2014	NL-MW-2E 05/02/2014	NL-MW-2E 07/10/2014	NL-MW-2E 10/22/2014
Trichloroethene	5	**240**	**260**	**500**	**1,500**
cis-1,2-DCE	5	**55**	2.2	**45**	**320**
Trans-1,2-DCE	5	**48**	1.6	**31**	**150**
Vinyl chloride	2	**13**	0.45 J	**15**	**95**
Chloroform	7	0.49 J	0.69 J	0.81 J	0.70 J
Benzene	1	**1.8**	0.15 J	**1.5**	**14**
Ethylbenzene	5	ND	ND	ND	1.4 J
Isopropylbenzene	5	ND	ND	ND	0.54 J
Toluene	5	ND	ND	ND	ND

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-3E-D 03/05/2014	NL-MW-Dup. 03/05/2014	NL-MW-3E-D 05/02/2014	NL-MW-Dup. 05/02/2014	NL-MW-3E-D 07/10/2014	NL-MW-Dup. 07/10/2014	NL-MW-3E-D 10/22/2014	NL-MW-Dup. 10/22/2014
Trichloroethene	5	**15**	**14**	**21**	**18**	**13**	**13**	**37**	**37**
cis-1,2-DCE	5	**13**	**13**	**16**	**13**	2.9	3.3	**47**	**46**
Trans-1,2-DCE	5	**15**	**15**	**18**	**15**	2.8	2.7	**44**	**44**
Vinyl chloride	2	1.4	1.2	**3**	**2.3**	ND	ND	**9.7**	**8.9**
Chloroform	7	0.13 J	0.2 J	ND	ND	0.22 J	0.21 J	ND	ND
Benzene	1	0.72 J	0.75 J	**3.6**	**3.2**	0.15 J	0.13 J	**8.4**	**8.2**
Ethylbenzene	5	ND	ND	0.29 J	0.22 J	ND	ND	1.7	1.5
Isopropylbenzene	5	0.39 J	0.38 J	0.39 J	0.35 J	ND	ND	3.6	3.8
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-3 03/07/2014	NL-MW-3 05/05/2014	NL-MW-3 07/11/2014	NL-MW-3 10/22/2014
Trichloroethene	5	**2,500**	**2,100**	**4,500**	**4,800**
cis-1,2-DCE	5	**98**	**120**	**75**	**75**
Trans-1,2-DCE	5	**49**	**80**	**35**	**20**
Vinyl chloride	2	**4.2** J	**13**	**8.9** J	**9.9** J
Chloroform	7	**9.5** J	**8.8** J	**44**	**53**
Benzene	1	**16**	**27**	**5.5** J	**6.8** J
Ethylbenzene	5	ND	**10**	ND	ND
Isopropylbenzene	5	3.6 J	3.8 J	ND	ND
Toluene	5	ND	ND	ND	ND

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-4 03/06/2014	NL-MW-4 05/05/2014	NL-MW-4 07/11/2014	NL-MW-4 10/22/2014
Trichloroethene	5	**14**	**11**	3.1	**10**
cis-1,2-DCE	5	1.4	0.85 J	0.79 J	1.2
Trans-1,2-DCE	5	ND	0.24 J	0.16 J	0.51 J
Vinyl chloride	2	1.2	0.97 J	1.3	ND
Chloroform	7	1.3	0.59 J	ND	ND
Benzene	1	ND	ND	ND	ND
Ethylbenzene	5	0.41 J	0.55 J	1	3.1
Isopropylbenzene	5	4.3	**6.2**	**8**	**16**
Toluene	5	0.22 J	ND	0.54 J	0.54 J

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-2 03/06/2014	NL-MW-2 05/05/2014	NL-MW-2 07/11/2014	NL-MW-2 10/22/2014
Trichloroethene	5	2.1	1.7	3	0.73 J
cis-1,2-DCE	5	ND	ND	ND	ND
Trans-1,2-DCE	5	ND	ND	ND	ND
Vinyl chloride	2	ND	ND	ND	ND
Chloroform	7	0.66 J	0.77 J	1.2	0.57 J
Benzene	1	ND	0.55 J	ND	ND
Ethylbenzene	5	ND	ND	ND	ND
Isopropylbenzene	5	ND	ND	ND	ND
Toluene	5	ND	**13**	ND	ND

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-5D 03/07/2014	NL-MW-5D 05/05/2014	NL-MW-5D 07/10/2014	NL-MW-5D 10/22/2014
Trichloroethene	5	**15**	**13**	**32**	**54**
cis-1,2-DCE	5	4	3.8	**7.3**	4
Trans-1,2-DCE	5	4.2	**5.6**	**7.1**	2.6
Vinyl chloride	2	1.2	**2.1**	2	0.61 J
Chloroform	7	ND	ND	ND	0.35 J
Benzene	1	ND	**4.2**	**5.1**	0.41 J
Ethylbenzene	5	1.1	0.73 J	ND	ND
Isopropylbenzene	5	**6.1**	0.71 J	0.14 J	0.40 J
Toluene	5	ND	ND	ND	ND

Note:

1. Elevations refer to the borough of the Bronx topographical bureau datum, which is 2.608 feet above mean sea level.

2. Basemap taken from A15(Lower Floor Plan) Dated 9.20.90. Locations and Elevations of the on-site monitor wells and injection wells are based upon an updated January 8, 2013 Monitor Well Location Survey completed by Montrose Surveying Co., LLP., and subsequent surveying activities completed by DPK Consulting, LLC (revision dated July 9, 2014).

LEGEND

- PROJECT SITE BOUNDARY
- MW-3E-D — BEDROCK MONITOR WELL LOCATION
- MW-2 — MONITORING WELL LOCATION

0' 20' 40'
SCALE IN FEET

NOTES:

This plan only depicts VOC exceedances of NYSDEC AWQS in groundwater samples collected as part of the remedy.

J: The concentration given is an estimated value
ND: Not Detected

Exceedances of NYSDEC AWQS are highlighted in bold font.

GROUNDWATER

NYSDEC Class GA Ambient Water Quality Standards
NYSDEC Water Quality Standards listed in Technical And Operational Guidance Series 1.1.1

Concentrations reported in micrograms per liter (µg/l) or parts per billion (ppb)

Sample Date — Sample ID number

Sample ID: / Sample Date: / Analyte	NYSDEC AWQS	NL-MW-5D 03/07/2014	NL-MW-5D 05/05/2014	NL-MW-5D 07/10/2014	NL-MW-5D 10/22/2014
Trichloroethene	5	**15**	**13**	**32**	**54**
cis-1,2-DCE	5	4	3.8	**7.3**	4

Concentrations reported in micrograms per Liter (µg/L) or parts per billion (ppb)

AKRF Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

BASELINE AND POST-REMEDIATION GROUNDWATER QUALITY

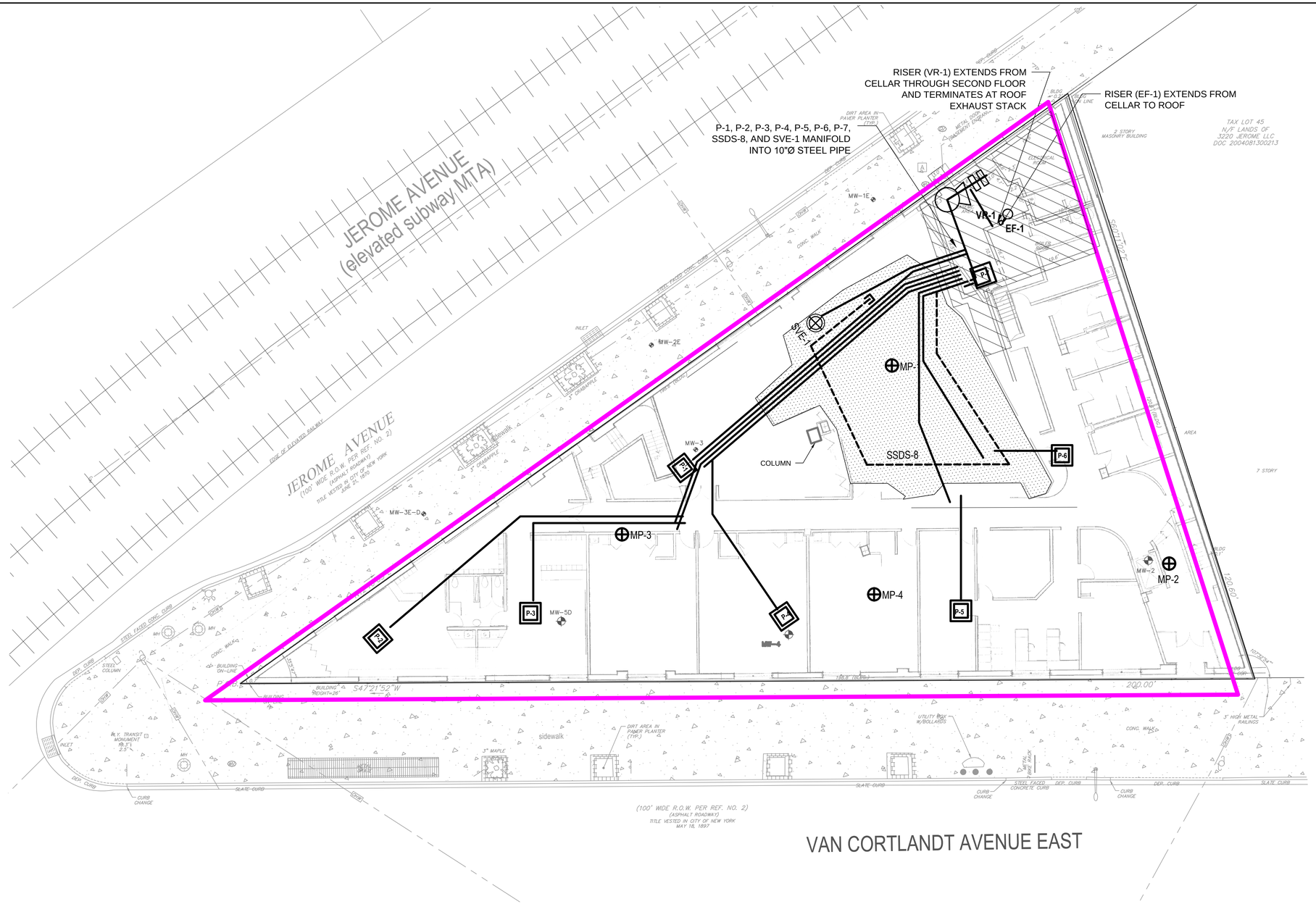
DATE
12.9.2014

PROJECT NO.
11455

SCALE
as shown

FIGURE
18

©2014 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11455 - 3200 Jerome Ave, Bronx\Site Management Plan\Figures\11455 Fig 18 Baseline & Post-Remediation GW quality FER fig 8.dwg



0' 10' 20'
SCALE IN FEET

NOTES:

1. THE ENTIRE SITE (BLOCK 3323, LOT 36) IS AFFECTED BY ENGINEERING CONTROLS CONSISTING OF THE CAP (CONCRETE FLOOR SLABS AND UNDERLYING MATERIALS) AND THE SUB-SLAB DEPRESSURIZATION AND SOIL VAPOR EXTRACTION SYSTEM.
2. BASEMAP TAKEN FROM A15 (LOWER FLOOR PLAN)DATED 9/20/90 AND EXTENT OF SOIL EXCAVATION TAKEN FROM DPK CONSULTING, LLC SURVEY DATED 5/13/14.

SSDS/SVE BLOWER
CARBON TREATMENT SYSTEM
PROJECT SITE BOUNDARY
BUILDING LINE
4-INCH SLOTTED PVC PIPE
4-INCH SOLID PVC PIPE (IN SUB-SLAB TRENCHES)

MP-1 SUB-SLAB MONITORING POINT
SVE-1 SOIL VAPOR EXTRACTION WELL
MW-3 GROUNDWATER MONITORING WELL
P-1 SUB-SLAB DEPRESSURIZATION PIT

LEGEND:

VAPOR BARRIER, GAS PERMEABLE AGGREGATE, AND CONCRETE SLAB RESTORATION ASSOCIATED WITH SOIL REMOVAL
EXTENT OF BASEMENT
VR-1 8-INCH STEEL PIPE VERTICAL RISER AND IDENTIFICATION NUMBER
EF-1 2-INCH STEEL PIPE VERTICAL RISER AND IDENTIFICATION NUMBER

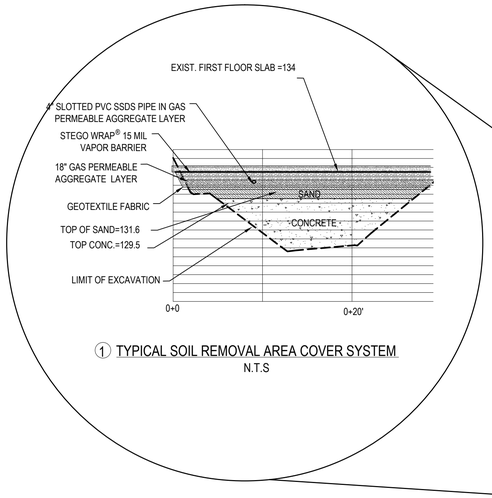
AKRF, Inc.
Engineering, D.P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMP SITE 3200 JEROME AVENUE
BRONX, NEW YORK

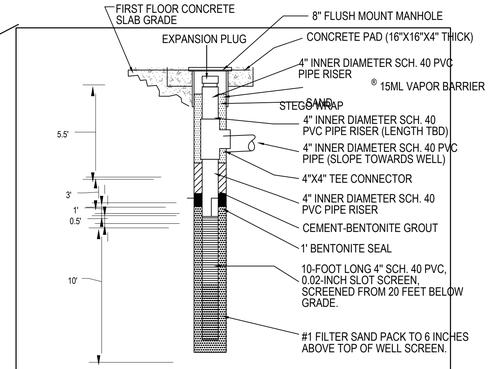
SUB-SLAB DEPRESSURIZATION & SOIL VAPOR EXTRACTION SYSTEM PLAN

DATE 12.9.2014
SCALE AS SHOWN
PROJECT No. 11455
FIGURE 19

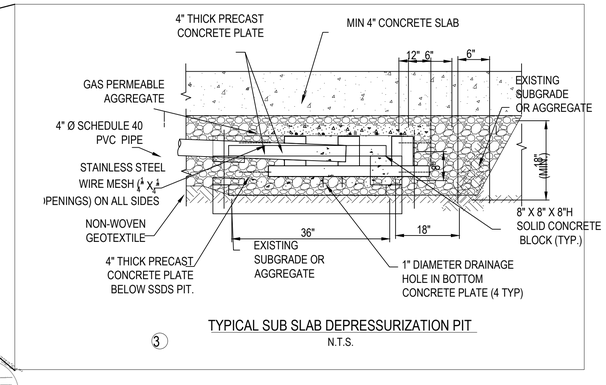
©2014 AKRF, Inc. Environmental Consultants W:\AKRF Projects\11455 - 3200 Jerome Ave, Bronx\Final Engineering Report\Figures\11455 Fig 19 FER SSDS and System Location Plan SMP Fig 19.dwg



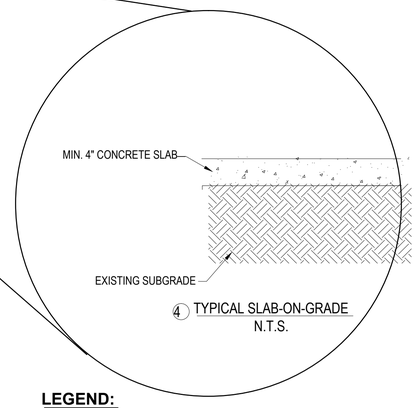
① TYPICAL SOIL REMOVAL AREA COVER SYSTEM
N.T.S



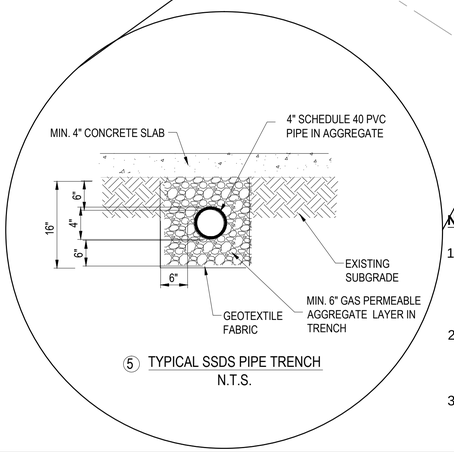
② SOIL VAPOR EXTRACTION WELL DETAIL
N.T.S.



③ TYPICAL SUB SLAB DEPRESSURIZATION PIT
N.T.S.



④ TYPICAL SLAB-ON-GRADE
N.T.S.



⑤ TYPICAL SSDS PIPE TRENCH
N.T.S.

SEE AS-BUILT DRAWINGS FOR SSDS AND SVE SYSTEM DETAILS

SCALE IN FEET

NOTES:

1. THE ENTIRE SITE (BLOCK 3323, LOT 36) IS AFFECTED BY ENGINEERING CONTROLS CONSISTING OF THE CAP (CONCRETE FLOOR SLABS AND UNDERLYING MATERIALS) AND THE SUB-SLAB DEPRESSURIZATION AND SOIL VAPOR EXTRACTION SYSTEM.
2. BASEMAP TAKEN FROM A15 (LOWER FLOOR PLAN) DATED 9/20/90 AND EXTENT OF SOIL EXCAVATION TAKEN FROM DPK CONSULTING, LLC SURVEY DATED 5/13/14.
3. ELEVATIONS SHOWN IN SOIL REMOVAL AREA ARE BASED ON THE BRONX BOROUGH DATUM.

SSDS/SVE BLOWER
CARBON TREATMENT SYSTEM
PROJECT SITE BOUNDARY
BUILDING LINE
4-INCH SLOTTED PVC PIPE
4-INCH SOLID PVC PIPE (IN SUB-SLAB TRENCHES)

LEGEND:

MP-1 SUB-SLAB MONITORING POINT
SVE-1 SOIL VAPOR EXTRACTION WELL
MW-3 GROUNDWATER MONITORING WELL
P-1 SUB-SLAB DEPRESSURIZATION PIT

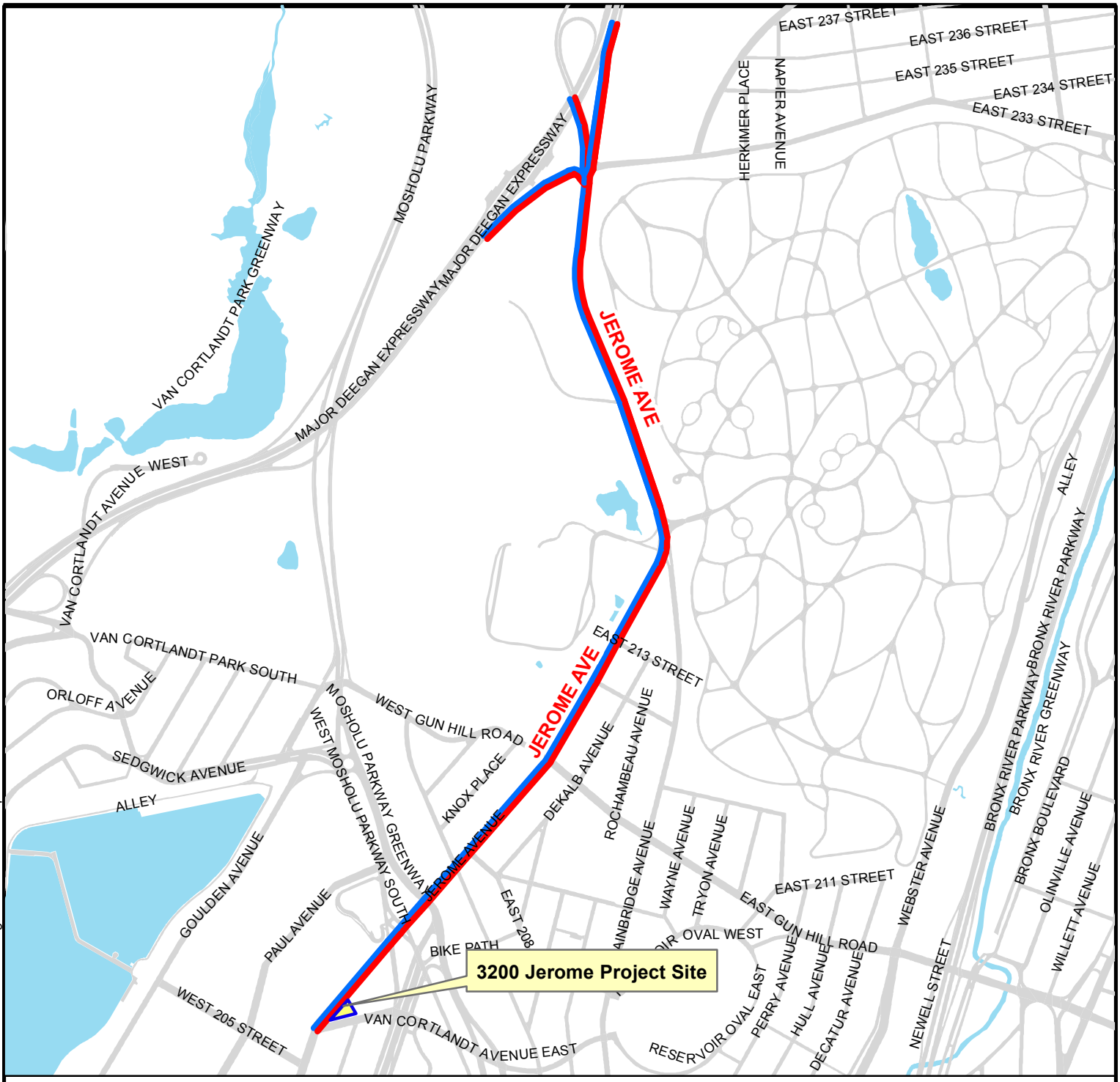
VAPOR BARRIER, GAS PERMEABLE AGGREGATE, AND CONCRETE SLAB RESTORATION ASSOCIATED WITH SOIL REMOVAL
EXTENT OF BASEMENT
VR-1 8-INCH STEEL PIPE VERTICAL RISER AND IDENTIFICATION NUMBER
EF-1 2-INCH STEEL PIPE VERTICAL RISER AND IDENTIFICATION NUMBER

AKRF Engineering, P.C.
440 Park Avenue South, New York, NY 10016

FORMER NESSEN LAMP SITE 3200 JEROME AVENUE
BRONX, NEW YORK

SITE COVER SYSTEM PLAN

DATE 12.9.2014
SCALE AS SHOWN
PROJECT No. 11455
FIGURE 20



Legend

- 3200 Jerome Project Site Location
- Truck Route Entrance/Exit to I-87

Feet
0 1,000 2,000

FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE
BRONX, NEW YORK

TRUCK ROUTE MAP

AKRF Engineering, P.C.
440 Park Avenue South, New York, N.Y. 10016

DATE
7/30/2014

PROJECT No.
11455

FIGURE
21

©2014 AKRF, Inc. Environmental Consultants
O:\Projects\11455 - 3200 JEROME AVE\11455 fig 21 Truck Route Map.mxd

APPENDIX A
ENVIRONMENTAL EASEMENT

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 30th day of June, 2014, between Owner(s) The Rinzler Family Limited Partnership c/o Dominion Management Company LLC (RFLP), having an office at 200 Madison Avenue, 24th Floor, County of New York, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 3200 Jerome Avenue in the City of Bronx, County of Bronx and State of New York, known and designated on the tax map of the County Clerk of Bronx as tax map parcel numbers: Section 2 Block 3323, Lot 36, being the same as that property conveyed to Grantor by deed dated January 21, 2000 and recorded in the Bronx County Clerk's Office in Liber and Page of Reel 1744, Page 1464. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.264 +/- acres, and is hereinafter more fully described in the Land Title Survey dated May 13, 2014 prepared by DPK Consulting, LLC, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation

established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C203061, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv) .

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Bronx County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation

pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5 the report and all attachments were prepared under the direction of, and reviewed by, the party making tiie certification;

(6) to the best of his/her 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

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C203061
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

The Rinzler Family Limited Partnership (c/o Dominion Management LLC):

By: _____

Print Name: Bradley Rinzler

Title: GP Date: 5/12/14

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF)

On the 12th day of May, in the year 2014, before me, the undersigned, personally appeared Bradley Rinzler, 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.

Robi Roberts
Notary Public - State of New York

ROBIN B. ROBERTS
Notary Public, State of New York
No. 02RO6153240
Qualified in New York County
Commission Expires October 02, 2016 2014

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

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

On the 30th day of June, in the year 2014, before me, the undersigned, personally appeared Robert W. Schick, 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/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2018

SCHEDULE "A" PROPERTY DESCRIPTION

ALL that certain plot, piece or parcel of land, situate, lying and being in the Borough of the Bronx, County of the Bronx, City and State of New Yrok, bounded and described as follows:

BEGINNING at the corner formed by the intersection of the northerly side of Van Cortlandt Avenue East and the easterly side of Jerome Avenue;

RUNNING THENCE Northeasterly along the northerly side of Van Cortlandt Avenue East, two hundred (200) feet;

THENCE Westerly along a line which forms an angle on its northerly side with the northerly side of Van Cortlandt Avenue East 107 degrees 32 minutes 54 seconds one hundred and twenty and sixty one hundredths (120.60) feet to the easterly side of Jerome Avenue;

THENCE Southerly along the easterly side of Jerome Avenue (200) feet to the point or place of BEGINNING.

1 TITLE INFORMATION

THE TITLE INFORMATION WAS PREPARED AND PROVIDED BY CHICAGO TITLE INSURANCE COMPANY, CHARLES H. SCHAEFER, ESQ., DATED APRIL 1, 2014, TITLE NO.: BRX-246311-L.

2 SURVEYOR CERTIFICATION

TO:
- THE RINZLER FAMILY LIMITED PARTNERSHIP
- CHICAGO TITLE INSURANCE COMPANY
- DOMINION FINANCIAL CORPORATION, ITS SUCCESSORS AND/OR ASSIGNS

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2011 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 2-4, 5 (PARTIAL) 7(a), 7(b)(1), 7(b)(2), 8, 11,12, 13, 16, 20, AND 21 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON APRIL 2, 2014.

DATE: 5/13/14

(SIGNED) Jeffrey D. Bunce (SEAL)

JEFFREY D. BUNCE
N.Y. LICENSE No. 050815

3 SCALE

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

GRAPHIC SCALE

3 0 1 2 3 6 12

(IN METERS)
1 inch = 3.048 meters

4 CLIENT INFORMATION BOX

THE RINZLER FAMILY LIMITED PARTNERSHIP

5 LEGEND

SYMBOL LEGEND:

- CONC. MONUMENT FND
- I.P. / I.B. FND
- TACK / STAKE FND
- WETLAND FLAG
- SPOT ELEVATIONS
- TREE
- SHRUB
- TRAFFIC SIGNAL POLE
- UTILITY POLE
- GUY WIRE
- MONITORING WELL
- LIGHT POLE
- SIGN
- FIRE HYDRANT
- MANHOLE
- WELL
- BOLLARD
- ROOF DRAIN
- CLEAN OUT
- SPRINKLER HEAD
- "A"-INLET
- "B"-INLET
- "E"-INLET
- YARD INLET
- FLARED END SECTION
- MAIL BOX
- CABLE TV BOX
- TELEPHONE BOX
- A/C UNIT
- TRANSFORMER
- WATER VALVE
- WATER METER
- GAS VALVE
- GAS METER
- ELECTRIC METER
- D.C. DEPRESSED CURB
- L.S.A. LANDSCAPED AREA

6 SQ. FOOTAGE OF BUILDINGS

BUILDING	11,488 SF
TOTAL	11,488 SF

7 SURVEYOR'S NOTES

GENERAL NOTES:

1. FIELD SURVEY PERFORMED ON FEBRUARY 7, 2014, MARCH 12, 2014 AND APRIL 2, 2014.
2. THE UTILITIES SHOWN HAVE BEEN LOCATED FROM EVIDENCE OBSERVED ON THE SURFACE ONLY OR HAVE BEEN SHOWN GRAPHICALLY PER SUPPLIED MATERIALS. DPK CONSULTING MAKES NO GUARANTEES THAT THE UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN-SERVICE OR ABANDONED. DPK CONSULTING FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. DPK CONSULTING HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.
3. PREMISES ARE COMMONLY KNOWN AS 3200 JEROME AVENUE, BRONX, NEW YORK.
4. ALSO KNOWN AS LOT 36 IN BLOCK 3323 AS SHOWN ON THE OFFICIAL TAX MAPS OF THE BOROUGH OF THE BRONX, BRONX COUNTY, CITY AND STATE OF NEW YORK.
5. DEED REFERENCE REEL 1744, PG. 1464.

8 LAND AREA

11,499 S.F.
0.2640 AC.

9 BASIS OF BEARING

THE BEARING N 12°16'05" E BEING THE SOUTHEASTERLY SIDELINE OF JEROME AVENUE SHOWN ON REF #2. ALSO BEING THE THIRD COURSE IN REEL 1744, PAGE 1464 .

10 POSSIBLE ENCROACHMENTS

A BASEMENT ENTERANCE OVER JEROME AVENUE

11a SURVEYOR'S DESCRIPTION

BEGINNING AT THE INTERSECTION OF THE NORTHWESTERLY SIDELINE OF VAN CORTLANDT AVENUE EAST, SHOWN 100 FEET WIDE ON RECORD MAP SECTION 20, LAST REVISED MARCH 29, 1950, WITH THE EASTERLY SIDELINE OF JEROME AVENUE, SHOWN 100 FEET WIDE ON SAID RECORD MAP, AND RUNS, THENCE:

COURSE 1. ALONG JEROME AVENUE, NORTH 12° 16' 05" EAST 200.00 FEET, TO A POINT WHERE THE SAME IS INTERSECTED BY THE DIVISION LINE BETWEEN LANDS HEREINDESCRIBED AND LANDS NOW OR FORMERLY OF 3220 JEROME LLC, DESCRIBED IN DOC 2004081300213; THENCE

COURSE 2. ALONG THE SAME AND THEN ALONG LANDS NOW OR FORMERLY OF 19 E. VAN CORTLANDT ASSOC. LLC, DESCRIBED IN REEL 1539 AT PAGE 1284, SOUTH 60 11' 02" EAST 120.60 FEET, TO A POINT IN THE NORTHERLY SIDELINE OF VAN CORTLANDT AVENUE EAST; THENCE

COURSE 3. ALONG THE SAME, SOUTH 47 21' 52" WEST 200.00 FEET, TO THE POINT AND PLACE OF BEGINNING.

11b RECORD LEGAL DESCRIPTION

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF THE BRONX, COUNTY OF THE BRONX, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE CORNER FORMED BY THE INTERSECTION OF THE NORTHERLY SIDE OF VAN CORTLANDT AVENUE EAST AND THE EASTERLY SIDE OF JEROME AVENUE;

RUNNING THENCE NORTHEASTERLY ALONG THE NORTHERLY SIDE OF VAN CORTLANDT AVENUE EAST, TWO HUNDRED (200) FEET;

THENCE WESTERLY ALONG A LINE WHICH FORMS AN ANGLE ON ITS NORTHERLY SIDE WITH THE NORTHERLY SIDE OF VAN CORTLANDT AVENUE EAST 107 DEGREES 32 MINUTES 54 SECONDS ONE HUNDRED AND TWENTY AND SIXTY ONE HUNDREDTHS (120.60) FEET TO THE EASTERLY SIDE OF JEROME AVENUE;

THENCE SOUTHERLY ALONG THE EASTERLY SIDE OF JEROME AVENUE (200) FEET TO THE POINT AND PLACE OF BEGINNING.

12 ENVIRONMENTAL EASEMENT DESCRIPTION

THE ENTIRE SITE (BLOCK 3323, LOT 36) IS AFFECTED BY ENGINEERING CONTROLS CONSISTING OF THE CAP (CONCRETE FLOOR SLABS) AND THE SUB-SLAB DEPRESSURIZATION AND SOIL VAPOR EXTRACTION SYSTEM.

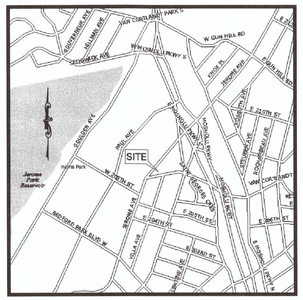
13 UTILITY SERVICES NOTIFIED BY DIGSAFE

CABLEVISION
CONED
EMPIRE CITY SUBWAY
LIGHT TOWER FIBER
CROWN CASTLE

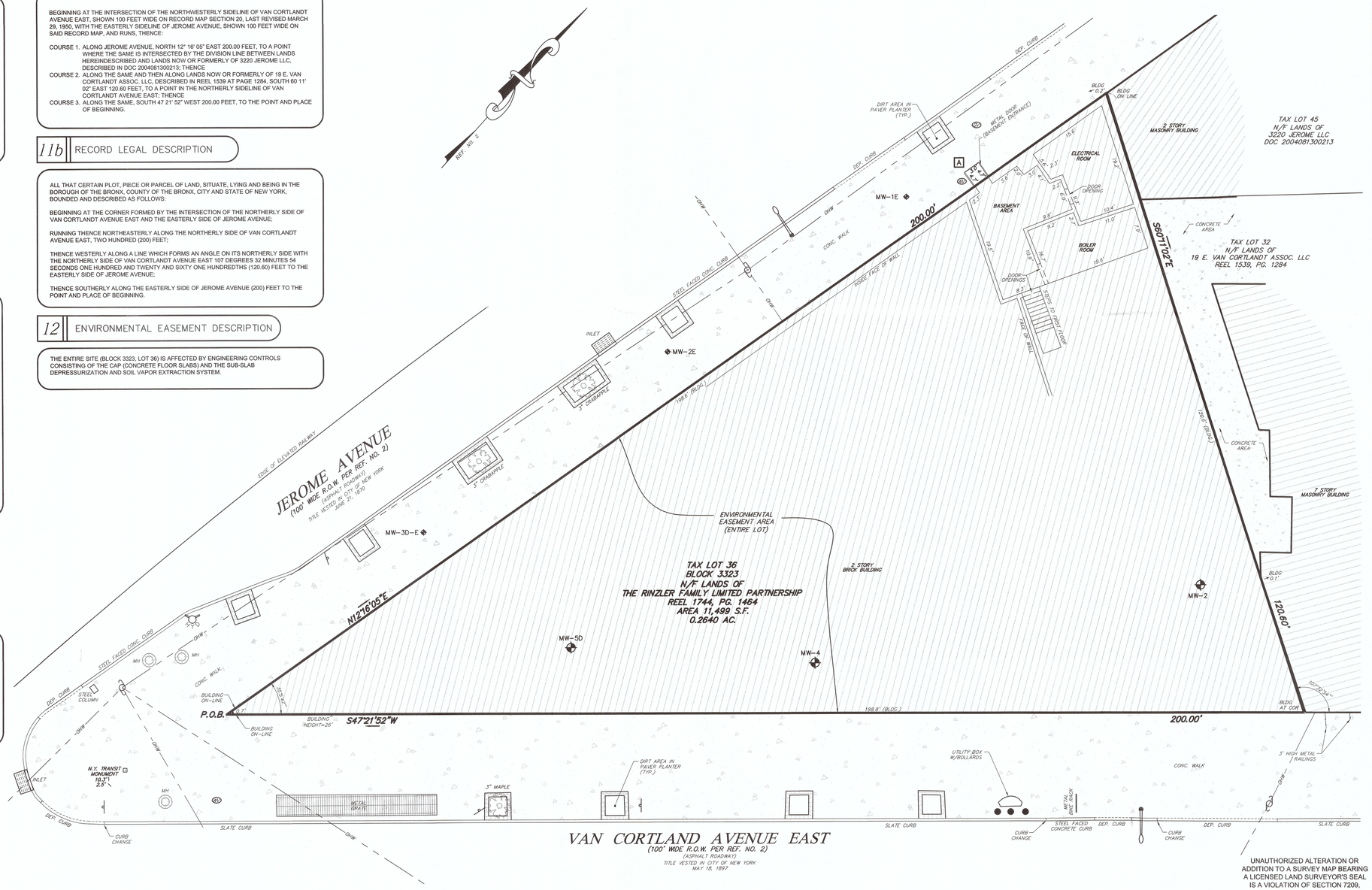
14 MAP REFERENCES

MAP REFERENCES:

1. MAP ENTITLED "MONITORING WELL LOCATION SURVEY, TAX LOT 36, TAX BLOCK 3323", PREPARED BY MONTROSE SURVEYING CO., LLP., DATED AUGUST 14, 2012, LAST REVISED JANUARY 8, 2013.
2. MAP ENTITLED "RECORD MAP SECTION 20," LAST REVISED MARCH 29, 1950
3. MAP ENTITLED "FINAL SECTION FILED DEC 17, 1895 FINAL MAP SECTION 20, AS AMMENDED" LAST REVISED JULY 1, 1999.
4. MAP ENTITLED "TITLE MAP 14".



15 VICINITY MAP
SCALE: N.T.S.



UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

REV	DATE	DESCRIPTION	BY	CHKD

Steven D. Parent — date
Professional Land Surveyor
N.J. Lic: 24GS03626900
SPARENT@DPKCONSULTING.NET

Jeffrey D. Bunce — 5/13/14 — date
Professional Land Surveyor
N.Y. Lic: 050815 N.J. Lic: 24GS04104500
JBUNCE@DPKCONSULTING.NET

In consideration of the mutual covenants between the undersigned, it is agreed that the undersigned has reviewed the survey map and the notes listed above and to the best of my professional knowledge, information and belief correctly and/or accurately represents the property shown hereon. Underground utilities and/or improvements above the surface of the lands are not visible. Underground utilities and/or improvements may exist which are not shown hereon. Unless otherwise noted, this survey is made to provide relevant conditions which an abstractor title search might disclose. This plan is made to provide relevant conditions which an abstractor title search might disclose. This plan is made for the exclusive use of the undersigned and is not transferable, except as noted, to the above named parties for this transaction only and is not to be used for any other purpose.

DPK CONSULTING
147 Union Ave, Ste. 1C, Middlesex, NJ 08846 P: 732-764-0100 F: 732-764-0990
NEW JERSEY CERTIFICATE OF AUTHORIZATION NO. 24GA28042200

DRAWN BY:	R.A.Q.
CHK'D BY:	S.D.P.
SCALE:	1" = 10'
DATE:	05/13/2014

ENVIRONMENTAL EASEMENT PLAN
TAX MAP LOT 36
BLOCK 3323
3200 JEROME AVENUE
BOROUGH OF THE BRONX
BRONX COUNTY
CITY AND STATE OF NEW YORK

DRAWING FILE:	14-6089EE00
PROJECT NUMBER:	14-6089
SHEET	1 / 1
REV.	0

APPENDIX B
EXCAVATION WORK PLAN

B-1 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 NYSDEC. Currently, this notification will be made to:

Jane O'Connell (jane.oconnell@dec.ny.gov)
Regional Hazardous Waste Remediation Engineer
New York State Department of Environmental Conservation
Division of Environmental Remediation
47-40 21st Street
Long Island City, NY 11101-5401

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, if it differs from the HASP provided in Appendix C of this document;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based soil screening will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soil 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.

B-3 STOCKPILE METHODS

Soil stockpiles generated outside of the Site building will be continuously encircled with a berm and/or silt fence. Hay bales 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. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC.

B-4 MATERIALS EXCAVATION AND LOAD OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash will be operated on-site if deemed appropriate by NYSDEC. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash 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.

B-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks will be washed prior to leaving the site. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Truck transport routes are shown on Figure 20, and are described as follows:

Trucks will travel to and from the Site via Jerome Avenue. Arriving trucks will proceed to the Site from the Major Deegan Expressway (I-87), entering Manhattan via the Robert F. Kennedy Bridge or the George Washington Bridge. Arriving trucks will proceed south from I-87 on Jerome Avenue to the Site. Depending on the final destination, trucks departing the Site will travel from the Site north on Jerome Avenue to East 233rd Street, then take the appropriate on-ramp towards northbound or southbound I-87. All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes. All trucks loaded with Site materials will exit the vicinity of the Site using these truck routes; however, the truck route is subject to change depending on available truck routes at the time of the work (pending road closures, etc.), and trucking company input related to the allowable truck routes.

All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; (f) overall safety in transport; and (g) community input.

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. Off-site queuing will be prohibited.

B-6 MATERIALS DISPOSAL OFF-SITE

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, Construction and Demolition (C&D) debris 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).

B-7 MATERIALS REUSE ON-SITE

Chemical criteria for on-site reuse of material will meet the lower of the NYSDEC Part 375 protection of groundwater or the protection of public health for restricted residential use SCOs and can only be used as backfill beneath the site cover system for the approved use of the Site consistent with the Environmental Easement. 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, 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.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

B-8 FLUIDS MANAGEMENT

All liquids to be removed from the Site, including excavation dewatering and groundwater monitoring well purge and development waters, will be handled, transported, and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, but will be managed off-site.

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.

B-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with this SMP and the COC. An appropriate demarcation layer will be replaced to provide a visual reference to the top of the 'Remaining Contamination Zone', the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this Site Management Plan. 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.

B-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the Site.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported 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 to be used at the Site are listed in Table 1 (included in Section 1 of this SMP). 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.

B-11 STORMWATER POLLUTION PREVENTION

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.

B-12 CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment, and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for full 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. These findings will be also included in the periodic reports prepared pursuant to Section 5 of the SMP.

B-13 COMMUNITY AIR MONITORING PLAN

Work zone monitoring will be performed for the health and safety of workers during interior intrusive work (excavation, vapor barrier installation, groundwater treatment, and SSDS installation) activities in accordance with action levels and guidance outlined in the Site specific HASP. During intrusive activities, all windows and doors at street level will remain closed to prevent exposure to the public and the existing ventilation system and any additional ventilation fans will vent to the roof. Temporary carbon filters will be installed within the existing ventilation fans and HVAC units to prevent potential odors from emanating toward the adjacent apartment building.

Community air monitoring will be performed at the perimeter of the Site continuously during intrusive Site activities including the loading or staging of excavated soil prior to transportation and off-site disposal. In addition, community air monitoring will be performed periodically (at a minimum once per hour) on a roving basis with a concentration on any active exterior work area(s). Work areas may include the following: any staging/load out areas for roll-off containers outside of the building along Jerome Avenue and areas immediately adjacent to the roll-up door in the northeastern portion of the Site along Jerome Avenue which would be a primary egress point for transferring excavated soil from the interior of the building for loading and/or staging.

VOC and particulate monitoring equipment will consist of a photoionization detector (PID) capable of detecting the VOCs found in the excavated soil and real-time aerosol or particulate monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM_{10}). VOC monitoring equipment will be calibrated, and the particulate monitoring equipment zeroed, on a daily basis and documented in a dedicated field log book. Both VOC and particulate monitoring equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the prescribed action levels.

If VOC monitoring results in the ambient air concentration of total organic vapors in excess of 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases below 5 ppm over background, work activities can resume with measures taken to reduce vapors and continue monitoring. If total organic vapor levels persist at levels in excess of 5 ppm over background, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. If the organic vapor level is repeatedly over 25 ppm above background, activities will be shut down and the engineering controls and the Site work plan re-evaluated.

If particulate monitoring results in a 15-minute average concentration measurement that is between 100 $\mu g/m^3$ and 150 $\mu g/m^3$ above the background level, additional dust suppression techniques will be implemented to reduce the generation of fugitive dust and corrective action taken to protect Site personnel and reduce the potential for contaminant migration. Should dust suppression measures being utilized not lower particulates to an acceptable level (e.g., below 150 $\mu g/m^3$ above the background level, and no visible dust from the work area), work will be suspended until appropriate corrective measures are implemented to remedy the situation.

Details regarding work zone and community air monitoring are outlined in the HASP attached as Appendix C. Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

B-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include (a) through (f), as outlined below. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's QEP, 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.

B-15 DUST CONTROL PLAN

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- 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.

B-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX C

HEALTH AND SAFETY PLAN AND COMMUNITY AIR MONITORING PLAN

Former Nessen Lamps Site

3200 JEROME AVENUE

BRONX, NEW YORK

Health and Safety Plan

AKRF Project Number: 11455

NYSDEC Brownfield Cleanup Program Site Number: C203061

Prepared for:

Rinzler Family Limited Partnership
200 Madison Avenue, 24th Floor
New York, New York 10016

Prepared by:

AKRF Engineering, P.C.
440 Park Avenue South, 7th Floor
New York, New York 10016
212-696-0670

DECEMBER 2014

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Figure HASP-1 – Hospital Route Map

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ATTACHMENT A – Potential Health Effects from On-site Contaminants
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1.0 INTRODUCTION

The Former Nessen Lamps Site (the Site) is located at 3200 Jerome Avenue, Bronx, New York. The Site consists of a triangular-shaped, approximately 11,500-square foot (SF) property that is fully occupied by an approximately 18,500-SF two-story building.

Following the identification of a trichloroethene (TCE)-contaminated soil source beneath the central portion of the Site building, the owner, Rinzler Family Limited Partnership (RFLP) entered into a Brownfield Cleanup Agreement (BCA) as a volunteer in the New York State Department of Environmental Conservation's (NYSDEC's) Brownfield Cleanup Program to remediate the Site. A Remedial Investigation (RI) was performed to characterize the nature and extent of contamination at the Site as detailed in the Remedial Investigation Report (RIR).

Generally, the RI determined that the areas of concern at the Site are based on the former use of the Site as a lamp manufacturer who was known to have stored and disposed of TCE-related waste and the prior use of the Site as an automotive garage which maintained underground gasoline storage tanks. Releases from the use, storage, or disposal of the chlorinated solvent TCE, and to a lesser extent, petroleum-related compounds, have contaminated soil, groundwater, and soil vapor beneath the Site. The identified location of the source of both of these contaminants has been identified in the central portion of the Site. The soil contaminated source area was determined to be confined within the extents of the Site and generally delineated within an approximately 1,500-square foot area from approximately 6 to 9 feet below the grade of the first floor based on soil sampling completed during the RI. The soil source had resulted in TCE and petroleum-related groundwater contamination, and predominantly TCE-contaminated soil vapor and related soil vapor intrusion concerns.

Based on the known geologic conditions (shallow bedrock and a west-southwesterly groundwater flow direction) and off-site investigation activities, the on-site contamination did not adversely affect nearby properties or sensitive receptors. The findings of the RI were used to determine the appropriate remedial actions, which were summarized in the NYSDEC-approved Remedial Action Work Plan (RAWP).

The Site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index #C203061-02-12, Site #C203061 between September 2013 and September 2014. After completion of the remedial work described in the RAWP, some residual contamination remains in the subsurface at the Site. A Site Management Plan (SMP) was prepared to manage remaining contamination at the Site until the Environmental Easement (an institutional control restricting the type of use at the property to restricted residential, commercial, and industrial use) is extinguished. This Health and Safety Plan (HASP) has been designed to provide workplace safety while completing the requirements of the SMP.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Check all that apply		
(**X**) Organic Chemicals	(**X**) Inorganic Chemicals	( ) Radiological
( ) Biological	( ) Explosive/Flammable	( ) Oxygen Deficient Atm.
(**X**) Heat Stress	(**X**) Cold Stress	( ) Carbon Monoxide
Comments: No personnel are permitted to enter permit confined spaces.		

2.1.2 Physical Characteristics

Check all that apply		
(X) Liquid	(X) Solid	( ) Sludge
(X) Vapors	( ) Unknown	( ) Other
Comments:		

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	(**X**) Halogens	( ) Transformer	( ) Lab
( ) Caustics	() Asbestos	( ) Metals	(**X**) Petroleum	( ) Other DF	( ) Pharm
( ) Pesticides	( ) Tailings	( ) POTW	(**X**) Other Chlorinated Organic Solvents	( ) Motor or Hydraulic Oil	( ) Hospital
(**X**)Petroleum	(**X**) Other	( ) Other		(**X**) Gasoline	( ) Rad
( ) Inks	Fill material			(**X**) Fuel Oil	( ) MGP
( ) PCBs					( ) Mold
(**X**) Metals					( ) Cyanide
(**X**)Other: **SVOCs**					

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Tetrachloroethylene (PCE)	REL = Lowest possible PEL = 100 ppm STEL = 100 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination, headache, drowsiness, skin erythema (skin redness), and liver damage.
Trichloroethylene (TCE)	REL = 25 ppm PEL = 100 ppm	Headaches, lung irritation, dizziness, poor coordination, impaired heart function, unconsciousness, and nerve, kidney and liver damage.
1,2 Dichloroethene	REL = 200 ppm PEL = 200 ppm	Nausea, drowsy, tiredness possible heart damage.
Arsenic	REL= 0.002 mg/m^3 PEL= 0.010 mg/m^3	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]
Lead	REL= 0.1 mg/m^3 PEL= 0.05 mg/m^3	Weak, lassitude, insomnia; facial pallor, pale eye, anorexia, low-weight, malnutrition, constipation, abdominal pain, colic; anemia; gingival lead line; tremors, paralysis wrists and ankles; encephalopathy; kidney disease; irritation eyes; hypotension.
Mercury	REL= 0.05 mg/m^3 (Hg vapor) REL=0.1 mg/m^3 (other) PEL= 0.1 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Polyaromatic Hydrocarbons (PAHs)	REL= 0.1 mg/m^3 PEL= 5 mg/m^3	Harmful effects on the skin, body fluids, and ability to fight disease after both short and long term exposure, birth defects, and potential occupational carcinogen.
Phthalates	REL= 5 mg/m^3 PEL= 5 mg/m^3	Nausea, vomiting, gastrointestinal distress, and chronic effects to the liver.
Comments: REL = NIOSH Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit		

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO) during detailed inspections and sampling events associated with the SMP. RFLP will appoint of its on-site personnel as the SSO during routine inspections associated with the SMP. This individual will be responsible for the implementation of the HASP. The SSO during detailed inspections and sampling events will have a 4-year college degree in occupational safety or a related science/engineering field, and experience in implementation of air monitoring and hazardous materials sampling programs. Health and safety training required for the SSO during detailed inspections and sampling events and all field personnel is outlined in Section 2.3 of this HASP.

2.3 Training

All personnel who enter the Site building/work area while intrusive/sampling activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety. All field personnel must attend a training program, whose purpose is to:

- Make them aware of the potential hazards they may encounter;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety; make them aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the field crew will be instructed in these objectives before he/she goes onto the Site. A site safety meeting will be conducted at the start of the project. Additional meetings shall be conducted, as necessary, for new personnel working at the Site.

2.4 Medical Surveillance Program

All AKRF and subcontractor personnel performing field work involving subsurface disturbance or sampling at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin Site activities. The medical release shall consider the type of work to be performed and the required PPE. The medical examination will, at a minimum, be provided annually and upon termination of hazardous waste Site work.

2.5 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may changed by SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

For locations on public streets and sidewalks, the necessary permits will be obtained from the New York City Department of Transportation (NYCDOT) to close the portion of the street or sidewalk where work is being performed. Appropriate barriers will be set up to secure the area and prevent anyone from approaching within 15 feet of the work area.

Site Work Zones			
Task	**Exclusion Zone**	**CRZ**	**Support Zone**
Any Excavation Performed for System Repair or Renovation	10 ft. from Excavator	15 ft. from Excavator	As Needed
In-Situ Groundwater Remediation or Monitor/Soil Vapor Extraction Well Installation	10 ft from Drilling or Injection Mixing Equipment	15 ft from Drilling or Mixing Equipment	As Needed

2.6 Air Monitoring

The purpose of the air monitoring program is to identify any exposure of the field personnel to potential environmental hazards in the soil and groundwater. Results of the air monitoring will be used to determine the appropriate response action, if needed.

2.6.1 Work Zone Air Monitoring

Real time air monitoring will be performed with a photoionization detector (PID) during applicable intrusive activities. Measurements will be taken prior to commencement of work and at a minimum once every half-hour during intrusive work, as outlined in the following table. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The SSO shall set up the equipment and confirm that it is working properly. The PID will be calibrated with 100 parts per million (ppm) isobutylene standard in accordance with the manufacturer's instructions at the start of each work day. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the following table.

Work Zone Air Monitoring Action Levels		
Instrument	**Action Level**	**Response Action**
PID	Less than 10 ppm in breathing zone	Level D or D-Modified
	Between 10 ppm and 500 ppm	Level C
	More than 500 ppm	Stop work. Resume work when readings are less then 500 ppm.

2.6.2 Community Air Monitoring Plan

Community air monitoring will be conducted during exterior Site activities including the loading or staging of excavated soil prior to transportation and off-site disposal in compliance with a site-specific Community Air Monitoring Plan (CAMP). Real-time air monitoring for volatile compounds at the perimeter of the exclusion zone will be performed as described below.

VOC Monitoring

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of groundwater samples. Periodic monitoring may include obtaining measurements upon arrival at a location, while opening a monitoring well cap, when bailing/purging a well, and upon leaving the location. In some instances, depending on the proximity of exposed individuals, continuous monitoring may be conducted during these activities.

Continuous monitoring for VOCs will be conducted during all soil handling activities (i.e. loading and staging of material for disposal) conducted outside of the building. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored continuously at the downwind perimeter of the exclusion zone. Monitoring will be conducted with a PID equipped with a 10.6 eV lamp capable of calculating 15-minute running average concentrations. The following actions will be taken based on organic vapor levels measured:

- If total organic vapor levels exceed 5 ppm above background for the 15-minute average at the exclusion zone perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the exclusion zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the hot 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 above background for the 15-minute average.
- If the total organic vapor level is above 25 ppm at the perimeter of the exclusion zone, activities will be shutdown.

More frequent intervals of monitoring will be conducted if required as determined by the SSO. All 15-minute readings will be recorded and available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, will also be recorded.

Major Vapor Emission Response Plan

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work Site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or vapor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If either of the following criteria is exceeded in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 1 ppm above background for a period of more than 30 minutes, or
- Organic vapor levels greater than 5 ppm above background for any time period.

Upon activation, the following activities shall be undertaken as part of the Major Vapor Emission Response Plan:

- The NYSDEC, NYSDOH, and local police authorities will be immediately contacted by the SSO and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site Health and Safety Officer; and
- All Emergency contacts will go into effect as appropriate.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review.

2.6.3 Personal Protection Equipment

The personal protection equipment required for various kinds of site investigation tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

AKRF field personnel and other site personnel shall wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in this section.

Personal Protection Equipment Requirements		
LEVEL OF PROTECTION & PPE		**All Tasks**
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig/excavator) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig/excavator) (**X**) Nitrile Gloves (**X**) Tyvek for drill operator if NAPL present	Yes
Level C *(in addition to Level D)* (**X**) Half-Face Respirator OR (**X**) Full Face	( ) Particulate Cartridge ( ) Organic Cartridge	If PID > 10 ppm (breathing zone) Full face respirator if PID > 50

Personal Protection Equipment Requirements		
LEVEL OF PROTECTION & PPE		**All Tasks**
Respirator ( ) Full-Face PAPR	(**X**) Dual Organic/ Particulate Cartridge	ppm (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breath or any odors detected).		

2.7 General Work Practices

To protect the health and safety of the field personnel, field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be driven to the North Central Bronx Hospital by on-site personnel. Directions to the hospital are provided below, and a hospital route map is attached.

3.1 Hospital Directions

Hospital Name:	North Central Bronx Hospital
Phone Number:	718-519-5000
Address/Location:	3424 Kossuth Avenue, Bronx, New York
Directions:	1. Head **northeast** on **Jerome Avenue** toward **W. Mosholu Parkway South** for 0.3 miles. 2. Turn **right** onto **East 208th Street** and drive 0.2 miles 3. Take sharp **left** onto **Steuben Avenue** and drive 0.1 miles 4. Turn **left** onto **East 210th Street** and drive 256 feet 5 Take first **right** onto **Kossuth Avenue** 6. Destination will be on the right

	The total trip distance = **0.7** miles.

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Marc Godick	Project Director	914-922-2356 (office)
	Dustin Kapson	Project Manager/ SSO	646-388-9767 (office) 646-823-5144 (cell)
Rinzler Family Limited Partnership	James Rinzler	Owner Representative	212-685-6500(office)
New York State Department of Environmental Conservation	Dana Kaplan	Project Manager	718-482-7541 (office) 718-482-4043 (fax)
New York State Department of Health	Dawn Hettrick	Public Health Engineer	518-402-7880 (office)
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

APPROVAL

Signed: _____ Date: _____

AKRF Project Manager

Signed: _____ Date: _____

AKRF Health and Safety Officer

Below is an affidavit that must be signed by all workers who enter the site. A copy of the HASP must be on-site at all times and will be kept by the SSO.

AFFIDAVIT

I,_____(name), of_____(company name), have read the Health and Safety Plan (HASP) for the Former Nessen Lamps Site. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signed: _____ Company: _____ Date: _____
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ATTACHMENT A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 784 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenic (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

❑ Arsenic occurs naturally in soil and minerals and it therefore may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
❑ Arsenic cannot be destroyed in the environment. It can only change its form.
❑ Rain and snow remove arsenic dust particles from the air.
❑ Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
❑ Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

❑ Ingesting small amounts present in your food and water or breathing air containing arsenic.
❑ Breathing sawdust or burning smoke from wood treated with arsenic.
❑ Living in areas with unusually high natural levels of arsenic in rock.
❑ Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the lungs, bladder, liver, kidney and prostate. Inhalation of inorganic arsenic can cause increase risk of lung cancer. The Department of Health and Human Services (DHHS) has determined that inorganic arsenic is a known carcinogen. The International Agency for Research on Cancer (IARC), and the EPA have determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is also some evidence that suggests that long-term exposure to arsenic in children may result in lower IQ scores. There is some information suggesting that children may be less efficient at converting inorganic arsenic to the less harmful organic forms. For this reason, children may be more susceptible to health effects from inorganic arsenic than adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

❑ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.

❑ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Arsenic (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.
- A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2005**

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HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 784 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenic (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

❑ Arsenic occurs naturally in soil and minerals and it therefore may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
❑ Arsenic cannot be destroyed in the environment. It can only change its form.
❑ Rain and snow remove arsenic dust particles from the air.
❑ Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
❑ Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

❑ Ingesting small amounts present in your food and water or breathing air containing arsenic.
❑ Breathing sawdust or burning smoke from wood treated with arsenic.
❑ Living in areas with unusually high natural levels of arsenic in rock.
❑ Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the lungs, bladder, liver, kidney and prostate. Inhalation of inorganic arsenic can cause increase risk of lung cancer. The Department of Health and Human Services (DHHS) has determined that inorganic arsenic is a known carcinogen. The International Agency for Research on Cancer (IARC), and the EPA have determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is also some evidence that suggests that long-term exposure to arsenic in children may result in lower IQ scores. There is some information suggesting that children may be less efficient at converting inorganic arsenic to the less harmful organic forms. For this reason, children may be more susceptible to health effects from inorganic arsenic than adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

❑ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.

❑ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Arsenic (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Di(2-ethylhexyl) phthalate (DEHP)

CAS # 117-81-7

This fact sheet answers the most frequently asked health questions (FAQs) about di(2-ethylhexyl) phthalate (DEHP). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Di(2-ethylhexyl) phthalate (DEHP) is found in many plastics. Exposure to DEHP is generally very low. Increased exposures may come from intravenous fluids delivered through plastic tubing, and from ingesting contaminated foods or water. DEHP is not toxic at the low levels usually present in the environment. In animals, high levels of DEHP damaged the liver and kidney and affected the ability to reproduce. DEHP has been found in at least 733 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is di(2-ethylhexyl) phthlate?

Di(2-ethylhexyl) phthlate (DEHP) is a manufactured chemical that is commonly added to plastics to make them flexible. DEHP is a colorless liquid with almost no odor.

DEHP is present in plastic products such as wall coverings, tablecloths, floor tiles, furniture upholstery, shower curtains, garden hoses, swimming pool liners, rainwear, baby pants, dolls, some toys, shoes, automobile upholstery and tops, packaging film and sheets, sheathing for wire and cable, medical tubing, and blood storage bags.

What happens to DEHP when it enters the environment?

❏ DEHP is everywhere in the environment because of its use in plastics, but it does not evaporate easily or dissolve in water easily.
❏ DEHP can be released in small amounts to indoor air from plastic materials, coatings, and flooring.
❏ It dissolves faster in water if gas, oil, or paint removers are present.
❏ It attaches strongly to soil particles.
❏ DEHP in soil or water can be broken down by microorganisms into harmless compounds.
❏ DEHP does not break down easily when it is deep in the soil or at the bottom of lakes or rivers.
❏ It is in plants, fish, and other animals, but animals high on the food chain are able to break down DEHP, so tissue levels are usually low.

How might I be exposed to DEHP?

DEHP is usually present at very low levels in:
❏ Medical products packaged in plastic such as blood products.
❏ Some foods packaged in plastics, especially fatty foods like milk products, fish or seafood, and oils.
❏ Well water near waste sites.
❏ Workplace air or indoor air where DEHP is released, but usually not at levels of concern.
❏ Fluids from plastic intravenous tubing if used extensively as for kidney dialysis.

How can DEHP affect my health?

At the levels found in the environment, DEHP is not expected to cause harmful health effects in humans. Most of what we know about the health effects of DEHP comes from studies of rats and mice given high amounts of DEHP.

Di(2-ethylhexyl) phthalate (DEHP)
CAS # 117-81-7

Harmful effects in animals generally occurred only with high amounts of DEHP or with prolonged exposures. Moreover, absorption and breakdown of DEHP in humans is different than in rats or mice, so the effects seen in rats and mice may not occur in humans.

Rats that breathed DEHP in the air showed no serious harmful effects. Their lifespan and ability to reproduce were not affected.

Brief oral exposure to very high levels of DEHP damaged sperm in mice. Although the effect reversed when exposure ceased, sexual maturity was delayed in the animals.

High amounts of DEHP damaged the liver of rats and mice. Whether or not DEHP contributes to human kidney damage is unclear.

Skin contact with products containing DEHP will probably cause no harmful effects because it cannot be taken up easily through the skin.

How likely is DEHP to cause cancer?

The Department of Health and Human Services (DHHS) has determined that DEHP may reasonably be anticipated to be a human carcinogen. The EPA has determined that DEHP is a probable human carcinogen. These determinations were based entirely on liver cancer in rats and mice. The International Agency for Research on Cancer (IARC) has stated that DEHP cannot be classified as to its carcinogenicity to humans.

How can DEHP affect children?

Children can be exposed to DEHP in the same manner as adults. In addition, small children can be exposed by sucking on or skin contact with plastic toys and pacifiers that contain DEHP, but there is no conclusive evidence of adverse health effects after such exposures. Nonetheless, because of concern for children's health, many toy manufacturers have discontinued use of DEHP in their products. In pregnant rats and mice exposed to high amounts of DEHP, researchers observed birth defects and fetal deaths.

How can families reduce the risk of exposure to DEHP?

❑ It is almost impossible to completely avoid contact with some DEHP because it is commonly found in plastics.
❑ Prevent babies and small children from chewing on plastic objects not designed for that purpose.

Is there a medical test to show whether I've been exposed to DEHP?

There is a test available that measures a breakdown product of DEHP called mono(2-ethylhexyl) phthalate (MEHP) in your urine or blood. This test can only detect recent exposure because DEHP is rapidly broken down and eliminated from your body. This test is not routinely available at the doctor's office because it requires special equipment.

Has the federal government made recommendations to protect human health?

The EPA limits the amount of DEHP that may be present in drinking water to 6 parts of DEHP per billion parts of water (6 ppb).

The Occupational Safety and Health Administration (OSHA) sets a maximum average of 5 milligrams of DEHP per cubic meter of air (5 mg/m^3) in the workplace during an 8-hour shift. The short-term (15-minute) exposure limit is 10 mg/m^3.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Di(2-ethylhexyl) phthlate (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.
- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of

people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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TETRACHLOROETHYLENE
CAS # 127-18-4

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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MERCURY
CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mŭr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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LEAD
CAS # 7439-92-1

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,026 of 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is lead?

(Pronounced lĕd)

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays.

Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

What happens to lead when it enters the environment?

- Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- When lead is released to the air, it may travel long distances before settling to the ground.
- Once lead falls onto soil, it usually sticks to soil particles.
- Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.
- Much of the lead in inner-city soils comes from old houses painted with lead-based paint.

How might I be exposed to lead?

- Eating food or drinking water that contains lead.
- Spending time in areas where lead-based paints have been used and are deteriorating.
- Working in a job where lead is used.
- Using health-care products or folk remedies that contain lead.
- Engaging in certain hobbies in which lead is used (for example, stained glass).

How can lead affect my health?

Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed.

At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

How likely is lead to cause cancer?

The Department of Health and Human Services has determined that lead acetate and lead phosphate may reasonably

be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine lead's carcinogenicity in people.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. A large amount of lead might get into a child's body if the child ate small pieces of old paint that contained large amounts of lead. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead.

How can families reduce the risk of exposure to lead?

Avoid exposure to sources of lead. Do not allow children to chew or mouth painted surfaces that may have been painted with lead-based paint (homes built before 1978). Run your water for 15 to 30 seconds before drinking or cooking with it. This will get rid of lead that may have leached out of pipes. Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children. Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to show whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth and bones can be measured with X-rays, but this test is not as readily available. Medical treatment may be necessary in children if the lead concentration in blood is higher than 45 micrograms per deciliter (45 µg/dL).

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that children ages 1 and 2 be screened for lead poisoning. Children who are 3 to 6 years old should be tested for lead if they have never been tested for lead before and if they receive services from public assistance programs; if they live in or regularly visit a building built before 1950; if they live in or visit a home built before 1978 that is being remodeled; or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers children to have an elevated level of lead if the amount in the blood is 10 µg/dL.

The EPA requires lead in air not to exceed 1.5 micrograms per cubic meter (1.5 $\mu g/m^3$) averaged over 3 months. EPA limits lead in drinking water to 15 µg per liter.

The Occupational Health and Safety Administration (OSHA) develops regulations for workers exposed to lead. The Clean Air Act Amendments of 1990 banned the sale of leaded gasoline. The Federal Hazardous Substance Act bans children's products that contain hazardous amounts of lead.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for lead. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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ETHYLBENZENE
CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕthʹ əl bĕnʹ zēnʹ)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?

(Pronounced 1,2-dī-klôrʹ ō-ĕthʹēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- 1,2-Dichloroethene evaporates rapidly into air.
- In the air, it takes about 5-12 days for half of it to break down.
- Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- In groundwater, it takes about 13-48 weeks to break down.
- There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high

levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.
- A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?

(Pronounced 1,2-dī-klôrʹ ō-ĕthʹēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- 1,2-Dichloroethene evaporates rapidly into air.
- In the air, it takes about 5-12 days for half of it to break down.
- Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- In groundwater, it takes about 13-48 weeks to break down.
- There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high

levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ETHYLBENZENE
CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕthʹ əl bĕnʹ zēnʹ)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD
CAS # 7439-92-1

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,026 of 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is lead?

(Pronounced lĕd)

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays.

Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

What happens to lead when it enters the environment?

- Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- When lead is released to the air, it may travel long distances before settling to the ground.
- Once lead falls onto soil, it usually sticks to soil particles.
- Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.
- Much of the lead in inner-city soils comes from old houses painted with lead-based paint.

How might I be exposed to lead?

- Eating food or drinking water that contains lead.
- Spending time in areas where lead-based paints have been used and are deteriorating.
- Working in a job where lead is used.
- Using health-care products or folk remedies that contain lead.
- Engaging in certain hobbies in which lead is used (for example, stained glass).

How can lead affect my health?

Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed.

At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

How likely is lead to cause cancer?

The Department of Health and Human Services has determined that lead acetate and lead phosphate may reasonably

be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine lead's carcinogenicity in people.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. A large amount of lead might get into a child's body if the child ate small pieces of old paint that contained large amounts of lead. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead.

How can families reduce the risk of exposure to lead?

Avoid exposure to sources of lead. Do not allow children to chew or mouth painted surfaces that may have been painted with lead-based paint (homes built before 1978). Run your water for 15 to 30 seconds before drinking or cooking with it. This will get rid of lead that may have leached out of pipes. Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children. Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to show whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth and bones can be measured with X-rays, but this test is not as readily available. Medical treatment may be necessary in children if the lead concentration in blood is higher than 45 micrograms per deciliter (45 µg/dL).

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that children ages 1 and 2 be screened for lead poisoning. Children who are 3 to 6 years old should be tested for lead if they have never been tested for lead before and if they receive services from public assistance programs; if they live in or regularly visit a building built before 1950; if they live in or visit a home built before 1978 that is being remodeled; or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers children to have an elevated level of lead if the amount in the blood is 10 µg/dL.

The EPA requires lead in air not to exceed 1.5 micrograms per cubic meter (1.5 $\mu g/m^3$) averaged over 3 months. EPA limits lead in drinking water to 15 µg per liter.

The Occupational Health and Safety Administration (OSHA) develops regulations for workers exposed to lead. The Clean Air Act Amendments of 1990 banned the sale of leaded gasoline. The Federal Hazardous Substance Act bans children's products that contain hazardous amounts of lead.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for lead. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

MERCURY
CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mŭr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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TETRACHLOROETHYLENE
CAS # 127-18-4

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.
- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of

people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Di(2-ethylhexyl) phthalate (DEHP)

CAS # 117-81-7

This fact sheet answers the most frequently asked health questions (FAQs) about di(2-ethylhexyl) phthalate (DEHP). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Di(2-ethylhexyl) phthalate (DEHP) is found in many plastics. Exposure to DEHP is generally very low. Increased exposures may come from intravenous fluids delivered through plastic tubing, and from ingesting contaminated foods or water. DEHP is not toxic at the low levels usually present in the environment. In animals, high levels of DEHP damaged the liver and kidney and affected the ability to reproduce. DEHP has been found in at least 733 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is di(2-ethylhexyl) phthlate?

Di(2-ethylhexyl) phthlate (DEHP) is a manufactured chemical that is commonly added to plastics to make them flexible. DEHP is a colorless liquid with almost no odor.

DEHP is present in plastic products such as wall coverings, tablecloths, floor tiles, furniture upholstery, shower curtains, garden hoses, swimming pool liners, rainwear, baby pants, dolls, some toys, shoes, automobile upholstery and tops, packaging film and sheets, sheathing for wire and cable, medical tubing, and blood storage bags.

What happens to DEHP when it enters the environment?

❏ DEHP is everywhere in the environment because of its use in plastics, but it does not evaporate easily or dissolve in water easily.
❏ DEHP can be released in small amounts to indoor air from plastic materials, coatings, and flooring.
❏ It dissolves faster in water if gas, oil, or paint removers are present.
❏ It attaches strongly to soil particles.
❏ DEHP in soil or water can be broken down by microorganisms into harmless compounds.
❏ DEHP does not break down easily when it is deep in the soil or at the bottom of lakes or rivers.
❏ It is in plants, fish, and other animals, but animals high on the food chain are able to break down DEHP, so tissue levels are usually low.

How might I be exposed to DEHP?

DEHP is usually present at very low levels in:
❏ Medical products packaged in plastic such as blood products.
❏ Some foods packaged in plastics, especially fatty foods like milk products, fish or seafood, and oils.
❏ Well water near waste sites.
❏ Workplace air or indoor air where DEHP is released, but usually not at levels of concern.
❏ Fluids from plastic intravenous tubing if used extensively as for kidney dialysis.

How can DEHP affect my health?

At the levels found in the environment, DEHP is not expected to cause harmful health effects in humans. Most of what we know about the health effects of DEHP comes from studies of rats and mice given high amounts of DEHP.

Di(2-ethylhexyl) phthalate (DEHP)
CAS # 117-81-7

Harmful effects in animals generally occurred only with high amounts of DEHP or with prolonged exposures. Moreover, absorption and breakdown of DEHP in humans is different than in rats or mice, so the effects seen in rats and mice may not occur in humans.

Rats that breathed DEHP in the air showed no serious harmful effects. Their lifespan and ability to reproduce were not affected.

Brief oral exposure to very high levels of DEHP damaged sperm in mice. Although the effect reversed when exposure ceased, sexual maturity was delayed in the animals.

High amounts of DEHP damaged the liver of rats and mice. Whether or not DEHP contributes to human kidney damage is unclear.

Skin contact with products containing DEHP will probably cause no harmful effects because it cannot be taken up easily through the skin.

How likely is DEHP to cause cancer?

The Department of Health and Human Services (DHHS) has determined that DEHP may reasonably be anticipated to be a human carcinogen. The EPA has determined that DEHP is a probable human carcinogen. These determinations were based entirely on liver cancer in rats and mice. The International Agency for Research on Cancer (IARC) has stated that DEHP cannot be classified as to its carcinogenicity to humans.

How can DEHP affect children?

Children can be exposed to DEHP in the same manner as adults. In addition, small children can be exposed by sucking on or skin contact with plastic toys and pacifiers that contain DEHP, but there is no conclusive evidence of adverse health effects after such exposures. Nonetheless, because of concern for children's health, many toy manufacturers have discontinued use of DEHP in their products. In pregnant rats and mice exposed to high amounts of DEHP, researchers observed birth defects and fetal deaths.

How can families reduce the risk of exposure to DEHP?

❑ It is almost impossible to completely avoid contact with some DEHP because it is commonly found in plastics.
❑ Prevent babies and small children from chewing on plastic objects not designed for that purpose.

Is there a medical test to show whether I've been exposed to DEHP?

There is a test available that measures a breakdown product of DEHP called mono(2-ethylhexyl) phthalate (MEHP) in your urine or blood. This test can only detect recent exposure because DEHP is rapidly broken down and eliminated from your body. This test is not routinely available at the doctor's office because it requires special equipment.

Has the federal government made recommendations to protect human health?

The EPA limits the amount of DEHP that may be present in drinking water to 6 parts of DEHP per billion parts of water (6 ppb).

The Occupational Safety and Health Administration (OSHA) sets a maximum average of 5 milligrams of DEHP per cubic meter of air (5 mg/m^3) in the workplace during an 8-hour shift. The short-term (15-minute) exposure limit is 10 mg/m^3.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Di(2-ethylhexyl) phthlate (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATTACHMENT B

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

The following section is based upon information provided by the CDC Division of Vector-Borne Infectious Diseases. Symptoms of West Nile Virus include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands, with most infections being mild. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death. Most infections of St. Louis encephalitis are mild without apparent symptoms other than fever with headache. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions (especially infants) and spastic (but rarely flaccid) paralysis. The only way to avoid infection of West Nile Virus and St. Louis encephalitis is to avoid mosquito bites. To reduce the chance of mosquito contact:

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET (N, N-diethyl-meta-toluamide), since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET. DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's directions for use, as printed on the product.

ATTACHMENT C

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

_____

_____

_____

Summary of any job related injuries, illnesses, or near misses that week:

_____

_____

_____

_____

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

_____

_____

_____

Comments:

_____

_____

_____

Name: _____ Company: _____

Signature: _____ Title: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____ _____
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury	___ Illness	___ Near Miss
__ Property Damage	___ Fire	___ Chemical Exposure
__ On-site Equipment	___ Motor Vehicle	___ Electrical
__ Mechanical	___ Spill	___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WITNESS TO ACCIDENT/INCIDENT:

Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____
Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____

INJURED - ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling ___ Non-disabling ___ Fatality

____ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____

NATURE OF INJURY OR ILLNESS: _____

_____

_____

_____

CLASSIFICATION OF INJURY:

__ Abrasions _____ Dislocations ____ Punctures

__ Bites _____ Faint/Dizziness ____ Radiation Burns

__ Blisters _____ Fractures ____ Respiratory Allergy

__ Bruises _____ Frostbite ____ Sprains

__ Chemical Burns _____ Heat Burns ____ Toxic Resp. Exposure

__ Cold Exposure _____ Heat Exhaustion ____ Toxic Ingestion

__ Concussion _____ Heat Stroke ____ Dermal Allergy

__ Lacerations

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

_____

Cost of Damage: $ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident (Object, substance, material, machinery, equipment, conditions)

_____

_____

_____

_____

Was weather a factor?:_____

_____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

_____

_____

_____

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

_____

_____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

_____

_____

Modifications:

_____

Was injured using required equipment?:

_____

_____

If not, how did actual equipment use differ from plan?:

_____

_____

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed | SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature | Title

Signature | Title

Signature | Title

ACCIDENT/INCIDENT FOLLOW-UP: Date: _____

Outcome of accident/incident: _____

Physician's recommendations: _____

Date injured returned to work: _____

Follow-up performed by:

Signature | Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT D

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATH!

Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

(No Picture) Grip partner's wrist or place both hands around waist

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

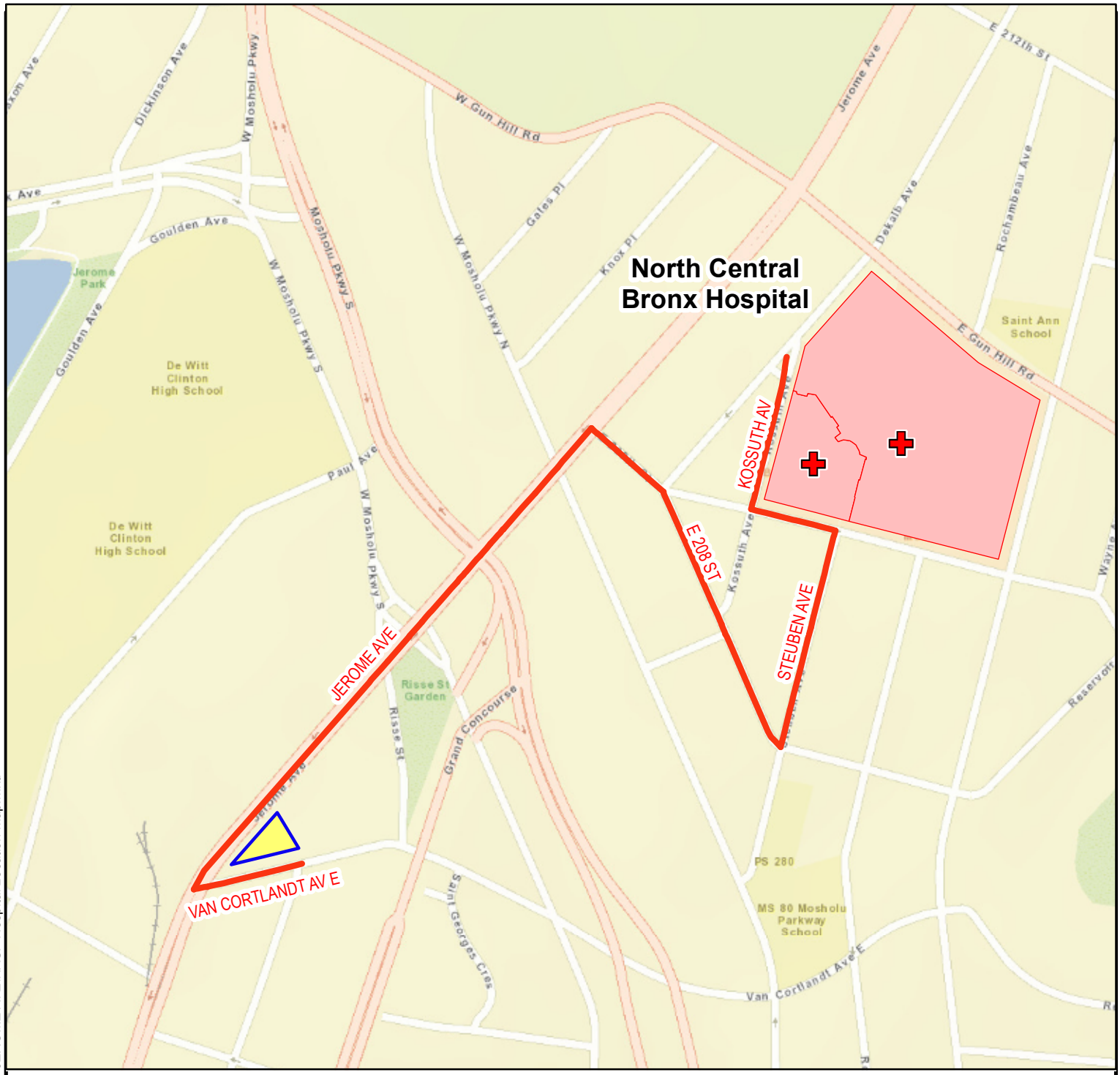
- I UNDERSTAND!

Thumbs up

NO! - NEGATIVE!

Thumbs down

FIGURES



Legend

- Route to Hospital
- 3200 Jerome Project Site Location
- Hospital Location

0 500 1,000 Feet

North Central Bronx Hospital
3424 Kossuth Avene
Bronx, NY 10467

FORMER NESSEN LAMP SITE
3200 JEROME AVENUE
BRONX, NEW YORK

HOSPITAL LOCATION MAP

AKRF
Environmental Consultants
440 Park Avenue South, New York, N.Y. 10016

DATE
10/7/2011

PROJECT No.
11455

FIGURE
1

©2011 AKRF, Inc. Environmental Consultants O:\Projects\11455 - 3200 JEROME AVE\HASP Hospital Location map.mxd

Former Nessen Lamps Site

3200 JEROME AVENUE

BRONX, NEW YORK

Community Air Monitoring Plan

AKRF Project Number: 11455

NYSDEC Brownfield Cleanup Program Site Number: C203061

Prepared for:

Rinzler Family Limited Partnership
200 Madison Avenue, 24th Floor
New York, New York 10016

Prepared by:

AKRF, Inc.
440 Park Avenue South
New York, NY 10016
212-696-0670

DECEMBER 2014

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Table 1 – Air Monitoring Summary Table

1.0 INTRODUCTION

The Former Nessen Lamps site (the Site) is located at 3200 Jerome Avenue, Bronx, New York. The Site consists of a triangular-shaped, approximately 11,500-square foot (SF) property that is fully occupied by an approximately 18,500-SF two-story building.

Following the identification of a trichloroethene (TCE)-contaminated soil source beneath the central portion of the Site building, the owner, Rinzler Family Limited Partnership (RFLP) entered into a Brownfield Cleanup Agreement (BCA) as a volunteer in the New York State Department of Environmental Conservation's (NYSDEC's) Brownfield Cleanup Program to remediate the Site. A Remedial Investigation (RI) was performed to characterize the nature and extent of contamination at the Site as detailed in the Remedial Investigation Report (RIR).

Generally, the RI determined that the areas of concern at the Site are based on the former use of the Site as a lamp manufacturer who was known to have stored and disposed of TCE-related waste and the prior use of the Site as an automotive garage which maintained underground gasoline storage tanks. Releases from the use, storage, or disposal of the chlorinated solvent TCE, and to a lesser extent, petroleum-related compounds, have contaminated soil, groundwater, and soil vapor beneath the Site. The identified location of the source of both of these contaminants has been identified in the central portion of the Site. The soil contaminated source area was determined to be confined within the extents of the Site and generally delineated within an approximately 1,500-square foot area from approximately 6 to 9 feet below the grade of the first floor based on soil sampling completed during the RI. The soil source had resulted in TCE and petroleum-related groundwater contamination, and predominantly TCE-contaminated soil vapor and related soil vapor intrusion concerns.

Based on the known geologic conditions (shallow bedrock and a west-southwesterly groundwater flow direction) and off-site investigation activities, the on-site contamination did not adversely affect nearby properties or sensitive receptors. The findings of the RI were used to determine the appropriate remedial actions, which were summarized in the NYSDEC-approved Remedial Action Work Plan (RAWP).

The Site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index #C203061-02-12, Site #C203061 between September 2013 and September 2014. After completion of the remedial work described in the RAWP, some contamination was left in the subsurface at the Site. A Site Management Plan (SMP) was prepared to manage remaining contamination at the Site until the Environmental Easement (an institutional control restricting the type of use at the property to restricted residential, commercial, and industrial use) is extinguished. This Community Air Monitoring Plan (CAMP) provides details for the perimeter air monitoring to be performed during any necessary activities completed at the Site under the requirements of the SMP.

1.1 Purpose and Objectives

The principal purpose of the CAMP is to monitor air quality in the vicinity of any intrusive activities that would require subsurface disturbance and/or soil disposal activities. The CAMP consists of monitoring dust, vapors and nuisance odors on a periodic/roving basis. Monitoring of any intrusive work associated with the SMP will include real-time air monitoring for particulate matter/dust and volatile organic compounds (VOCs), observations for visible emissions and odors, inspection and monitoring of the contractor's work practices, and reporting to the NYSDEC and the NYSDOH. Work zone monitoring will be performed during all slab-intrusive activities.

Principal objectives of the program are as follows:

- Monitor VOC vapors such that vapors associated with the remedial actions are maintained below action levels.
- Monitor dust as PM_{10} such that dust associated with the remedial actions is maintained below action levels.
- Monitor VOCs and visible emissions so that vapors and dust from the excavation operations do not leave the Site.
- Monitor for nuisance odors to prevent odors that could impact the surrounding community.
- In the event that VOCs, dust or odors exceed action levels, construction personnel will be immediately notified so that all necessary corrective actions can be taken.

2.0 COMMUNITY AIR MONITORING PROCEDURES

Work zone air monitoring will be performed continuously during all intrusive activities, from any cutting through the surficial floor slab through the final restoration (capping) of the floor slab, in accordance with the Health and Safety Plan (HASP) provided in Appendix C of the SMP. As outlined in the HASP, community air monitoring will be conducted during exterior Site activities including the loading or staging of excavated soil prior to transportation and off-site disposal. Community air monitoring will be performed periodically (at a minimum once per hour) on a roving basis around any active work area(s). Work areas may include the following: inside the building adjacent to any excavation, adjacent to drill rigs/bore holes, and/or any stockpile/staging/transfer areas outside of the excavation within or outside of the Site building.

The action levels specified herein require increased monitoring, corrective actions to abate emissions (see Section 3.0), and/or work shutdown. Table 1 summarizes dust, VOC and odor action levels and appropriate actions.

2.1 VOC Direct Reading Monitoring

VOC monitoring equipment will consist of a photoionization detector (PID) capable of detecting the VOCs found in the underlying soil and groundwater. The monitoring equipment will be calibrated on a daily basis and documented in a dedicated field log book. The instrument will be capable of calculating 15-minute running average concentrations, which will be compared to the prescribed action levels.

Readings will be subtracted from the background concentrations, to be measured each day prior to the start of work, to establish concentrations reflective of work activities during the periods between collection of background readings.

The 15-minute average concentrations will be compared to the following:

- If, during exterior work activities including loading out of contaminated soil, the ambient air concentration of total organic vapors 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 measures taken to reduce vapors and continue monitoring.
- If total organic vapor levels persist at levels in excess of 5 ppm over background during exterior work activities, work activities must be halted, the source of vapors identified,

corrective actions taken to abate emissions, and monitoring continued. If the exterior organic vapor level is repeatedly over 25 ppm above background, activities must be shutdown and the engineering controls and the Site work plan reevaluated.

- The appropriate actions for detections of total organic vapor levels inside of the building during excavation activities will be determined based on the thresholds outlined in the HASP.

2.2 Particulate (Dust) Direct Reading Monitoring

The particulate monitoring will only be performed during exterior (excavation/drilling outside of the Site building or loading soil for off-site disposal) work activities using real-time aerosol or particulate 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 established below. The dust monitor will be equipped with an audible alarm to indicate exceedance of the action level, and will be zeroed on a daily basis in accordance with the manufacturer's operating instructions and documented in a dedicated logbook. In addition, fugitive dust migration will be visually assessed during all work activities.

The primary standards for PM_{10} are 150 micrograms per cubic meter ($\mu g/m^3$) over a 24-hour averaging time and 50 $\mu g/m^3$ over an annual averaging time. Both of these standards are averaged arithmetically. The action level will be established at 150 $\mu g/m^3$ above background, over 15-minute time weighted average (TWA). While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety.

The 15-minute average concentrations will be compared to the following:

- If the particulate measurement is between 100 $\mu g/m^3$ and 150 $\mu g/m^3$ above the background level, additional dust suppression techniques will be implemented to reduce the generation of fugitive dust and corrective action taken to protect Site personnel and reduce the potential for contaminant migration.
- If the dust suppression measures being utilized at the Site do not lower particulates to an acceptable level (e.g., below 150 $\mu g/m^3$ above the background level, and no visible dust from the work area), work will be suspended until appropriate corrective measures are implemented to remedy the situation.

2.3 Odor Monitoring

Subsurface excavation work exposing contaminated materials may cause odors to be detectable. This may cause concern among the on-site workers or authorized visitors to the Site. Health risks or the potential for health risks do not rely strictly on detectable odors. However, controlling odor emissions from a site can allay public fears about health risks and provide additional means of controlling nuisance emissions during remediation activities. Periodic walk-around monitoring will be performed to observe perceptible odor that may be a nuisance to nearby sensitive receptors during excavation work. If perceptible odors are noted adjacent to a nearby receptor or a complaint is received, work will be suspended until appropriate corrective measures are implemented to remedy the situation. Continuous odor monitoring during exterior loading or staging activities will be performed to prevent health risks or potential risks to the surrounding public.

2.4 Equipment Operational Requirements

The air monitoring equipment must be operated by trained and qualified personnel. Personnel who perform air monitoring functions described in this section shall be experienced in the use of field air monitoring equipment, as well as the air monitoring procedures described above. There must also be appropriate staff (chemist, industrial hygienist or environmental scientist) for assessing the results of air monitoring and advising field personnel of air quality considerations.

3.0 VOC, DUST AND ODOR CONTROLS

The information and procedures presented in this section will be used for VOC, dust and odor control during activities summarized in Section 1.2. The construction manager for the project will be responsible for implementing these procedures based on the air monitoring results and required Action Levels described in Table 1. The information and procedures that are to be used for VOC, dust and odor control are presented in the following sub-sections.

3.1 VOC Controls

Control of VOCs during excavation work or other soil disturbance activities will consist of the construction manager implementing one or more of the following methods or measures:

- Covering stockpile or other material staging areas;
- Covering the exposed excavation/removal areas;
- Wetting excavated material; and
- Backfilling the excavation.

3.2 Dust Controls

The primary measure of preventing exposure to dust during excavation or other soil disturbance activities will be wetting techniques. The Contractor will provide for engineering controls (wet techniques) or other techniques (e.g., covering exposed soil surfaces, limiting active work areas) to control dust during work tasks that have the potential for generating dust. Dust controls involving the use of water (wetting or water spraying) will be employed at potential dust generating activity areas as follows:

- Before each task is initiated;
- During the tasks to keep the materials damp; and
- When air monitoring results dictate the need for dust control.

3.3 Odor Controls

Control of odors during excavation work or other soil disturbance activities will consist of one or more of the following measures:

- Covering stockpile or other material staging areas;
- Covering the exposed excavation/removal areas;
- Wetting excavated material; and
- Backfilling the excavation.

4.0 COMMUNITY AIR MONITORING RECORDKEEPING

The qualified safety officer or technician will ensure that all air monitoring data is logged in a log book or on daily field log sheets to document observations as part of the community air monitoring. Documentation shall be made clear, concise, and provide the date, time of entry, location, personnel, weather conditions, and measured concentrations. Documentation will also include all observational data that has potential for impacting results, such as potential off-site interferences, on-site public interferences, damage to instruments, Site equipment problems, or weather related interferences.

All pages must be numbered; no lines shall be left blank (or put a line through it), and must be initialed on each page in ink. The last entry page for the shift or day that has blank space left at the bottom shall have a line drawn diagonally across it and signed at the bottom of the page. All corrections must be made with a single line, initialed, and dated.

Copies of the log book or field log sheets will be submitted to NYSDEC with the Periodic Review Report (PRR). The Owner and NYSDEC will be notified promptly via phone and electronic mail of any exceedance of an Action Level and of the corrective actions taken in connection with the exceedance. If an exceedance occurs, the QEP will ensure corrective actions are taken document the actions and results in the PRR.

All monitoring equipment must be calibrated on a daily basis in accordance with the manufacturer's operating instructions. A dedicated log book for each monitoring unit will be maintained that details the date, time, calibration gas, or other standard, and name of person performing the calibration.

TABLES

Table 1
Air Monitoring Summary
Former Nessen Lamps Site
3200 Jerome Avenue, Bronx, NY

Monitoring Device	Monitoring Location/Personnel	Monitoring Frequency	Action Level	Action
PID	Interior of the Building adjacent to planned excavation during intrusive work Perimeter of Work Area During Loading Activities or adjacent to any exterior intrusive work	Periodic during all interior and exterior disturbance and/or exterior loading activities Background is the most recent upwind 15-minute average reading	<u>Interior of Building</u> < 10 ppm above background in breathing zone >10 ppm but < 250 ppm in breathing zone > 250 ppm above background in breathing zone <u>Exterior of Building</u> < 5 ppm above background at the downwind perimeter of the work zone (15-min TWA) > 5 ppm but < 25 ppm above background at the downwind perimeter of the work zone (15-min TWA) > 25 ppm above background at the downwind perimeter of the work zone (15-min TWA)	Level D or D-Modified PPE Level C PPE Shut down operations and reevaluate work and controls Continue normal operations Suspend operations until readings indicate < 5 ppm for 15-minute TWA. Take steps to abate emissions* Shut down operations and reevaluate work and controls
PM-10 Aerosol/ Particulate Air Monitoring Unit with Audible Alarm	Perimeter of Work Area	Periodic during interior and exterior Site activities including the loading or staging of excavated soil prior to transportation and off-site disposal Background is the most recent upwind 15-minute average reading	< 100 µg/m^3 above background at the downwind perimeter of the work zone (15-min TWA) > 100 µg/m^3 above background at the downwind perimeter of the work zone (15-min TWA), or visible dust leaving the excavation area > 150 µg/m^3 above upwind background level downwind perimeter of the work zone (15-min TWA)	Continue normal operations Implement dust control measures* Halt all soil disturbance work until downwind perimeter of excavation area reading is <150 µg/m^3 above background (upwind perimeter).
Olfactory	Perimeter of Work Area	Continuously during all disturbance activities and loading or staging activities	Perceptible odors outside work zone, adjacent to receptor, or complaint	Suspend operations until odor condition abated. Take steps to abate odor*

<u>NOTES:</u>
*See VOC, dust and odor control measures in Section 3.0 of this CAMP
TWA - Time weighted average
PID – Photoionization detector
µg/m^3 – Microgram per cubic meter
ppm – Parts per million

APPENDIX D

MONITORING WELL BORING AND CONSTRUCTION LOGS

SOIL BORING LOG

3200 Jerome Avenue
AKRF Project Number: 11455

Boring No. **SB/MW-1E**
Sheet 1 **of 1**

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Sonic Rig
Sampling Method: Plastic Liners
Driller : ADT Drilling, Inc.
Sampler: D. Kapson

Drilling
Start **Time** 10:30
Finish **Time** 11:20
Date 5/8/2012
Weather: Overcast, 60 °F

Depth (feet)	Recovery (Inches)	Surface Condition: Concrete Sidewalk (6")	Odor	Moisture	PID (PPM)	NAPL	Samples Collected for Lab Analysis
1	24	(Hand Dug) Brown SAND, little Silt, trace Ash, Brick, fine Gravel (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3	70	Top 20": Grey-Brown SAND, little Silt, fine Gravel (FILL).	ND	Dry	ND	ND	
4			ND	Dry	ND	ND	
5		Bottom 50": Brown fine SAND, little Silt, trace fine Gravel.	ND	Dry	ND	ND	
6							
7			ND	Dry	ND	ND	
8			ND	Dry	ND	ND	
9			ND	Dry	ND	ND	
10			ND	Dry	ND	ND	
11	50	Top 22": Brown fine SAND, some Silt, trace fine Gravel.	ND	Dry	ND	ND	
12			ND	Dry	ND	ND	
13		Bottom 28": Brown SAND, little Silt, Cobbles, trace fine Gravel.	ND	Dry	ND	ND	
14			ND	Dry	ND	ND	
15			ND	Dry	ND	ND	
16	47	Brown SAND, little Silt, Cobbles, trace fine Gravel.	ND	Dry	ND	ND	
17			ND	Moist	ND	ND	
18			ND	Moist	ND	ND	
19			ND	Moist	ND	ND	
20			ND	Moist	ND	ND	

Notes:

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Avenue
AKRF Project Number: 11455

Boring No. **SB/MW-1E**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Sonic Rig
Sampling Method: Plastic Liners
Driller : ADT Drilling, Inc.
Sampler: D. Kapson

Drilling
Start **Time** 10:30
Finish **Time** 11:20
Date 5/8/2012
Weather: Overcast, 60 °F

Depth (feet)	Recovery (Inches)	Surface Condition: Concrete Sidewalk (6")	Odor	Moisture	PID (PPM)	NAPL	Samples Collected for Lab Analysis
21	56	Top 26": Brown SAND, little Silt, Cobbles, trace fine Gravel.	ND	Moist	ND	ND	SB/MW-1E (21-22)
22			ND	Wet	ND	ND	
23		Bottom 30": Grey-Brown SAND, some Silt, little Cobbles, trace fine Gravel.	ND	Wet	ND	ND	
24			ND	Wet	ND	ND	
25							
26	58	Top 18": Grey SAND, little Silt, trace fine Gravel, Weathered Rock.	ND	Wet	ND	ND	
27			ND	Wet	ND	ND	
28		Next 14": Grey SAND and COBBLES, little Silt, fine Gravel.	ND	Wet	ND	ND	
29		Bottom 26": Grey SAND, some Weathered Rock, little Silt.	ND	Wet	ND	ND	
30			ND	Wet	ND	ND	
31	24	Top 10": Grey-Brown SILT, trace Sand, Roots.	Organic	Wet	ND	ND	
32		Bottom 14": Grey SAND, some Silt, little Cobbles.	ND	Wet	ND	ND	
33		EOB @ 32.0' below grade.					
34							
35							
36							
37							
38							
39							
40							

Notes:
Sonic Rig refusal on competent bedrock at 32 feet below grade. Groundwater encountered at 22 feet below grade.
Installed 2" PVC Monitor Well to 32 feet below ground surface. Well screened from 17 to 32 feet below ground surface.
PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **SB/MW-2E**
Sheet 1 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Visual Observ.
Driller : ADT
Sampler: D. Kapson

Drilling

Start	Finish
Time	Time

Date 7/24/2012 **7/26/2012**
Weather: 85 °F, Sunny

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete slab (4")	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
1	NA	Grey SAND, some fine gravel, little ash, trace asphalt (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3		Light brown SAND, little silt, trace asphalt, gravel (FILL).	ND	Dry	ND	ND	
4		Light brown SAND, little silt.	ND	Dry	ND	ND	
5			ND	Dry	ND	ND	
6	NA		ND	Dry	ND	ND	
7			ND	Dry	ND	ND	
8		Brown fine SAND, little silt.	ND	Dry	ND	ND	
9		Brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
10			ND	Dry	ND	ND	
11	NA		ND	Dry	ND	ND	
12			ND	ND	ND	ND	
13		Brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
14		Grey-brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
15			ND	Dry	ND	ND	
16	NA		ND	Dry	ND	ND	
17			ND	Dry	ND	ND	
18		Grey-brown SAND, little silt, trace fine gravel and weathered rock.	ND	Dry	ND	ND	
19			ND	Dry	ND	ND	
20			ND	Dry	ND	ND	

Notes: Advancement with augers until approx 10 feet below grade. Air tools used to advance boring to 25'
PID readings collected from headspace above the bore hole and not from cuttings due to drilling method.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **SB/MW-2E**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Visual Observ.
Driller : ADT
Sampler: D. Kapson

Drilling
Start **Time** — **Finish** **Time**
Date 7/24/2012 — **7/26/2012**
Weather: 85 °F, Sunny

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete slab (4")	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
21	NA	Grey-brown SAND, Some Weathered Rock encountered with air tools.	ND	Dry	ND	ND	
22			ND	Dry	ND	ND	
23			ND	Dry	ND	ND	
24			ND	Wet	ND	ND	
25			ND	Wet	ND	ND	
26		End of boring at 25 feet below grade on bedrock interface. Monitor Well MW-2E Installed.					
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

Notes: Advancement with augers until approx 10 feet below grade. Air tools used to advance boring to 25'
PID readings collected from headspace above the bore hole and not from cuttings due to drilling method.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Avenue
AKRF Project Number: 11455

Boring No. **SB-2**
Sheet 1 **of 2**

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Mini-Track Geoprobe
Sampling Method: 4' Macrocore
Driller : Zebra
Sampler: D. Kapson

Drilling
Start **Time** 10:30
Finish **Time** 11:30
Date 10/21/2011
Weather: Partly Sunny, 65 °F

Depth (feet)	Recovery (Inches)	Surface Condition: Floor Tile/Concrete Slab (4")	Odor	Moisture	PID (PPM)	NAPL	Samples Collected for Lab Analysis
1	30	Top 11": Dark Brown SAND, little Silt, trace Gravel, Brick (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3		Bottom 19": Light Brown fine SAND, some Silt, trace fine Gravel.	ND	Dry	ND	ND	
4			ND	Dry	ND	ND	
5	36	Top 14": Brown fine to medium SAND, some Silt, trace Clay, fine Gravel.	ND	Dry	ND	ND	
6		Next 10": Brown-red fine SAND, some Silt, trace fine Gravel.	ND	Dry	ND	ND	
7		Bottom 12": Light Brown fine SAND, some Silt, trace fine Gravel.	ND	Dry	ND	ND	
8							
9	43	Top 23": Dark Brown fine to medium SAND, some Silt, little fine Gravel.	ND	Dry	ND	ND	
10		Next 6": Brown fine to medium SAND, little Gravel, trace Silt.	ND	Dry	ND	ND	
11		Bottom 14": Dark Brown fine SAND, little Silt, trace Gravel.	ND	Dry	ND	ND	
12							
13	40		ND	Dry	ND	ND	
14		Brown fine SAND, some Silt, trace fine Gravel.	ND	Dry	ND	ND	
15		(Drilling through Cobbles from 14 fbg to 16 fbg)					
16			ND	Dry	ND	ND	
17	41	Top 20": Dark Brown fine to medium SAND, some Silt.	ND	Dry	ND	ND	
18		Bottom 21": Dark Grey SAND, trace Silt, fine Gravel.	ND	Moist	ND	ND	SB-2 (18-19)
19			ND	Wet	ND	ND	
20			ND	Wet	ND	ND	

Notes:
Groundwater encountered at 19.0 feet below grade.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Avenue
AKRF Project Number: 11455

Boring No. **SB-2**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Mini-Track Geoprobe
Sampling Method: 4' Macrocore
Driller : Zebra
Sampler: D. Kapson

Drilling
Start **Time** 10:30
Finish **Time** 11:30
Date 10/21/2011
Weather: Partly Sunny, 65 °F

Depth (feet)	Recovery (Inches)	Surface Condition: Floor Tile/Concrete Slab (4")	Odor	Moisture	PID (PPM)	NAPL	Samples Collected for Lab Analysis
21			ND	Wet	ND	ND	
22	47	Dark Grey SAND, trace Silt, fine Gravel.	ND	Wet	ND	ND	
23			ND	Wet	ND	ND	SB-2 (23-24)
24							
25		EOB @ 24' below grade.					
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

Notes:
Groundwater encountered at 19.0 feet below grade. End of boring at 24.0 feet below grade due to refusal. Monitor Well MW-2 set at 24.0 feet below grade.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **SB-20/MW-3**
Sheet 1 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Visual Observ.
Driller : ADT
Sampler: D. Kapson

Drilling

Start	Finish
Time	Time
Date 7/31/2012	7/31/2012

Weather: 85 °F, Sunny

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete slab (4")	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
1	NA	Grey SAND, some fine gravel, little ash, trace asphalt (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3		Light brown SAND, little silt, trace asphalt, gravel (FILL).	ND	Dry	ND	ND	
4		Light brown SAND, little silt.	ND	Dry	ND	ND	
5			ND	Dry	ND	ND	
6	NA		ND	Dry	ND	ND	
7			ND	Dry	ND	ND	
8		Brown fine SAND, little silt.	ND	Dry	ND	ND	
9		Brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
10			ND	Dry	ND	ND	
11	NA		ND	Dry	ND	ND	
12			ND	ND	ND	ND	
13		Brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
14		Grey-brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
15			ND	Dry	ND	ND	
16	NA		ND	Dry	ND	ND	
17			ND	Dry	ND	ND	
18		Grey-brown SAND, little silt, trace fine gravel and weathered rock.	ND	Dry	ND	ND	
19				Dry	ND	ND	
20			Gas/ Chemical	Wet	220	ND	

Notes: Advancement with augers until approx 10 feet below grade. Air tools used to advance boring to 24'
PID readings collected from headspace above the bore hole and not from cuttings due to drilling method.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **SB-20/MW-3**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Visual Observ.
Driller : ADT
Sampler: D. Kapson

Drilling
Start **Time** — **Finish** **Time**
Date 7/31/2012 — **7/31/2012**
Weather: 85 °F, Sunny

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete slab (4")	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
21	NA	Grey-brown SAND, Some Weathered Rock encountered with air tools.	Gas/ Chemical	Wet	115	ND	
22				Wet	108	ND	
23			Gas/ Chemical	Wet	65.7	ND	
24				Wet	78.5	ND	
25		End of boring at 24 feet below grade on bedrock interface. Monitor Well MW-3 Installed.					
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

Notes: Advancement with augers until approx 10 feet below grade. Air tools used to advance boring to 24'
PID readings collected from headspace above the bore hole and not from cuttings due to drilling method.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **SB-21/MW-4**
Sheet 1 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Macrocore
Driller : ADT
Sampler: D. Kapson

Drilling

Start Time	9:50	**Finish Time**	10:30

Date 11/13/2012 **11/14/2012**
Weather: 47 °F, Partly Cloudy

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete slab (4")	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
1	47	Top 12" - Grey SAND, some fine gravel, little ash, trace asphalt (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3		Next 14" - Light brown SAND, little silt, trace asphalt, gravel (FILL).	ND	Dry	ND	ND	
4		Bottom 21" - Light brown SAND, little silt.	ND	Dry	ND	ND	
5			ND	Dry	ND	ND	
6	55	Top 8" - SLOUGH	ND	Dry	ND	ND	
7			ND	Dry	ND	ND	
8		Next 15" - Brown fine SAND, little silt.	ND	Dry	ND	ND	
9		Bottom 32" - Brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
10			ND	Dry	ND	ND	
11	54	Top 4" - SLOUGH	ND	Dry	ND	ND	
12			ND	ND	ND	ND	
13		Next 25" - Brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
14		Bottom 25" - Grey-brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
15			ND	Dry	ND	ND	
16	22	Top 6" - Grey-brown SAND, little silt, trace fine gravel and weathered rock.	ND	Dry	ND	ND	SB-21 (17-18)
17		Next 8" - Grey-brown SAND, some weathered rock.	ND	Dry	ND	ND	
18		Bottom 8" - Grey-brown SAND, little weathered rock, trace fine gravel.	ND	Moist	ND	ND	
19		End of Geoprobe boring at 18 feet below grade. Grey-Brown SAND, Some Weathered Rock encountered with air tools.	ND	Dry	ND	ND	
20			ND	Dry	ND	ND	

Notes: Slow advancement with Geoprobe after 15' below grade. No groundwater encountered. Air tools used to advance boring to 24'

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **(SB-21/MW-4)**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Macrocore
Driller : ADT
Sampler: D. Kapson

Drilling

Start Time	9:50	**Finish Time**	10:30

Date 11/13/2012 **11/14/2012**
Weather: 47 °F, Partly Cloudy

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete slab (4")	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
21	NA	Grey-brown SAND, Some Weathered Rock encountered with air tools.	ND	Dry	ND	ND	
22			ND	Wet	ND	ND	
23			Petroleum	Wet	ND	ND	
24			Petroleum	Wet	ND	ND	
25		End of boring at 24 feet below grade on bedrock interface. Monitor Well MW-4 Installed.					
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

Notes: Slow advancement with Geoprobe after 15' below grade. No groundwater encountered. Air tools used to advance boring to 24'

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. SB-22/MW-5D
Sheet 1 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Macrocore
Driller : ADT
Sampler: D. Kapson

Drilling
Start Time 11:15
Finish Time 12:30 PM
Date 11/15/12 **11/16/2012**
Weather: 47 °F, Partly Cloudy

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete Floor	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
1	49	Top 6" - Grey ASH, trace sand, little fine gravel (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3		Next 24" - Brown SAND, little silt, trace ash, brick, fine gravel (FILL).	ND	Dry	ND	ND	
4		Bottom 19" - Brown fine SAND, little silt.	ND	Dry	ND	ND	
5			ND	Dry	ND	ND	
6	54	Top 6" - SLOUGH	ND	Dry	ND	ND	
7			ND	Dry	ND	ND	
8		Next 27" - Brown fine SAND, little Silt.	ND	Dry	ND	ND	
9		Bottom 21" - Grey-brown SAND, little Silt, fine gravel, trace fine gravel.	ND	Dry	ND	ND	
10			ND	Dry	ND	ND	
11	50	Top 4" - SLOUGH	ND	Dry	ND	ND	
12			ND	Dry	ND	ND	
13		Next 20" - Grey-brown SAND, little silt, fine gravel.	ND	Dry	ND	ND	
14		Bottom 36" - Grey SAND, little silt, fine gravel, trace gravel.	ND	Dry	ND	ND	
15			ND	Dry	ND	ND	
16	23	Top 3" - SLOUGH	ND	Dry	ND	ND	
		Next 8" - Brown SAND, little silt, trace weathered rock.					SB-22
17		Bottom 12" - WEATHERED ROCK, trace Sand.	ND	Dry	ND	ND	(16-17)
18	NA	End of Geoprobe boring at 17 feet below grade on Bedrock.	ND	Dry	ND	ND	
19		Grey Bedrock encountered from 17 to 20 feet	ND	Dry	ND	ND	
20			ND	Dry	ND	ND	

Notes:
Groundwater not encountered within Geoprobe bore hole. Switch to air tools to advance through bedrock to depth of 30 feet.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Ave.
AKRF Project Number: 11455

Boring No. **SB-22/MW-5D**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Geoprobe 6610
Sampling Method: Macrocore
Driller : ADT
Sampler: D. Kapson

Drilling

Start Time	11:15	**Finish Time**	12:30 PM

Date 11/15/2012 **11/16/2012**

Weather: 47 °F, Partly Cloudy

Depth (feet)	Recovery (Inches)	Surface Condition: Tile/Concrete Floor	Odor	Moisture	PID	NAPL	Samples Collected for Lab Analysis
21	NA	Grey BEDROCK.	ND	Dry	ND	ND	
22			ND	Dry	ND	ND	
23			ND	Dry	ND	ND	
24			ND	Dry	ND	ND	
25			ND	Dry	ND	ND	
26			ND	Dry	ND	ND	
27		Grey BEDROCK, trace Grey Sand, fine gravel.	ND	Dry	ND	ND	
28			ND	Wet	ND	ND	
29		Grey BEDROCK.	ND	Wet	ND	ND	
30			ND	Wet	ND	ND	
31		End of boring at 30 feet below grade after encountering bedrock aquifer.					
32		Monitor well MW-5D installed.					
33							
34							
35							
36							
37							
38							
39							
40							

Notes:
Groundwater not encountered within Geoprobe bore hole. Switch to air tools to advance through bedrock to depth of 30 feet.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Avenue
AKRF Project Number: 11455

Boring No. **MW-3E-D**
Sheet 1 **of 2**

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Sonic Rig
Sampling Method: Plastic Liners
Driller : ADT Drilling, Inc.
Sampler: D. Kapson

Drilling
Start **Time** 10:15 **Date** 12/3/2012
Finish **Time** 11:50 **Date** 12/7/2012
Weather: Light Rain, 45 °F

Depth (feet)	Recovery (Inches)	Surface Condition: Concrete Sidewalk (6")	Odor	Moisture	PID (PPM)	NAPL	Samples Collected for Lab Analysis
1	49	Top 12": ASH and GRAVEL, trace Sand, Brick (FILL).	ND	Dry	ND	ND	
2			ND	Dry	ND	ND	
3		Bottom 37": Dark Brown SAND, some Silt, trace fine Gravel, Ash (FILL).	ND	Dry	ND	ND	
4			ND	Dry	ND	ND	
5							
6	46	Top 28": Brown fine SAND, some Silt, trace Clay.	ND	Dry	ND	ND	
7			ND	Dry	ND	ND	
8							
9		Bottom 18": Brown SAND, Some Weathered Rock.	ND	Dry	ND	ND	
10			ND	Dry	ND	ND	
11	38		ND	Dry	ND	ND	
12		Top 18": Brown SAND, little Silt, fine Gravel.					
13		Next 8": Brown fine SAND, little Silt.	ND	Dry	ND	ND	
14		Bottom 12": Dark Grey-Brown SAND, some Silt, trace fine Gravel, Weathered Rock, Cobbles.	ND	Dry	ND	ND	MW-3E-D (14-15)
15							
16	NA	End of Geoprobe Boring at 15 feet below grade on weathered rock/Bedrock interface.	ND	Dry	ND	ND	
17			ND	Dry	ND	ND	
18		Grey BEDROCK	ND	Dry	ND	ND	
19			ND	Dry	ND	ND	
20			ND	Dry	ND	ND	

Notes:
Sonic Rig refusal on weathered rock/bedrock at 15 feet below grade. Groundwater not encountered to 15'. Switch to air tools for coring to 30'.

PID = photoionization detector ppm = parts per million ND = Not Detected

SOIL BORING LOG

3200 Jerome Avenue
AKRF Project Number: 11455

Boring No. **MW-3E-D**
Sheet 2 of 2

AKRF
440 Park Avenue South, New York, NY 10016
Phone (212) 696-0670 Fax (212) 726-0942

Drilling Method: Sonic Rig
Sampling Method: Plastic Liners
Driller : ADT Drilling, Inc.
Sampler: D. Kapson

Drilling
Start **Time** 10:15 **Date** 12/3/2012
Finish **Time** 11:50 **Date** 12/7/2012
Weather: Light Rain, 45 °F

Depth (feet)	Recovery (Inches)	Surface Condition: Concrete Sidewalk (6")	Odor	Moisture	PID (PPM)	NAPL	Samples Collected for Lab Analysis
21			ND	Dry	ND	ND	
22			ND	Dry	ND	ND	
23			ND	Dry	ND	ND	
24			ND	Dry	ND	ND	
25	NA	Grey BEDROCK.	ND	Dry	ND	ND	
26							
27		Grey BEDROCK, trace Grey Sand, fine gravel.	ND	Wet	ND	ND	
28			ND	Wet	ND	ND	
29		Grey BEDROCK.					
30			ND	Dry	ND	ND	
31		End of boring at 30 feet below grade after encountering bedrock aquifer.					
32		Monitor well MW-5D installed.					
33							
34							
35							
36							
37							
38							
39							
40							

Notes:
Sonic Rig refusal on weathered rock/bedrock at 15 feet below grade. Groundwater not encountered. Switch to air tools for coring to 30'.

PID = photoionization detector ppm = parts per million ND = Not Detected

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-1E Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Sonic Rig	**Drilling**	
	Sampling Method:	5' Plastic Liners	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time:** 10:30	**Time: 11:20**
	Weather:	60, Overcast	**Date: 5**/8/12	**Date: 5**/8/12
	Field Supervisor:	AKRF/ Dustin Kapson		

Depth (feet)	Well Construction	
		Surface Condition: Concrete Sidewalk
1		**Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.**
2		**Grout from 0.5' to 12'**
3		**PVC well riser from 0 to 17'**
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		**Bentonite Seal 12'-14.5'**
14		
15		
16		**Sand pack filter 14.5' to 32'**
17		
18		**002-Slot 2-inch PVC well screen 17' to 32'**
19		
20		
21		
22	▽	
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		

Notes:

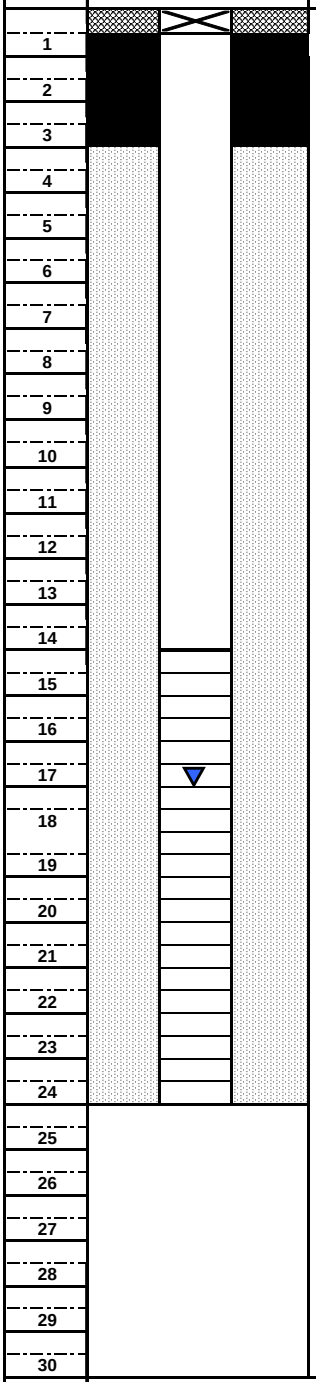
Groundwater was encountered at approximately 22 feet below grade during drilling on 5/8/12.
No free-phase product was detected with the oil/water interface probe prior to development on 5/9/12.

▽ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-2 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Direct Push/Geoprobe	**Drilling**	
	Sampling Method:	4' Macrocore	**Start**	**Finish**
	Driller :	Zebra	**Time:** 10:30	**Time: 11:30**
	Weather:	65 Sunny	**Date: 10**/21/11	**Date: 10**/21/11
	Field Supervisor:	AKRF/ Dustin Kapson		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete



Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.

Bentonite Seal 0.5' to 3'

PVC well riser from 0 to 14'

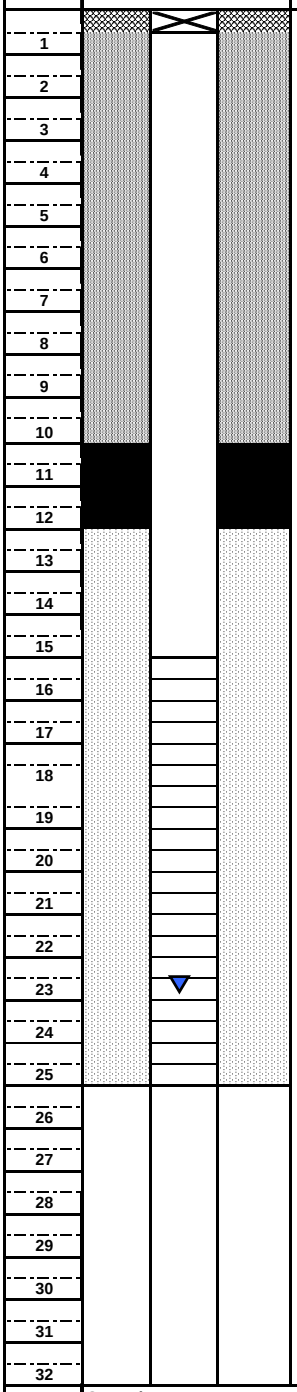
002-Slot 2-inch PVC well screen 14' to 24'

Sand pack filter 3' to 24'

Notes:

Groundwater was encountered at approximately 19 feet below grade during drilling on 10/21/11.
No free-phase product was detected with the oil/water interface probe prior to sampling on 10/28/11.
Stabilized groundwater level measurement of 16.97 feet below grade taken prior to sampling on 10/28/11.
▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-2E Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time:**	**Time:**
	Weather:	85, Sunny	**Date: 7/24/12**	**Date: 7/26/12**
	Field Supervisor:	AKRF/ Dustin Kapson		



Surface Condition: Concrete Sidewalk

Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.

Grout from 0.5' to 10'

PVC well riser from 0 to 15'

Bentonite Seal 10'-12'

Sand pack filter 12' to 25'

002-Slot 2-inch PVC well screen 15' to 25'

25' Bottom of well

Notes:

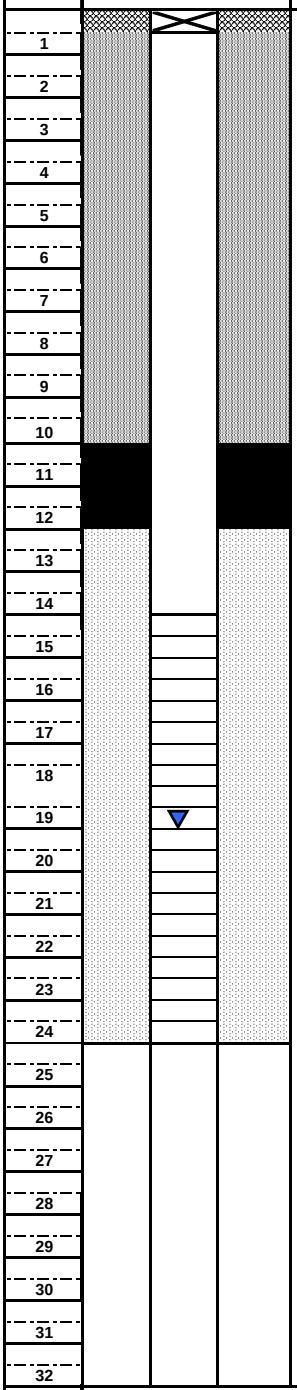
Groundwater was encountered at approximately 23 feet below grade during drilling on 7/26/12.
No free-phase product was detected with the oil/water interface probe prior to development on 7/26/12.

▽ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-3 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time:**	**Time:**
	Weather:	85, Sunny	**Date: 7/31/12**	**Date: 7/31/12**
	Field Supervisor:	AKRF/ Dustin Kapson		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.

Grout from 0.5' to 10'

PVC well riser from 0 to 14'

Bentonite Seal 10'-12'

Sand pack filter 12' to 24'

002-Slot 2-inch PVC well screen 14' to 24'

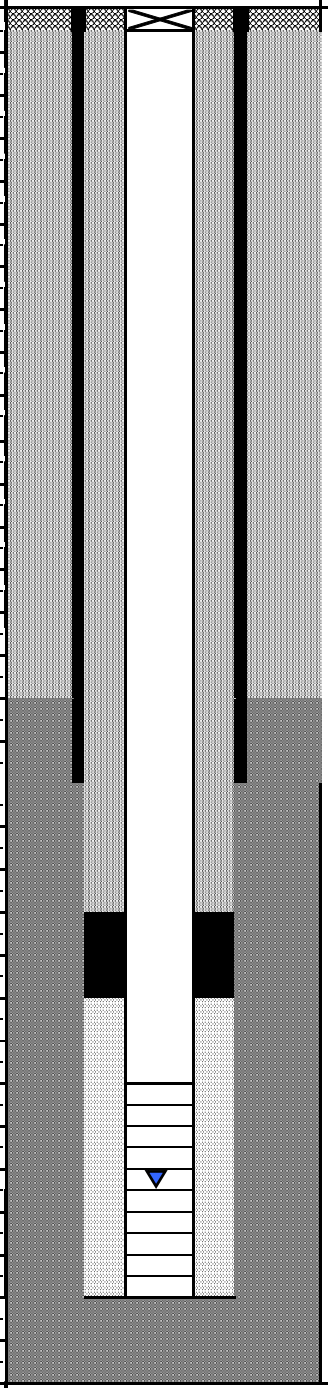
24' Bottom of well

Notes:

Groundwater was encountered at approximately 19 feet below grade during drilling on 7/31/12.
No free-phase product was detected with the oil/water interface probe prior to development on 7/31/12.

▽ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-3E-D Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Sonic Rig/Air	**Drilling**	
	Sampling Method:	Plastic Liners/Air Tools	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time:**	**Time:**
	Weather:	45, Overcast, Light Rain	**Date: 12/3/12**	**Date: 12/7/12**
	Field Supervisor:	AKRF/ Dustin Kapson		

Depth (feet)	Well Construction	
		Surface Condition: Concrete Sidewalk
1		**Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.**
2		**Grout from 0.5' to 18' to Set Steel Casing 2 feet into Bedrock**
3		**PVC well riser inside of casing from 0 to 25'**
4		
5		
6		**Grout from 0.5' to 21' to Set PVC Well Riser**
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		**Bentonite Seal from 21' to 23'**
23		
24		**Sand pack filter 23' to 30'**
25		
26		**002-Slot 2-inch PVC well screen 25' to 30'**
27		
28		
29		
30		**30' Below Exterior Grade - Bottom of Well**
31		
32		

Notes: **Groundwater was encountered at approximately 27.5 feet below grade in the bedrock aquifer during drilling on 12/7/12.**
No free-phase product was detected with the oil/water interface probe prior to development on 12/7/12.

▽ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-4 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	Macrocore/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time:**	**Time:**
	Weather:	45, Partly Cloudy	**Date: 11/12/12**	**Date: 11/16/12**
	Field Supervisor:	AKRF/ Dustin Kapson		

Depth (feet)	Well Construction	
		Surface Condition: Tile/Concrete Floor Slab
1		**Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.**
2		**Grout from 0.5' to 10'**
3		
4		**PVC well riser from 0 to 14'**
5		
6		
7		
8		
9		
10		
11		**Bentonite Seal 10'-12'**
12		
13		
14		
15		
16		**Sand pack filter 12' to 24'**
17		
18		**002-Slot 2-inch PVC well screen 14' to 24'**
19	▼	
20		
21		
22		
23		
24		**24' Bottom of well**
25		
26		
27		
28		
29		
30		
31		
32		

Notes:

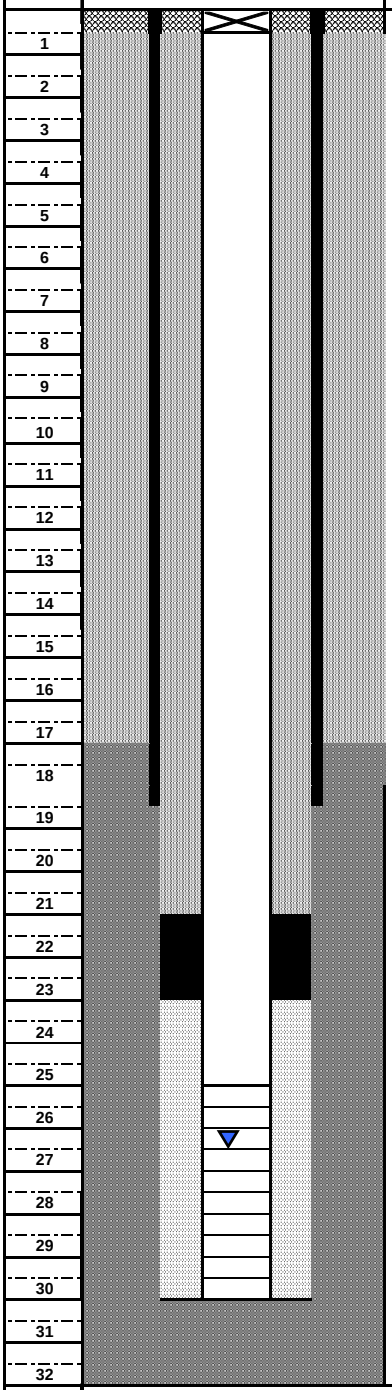
Groundwater was encountered at approximately 19 feet below grade during drilling on 1/16/12.
No free-phase product was detected with the oil/water interface probe prior to development on 11/17/12.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Well No. MW-5-D Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe Rig/Air	**Drilling**	
	Sampling Method:	Macrocore/Air Tools	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time:**	**Time:**
	Weather:	45, Partly Cloudy	**Date: 11/16/12**	**Date: 11/17/12**
	Field Supervisor:	AKRF/ Dustin Kapson		

Depth (feet)

Well Construction



Surface Condition: Concrete Sidewalk

Flush-mounted well cover, locking cap and concrete seal 0 to 0.5' below grade.

Grout from 0.5' to 18.5' to Set Steel Casing 2 feet into Bedrock

2-inch PVC well riser inside of steel casing from 0 to 25'

Grout from 0.5' to 21' to Set PVC Well Riser

Bentonite Seal from 21' to 23'

Sand pack filter 23' to 30'

002-Slot 2-inch PVC well screen 25' to 30'

30' Below First Floor Grade - Bottom of Well

Notes:

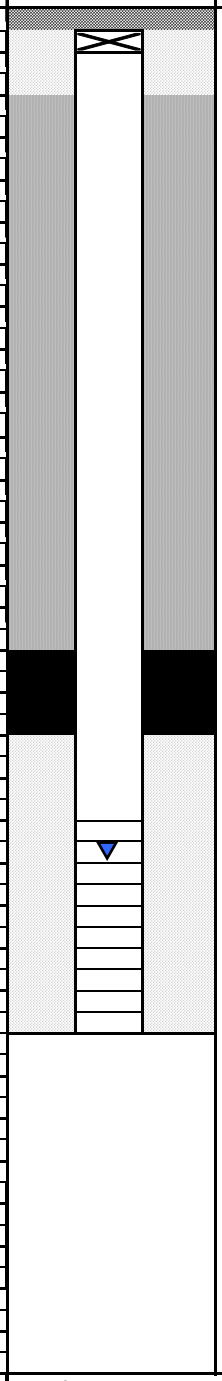
Groundwater was encountered at approximately 26.5 feet below grade in the bedrock aquifer during drilling on 11/17/12.
No free-phase product was detected with the oil/water interface probe prior to development on 11/17/12.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-1 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 8:40**	**Time: 16:00**
	Weather:	Overcast 21° Wind 20 MPH NW	**Date: 3/18/14**	**Date: 3/18/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5 to 19'

Grout 2' to 15'

Bentonite Seal 15' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

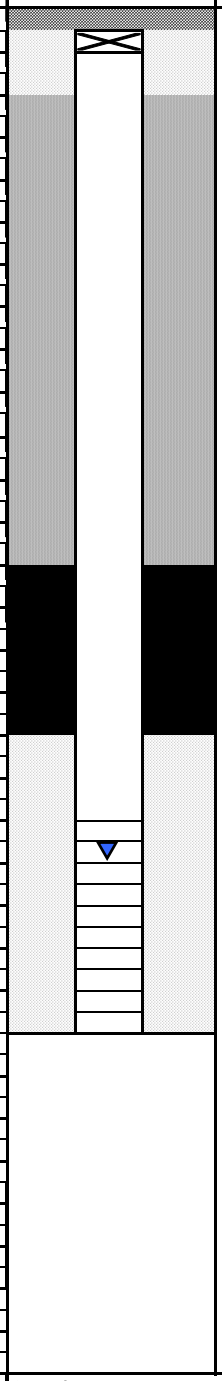
Notes:

Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/18/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-2 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 13:10**	**Time: 15:30**
	Weather:	Overcast 55° Wind 14 MPH W	**Date: 3/20/14**	**Date: 3/21/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**



Surface Condition: Tile/Concrete Floor Slab

Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0 to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/21/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-3 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 8:28**	**Time: 11:25**
	Weather:	Overcast 62° Wind 5 MPH S	**Date: 3/22/14**	**Date: 3/22/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet)	Well Construction	
		Surface Condition: Tile/Concrete Floor Slab
1		**Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment. Riser finished at approximately 0.5' below grade during completion of site cover system.**
2		**Clean Stone/Sand from 0.5' to 2'**
3		**PVC well riser from 0.5' to 19'**
4		**Grout 2' to 15'**
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		**Bentonite Seal 15' to 17'**
17		
18		**Sand pack filter 17' to 24'**
19		**002-Slot 2-inch PVC well screen 19' to 24'**
20		
21		
22		
23		
24		**24' Bottom of well**
25		
26		
27		
28		
29		
30		
31		
32		

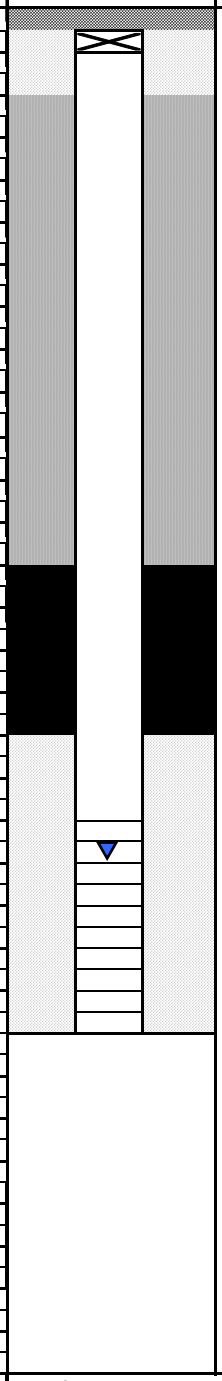
Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/22/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-4 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 11:30**	**Time: 14:10**
	Weather:	Clear 43° Wind 11 MPH NW	**Date: 3/17/14**	**Date: 3/17/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

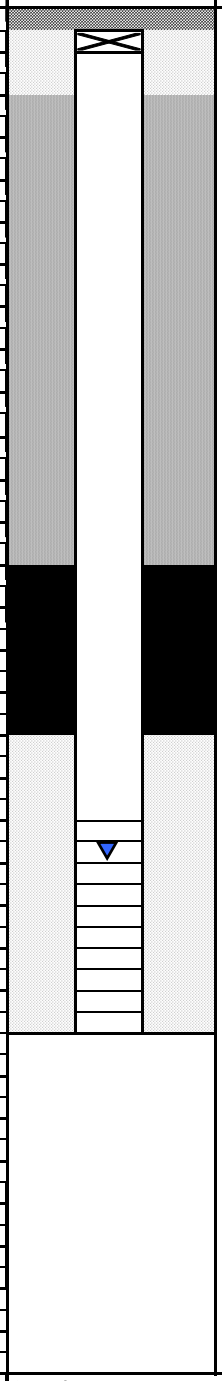
Notes:

Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/17/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-5 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 7:30**	**Time: 11:40**
	Weather:	Clear 43° Wind 11 MPH NW	**Date: 3/27/14**	**Date: 3/27/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**



Surface Condition: Tile/Concrete Floor Slab

Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5 to 19'

Grout 2' to 13'

Bentonite Seal 13'to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/27/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-6 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 8:00**	**Time: 10:20**
	Weather:	Overcast 44° Wind 9 MPH NE	**Date: 3/19/14**	**Date: 3/19/14**
	Field Supervisor:	AKRF/ Steve Grens/Steve Schmid		

Depth (feet)	Well Construction	
		Surface Condition: Tile/Concrete Floor Slab
1		**Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment. Riser finished at approximately 0.5' below grade during completion of site cover system.**
2		**Clean Stone/Sand from 0.5' to 2'**
3		**PVC well riser from 0.5' to 19'**
4		**Grout 2' to 13'**
5		
6		
7		
8		
9		
10		
11		
12		
13		**Bentonite Seal 13' to 17'**
14		
15		
16		
17		**Sand pack filter 17' to 24'**
18		
19		**002-Slot 2-inch PVC well screen 19' to 24'**
20	▼	
21		
22		
23		
24		**24' Bottom of well**
25		
26		
27		
28		
29		
30		
31		
32		

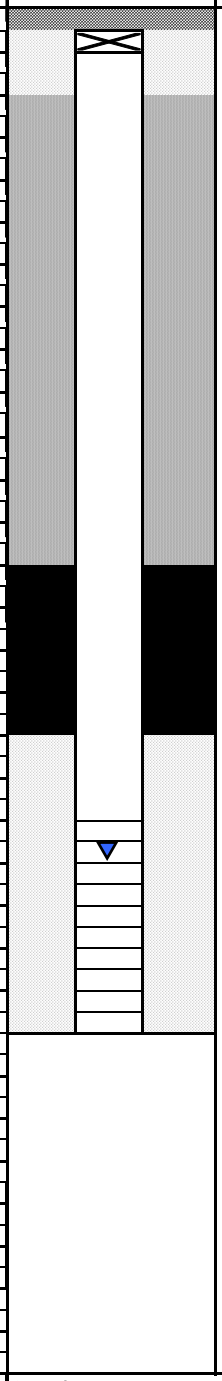
Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/19/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-7 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 9:00**	**Time: 11:30**
	Weather:	Overcast 55° Wind 14 MPH W	**Date: 3/20/14**	**Date: 3/20/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

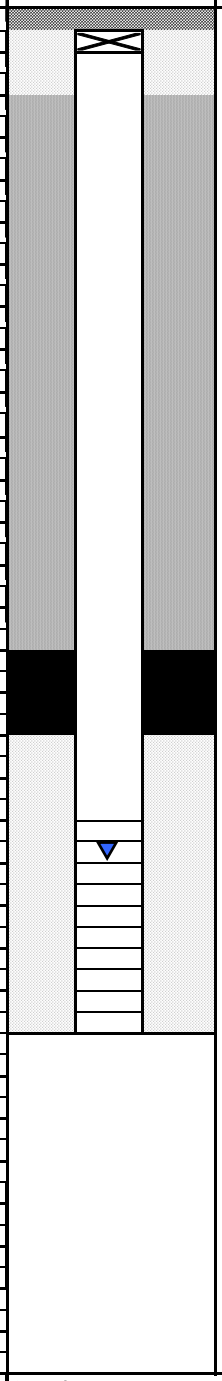
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/20/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-8 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 15:25**	**Time: 10:29**
	Weather:	Overcast 32°	**Date: 3/17/14**	**Date: 3/18/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 15'

Bentonite Seal 15' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

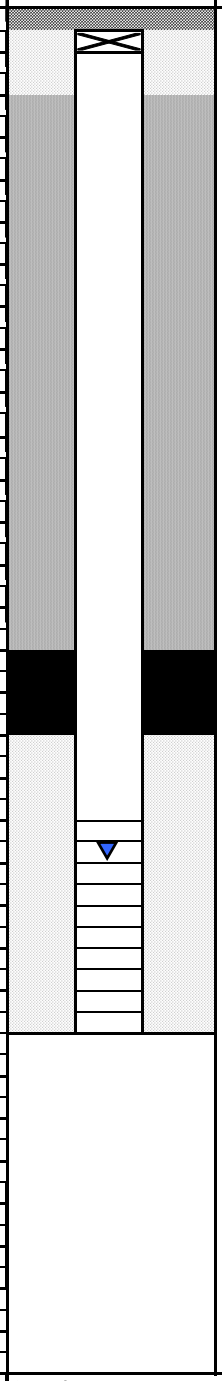
Notes:

Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/18/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-9 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 7:20**	**Time: 12:10**
	Weather:	Overcast 52° Wind 15 MPH WNW	**Date: 3/21/14**	**Date: 3/21/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**



Surface Condition: Tile/Concrete Floor Slab

Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 15'

Bentonite Seal 15' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

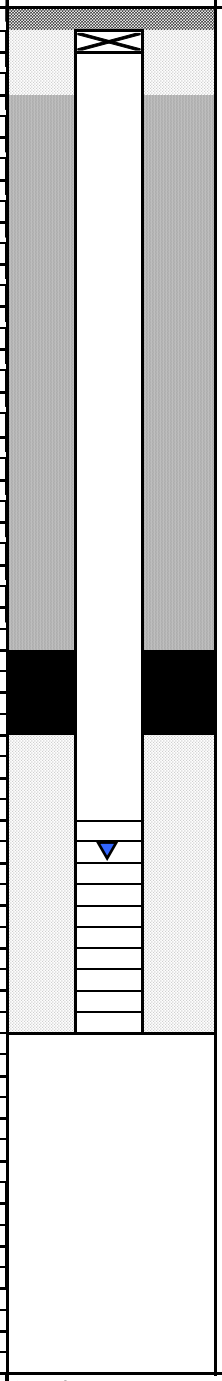
Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/21/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-10 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 13:00**	**Time: 16:15**
	Weather:	Overcast 52° Wind 15 MPH WNW	**Date: 3/21/14**	**Date: 3/21/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 15'

Bentonite Seal 15' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

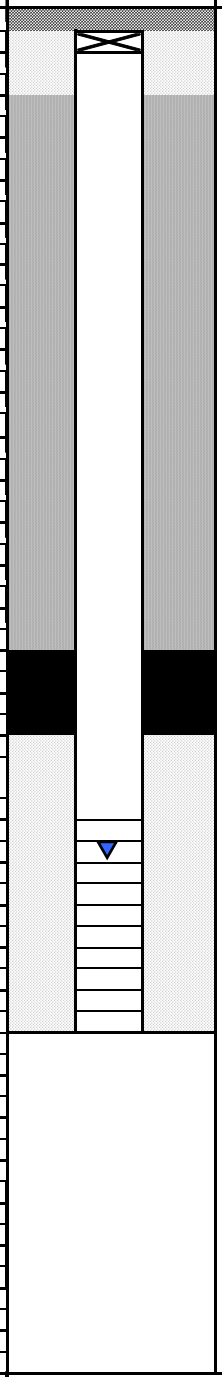
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/21/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-11 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 9:08**	**Time: 16:00**
	Weather:	Overcast 37° Wind 11 MPH NW	**Date: 3/24/14**	**Date: 3/24/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 15'

Bentonite Seal 15' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

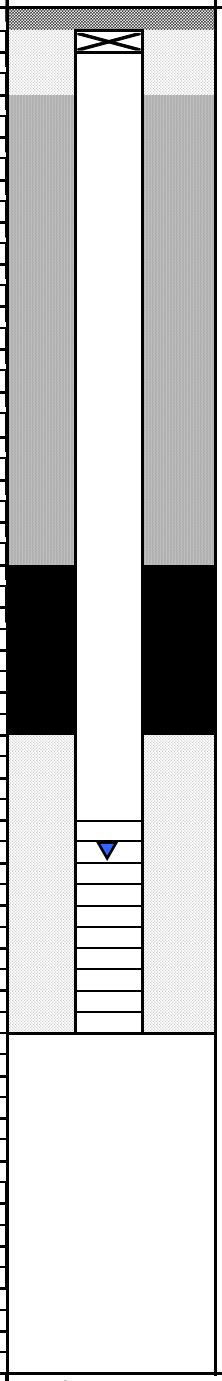
Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/24/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-12 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 12:00**	**Time: 14:30**
	Weather:	Overcast 44° Wind 9 MPH NE	**Date: 3/19/14**	**Date: 3/19/14**
	Field Supervisor:	AKRF/ Steve Schmid		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

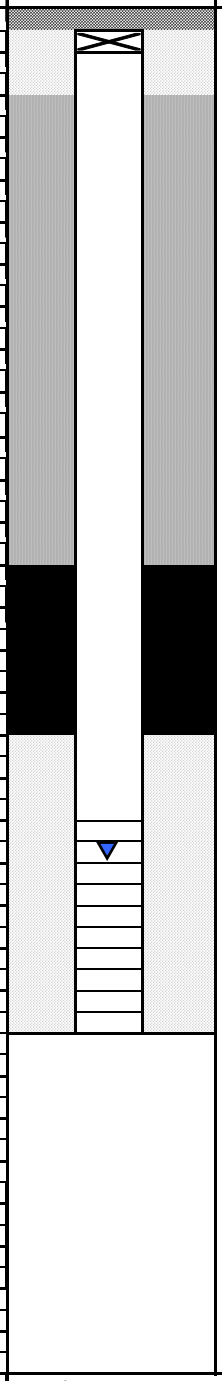
Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/19/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-13 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 11:30**	**Time: 14:57**
	Weather:	Overcast 21° Wind 20 MPH NW	**Date: 3/13/14**	**Date: 3/13/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

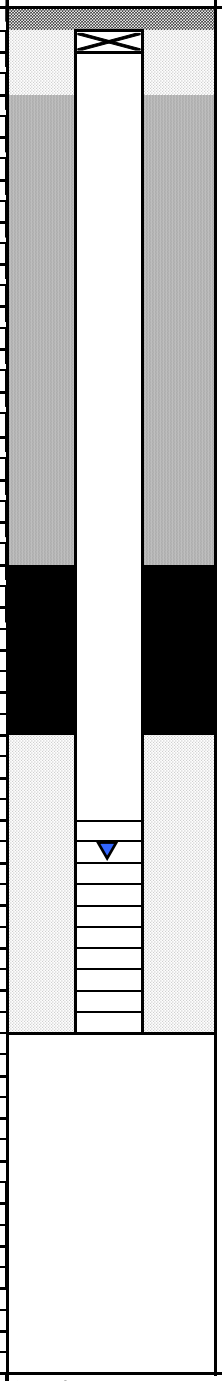
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/13/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-14 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 14:10**	**Time: 10:15**
	Weather:	Overcast 42°	**Date: 3/12/14**	**Date: 3/13/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

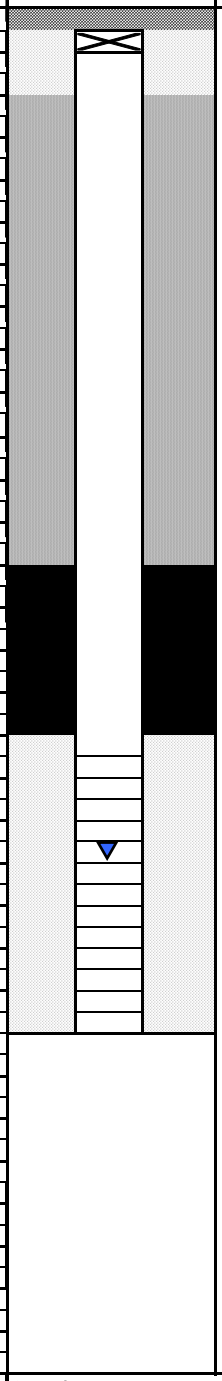
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/13/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-15 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 07:45**	**Time: 13:17**
	Weather:	Clear 20° Wind 15 MPH NE	**Date: 3/10/14**	**Date: 3/10/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

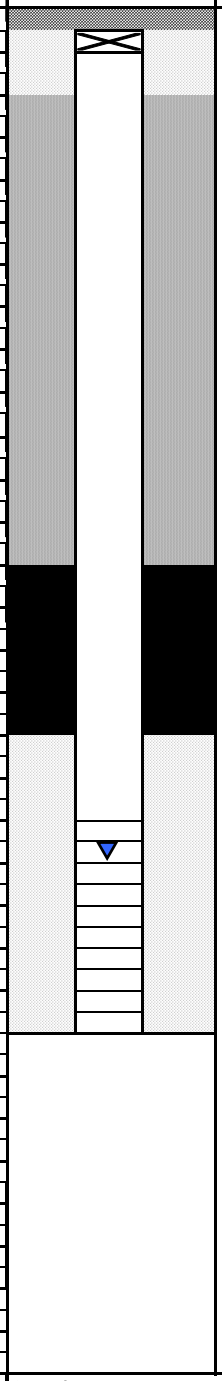
Notes: **Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/10/14**
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-16 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 12:30**	**Time: 14:50**
	Weather:	Overcast 37° Wind 22 MPH NNW	**Date: 3/26/14**	**Date: 3/26/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

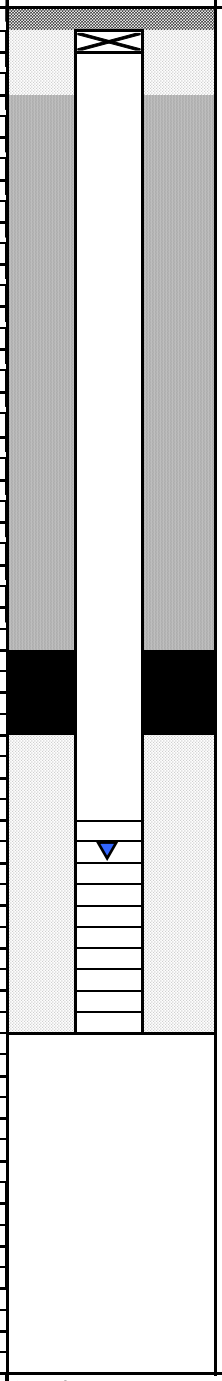
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/26/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-17 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 8:36**	**Time: 11:30**
	Weather:	Overcast 43° Wind 4 MPH W	**Date: 3/14/14**	**Date: 3/17/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 15'

Bentonite Seal 15' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

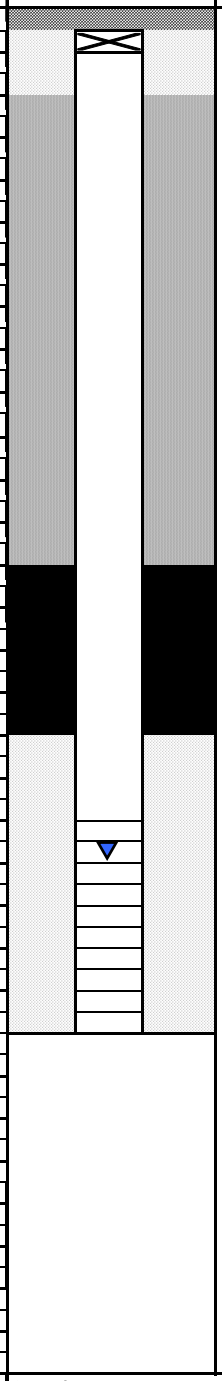
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/17/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-18 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 11:28**	**Time: 13:40**
	Weather:	Overcast 42°	**Date: 3/11/14**	**Date: 3/12/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

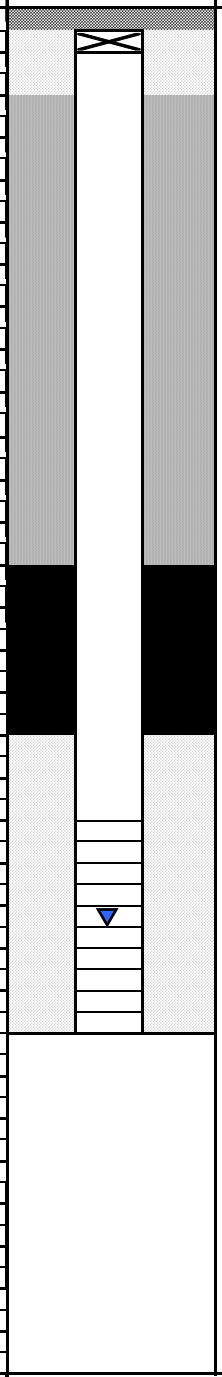
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/12/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-19 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 07:45**	**Time: 15:30**
	Weather:	Clear 20° Wind 15 MPH NE	**Date: 3/7/14**	**Date: 3/7/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

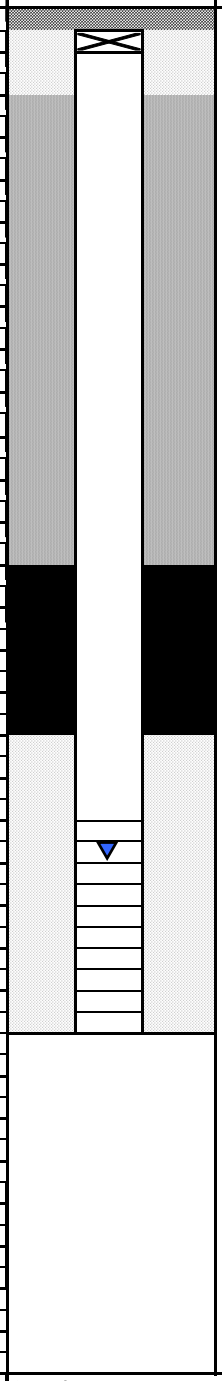
Groundwater was encountered at approximately 21 ft below first floor grade during drilling on 3/7/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-20 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 14:45**	**Time: 9:23**
	Weather:	Overcast 38° Wind 9 MPH ENE	**Date: 3/25/14**	**Date: 3/26/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

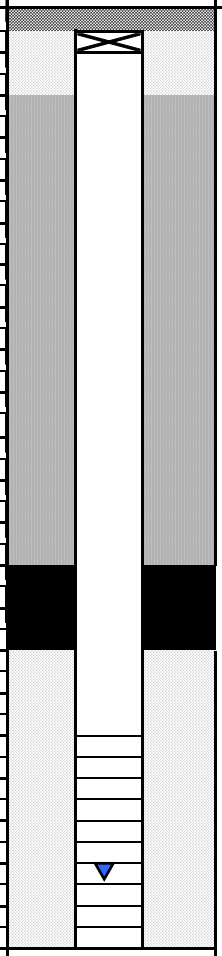
Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/26/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-21 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 14:20**	**Time: 11:15**
	Weather:	Overcast 40°	**Date: 3/10/14**	**Date: 3/11/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 15'

Sand pack filter 15' to 22'

002-Slot 2-inch PVC well screen 17' to 22'

22' Bottom of well

Notes:

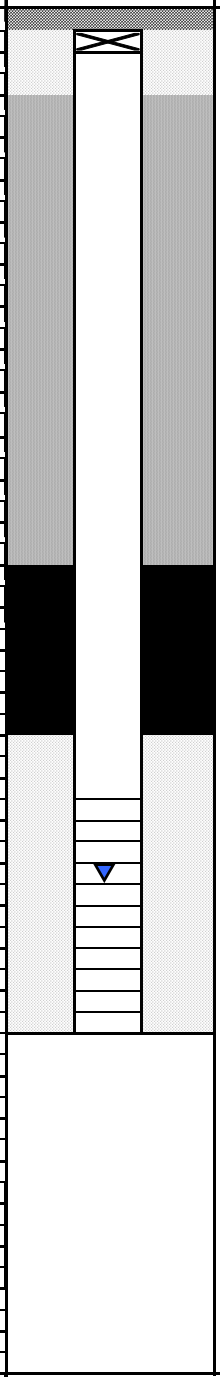
Groundwater was encountered at approximately 20 ft below first floor grade during drilling on 3/11/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-22 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 10:00**	**Time: 15:50**
	Weather:	Clear 20° Wind 15 MPH NNE	**Date: 3/6/14**	**Date: 3/6/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

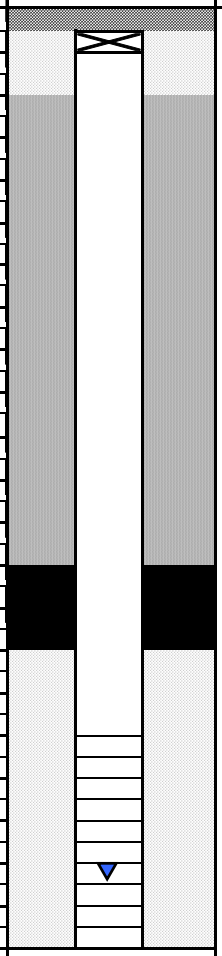
Groundwater was encountered at approximately 20 feet below first floor grade during drilling on 3/6/14.
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-23 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 9:30**	**Time: 12:55**
	Weather:	Overcast 38° Wind 9 MPH ENE	**Date: 3/25/14**	**Date: 3/25/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 15'

Sand pack filter 15' to 24'

002-Slot 2-inch PVC well screen 17' to 22'

22' Bottom of well

Notes:

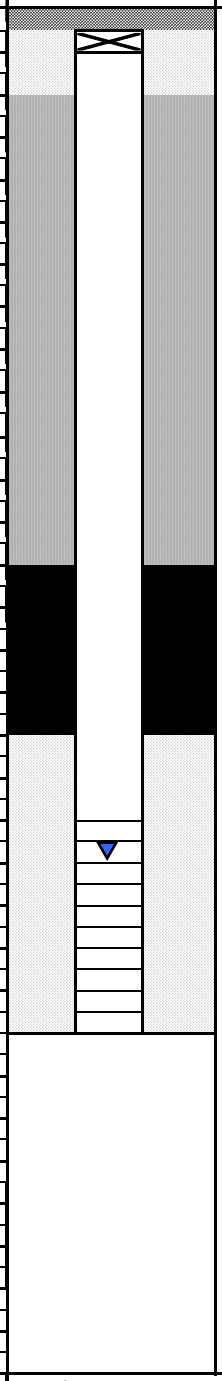
Groundwater was encountered at approximately 20 ft below first floor grade during drilling on 3/25/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

AKRF, Inc.	3200 Jerome Avenue AKRF Project Number : 11455		Injection Well No. IW-24 Sheet 1 of 1	
Environmental Consultants 440 Park Avenue South, 7th Floor New York, NY 10016	**Drilling Method:**	Geoprobe/Air	**Drilling**	
	Sampling Method:	HSA/Driven Casing	**Start**	**Finish**
	Driller :	ADT Drilling, Inc.	**Time: 11:45**	**Time: 16:00**
	Weather:	Overcast 37° Wind 11 MPH NW	**Date: 3/24/14**	**Date: 3/24/14**
	Field Supervisor:	AKRF/ Steve Grens		

Depth (feet) | **Well Construction**

Surface Condition: Tile/Concrete Floor Slab



Well completed with riser approximately 2 feet above grade at time of installation to allow for GW treatment.
Riser finished at approximately 0.5' below grade during completion of site cover system.

Clean Stone/Sand from 0.5' to 2'

PVC well riser from 0.5' to 19'

Grout 2' to 13'

Bentonite Seal 13' to 17'

Sand pack filter 17' to 24'

002-Slot 2-inch PVC well screen 19' to 24'

24' Bottom of well

Notes:

Groundwater was encountered at approximately 19.5 ft below first floor grade during drilling on 3/24/14
Free-phase product was not detected with the oil/water interface probe prior to development.

▼ **Groundwater level indicator.**

APPENDIX E

GROUNDWATER MONITORING WELL SAMPLING LOG FORM

Well Sampling Log

Job No: 11455		**Client:** RFLP	**Well No:**
Project Location: Former Nessen Lamps - 3200 Jerome Avenue, Bronx, NY		**Sampled By:**	
Date:		**Sampling Time:**	
LEL at surface:			
PID at surface:			
Total Depth:	ft. below top of casing	**Water Column (WC):** feet	*= 0.163 * WC for 2" wells
Depth to Water:	ft. below top of casing	**Well Volume*:** gallons	*= 0.653 * WC for 4" wells
Depth to Product:	ft. below top of casing	**Volume Purged:** gallons	*= 1.469 * WC for 6" wells
Depth to top of screen:	ft. below top of casing	**Well Diam.:** inches	Target maximum flow rate is 100 ml/min
Depth to bottom of screen:	ft. below top of casing	**Purging Device (pump type):**	
Approx. Pump Intake:	ft. below top of casing		

Time	Depth to Water (Ft.)	Purge Rate (ml/min)	Temp (^{o}C)	Conductivity (mS/cm)	DO (mg/L)	pH	ORP (mV)	Turbidity (NTU)	Comments (problems, odor, sheen)
Stabilization Criteria:				**+/- 3 mS/cm**	**+/- 0.3 mg/L**	**+/- 0.1 pH units**	**+/- 10 mV**	**<50 NTU**	If water quality parameters do not stabilize and/or turbidity is greater than 50 NTU within two hours, discontinue purging and collect sample.

Groundwater samples analyzed for:

APPENDIX F
QUALITY ASSURANCE PROJECT PLAN

Former Nessen Lamps Site

3200 JEROME AVENUE

BRONX, NEW YORK

Quality Assurance Project Plan

AKRF Project Number: 11455

NYSDEC Brownfield Cleanup Program Site Number: C203061

Prepared for:

Rinzler Family Limited Partnership
200 Madison Avenue, 24th Floor
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Prepared by:

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DECEMBER 2014

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of the Site Management Plan (SMP) at the Former Nessen Lamps Site (the "Site") located at 3200 Jerome Avenue, Bronx, New York. The objective of the QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) during sampling performed to evaluate the performance and effectiveness of the remedy (including treatments and Engineering Controls as described in the SMP) to reduce or mitigate contamination at the Site. Adherence to the QAPP will ensure that defensible data will be obtained to confirm the successful operation and maintenance of remedial systems.

2.0 PROJECT TEAM

The project team will be drawn from AKRF professional and technical personnel and AKRF's subcontractors. All field personnel and subcontractors will have completed a 40-hour training course and updated 8-hour refresher course that meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Part 1910. The following sections describe the key project personnel and their responsibilities.

2.1 PROJECT DIRECTOR

The project director will be responsible for the general oversight of all aspects of the project, including scheduling, budgeting, data management, and decision-making regarding the field program. The project director will communicate regularly with all members of the AKRF project team and the New York State Department of Environmental Conservation (NYSDEC) to ensure a smooth flow of information between involved parties. Marc Godick will serve as the project director for the SMP. Mr. Godick's resume is included in Attachment A.

2.2 PROJECT MANAGER

The project manager will be responsible for directing and coordinating all elements of the SMP. He will prepare reports and participate in meetings with the Site owner and/or the NYSDEC. Dustin Kapson will serve as the project manager for the SMP. Mr. Kapson's resume is included in Attachment A.

2.3 FIELD TEAM LEADER

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and HASP. He will report to the Project Manager on a regular basis regarding daily progress and any deviations from the SMP. The field team leader will be a qualified, responsible person, able to act professionally and promptly during required activities. Robert Andrews will be the field team leader for the SMP.

2.4 PROJECT QUALITY ASSURANCE/QUALITY CONTROL OFFICER

The Quality Assurance/Quality Control (QA/QC) Officer will be responsible for adherence to the QAPP. He/She will review the procedures with all personnel prior to commencing any fieldwork and will assess implementation of the required procedures. Marcus Simons will serve as the QA/QC officer for the SMP.

2.5 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL OFFICER

The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. He/she will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued. He/she will conduct a final check on the analytical calculations and sign off on the

laboratory reports. The laboratory QA/QC officer will be determined upon selection of a contract laboratory(s) for the SMP.

3.0 STANDARD OPERATING PROCEDURES

The following sections describe the standard operating procedures (SOPs) for the monitoring activities included in the SMP. During these operations, safety monitoring will be performed as described in the Site specific Health and Safety Plan (HASP) and all field personnel will wear appropriate personal protective equipment. SMP implementation will include quarterly groundwater monitoring and sampling, and sampling associated with the operation and maintenance of the sub-slab depressurization system (SSDS) and soil vapor extraction (SVE) well. The SMP also includes provisions and appropriate actions to be taken in the event that future renovation or redevelopment of the Site requires the breaching of the composite cover system and excavation/removal of underlying soil.

3.1 EXCAVATION AND REMOVAL OF SOIL/FILL

Any planned disturbance to the composite cover system will comprise the following activities:

1. The location of existing monitoring points, groundwater monitor wells, and engineering controls (ECs) located within or beneath the concrete floor slab including SSDS pits, SSDS piping, the SVE well and associated piping, and the injection well network will be identified using SMP Figures 16 and 19.
2. The existing concrete floor will be marked out and saw cut, at a minimum, around the perimeter of the designated removal area.
3. Excavated fill material will be removed using an excavator or hand tools. Fill material excavated from beneath the concrete slab to a maximum depth of five feet below grade and that exhibits no evidence of contamination may be characterized for potential reuse as backfill material on-site or handled and disposed of as non-hazardous waste. Material excavated from the three soil sample locations that identified residual TCE-contaminated soil following completion of the removal activities (depths ranging from approximately 10 to 12 feet below grade) will be characterized and are expected to be handled and disposed of as hazardous waste. Material excavated in other areas of the Site should be handled in accordance with the Excavation Work Plan included as Appendix B of the SMP.
4. All excavated material requiring staging for overnight or longer will follow the procedures in Section 3.1.1.

Damaged floors, walls, sub-slab venting system piping, additional utilities, or other building elements outside the removal area, will be repaired prior to demobilization from the Site.

3.1.1 Stockpiling/Staging Area

Prior to excavation and removal of contaminated material, the stockpiling/staging area will be selected and prepared prior to the commencement of excavation activities to protect building occupants. Staging area(s) will be prepared for staging any contaminated material overnight or longer using the procedures described below:

The material staging area(s) will be prepared by placing 6-mil plastic on the ground and covered with additional 6-mil plastic sheeting. Sealable containers with tight-fitting covers may also be utilized for the staging of VOC-contaminated material overnight or longer, to prevent the migration of VOCs into the site building.

3.1.2 Backfill/Reuse Sampling

In addition to any proposed soil excavation, some shallow soil throughout the Site, such as the material removed from a maximum depth of five feet below the concrete slab in the soil excavation area, or as part of SSDS component repairs may be excavated. Prior to reuse as backfill, the excavated soil will be evaluated using the criteria below:

1. Concrete or demolition debris that does not exhibit signs of contamination will be sampled for asbestos prior to reuse on-Site.
2. Material proposed for reuse will be sampled at a frequency and for the required parameters as outlined in NYSDEC's DER-10, Table 5.4.
3. Samples will be collected into laboratory-supplied containers.
4. Samples will be kept in an ice-filled cooler or refrigerator (not asbestos samples) until receipt by the laboratory.
5. Decontaminate all sampling equipment between sampling locations as described in Sections 3.4 of this QAPP.

3.2 MONITOR/INJECTION WELL RE-INSTALLATION AND DEVELOPMENT

Groundwater monitoring and injection wells have been installed throughout the Site. The following procedure should be followed in the event that a monitor or injection well requires replacement or redevelopment. The well locations and/or screen depths may be adjusted based on observations and data compiled during the necessary field activities. Details outlined below may be altered based on the preparation and submittal of Interim work plan documents to be submitted to NYSDEC and NYSDOH. This QAPP will be updated accordingly and included in the SMP.

Each monitor or injection well will be screened across the water table, which is anticipated to be encountered at approximately 17 to 25 feet below grade. Overburden monitor and injection wells inside the Site building would be re-installed by a direct push Geoprobe drill rig retrofitted with air-hammer attachments by driving a 2.25-inch outside diameter hollow core barrel fitted with an expendable drive point. The wells would be constructed with two-inch diameter PVC.

Any replacement monitor or injection wells will be constructed with approximately 10 feet of 0.02 slotted screens installed to approximately 25 feet below grade, the expected depth to bedrock. The annular space around all well screens will be backfilled with sand filter pack extending from the bottom of the boring to one to two feet above the screen. The annular space around the well riser will be sealed with bentonite extending one to two feet above the sand filter pack and completed with a non-shrinking cement mixture to approximately one foot below grade. Any replacement monitor wells will be completed using flush-to-grade manholes. A concrete apron will be set around the manhole to prevent drainage of surface runoff toward the well. Any replacement injection well will be properly connected to the injection well tubing network located beneath the concrete floor slab. The floor slab would then be restored in accordance with the requirements of the composite cover system (including repairs to the vapor barrier, if necessary) and the injection well would be accessed from the manifold located in the basement of the Site building. The screen interval for any replacement monitor or injection wells will be determined according to the following procedure:

- Measure the depth to water in the open hole using a Solinst® Water Table Meter – Model 101 or equivalent.

- If the groundwater recharge into the borehole is limited due to low hydraulic conductivity, the point of saturation identified during soil sampling will be used to assist with identifying the depth to groundwater
- Place PVC riser with a 10- to 15-foot length of PVC 0.02-slotted screen starting at approximately 15 feet below the first floor grade and extending to the bottom of the borehole (immediately above bedrock), if feasible.
- Install No. 2 sand filter pack around the well screen to a depth of one to two feet above the top of the screen.
- Install a bentonite seal to a depth of one to two feet above the filter pack.
- Backfill the remaining annular space using a bentonite-cement grout.
- Complete the well with a locking cap and flush-to-grade manhole (road box) set in concrete. Provide a concrete apron around the base of the manhole to direct run-off away from the well.
- Decontaminate the probe and drilling rods prior to and following installation of each injection well as described in Section 3.4 of this QAPP.
- Document injection well installation data (location, depth, construction details, water level measurements) in the field logbook or on field data sheets.
- Following monitor or injection well re-installation, the wells will be developed according to the following procedure:
    - Measure the depth to water using an oil/water interface probe and the total depth of the well using a weighted tape. Use these measurements to calculate the length of the water column. Calculate the volume of water in the well using 0.163 volumes per foot of water column (gallons) as the conversion factors for a 2-inch diameter well.
    - For the first five minutes of well development, develop the well using a check valve pump and re-circulate the water back into the well to create maximum agitation. This method is intended to remove fines from the sand pack, the adjacent formation and from the well.
    - After the first five minutes of well development, develop the well using a check valve pump and discharge the water to five-gallon buckets. Transfer water from the buckets to 55-gallon drums designated for well development water.
    - During development, collect periodic samples and analyze for turbidity and water quality indicators (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
    - Continue developing the well until turbidity is less than 50 nephelometric turbidity units (NTUs) for three successive readings and until water quality indicators have stabilized to within 10% for pH, temperature and specific conductivity for three successive readings, or until at least three well volumes have been purged from the well.
    - Document the volume of water removed and any other observations made during well development in the field logbook or on field data sheets.
    - Decontaminate the equipment prior to and following development at each well location as described in Section 3.4 of this QAPP. All well development water,

decontamination, and purge water will be containerized in 55-gallon drums and handled as described in Section 3.6 of this QAPP.

3.2.1 Decontamination and Restoration

- All sampling equipment (augers, drill rods, split spoon samplers) will be decontaminated in accordance with Section 3.4 of this QAPP. All drill cuttings and decontamination water will be containerized in 55-gallon drums and handled as described in Section 3.6 of this QAPP. If multiple borings are needed at a location to reach the target depth, each boring not completed as a monitor or injection well will be grouted with a bentonite-cement slurry upon completion.

3.3 SURVEYING AND WATER TABLE READINGS

Any re-installed monitor or injection well will be surveyed by a New York State-licensed surveyor. Three elevation measurements will be taken at each well location: the elevation of the ground beside the well; the elevation on the rim of the protective casing; and the elevation of the top of PVC casing.

Water table readings will be taken in the groundwater monitoring wells using an oil/water interface probe. The gate boxes will be unlocked and opened at each well location. The oil/water interface probe will be turned on and sound tested. The probe of the meter will be inserted into the PVC casing. The probe will be lowered down the casing until the meter alarm indicates the probe is at the water table. A reading of the depth from the top of the top of the PVC casing to the groundwater table will be recorded in the field notebook. The probe will then be lowered to the bottom of the well. If the meter alarm changes cadence indicating separate phase product, a reading of the product thickness will be documented.

3.4 DECONTAMINATION OF SAMPLING EQUIPMENT

All sampling equipment (drilling rods and casing, macro core samplers, probe rods and pumps, etc.) will be either dedicated or decontaminated between sampling locations. The decontamination procedure will be as follows:

1. Scrub using tap water/Simple Green® mixture and bristle brush.
2. Rinse with tap water.
3. Scrub again with tap water/ Simple Green® and bristle brush.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment, if possible.

Decontamination will be conducted within 55-gallon drums or on plastic sheeting (or equivalent) that is bermed to prevent discharge to the ground or drains.

3.5 HEAVY EQUIPMENT DECONTAMINATION

Decontamination of chemically contaminated heavy equipment will be accomplished using high-pressure steam or dry decontamination with brushes and shovels. Decontamination will take place on a decontamination pad and all liquids used in the decontamination procedure will be collected. Vehicles or equipment brought into an exclusion zone will be treated as contaminated, and will be decontaminated prior to removal. All liquids used in the decontamination procedure will be collected, stored and disposed of in accordance with Federal, State and local regulations.

Personnel performing this task will wear the proper PPE as prescribed in Table 2 of the Site-Specific Health and Safety Plan (HASP).

A decontamination area will be established around the planned excavation area, adjacent to the environmental enclosure. The floor of the decontamination area will be covered with 6-mil plastic sheeting, as necessary, and bermed to prevent spreading of decontamination fluids or potential discharge to the ground surface.

All equipment in direct contact with known or potentially contaminated material will be either dedicated or decontaminated prior to handling less contaminated material or removal from the Site. Decontamination of chemically contaminated heavy equipment will be accomplished using high-pressure steam or by dry decontamination with brushes and shovels. All liquids used in the decontamination procedure will be collected, stored and disposed of in accordance with Federal, State and local regulations. Personnel performing this task will wear the proper PPE prescribed in Table 2 of the HASP.

3.6 MANAGEMENT OF INVESTIGATION DERIVED WASTE

All investigation-derived waste (IDW) and condensate water generated during the operation of the SSDS will be containerized in DOT-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, development water or purge water) and the name of an AKRF point-of-contact. Soil samples collected from soil boring activities will be used for waste characterization of soils, since such data would be biased towards areas which are expected to be most contaminated. Groundwater data from groundwater samples collected during the monitoring program will be used to characterize development and purged groundwater. Notwithstanding, additional waste characterization soil or groundwater samples will be collected, if warranted. All IDW will be disposed of or treated according to applicable local, state and federal regulations.

4.0 SAMPLING AND LABORATORY PROCEDURES

4.1 BACKFILL/REUSE SAMPLING

Prior to reuse as backfill, excavated material (such as material removed as part of piping installation for SSDS and SVE system) will be evaluated using the criteria below:

- Concrete or demolition debris that does not exhibit signs of contamination will be sampled for asbestos prior to reuse on-Site.
- Material proposed for reuse will be sampled at a at a frequency and for the required parameters as outlined in NYSDEC's DER-10, Table 5.4.
- Samples will be collected into laboratory-supplied containers.
- Samples will be kept in an ice-filled cooler or refrigerator (not asbestos samples) until receipt by the laboratory.
- Decontaminate all sampling equipment between sampling locations as described in Sections 3.4 of this QAPP.

4.2 END-POINT SOIL SAMPLING

In the event that evidence of contamination (odors, staining, elevated PID readings, or analytical results of soil samples above NYSDEC Part 375 PGWSCOs) is identified during any breach to the composite cover system or excavation of soil/fill as part of the redevelopment or renovation of the Site, end-point soil sampling activities will be performed in accordance with NYSDEC

DER-10. Per NYSDEC DER-10 Section 5.4, side-wall samples will be collected a minimum one sample for every 30 linear feet and bottom samples will be collected at a frequency of one every 900 square feet. As outlined in Section 4.5 of this QAPP, soil samples will be analyzed for Target Compound List (TCL) VOCs via USEPA Method 8260B.

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- While advancing soil borings or completing excavation activities and field screening for evidence of contamination (e.g. odors, staining, elevated PID measurements), collect an aliquot of soil from each sampling interval and place in labeled sealable plastic bags. The bag should be labeled with the soil boring number and the depth the sample was collected. Place the plastic bags in a chilled cooler to await selection of samples for laboratory analysis.
- After selecting which samples will be analyzed in the laboratory, fill the required laboratory-supplied sample jars with the soil from the selected sampling location or labeled sealable plastic bags. Seal and label the sample jars as described in Section 4.5 of this QAPP and place in an ice-filled cooler.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.4 of this QAPP.
- Record boring number, sample depth and sample observations (evidence of contamination, PID readings, soil classification) in field log book and boring log data sheet, if applicable.

4.3 GROUNDWATER MONITORING WELL SAMPLING

Groundwater samples will be collected at least one week following well development (performed during re-installation or if silt accumulates in any of the existing wells). Low flow sampling techniques will be used, as described in U.S. EPA's Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers [EPA 542-S-02-001, May 2002]. Sampling will be conducted according to the following procedure:

- Slowly remove the access manhole and locking cap and immediately measure the vapor concentrations in the well with a PID calibrated to the manufacturer's specifications;
- Measure the depth to water and total well depth of the wells prior to conducting any purging, and check for the presence of NAPL using an oil/water interface probe. Measure the thickness of NAPL, if any, and record in field book and the well sampling field log. Collect a sample of NAPL (if present) using a disposable plastic weighted bailer or similar collection device. Groundwater samples will not be collected from wells containing measurable NAPL;
- Use the water level and total well depth measurements to calculate the length of the mid-point of the water column within the screened interval. For example, for a well where the total depth is 30 feet, screened interval is 20 to 30 feet, and depth to water is 24 feet, the mid-point of the water column within the screened interval would be 27 feet.
- For the 1-inch well (MW-2), lower dedicated tubing into the well such that the intake of the tubing is set at the mid-point of the water column within the screened interval. Connect the discharge end of the tubing to a peristaltic pump, and connect a dedicated discharge line to the flow-through cell of a Horiba Quanta multi-parameter (or equivalent) meter. Connect tubing to the output of the cell and place the discharge end of the tubing in a five-gallon bucket.

- For all 2-inch wells, connect dedicated tubing to either a submersible or bladder pump and lower the pump such that the intake of the pump is set at the mid-point of the water column within the screened interval of the well. Connect the discharge end of the tubing to the flow-through cell of a Horiba Quanta multi-parameter (or equivalent) meter. Connect tubing to the output of the cell and place the discharge end of the tubing into a five-gallon bucket.
- Activate the applicable pump at the lowest flow rate setting of the pump.
- Measure the depth to water within the well while purging. The pump flow rate may be increased such that the water level measurements do not change by more than 0.3 feet as compared to the initial static reading. The well-purging rate should be adjusted so as to produce a smooth, constant (laminar) flow rate and so as not to produce excessive turbulence in the well. The expected targeted purge rate will be approximately 100 milliliters/minute and will be no greater than 300 milliliters/minute.
- Transfer discharged water from the 5-gallon buckets to 55-gallon drums designated for well-purge water.
- During purging, collect periodic samples and analyze for water quality indicators (e.g., turbidity, pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue purging the well until turbidity is less than 50 NTU and water quality indicators have stabilized to the extent practicable. The criteria for stabilization will be three successive readings for the following parameters and criteria:

Table 1
Stabilization Criteria

Parameter	Stabilization Criteria
PH	+/- 0.1 pH units
Specific Conductance	+/- 3% mS/cm
ORP/Eh	+/- 10mV
Turbidity	<50 NTU
Dissolved Oxygen	+/- 0.3 mg/l

Notes: mS/cm = millisievert per centimeter
mV = millivolts
NTU = nephthalometric turbidity units
mg/l = milligrams per liter

- If the water quality parameters do not stabilize and/or turbidity is greater than 50 NTU within two hours, purging may be discontinued. Efforts to stabilize the water quality for the well must be recorded in the field book, and samples may then be collected as described herein.
- After purging, disconnect the tubing to the inlet of the flow-through cell. Collect groundwater samples directly from the discharge end of the tubing and place into the required sample containers as described in Section 4.5 of this QAPP. Label the containers as described in Section 4.7 of this QAPP and place in a chilled cooler. Samples should be collected for VOCs.
- Collect one final field sample and analyze for turbidity and water quality parameters (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity).

- Once sampling is complete, remove the pump and tubing from the well. Disconnect the tubing and place it back in the well for reuse during the next sampling event. Dispose of the sample filter in a 55-gallon drum designated for disposable sampling materials and PPE. The purge water will be managed as described in Section 3.6 of this QAPP.
- Decontaminate the pump, oil/water interface probe, and flow-through cell, as described in Section 3.4 of this QAPP.
- Record all measurements (depth to water, depth to NAPL, water quality parameters, turbidity), calculations (well volume), and observations in the project logbook and field data sheet, if applicable.

4.4 SSDS and SVE SYSTEM OPERATIONS SAMPLING

4.4.1 System Vacuum Monitoring

A network of 4 vacuum monitoring points (MP-1 through MP-4) was installed during remedial action implementation at strategic locations to inspect induced vacuum conditions during the operation of the SSDS and SVE system. Vacuum will be monitored at these locations at regular intervals as designated in the SMP. The procedures for instantaneously screening the vacuum monitoring points are as follows:

- Slowly remove the access manhole.
- Attach the analog vacuum gauge or digital manometer with male Quik-Connect fitting to the female Quik-Connect fitting at the monitoring point and document reading.
- Detach vacuum gauge/manometer and confirm that Quik-Connect female fitting is closed/sealed.
- Replace the access manhole and twist to tighten seal.

4.4.2 Indoor Air Sampling

To confirm indoor air quality during the operation of the SSDS and SVE system, one round of indoor air samples was collected from within the Site building within the first heating season following system startup and operation (November 2014) in accordance with the NYSDOH Vapor Intrusion Guidance Document. Indoor air quality sampling will be performed at the Site following system failure greater than 48 hours in accordance with the following details:

- The indoor air sampling is to be conducted following the completion of a pre-sampling inspection and chemical inventory of the Site building.
- Place a labeled 6-liter Summa canister at the breathing zone level (3 to 4 feet above ground surface) in the approximate area of the five sampling locations established as part of the confirmatory sampling completed in November 2014 throughout the first floor of the Site building.
- Record the vacuum reading from the vacuum gauge on the canister at the beginning of the 8-hour sampling period.
- Open the valve of the canister and record the time in the field book. At the end of the 8-hour sampling period, close valve, remove flow-rate controllers and vacuum gauges, install caps on canisters, and record time.

- Place canisters in shipping containers for transportation to laboratory.
- Repeat procedure for all of the sampling locations.

4.4.3 Influent/Effluent Vapor Sampling

Confirmatory effluent vapor sampling will be conducted following startup and 6 months of operation (and as determined by the SMP and NYSDEC thereafter) as part of a reassessment of VOC emissions calculations according to the following procedure:

- Confirmatory sampling will comprise grab samples from each individual SSDS and SVE line and combined influent, intermediate and effluent samples, as appropriate.
- A peristaltic pump will be used to extract influent/effluent vapors from each of the sample ports installed on the SSDS/SVE lines. A 1 liter tedlar bag will be filled with extracted vapors by attaching dedicated silicon-lined or silicon tubing from the sampling port to the inlet of the peristaltic pump. The tedlar bag fill port will be attached to the outlet of the peristaltic pump. Both ports will be opened and the peristaltic pump will be started. The pump rate will be throttled to fill the one liter Tedlar bag in approximately 10 minutes, resulting in a an approximate air flow rate of 0.1 liters per minute. The tedlar bag will be removed after its fill port has been closed.
- The tedlar bag will be properly labeled and enclosed in a zip-lock bag which will be used as an added protection layer to ensure safety in transit to the laboratory.
- The silicone tubing used in the peristaltic pump will be replaced after each sample collected.
- Place tedlar bars in a shipping container for transportation to laboratory (do not put the tedlar bags on ice).
- Samples will be collected in accordance with the QAPP and analyzed for VOCs by EPA Method TO-15.
- Decontaminate all non-dedicated sampling equipment between sampling locations as described in Section 3.4 of this QAPP.

4.4.4 Carbon Sampling

Based on monitoring inspections performed during the operation of the SSDS/SVE system, a representative grab sample of spent carbon will be collected and submitted for laboratory analysis prior to off-site disposal according to the following procedure:

- Access carbon treatment filter in accordance with manufacturer's specification and component manuals.
- Note any visual or field observations.
- Collect one aliquot of spent carbon material into a laboratory supplied sampling container.
- Relinquish sealed sampling container to a certified laboratory for analysis of total VOCs.

4.4.5 Condensate Water Sampling

Based on monitoring inspections performed during the operation of the SSDS/SVE system, a representative sample of condensate water will be collected and submitted for laboratory analysis prior to off-site disposal according to the following procedure:

- Slowly remove the lid of the 55-gallon drum containing the collected condensate water and immediately measure the vapor concentrations in the well with a PID calibrated to the manufacturer's specifications.
- Lightly stir the water in the drum with clean, dedicated sample collection equipment or tubing to homogenize the collected condensate water.
- Collect a representative sample directly from a dedicated bailer or tubing connected to a peristaltic pump and place into the required sample containers as described in Section 4.5 of this QAPP. Sample should be collected for VOCs and submitted to a certified laboratory.

4.5 LABORATORY METHODS

Table 2 summarizes the laboratory methods that will be used to analyze field samples as well as the sample container type, preservation, and applicable holding times. An ELAP Certified laboratory will be used for all chemical analyses in accordance with DER-10 2.1(b) and 2.1(f), including NYSDEC July 2005 Analytical Services Protocol (ASP) Category B Deliverables.

Table 2
Laboratory Analytical Methods for Analysis Groups

Sample Matrix	Analysis	Method	Container Type	Preservative	Hold Time
Soil (Reuse/Backfill)	TCL VOCs,	8260C	EnCore sampler	4°C	48 hours
	SVOCs,	8270D	Min. 4 oz. clear glass jar	4°C	5 days to extract, 49 days for analysis
	TAL Metals Mercury	6010C 7471B	Min. 4 oz. clear glass jar	4°C	14 days 26 days
	PCBs	8082A	Min.4 oz. clear glass jar	4°C	14 days
	Pesticides	8081B	Min.4 oz. clear glass jar	4°C	5 days to extract, 49 days for analysis
Soil (Endpoint Sampling)	TCL VOCs	8260C	EnCore sampler	4°C	48 hours
Granular Activated Carbon	TCL VOCs	8260C	EnCore sampler	4°C	48 hours
Groundwater and Condensate Water	TCL VOCs	8260C	40 mL glass vial, septa top	4°C, HCL	14 days
Groundwater Natural Attenuation Parameters	Nitrate (NO_3)	300.0	500 ml plastic	4°C	48 hours
	Reduced Manganese (Mn^{+2}) and Iron (Fe^{+2})	6010	500 ml plastic	HNO3, 4oC	180 days
	Sulfate (SO_4)	300.0	500 ml plastic	4°C	48 hours
	Sulfide (H_2S)	SM4500	500 ml plastic	NaOH/Zn Acetate, 4°C	7 days
	Methane (CH_4)	RSK175	(3) 40 ml glass vial	HCl, 4°C	14 days
	Alkalinity	SM2320B	500 ml plastic	4°C	14 days
Indoor Air	PCE, TCE, Cis-1,2-DCE, Trans-1,2-DCE, Vinyl Chloride	TO-15	6L Summa Canisters (8-hr flow controllers)	None	30 days
SSDS/SVE Total Influent, Intermediate, Effluent	TCL VOCs	TO-15	1L Tedlar Bags	None	72 hours
SSDS/SVE Individual Line Samples	TCL VOCs	TO-15	1L Tedlar Bags	None	3 days

4.6 QUALITY CONTROL SAMPLING

In addition to the laboratory analysis of the investigative soil and groundwater samples, additional analysis will be included for quality control measures, as required by the NYSDEC July 2005 ASP Category B sampling techniques. These samples will include equipment rinseate blanks, trip blanks, matrix spike/matrix spike duplicates (MS/MSD), and duplicate/blind duplicate

samples at a frequency of one sample per 20 field samples collected. Table 3 provides a summary of the field samples and QA/QC samples to be analyzed by the laboratory.

Table 3
Field Sample and QC Sample Quantities

Sample Type	Parameters	Analytical Method[1]	Field Samples	QC Samples			
				Equipment Blank[2]	Trip Blank[2]	MS/MSD[3]	Duplicate[3]
Soil	TCL VOCs	EPA 8260C	TBD	NA	1 (Laboratory -Supplied)	1/20 (TBD)	1/20 (TBD)
	SVOCs, TAL Metals, Mercury, PCBs, and Pesticides	EPA 8270D, 6010C/7471B, 8082A, and 8081B	TBD	NA	NA	1/20	1/20
Groundwater	TCL VOCs	EPA 8260C	7 quarterly (1 from each existing well)	1	1 (Laboratory -Supplied)	1/20 (Typically collected from MW-2)	1/20 (Typically collected from MW-3E-D)
	Nitrate (NO3) Reduced Mn and Fe Sulfate (SO4) Sulfide (H2S) Methane (CH4) Alkalinity	300.0 6010 6010 300.0 SM4500 RSK175 SM2320B	7 quarterly	1	NA	1/20 (Typically collected from MW-2)	1/20 (Typically collected from MW-3E-D)
Indoor Air	PCE, TCE, Cis-1,2-DCE, Trans-1,2-DCE, 1,1-DCE, Vinyl Chloride	TO-15	5 indoor air (on first floor)	NA	1 Ambient Air	NA	1 (Collected on First Floor)
SSDS/SVE Total Influent, Intermediate, Effluent	TCL VOCs	TO-15	13	NA	NA	NA	1 (Collected from Total SSDS/SVE Influent)
SSDS/SVE Individual Line Samples	TCL VOCs	TO-15	Each of the 9 Lines	NA	NA	NA	NA

Notes:
MS/MSD - matrix spike/matrix spike duplicate
TBD – To be determined based on planned work activities
NA – Not Applicable
[1] - NYSDEC July 2005 ASP Category B deliverables
[2] – One trip blank per shipment with VOC analyses
[3] - One MS/MSD and Duplicate sample per twenty field samples or sample shipment

4.7 SAMPLE HANDLING

4.7.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody documents and laboratory reports using an alpha-numeric code. All samples will be

identified with a prefix of "NL" to designate the former Nessen Lamps Site. Groundwater samples will be identified by the monitoring well number and soil boring samples will be identified by the soil boring location followed by the sample depth interval (in parenthesis).

The designation "NL" will be added to the designation for matrix spike/matrix spike duplicate samples. The field duplicate samples will be labeled with a dummy sample location to ensure that they are submitted as blind samples to the laboratory. Trip blanks and field blanks will be identified with "TB" and "FB", respectively.

Table 4 provides examples of the sampling identification scheme:

Table 4
Examples of Sample Names

Sample Description	Sample Designation
Soil endpoint sample collected from 5 to 7 feet at the north wall of an excavation	NL-EP-NW-1 (5-7)
Duplicate soil sample collected from 5 to 7 feet at the north wall of the excavation	NL-EP-DUPLICATE
Groundwater sample collected from monitor well MW-2	NL-MW-2
MS/MSD duplicate groundwater sample from MW-2	NL-MW-2-MS
Indoor Air sample collected from the first floor of the building	NL-IAQ-1
SSDS/SVE effluent sample collected from the carbon treatment system intermediate port	NL-EV-INT
SSDS vapor sample collected from SSDS pit 1	NL-IV-1

4.7.2 Sample Labeling and Shipping

All sample containers will be provided with labels containing the following information:

- Project identification
- Sample identification
- Date and time of collection
- Analysis(es) to be performed
- Sampler's initials

Once the soil and groundwater samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. All samples will be shipped to the laboratory twice per week. At the start and end of each workday, field personnel will add ice to the coolers as needed.

The samples will be prepared for shipment by placing each sample in a sealable plastic bag, then wrapping each container in bubble wrap to prevent breakage, adding freezer packs and/or fresh ice in sealable plastic bags and the chain-of-custody (COC) form.

Tedlar bags will be enclosed in a zip lock bag as an added protection prior to being placed in a cooler or shipment container without ice. Summa canisters will also be placed into their appropriate shipment containers and do not require preservation with ice. All samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. All coolers and shipment containers shipped to the laboratory will be sealed with mailing tape and a COC seal to ensure that they remain sealed during delivery.

4.7.3 Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; and signatures of individuals involved in sample transfer, and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

4.8 FIELD INSTRUMENTATION

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the site for referencing proper operation, maintenance and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork, if applicable. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas.

4.9 DATA REVIEW

In accordance with DER-10, each of the samples collected will undergo a third party data review process to ensure the usability of the data collected. Data usability summary reports documenting any issues with QA/QC will be prepared and included in the Periodic Review Report (PRR).

4.10 REPORTING OF DATA

All data generated during the monitoring activities will be submitted in the appropriate EqUIS EDD format.

ATTACHMENT A

RESUME OF PROJECT QA/QC OFFICER, PROJECT DIRECTOR, AND PROJECT MANAGER

MARCUS SIMONS

SENIOR VICE PRESIDENT

Marcus Simons is a Senior Vice President of AKRF with 20 years of environmental consulting experience, specializing in the assessment and cleanup of contaminated sites, including federal and state superfund, RCRA, TSCA, brownfield, voluntary cleanup and spill sites. His expertise includes health risk assessment, development of sampling plans, economic evaluations of remedial alternatives, and regulatory analysis. He is also AKRF's Health and Safety Officer with extensive experience of Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) issues during sampling and remediation of contaminated sites.

Mr. Simons directs much of AKRF environmental due diligence work (recently managing environmental due diligence on Tishman/Blackrock's Peter Cooper/Stuyvesant Town acquisition, reportedly the largest real estate transaction in US history), including supervising preparation of numerous Phase I and Phase II Environmental Site Assessments, as well as more complex multi-site and litigation-related projects. Mr. Simons manages preparation of the contaminated-materials portions of AKRF's Environmental Impact Statements and Environmental Assessments and has experience with procedures for hazardous material requirements under NEPA and New York SEQRA/CEQR and E-designation programs. He also has extensive experience in statistics, selection of sites for controversial facilities, and federal and state wetland regulations and waterfront permitting. In addition to analytical work, Mr. Simons has considerable experience in presenting results to regulatory agencies and the general public.

BACKGROUND

Education

M.S., Engineering and Public Policy, Carnegie-Mellon University, 1988

M.A. and B.A. (Honors), Mathematics/Engineering, Cambridge University, England, 1986

Certifications

Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) – 40 Hour Site Worker and 8 Hour Site Supervisor

Years of Experience

Year started in company: 1995

Year started in industry: 1988

Mr. Simons has managed some of the most complex cleanup sites in New York State including: the recently completed cleanup of a 12-acre PCB-contaminated former utility property in Flushing, Queens where a 3 million square foot retail/residential building is nearing completion (remediation was performed under the State Brownfield Cleanup Program, though the site was also subject to City jurisdiction under its E-Designation program); cleanup of the nation's largest former dental factory in Staten Island for reuse as single family housing; the investigation of several former manufactured gas plants; and the investigation and remediation associated with the reconstruction of the West Side Highway and Hudson River Park in Manhattan (from the Battery to 59th Street). Mr. Simons also has extensive experience with transportation projects (Second Avenue Subway, MTA/LIRR East Side Access, Cross Harbor Freight Movement Study, Route 9A Reconstruction), large-scale rezoning projects (Long Island City, Downtown Brooklyn, Jamaica) and public and private redevelopment work (Atlantic Yards, School Construction Authority, Queens West).

RELEVANT EXPERIENCE

CE Flushing Site, Flushing, NY

Mr. Simons directed the remediation of a former industrial site in Flushing, Queens, NY prior to its redevelopment as a 3 million square foot retail/residential complex. The property was cleaned up under the NYS Department of Environmental Conservation Brownfield Cleanup Program and the NYC Department of Environmental Protection's E-Designation requirements. The remedial measures included the removal of aboveground and underground storage tanks, excavation and off-site disposal of TSCA, RCRA and non-hazardous wastes, NAPL removal, and removal and investigation of on-site drainage structures. The remediation and subsequent construction involved obtaining (or obtaining waivers from) numerous permits including those for NYSDEC Tidal Wetlands, NYSDEC Long Island Wells, NYSDEC SPDES/Stormwater and NYCDEP Sewer Use.

Peter Cooper Village/Stuyvesant Town, New York, NY

Mr. Simons directed the purchaser's environmental due diligence efforts for the bidding and subsequent acquisition of this 80-acre property in Manhattan. Much of the 110-building complex is underlain by former manufactured gas plants and Con Edison entered the site into NYSDEC's Voluntary Cleanup Program. Going forward Mr. Simons will manage oversight of activities that involve disturbance of MGP-contaminated soils, as well as future testing and potentially remediation.

MTA New York City Transit Manhattan East Side Transit Alternative (MESA)/Second Avenue Subway, New York, NY

Mr. Simons directed the contaminated material assessment for this multi-billion dollar transit initiative that would provide subway service to Manhattan's East Side. The assessment identified several hundred facilities along the alignment that could have impacted soil and/or groundwater and could require special materials handling and enhanced health and safety procedures. Additional evaluation of these sites is underway.

Ferry Point Park, Bronx, NY

Mr. Simons developed the material acceptance criteria (soil standards for capping materials) for the development of Ferry Point Park (including a golf course) in the Bronx. The New York City Department of Environmental Protection DEP and the New York State Departments of Health (DOH) and Environmental Conservation (DEC) agreed for the first time to relax their strict (TAGM 4046) criteria for clean soil, based on statistical analyses of background conditions and risk-based modeling.

Prince's Point, Staten Island, NY

Mr. Simons managed the complex cleanup (including the relocation of a contaminated tidal creek) of the nation's largest former dental factory site on Staten Island's waterfront. The site was on the State Superfund list. The future use of the site as single-family residential property entailed extensive negotiations with NYSDEC and NYSDOH. The project required obtaining (or obtaining waivers from) numerous permits including those for NYSDEC Tidal and Fresh Water Wetlands, USACOE (Nationwide) Permits, NYSDEC Coastal Erosion Hazard Area, NYSDEC SPDES and Stormwater, FEMA Modifications to Land in Floodplain, and USEPA Notification of PCB Waste Activity.

Route 9A Reconstruction, New York, NY

AKRF directed extensive studies for the reconstruction in Lower Manhattan proposed by the New York State Department of Transportation (NYSDOT) in cooperation with the Federal Highway Administration (FHWA). The project is arguably the most complex environmental analyses performed for a federally funded transportation project in New York City in the last 10 years. The firm was responsible for all environmental tasks as well as the preparation for the Draft, Supplementary,

and Final Environmental Impact Statements (EISs) and Section 4(f) Evaluation for this 5-mile $250 million reconstruction of Route 9A as part of the recovery effort following the events of September 11th, 2001. Mr. Simons managed the extensive hazardous materials investigations and prepared the contract specifications for contaminated soil and tank removal, including Health and Safety oversight.

Hudson River Park, New York, NY

Mr. Simons is managing hazardous materials issues for the ongoing Hudson River Park construction, located adjacent to the Route 9A roadway. Construction is ongoing and Mr. Simons directs health and safety oversight and remediation during construction.

Jamaica Rezoning, Queens, NY

As part of the preparation of an Environmental Impact Statement, Mr. Simons managed the hazardous materials assessment of a multi-block area. In addition to conducting the assessment, Mr. Simons made recommendation as to the properties where "E-Designations" (city-recorded institutional controls on future development) should be placed.

Outlet City, Long Island City, Queens, NY

In Long Island City, Mr. Simons managed the investigation and interim remediation of an old factory complex where large volumes of creosote were spilled. The investigations and interim remedial measures (IRMs) took place under the New York State's Voluntary Cleanup Program (VCP).

MTA/LIRR East Side Access Project, New York, NY

Mr. Simons managed the hazardous materials investigations for multiple sites in the Bronx, Manhattan, and Queens associated with the Environmental Impact Statement (EIS) for the Long Island Rail Road connection to Grand Central Terminal. Mr. Simons continues to be involved in health and safety oversight related to the construction of the project.

New York City Department of Transportation, Lead Paint Removal and Disposal on Bridges Project, New York, NY

Mr. Simons conducted a regulatory analysis of related to the removal of lead paint from nearly 800 bridges. This analysis included an evaluation of the regulatory compliance of various proposed procedures with federal and state hazardous and solid waste management requirements.

American Felt and Filter Company, New Windsor, NY

Mr. Simons prepared a Remedial Investigation (including exposure assessment) and Feasibility Study for the country's oldest active felt manufacturing facility, located in Orange County. This solvent-contaminated site is on the State Superfund List.

MARC S. GODICK, LEP

SENIOR VICE PRESIDENT

Marc S. Godick, a Senior Vice President of the firm, has 20 years of experience in the environmental consulting industry. Mr. Godick's broad-based environmental experience includes expertise in remedial investigation, design and implementation of remedial measures, environmental/compliance assessment, litigation support, and storage tank management.

RELEVANT EXPERIENCE

Queens West Development Project, AvalonBay Communities, Queens, NY

Mr. Godick managed one of the largest remediation projects completed to date under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP). The remedy for the site, which was contaminated by coal tar and petroleum, included the installation of a hydraulic barrier (sheet pile cut off wall), excavation of contaminated soil under a temporary structure to control odors during remediation, a vapor mitigation system below the buildings, and implementation of institution controls. The investigation, remediation design, remedy implementation, and final sign-off (issuance of Certificate of Completion) were completed in two years. Total remediation costs were in excess of $13 million.

Williamsburg Waterfront Redevelopment, RD Management/L&M Equities/Toll Brothers, Brooklyn, NY

The project is one of the largest development projects in the Greenpoint/Williamsburg Rezoning Area, which includes the construction of nearly 1 million square feet of residential and retail space along the Williamsburg waterfront. The site had a variety of industrial uses, including a railyard, junk yard, and waste transfer station. As part of the City's rezoning, the site was assigned an E-designation for hazardous materials. Mr. Godick managed the preparation of the Phase I and II environmental site assessments, remedial action plan (RAP), and construction health and safety plan (CHASP). Mr. Godick obtained NYSDEC closure of an open spill associated with former underground storage tanks at the site. The NYCDEP-approved RAP and CHASP included provisions for reuse of the existing fill material, with the excess being disposed off-site, installation of a vapor barrier below the new buildings, installation of a site cap, and environmental monitoring during the construction activities. Mr. Godick is currently managing the environmental monitoring work that began in 2006. A Notice of Satisfaction has been issued by NYCDEP for the first phase of the development.

BACKGROUND

Education

M.E., Engineering Science/Environmental Engineering, Pennsylvania State University, 1998

B.S., Chemical Engineering, Carnegie Mellon University, 1989

Licenses/Certifications

Licensed Environmental Professional (License # 396) – State of Connecticut – 2003

40 Hour HAZWOPER and Annual Refresher Training, 1990-2008

Supervisors of Hazardous Waste Operations (8 Hour), 1990

Professional Memberships

Chair, Village of Larchmont/Town of Mamaroneck Coastal Zone Management Commission, 1997 - Present

Chair, Westchester County Soil and Water Conservation District, 2005 - Present

Member, NYSDEC Risk-Based Corrective Action (RBCA) Advisory Group for Petroleum-Impacted Sites, 1997

Community Leadership Alliance, Pace University School of Law, 2001

Years of Experience

Year started in company: 2002

Year started in industry: 1990

Landfill Closure & Compost Facility Application, White Plains, NY

Mr. Godick is currently managing the closure of a formal ash landfill, which is currently being utilized as a leaf and yard waste compost facility by the City of White Plains. The remedial investigation included on-site and off-site assessment of soil, groundwater, and soil gas to delineate the extent of methane and solvent contamination associated with the landfill. The landfill closure plan includes provisions for enhancing the existing cap, methane venting, and groundwater treatment for solvent contamination. Mr. Godick also managed the preparation of the compost facility permit application, which required modification to the facility's operations necessary to close the landfill and address other regulatory requirements.

Landfill Redevelopment – RD Management, Orangeburg, NY

Mr. Godick is currently managing the remediation of the former Orangeburg Pipe site under the NYSDEC Voluntary Cleanup Program. The site contains widespread fill material, which has fragments of Orangeburg pipe that is impregnated with asbestos and coal tar. The site is being redeveloped for retail use. The site's closure plan provides for reuse of all fill material on-site and methane mitigation (vapor barrier and passive sub-slab ventilation system) for all new buildings. The fill management activities will include dust and sediment control measures and air monitoring to prevent airborne dust in accordance with a closure plan, stormwater pollution prevention plan (SWPPP), and CHASP. In pervious areas, the site cap will consist of 2 feet of clean fill and a liner in larger areas.

National Grid – Halesite Manufactured Gas Plant Site, Town of Huntington, NY

Mr. Godick managed the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surrounded by commercial and residential properties, and half the property where the remediation was conducted is a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Mr. Godick was responsible for the development of the remedial work plans, design/construction documents, landscape architecture, confirmatory sampling, air monitoring, supervision, and preparation of close-out documentation in accordance with NYSDEC requirements.

Site Investigation–7 World Trade Center Substation, Con Edison, New York, NY

Mr. Godick managed the site investigation at the former 7 World Trade Center Substation in an effort to delineate and recover approximately 140,000 gallons of transformer and feeder oil following the collapse of the building. The project involved coordination with several crews, Con Edison, and other site personnel.

Site Investigation–Former Manufactured Gas Plant (MGP) Facilities, Con Edison, New York, NY

Mr. Godick managed site investigations at four former MGP facilities. The investigations at three of the four sites were completed at a Con Edison substation, flush pit facility, and service center, respectively. The details associated with the fourth site are confidential. Site characterizations at the substation and flush pit facility were conducted in preparation of expansion at these locations. The findings from these characterizations were used by Con Edison to make appropriate changes to the design specifications and to plan for appropriate handling of impacted materials and health and safety protocols during future construction activities.

Verizon, Investigation & Remediation, Various Locations, NY, PA and DE

Mr. Godick managed over 50 geologic/hydrogeologic assessments and site remediation projects related to petroleum releases at various facilities. Responsibilities included annual budgeting, day-to-day project management, development and implementation of soil and ground water investigation workplans, ground water modeling, risk evaluation, remedial action work plans, remedial design, system installation, waste disposal, well abandonment, and operation and maintenance. Many of the assessment and remedial projects followed a risk-based approach. Remedial technologies implemented included air sparging, soil vapor extraction, bioremediation, pump and treat, soil excavation, and natural attenuation.

Storage Tank Management, Verizon, Various Locations, NY, PA, DE, and MA

Mr. Godick managed the removal and replacement of underground and aboveground storage tank systems for Verizon in New York, Pennsylvania, Delaware, and Massachusetts. Responsibilities included the management of design, preparation of specifications, contractor bidding, construction oversight, project budget, and documentation. For selected AST sites, managed the development of Spill Control, Contingency and Countermeasures (SPCC) plans.

Brownfield Opportunity Area (BOA) Grant Program Services for the Town of Babylon, Wyandanch, NY

AKRF was retained by the Town of Babylon to prepare a blight study, market study, NYS BOA Step 2 Nomination, an Urban Renewal Plan, and a Generic Environmental Impact Statement (GEIS) as part of a revitalization and redevelopment effort for downtown Wyandanch. Mr. Godick was responsible for overseeing the environmental data collection effort for the 226 brownfields identified in the 105-acre project area, and for identifying strategic sites for which site assessment funding should be sought. He also prepared the Hazardous Materials section of the Wyandanch Downtown Revitalization Plan (which incorporates the Nomination, Urban Renewal Plan, and GEIS), involving a summary of available environmental reports, a review of regulatory records, and limited street-level site inspections.

Alexander Street Urban Renewal Plan, Master Plan, Brownfield Opportunity Area Plan, Yonkers, NY

AKRF was retained by the City of Yonkers to prepare an Urban Renewal Plan, Master Plan, Brownfield Opportunity Area Plan, and a Generic Environmental Impact Statement (GEIS) for a 153 acre industrial area along Alexander Street on the Yonkers Waterfront. Mr. Godick was responsible for the Hazardous Materials sections of the GEIS and Urban Renewal Plan. Mr. Godick managed the environmental data collection effort for the entire study area which involved review and summary of existing environmental reports, a review of regulatory records, and field inspections. The collected information was used to prioritize individual parcels for funding and remediation. The Master Plan for the area called for the development of a mixed-use neighborhood consisting of residential, neighborhood retail, and office space uses with substantial public open space, access to the Hudson River, and marina facilities.

SEMINARS, LECTURES & PUBLICATIONS

"Let Nature Do the Work – Onsite Stormwater Management," Westchester County Department of Parks, Recreation and Conservation, Fall 2003

"Water Pollution Control and Site Assessments and Audits," Environmental Health and Safety Issues Course, Building Owners and Managers Institute (BOMI), 1997-1999

"Hydrogeologic and Geological Aspects of Tank Closures and Remedial Action," Underground Storage Tanks Course, Government Institutes, Summer 1996, Fall 1997

DUSTIN KAPSON, LEED® GREEN ASSOCIATE

SENIOR TECHNICAL DIRECTOR // ENVIRONMENTAL SCIENTIST

Mr. Kapson is an Environmental Scientist with over seven years of environmental assessment and remediation experience. He has performed numerous Phase I ESAs and supervised Phase II activities for a wide variety of clients and property types. Mr. Kapson has been responsible for cost proposals, sampling and analysis, health and safety, contract management and quality control plans for several site assessment and environmental remediation projects. Mr. Kapson is a LEED® Green Associate, certified in OSHA HAZWOPER, as an NYSDEC Erosion and Sediment Control inspector, and is a member of the Water Environment Federation.

BACKGROUND

Work Experience

AKRF, Inc., New York, NY – June 2011 to Present

Whitestone Associates, Inc., Warren, NJ – September 2007 to May 2011

Education

B.A, Environmental Studies, Bucknell University, Lewisburg, PA, 2007

Pursuing Masters of Environmental Engineering, Manhattan College

Licenses/Certifications

OSHA HAZWOPER, December 2007 – annual refresher every year (scheduled for December 2012)

LEED® Green Associate

NYSDEC Erosion and Sediment Control Inspector

PROFESSIONAL PROJECT EXPERIENCE (2007 TO 2014)

New York City School Construction Authority, Various Locations, New York City

Under an on-call contract, AKRF provides the New York City School Construction Authority (NYCSCA) with hazardous materials consulting services. Mr. Kapson is involved with various due diligence and environmental assessment projects including Phase I Environmental Site Assessments (ESAs); Phase II (Subsurface) Environmental Site Investigations (soil, groundwater and soil vapor intrusion investigations); Indoor Air Quality (IAQ) Assessments; Underground Storage Tank (UST) and Aboveground Storage Tank (AST) inspections relating to boiler conversions; and peer review of other consultant's due diligence reports. Mr. Kapson is also well versed in NYCSCA projects requiring oversight and management of the disinfection of newly installed or replaced domestic water piping.

Amtrak & NJ Transit's Portal Bridge Capacity Enhancement Project—Preliminary & Final Engineering, Hackensack River, NJ

New Jersey Transit's Portal Bridge Capacity Enhancement Project involves replacing a century-year-old, two-track rail swing bridge that crosses the Hackensack River along the Northeast Corridor. As the lead environmental subconsultant to the tri-venture of Gannett Fleming, Jacobs Engineering, and HNTB Corporation for preliminary and final engineering, AKRF is responsible for securing all necessary environmental permits and regulatory approvals, including those from the United States Army Corps of Engineers (USACE), United States Coast Guard (USCG), New Jersey Department of Environmental Protection (NJDEP), and the New Jersey Meadowlands

Commission (NJMC). The permits and approvals require substantial wetland and natural resource analyses, conceptual mitigation, Green Acres and parkland issues, contaminated materials investigations, and hydrology assessments. Mr. Kapson has been responsible for the review of the engineering team's remedial action workplans and correspondences which are being prepared to initiate the large scale project. Mr. Kapson reviews these documents prior to submission to NJDEP to verify regulatory framework in an effort to streamline project review.

Environmental Consulting Services for E-designated Sites

Mr. Kapson has provided environmental services required to satisfy hazardous materials-related E-designations on various locations in New York City, including 547-551 Tenth Avenue in Manhattan, NY for Extell Development Company, 41-43 Bond Street in Manhattan, NY for DDG Partners, 86 Delancey Street in Manhattan, NY for Helm Equities LLC, and 78-82 Irving Place in Brooklyn, NY for New York Concrete Corporation. These services included Phase I and Phase II site investigations, preparation of Sampling Protocols, Remedial Action Plans and Health and Safety Plans based on identified hazardous materials issues, correspondence with the New York City Mayor's Office of Environmental Remediation (OER), remediation oversight as required by identified conditions, and preparation of Remedial Investigation and Final Engineering Reports.

Tappan Zee Hudson River Crossing (NYSDOT/NYSTA), Rockland and Westchester Counties, New York

The New York State Department of Transportation and the New York State Thruway Authority are proposing to replace the existing Tappan Zee Bridge. AKRF completed an Environmental Impact Statement (EIS) for this project on a fast-track schedule. The EIS is being prepared in accordance with the National Environmental Policy Act (NEPA), with the Federal Highway Administration (FHWA) as lead agency. Mr. Kapson conducted an extensive Phase II Site Investigation in support of the Hazardous Materials and Construction Impacts chapters of the EIS. Findings of the study were utilized to develop numerous documents prepared to guide the construction team, including a Remedial Action Plan and a Construction Health and Safety Plan for the five-year bridge replacement project. Mr. Kapson has continued to conduct peer reviews of these reports and construction plans, which were prepared by others on the design and construction team, to confirm regulatory compliance.

3200 Jerome Avenue, Bronx, New York

AKRF conducted a Phase I ESA and an Indoor Air Quality Survey of this property in the Bronx during due diligence investigations for the NYCSCA which identified levels of trichloroethene (TCE) in indoor air that exceeded the New York State Department of Health (NYSDOH) standards. NYCSCA subsequently terminated its lease of the site and discontinued its use as a school. Following the termination of NYCSCA's lease of the site, AKRF was retained by the owner to conduct an investigation and cleanup. Mr. Kapson helped to prepare the application to enter the site into the NYSDEC Brownfield Cleanup Program (BCP). Following the sites acceptance into the program, Mr. Kapson has been responsible for managing the entire remediation project inclusive of preparing Citizen Participation Plans to identify health risks to the public, developing workplans, and conducting/overseeing Site Characterization and Remedial Investigations which culminated in NYSDEC's acceptance of a proposed remedial strategy which is being implemented to allow for the cleanup and reuse of the property. Other responsibilities have included design of engineering controls and coordination of investigation and remediation with the New York City Transit Authority and New York City Department of Transportation, and communicating findings with NYSDEC and NYSDOH representatives.

Soundview Park, Bronx, New York

AKRF is in the process of assisting the New York City Department of Parks and Recreation (NYCDPR) to fulfill the needs of surrounding South Bronx neighborhoods and achieve the much needed social and recreational functions of a park. The goal is to revitalize this 212-acre area into a destination park for the community. In conjunction with completing the engineering associated with the design and installation of new utilities, grading, stormwater and sanitary sewers, AKRF has also documented previous environmental testing, designed an additional testing program necessary to fully characterize the environmental conditions, and then coordinated remediation efforts to make the park safe for the public. Mr. Kapson is working closely with the Parks personnel, the architects, and the contractors hired to ensure that soil conditions encountered and the soil that is imported during the redevelopment is managed properly during the various stages of this work to make the Department's and the Public's vision of the park become a reality.

Lower Manhattan Development Corporation (LMDC) Phase I ESAs and Cultural Enhancement Projects, Various Locations, NY

AKRF provides environmental consulting services to the LMDC as it oversees the revitalization of Lower Manhattan in the aftermath of September 11th, 2001. To date, the firm has consulted on more than 18 projects in the area. Of these 18 projects, Mr. Kapson conducted Phase I ESAs on several sites around Lower Manhattan.

New Jersey ISRA Compliance Investigation and Remediation, Various Locations, New Jersey

While at Whitestone Associates, Inc. (Whitestone), Mr. Kapson completed preliminary and in-depth investigations to identify, delineate, and remediate soil and groundwater contamination on industrial properties in accordance with CERCLA, New Jersey Industrial Site Recovery Act (ISRA) & New Jersey PDES programs. Properties assessed included manufacturers, waste processing facilities, and energy-related facilities.

Janet Place, Flushing, NY

While at Whitestone, Mr. Kapson provided environmental oversight during the initial construction activities of a mixed-use high rise complex. Duties included preparing daily reports, and identifying contaminated soils/waters for handling and removal. Mr. Kapson closely monitored all excavations assisting in the separation and classification of soils for re-use criteria. Mr. Kapson also coordinated and oversaw the installation of a large network of groundwater monitor wells to determine the impact of historical operations at the site on the Flushing Creek.

Sunshine Lighting Company, Brooklyn, NY

While at Whitestone, Mr. Kapson conducted numerous groundwater sampling and gauging events in an effort to develop an effective bioremediation injection program to treat contaminated groundwater. Oversight of the remedial activities was followed by post-treatment groundwater sampling which eventually led to the closure of the case in the NYSDEC Spills program.

Vapor Intrusion Investigation and Mitigation System Oversight, Tarrytown, NY

While at Whitestone, Mr. Kapson conducted a vapor intrusion investigation including sub-slab and indoor air quality sampling and oversaw the installation of a vapor mitigation system at an active dry cleaning facility located in Tarrytown, New York. The active soil depressurization (ASD) system prevents vapor intrusion by creating negative pressure beneath the slab. Results of diagnostic tests were reviewed to evaluate the performance of the mitigation system.

Pepsi Bottling Facility, Bronx, NY

While at Whitestone, Mr. Kapson oversaw and conducted site investigation and remedial activities and inspections in support of a Pepsi Bottling and Distribution Center in Bronx, New York including the characterization and coordination of the transportation and disposal of over 25,000 tons of contaminated soil. Daily field reports and construction oversight were completed in accordance with detailed Remedial Action Workplans and Health and Safety Plans approved by the NYCDEP.

INTERN EXPERIENCE (2003 TO 2007)

Wilkes University, Wilkes-Barre, PA

Mr. Kapson worked as a Research Assistant and participated in a water quality research project conducted by the University at Harvey's Lake in northeastern Pennsylvania. He also performed surface water tests, collected zooplankton and chlorophyll samples, and recorded measurements which were used to create underwater topographic maps of the lake.

Rhode Island Public Interest Research Group, Providence, RI

Mr. Kapson worked as a Field Worker/Writer/Activist. Organized press conferences, participated in letter writing campaigns and public outreach programs to promote conservation of the state's natural resources and encourage local, state, and federal politicians to pass legislation designed to reduce pollution and promote sustainability.

Pennsylvania Department of Conservation and Natural Resources, Harrisburg, PA

Mr. Kapson served as a GPS/GIS Mapping Intern. He traveled to and navigated throughout numerous state parks in Pennsylvania to retrieve and/or update new or existing mapping data files. He also assisted regional park managers in conducting inspections and employing various conservation techniques.

APPENDIX G

SSDS/SVE SYSTEM OPERATIONS AND SAMPLING LOG FORMS

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name _____ Date/Time Prepared _____

Preparer's Affiliation _____ Phone No._____

Purpose of Investigation_____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants _____

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _____

Other characteristics:

Number of floors_____ Building age_____

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

_____

_____

_____

Airflow near source

_____

_____

_____

Outdoor air infiltration

_____

_____

_____

Infiltration into air ducts

_____

_____

_____

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other _____
c. Basement floor:	concrete	dirt	stone	other _____
d. Basement floor:	uncovered	covered	covered with _____	
e. Concrete floor:	unsealed	sealed	sealed with _____	
f. Foundation walls:	poured	block	stone	other _____
g. Foundation walls:	unsealed	sealed	sealed with _____	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	
j. Sump present?	Y / N			
k. Water in sump?	Y / N / not applicable			

Basement/Lowest level depth below grade: _____(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

_____

_____

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Stream radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other _____

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: _____

Boiler/furnace located in:	Basement	Outdoors	Main Floor	Other_____
Air conditioning:	Central Air	Window units	Open Windows	None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

_____

_____

_____

_____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA
Please specify_____

d. Has the building ever had a fire? Y / N When?_____

e. Is a kerosene or unvented gas space heater present? Y / N Where? _____

f. Is there a workshop or hobby/craft area? Y / N Where & Type? _____

g. Is there smoking in the building? Y / N How frequently? _____

h. Have cleaning products been used recently? Y / N When & Type? _____

i. Have cosmetic products been used recently? Y / N When & Type? _____

j. Has painting/staining been done in the last 6 months? Y / N Where & When? _____

k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____

l. Have air fresheners been used recently? Y / N When & Type? _____

m. Is there a kitchen exhaust fan? Y / N If yes, where vented?_____

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?_____

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type?_____

Are there odors in the building? Y / N
If yes, please describe: _____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _____
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

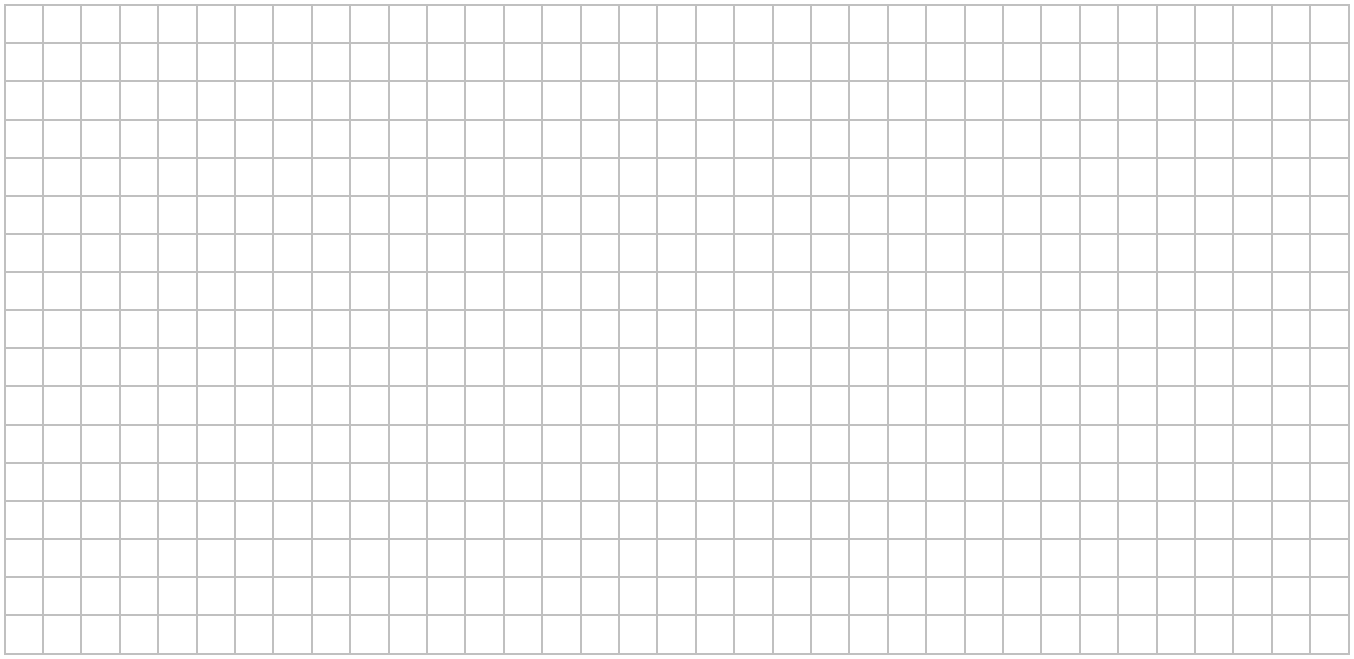
c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

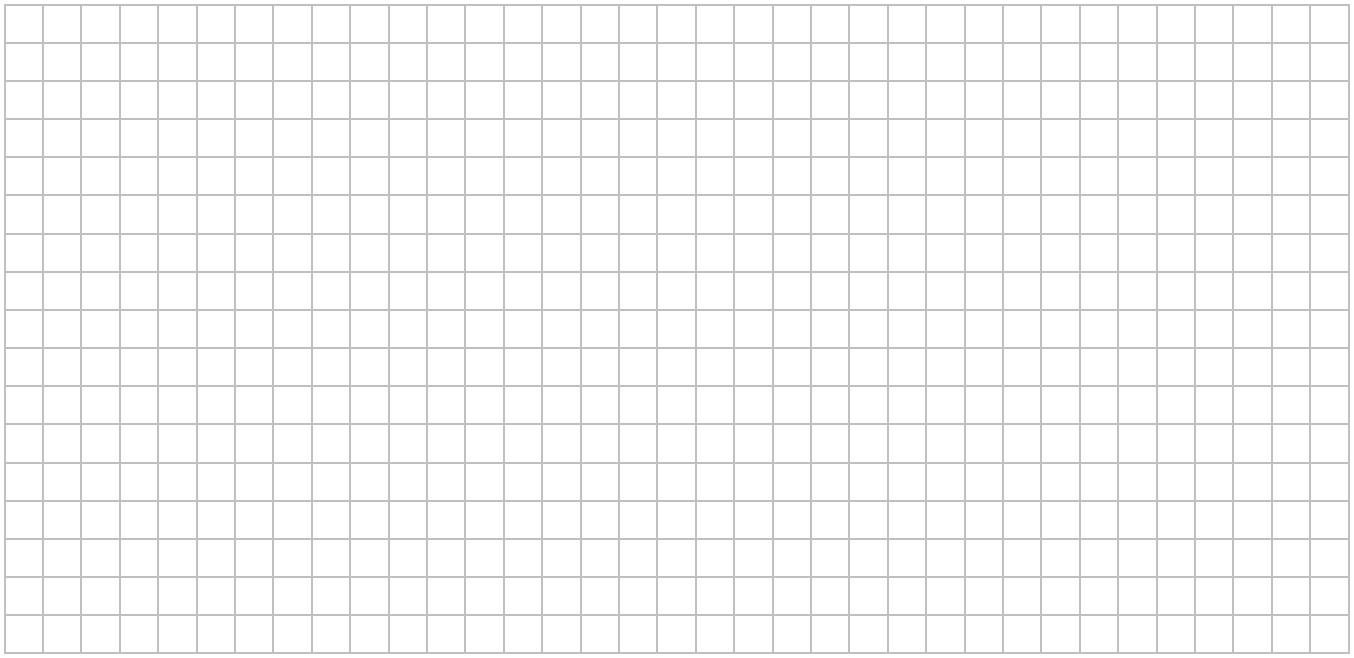
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:



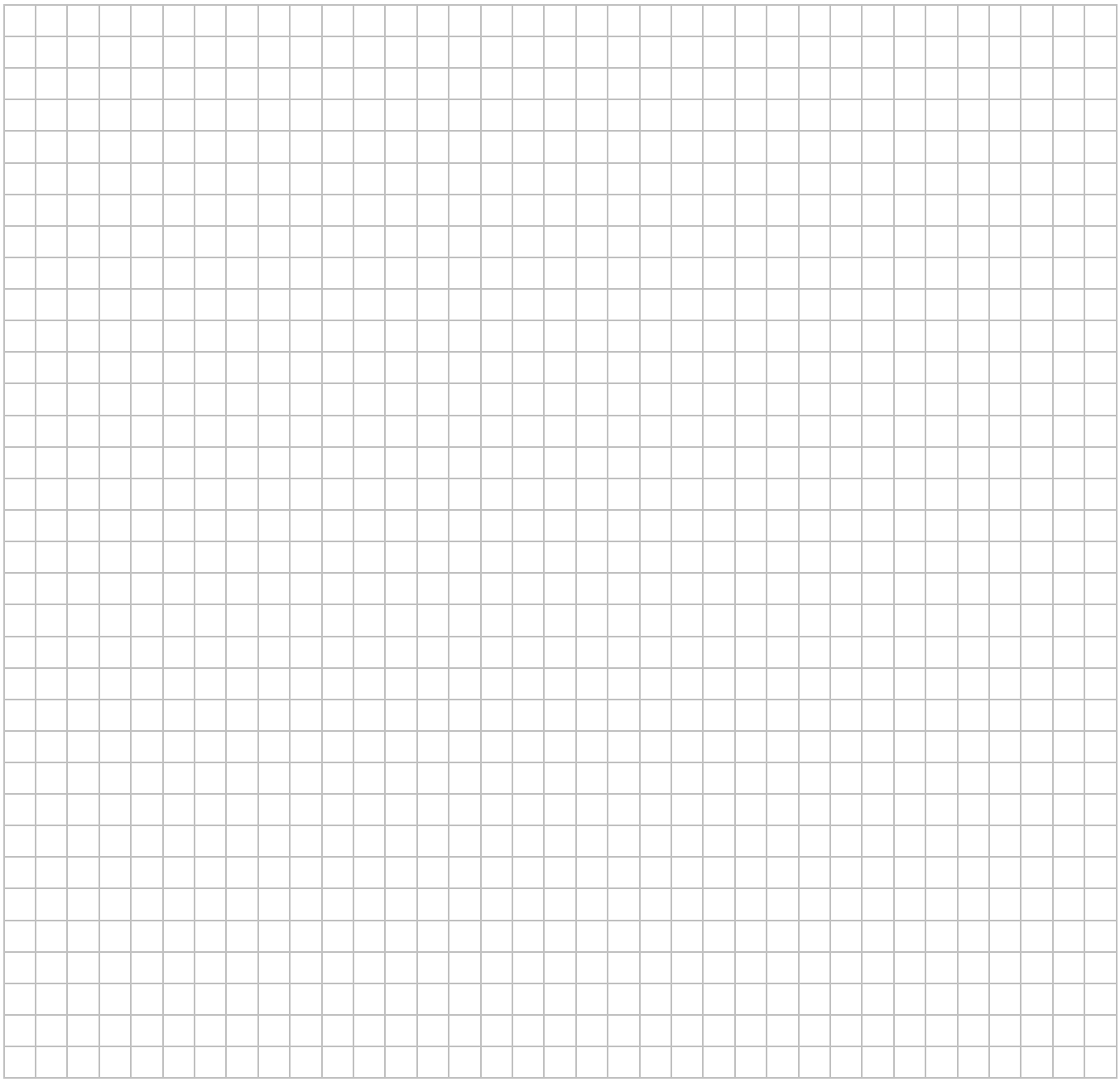
First Floor:



12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

ROUTINE SYSTEM MONITORING INSPECTION FORM
FORMER NESSEN LAMPS SITE
3200 JEROME AVENUE, BRONX, NY

Inspector Name:	**Date:**

General

Is the blower running? yes or no (*circle one*)
If blower is off, immediately notify an emergency contact.

Are gauges and exterior of SSDS control panel clean? yes or no *(circle one)*

Are there any unusual odors, spills or leaks near the system or on first floor? yes or no (*circle one*)
If yes, decribe suspected source and notify emergency contact.

Is air discharging from the exhaust piping to the roof?

Are there any problems with the exhaust piping on the basement, 1st, or 2nd floors? yes or no (circle one)
If yes, describe location of problem and notify emergency contact.

SSDS and SVE Operations

Sample Location [1]	**Flow Rate in Accepted Range?** [2] (50 to 100 cfm)	**Vacuum In Accepted Range?** [2] (0.1 to 0.5 in. H_2O)
SSDS-8	☐ YES ☐ NO	☐ YES ☐ NO
	Flow Rate in Accepted Range? [2] (50 to 100 cfm)	**Vacuum In Accepted Range?** [2] (0.5 to 5 in. H_2O)
SSDS-6	☐ YES ☐ NO	☐ YES ☐ NO
SSDS-5	☐ YES ☐ NO	☐ YES ☐ NO
SSDS-4	☐ YES ☐ NO	☐ YES ☐ NO
SSDS-3	☐ YES ☐ NO	☐ YES ☐ NO
SSDS-2	☐ YES ☐ NO	☐ YES ☐ NO
SSDS-1	☐ YES ☐ NO	☐ YES ☐ NO
	Flow Rate in Accepted Range? [2] (10 to 30 cfm)	**Vacuum In Accepted Range?** [2] (15 to 25 in. H_2O)
SVE-1	☐ YES ☐ NO	☐ YES ☐ NO
	Flow Rate in Accepted Range? [2] (50 to 100 cfm)	**Vacuum In Accepted Range?** [2] (0.5 to 5 in. H_2O)
SSDS-7	☐ YES ☐ NO	☐ YES ☐ NO

Comments:

Notes:
1. System vacuum points are located on the basement manifold and listed in as-built order from south to north, (viewed left to right when facing western basement wall.)
2. If readings are outside of the ranges indicated, inform emergency contacts below.

in. of H_2O - inches of water cfm - cubic feet per minute

Emergency Contact Information

Name	**Title**	**Contact Numbers**
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)

DETAILED SYSTEM MONITORING INSPECTION FORM
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx, New York

Inspector Name:		**Date:**	
Time IN:		**Time OUT:**	
General			
Weather:	Temperature:	Barometric Pressure:	Ambient Air PID (ppm):
When was the last rain event?			
Is the blower currently operating? Yes / No (circle one) If no, please list reason/alarm condition:			
Any evidence of system tampering, vandalism or damage in the basement? Any evidence of system tampering, vandalism or damage to the exhaust stack (view from 1st, 2nd floors, and exterior)?			
Were all cleanout/sampling port caps securely attached prior to system testing? If no, list location and contact Project Manager/Project Director.			
Is the concrete floor slab overlying all of the SSDS pits and piping runs in tact? If no, list location and contact Project Manager/Project Director.			

SSDS and SVE Operations		
Pre-Blower Influent Temperature (°F):	Post-Blower Effluent Temperature(°F):	Enclosure Temperature (°F):
Condensate in Header (inches):	Condensate in 55-gallon drum (gallons):	Transfer Pump Working? Yes/No
Comments:		
Notes: 1. Normal systems temperatures are <125°F for post-blower effluent vapor and <104°F for blower enclosure. PID - Photoionization Detector ppm - parts per million		

DETAILED SYSTEM MONITORING INSPECTION FORM
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx, New York

SSDS and SVE Operations

Sample Identification	Sample Location	Vacuum Reading [3] in. H_2O	Air Flow Reading [4] cfm	PID Reading [5] ppm	Notes
SSDS-8	Basement Manifold [1]				
SSDS-6	Basement Manifold [1]				
SSDS-5	Basement Manifold [1]				
SSDS-4	Basement Manifold [1]				
SSDS-3	Basement Manifold [1]				
SSDS-2	Basement Manifold [1]				
SSDS-1	Basement Manifold [1]				
SVE-1	Basement Manifold [1]				
SSDS-7	Basement Manifold [1]				
Ambient Air in Basement	Basement	NA	NA		
Total Influent (Pre-GAC)	Basement	NA	NA		
Intermediate GAC	Basement	NA	NA		
Total Effluent (Post-GAC)	Basement	NA	NA		
MP-1	First Floor [2]		NA	NA	
MP-2	First Floor [2]		NA	NA	
MP-3	First Floor [2]		NA	NA	
MP-4	First Floor [2]		NA	NA	

Comments:

Notes:

1. System vacuum points located on the basement manifold are listed in as-built order from south to north, (viewed left to right when facing western basement wall.)

2. Monitoring point locations (see Figure 19 of the Site Management Plan):

MP-1: North central portion of first floor
MP-2: Southeastern portion of first floor; adjacent to entrance stairway
MP-3: Western portion of first floor
MP-4: South central portion of first floor

3. Normal system vacuums range between 0.5 and 5 in. H_2O at sample locations SSDS-1 through SSDS-7, 0.1 and 0.5 in H_2O at sample location SSDS-8, and between 15 and 25 in. H_2O at SVE-1. A minimum of 0.005 in. H_2O at monitoring points MP-1 through MP-4 . If observations are confirmed to be outside of this range, inform emergency contacts and prepare corrective action plan.

4. Normal system flow rates range between 50 and 100 cfm sample locations SSDS-1 through SSDS-8, and between 10 to 30 cfm for SVE-1. If observations are confirmed to be outside of this range, inform emergency contacts and prepare corrective action plan, if necessary.

5. Peristalic pump and tedlar bag required to take PID readings.

in. of H2O - inches of water

cfm - cubic feet per minute

PID - Photoionization Detector

ppm - parts per million

GAC - granular activated carbon

NA - not applicable

DETAILED SYSTEM MONITORING INSPECTION FORM
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx, New York

Influent/Effluent Vapor Samples					
Sample Location	**Sample ID**	**Sample Date**	**Start Time**	**End Time**	**Notes**
SSDS-8					
SSDS-6					
SSDS-5					
SSDS-4					
SSDS-3					
SSDS-2					
SSDS-1					
SVE-1					
SSDS-7					
Total Influent (Pre-GAC)					
Intermediate GAC					
Total Effluent (Post-GAC)					

Note: Samples to be collected in accordance with the Quality Assurance Project Plan (QAPP) with a peristaltic pump and tedlar bag, and analyzed for volatile organic compounds (VOCs) by EPA Method TO-15.

Emergency Contact Information		
Name	**Title**	**Contact Number**
Marc Godick	AKRF Project Director	914-922-2356 (office) 917-991-4030 (cell)
Dustin Kapson	AKRF Project Manager	646-388-9767 (office) 646-823-5144 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)

APPENDIX H
SITE-WIDE INSPECTION FORM

Annual Site-Wide Inspection

Overview of Annual Site-Wide Inspection requirements:

1) General Site conditions at time of inspection;

2) Site Cover System Inspection;

3) Any Site activities currently being conducted (including active Engineering Controls);

4) Last SMP-related Site Activity conducted, upcoming SMP-related tasks;

5) Institutional Control (IC) Checklist (SMP, EWP maintained on-Site, routine SMP tasks being conducted);

6) Evaluation of Engineering Controls (in office); and

7) Site Documentation.

---

1) General Site conditions at time of inspection:

NAME:	**DATE:**
TIME:	**WEATHER:**
Annual Inspection or Emergency Inspection (if emergency, specify nature)?	

Notes:_____

_____

_____

_____

2) Cover System Inspection (Entire Site Building)

Environmental Control Type: Site Cover System		
Is the site cover system intact? If no, describe:	☐ YES	☐ NO
Are all access manhole covers and sampling ports in good condition? If no, list location and corrective action:	☐ YES	☐ NO

Observation Notes Regarding Basement and First Floor conditions:

_____

_____

_____

Have any disturbances to the Site cover system occurred over the last reporting period?
☐ YES ☐ NO

Notes/Details:

_____

_____

_____

_____

_____

3) Are any SMP-related site activities currently being conducted (including active SSDS/SVE system operation)?

☐ YES ☐ NO

Notes/Details:

_____

_____

_____

_____

_____

4) Last SMP-related Site Activity conducted; and next SMP-related task Scheduled?

Notes/Details:

_____

_____

_____

_____

_____

5) IC Checklist (SMP, EWP maintained on-Site, routine SMP tasks being conducted)

Copy of SMP on-Site?	☐ YES ☐ NO
Copy of EWP on-Site?	☐ YES ☐ NO
Building Use Still Consistent with SMP (Restricted Residential)?	☐ YES ☐ NO

Have the Required SMP tasks been conducted?

Routine SSDS/SVE system operations monitoring ☐ YES ☐ NO

Detailed SSDS/SVE system maintenance monitoring ☐ YES ☐ NO

Quarterly groundwater monitoring/sampling ☐ YES ☐ NO

Extracted vapor monitoring/sampling ☐ YES ☐ NO

Annual cover system monitoring ☐ YES ☐ NO

Notes:_____

_____

_____

_____

_____

6) Evaluation of ECs

Environmental Control Type: SSDS and SVE System		
Is the blower currently operating? If no, describe reason/alarm condition:	☐ YES	☐ NO
Are gauges and exterior of SSDS control panel clean?	☐ YES	☐ NO
Are there any unusual odors, spills or leaks near the system or on first floor? If yes, decribe source and plans for repair:	☐ YES	☐ NO
Any evidence of system tampering, vandalism or damage in the basement? If yes, describe:	☐ YES	☐ NO
Any evidence of system tampering, vandalism or damage to the exhaust stack (view from 1st, 2nd floors, and exterior)? If yes, describe:	☐ YES	☐ NO
Is air discharging from the exhaust piping to the roof?	☐ YES	☐ NO

SSDS/SVE system operations have also been documented using the applicable inspections logs (see attached) that will be provided as part of the PRR.

Notes:_____

_____

_____

_____

Is the Injection Well Access Manifold in Good/Working Condition?	☐ YES ☐ NO
Has the Injection Well Access Manifold Been Used for Groundwater Treatment over the Last Year?	☐ YES ☐ NO
Have any problems occurred that require corrective action regarding the Injection Well Access Manifold?	☐ YES ☐ NO If Yes, has pressure testing of the system occurred? ☐ YES ☐ NO

Notes:_____

_____

_____

_____

_____

7) Site documentation

Including updates regarding notification to NYSDEC regarding any changes to Site conditions/operations, annual hazardous waste tax filings, routine reporting to NYSDEC).

Notes:_____

_____

_____

_____

_____

APPENDIX I

ENGINEERING CONTROL AS-BUILT DRAWINGS

SYMBOL LEGEND

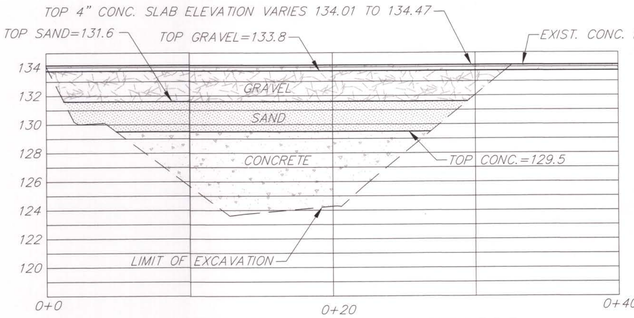
⊡	CONC. MONUMENT FND	▭	MAIL BOX
○	I.P. / I.B. FND	📡	CABLE TV BOX
◎	TACK / STAKE FND	△	TELEPHONE BOX
▲	WETLAND FLAG	▨	A/C UNIT
x 101.55	SPOT ELEVATIONS	⊠	TRANSFORMER
	TRAFFIC SIGNAL POLE	E	ELECTRIC METER
	UTILITY POLE	G	GAS METER
	GUY WIRE	W	WATER METER
	LIGHT POLE	WV	WATER VALVE
	SIGN	GV	GAS VALVE
	FIRE HYDRANT	CO	CLEAN OUT
	BOLLARD	SP	SPRINKLER HEAD
RD	ROOF DRAIN	XG	GAS
	MONITORING WELL	XW	WATER
	WELL	XE	ELECTRIC
	MANHOLE	XT	TELEPHONE
	"A"-INLET	XC	CABLE TV
	"B" INLET		TREE
	"E"-INLET		SHRUB
	YARD INLET	D.C.	DEPRESSED CURB
	FLARED END SECTION	L.S.A.	LANDSCAPED AREA

GENERAL NOTES:

1. FIELD SURVEY PERFORMED ON NOVEMBER 6, 2014 AND NOVEMBER 17, 2014.
2. THE UTILITIES SHOWN HAVE BEEN LOCATED FROM EVIDENCE OBSERVED ON THE SURFACE ONLY OR HAVE BEEN SHOWN GRAPHICALLY PER SUPPLIED MATERIALS. DPK CONSULTING MAKES NO GUARANTEES THAT THE UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN-SERVICE OR ABANDONED. DPK CONSULTING FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. DPK CONSULTING HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.
3. ELEVATIONS ARE BASED UPON REF. 1, REPORTED TO BE BOROUGH PF BRONX DATUM WHICH IS 2.608 FEET ABOVE MEAN SEA LEVEL DATUM.
4. NORTHING AND EASTING VALUES ARE IN THE NEW YORK LONG ISLAND STATE PLANE COORDINATE SYSTEM NAD 83 DETERMINED BY DIFFERENTIAL GPS USING THE NGS CORS NETWORK.

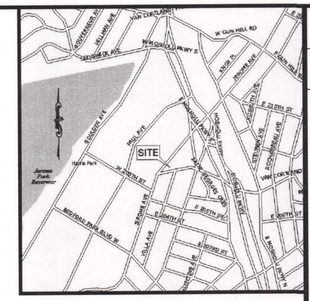
MAP REFERENCES:

1. MAP ENTITLED "MONITORING WELL LOCATION SURVEY, TAX LOT 36, TAX BLOCK 3323", PREPARED BY MONTROSE SURVEYING CO., LLP., DATED AUGUST 14, 2012, LAST REVISED JANUARY 8, 2013.
2. MAP ENTITLED "RECORD MAP SECTION 20," LAST REVISED MARCH 29, 1950
3. MAP ENTITLED "FINAL SECTION FILED DEC 17, 1895 FINAL MAP SECTION 20, AS AMMENDED" LAST REVISED JULY 1, 1999.
4. MAP ENTITLED "TITLE MAP 14".
5. MAP ENTITLED "SSDS/SVE LAYOUT AKRF-RINZLER 3200 JEROME AVENUE-BRONX, NY." PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS DATED JUNE 19, 2014. LAST REVISED JULY 7, 2014.
6. MAP ENTITLED "SSDS/SVE EXTRACTION MANIFOLD LAYOUT AKRF-RINZLER 3200 JEROME AVENUE-BRONX, NY." PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS DATED JUNE 19, 2014. LAST REVISED JULY 7, 2014.
7. MAP ENTITLED "ALTA/ACSM LAND TITLE SURVEY, TAX MAP LOT 36, BLOCK 3323, 3200 JEROME AVENUE, BOROUGH OF THE BRONX, BRONX COUNTY, CITY AND STATE OF NEW YORK" PREPARE BY DPK CONSULTING, DATED MAY 13, 2014, LAST REVISED JULY 9, 2014.



EXCAVATION SECTION

SCALE: HORZ=1"=5'
VERT=1"=5'



VICINITY MAP
SCALE: N.T.S.

INJECTION WELLS

Designation	TOP OF PVC	Northing	Easting	Latitude	Longitude
IW-1	133.85	258973.95	1015484.39	40° 52' 38.79	73° 53' 13.39
IW-2	133.92	258982.17	1015487.20	40° 52' 38.87	73° 53' 13.36
IW-3	132.43	258994.74	1015504.99	40° 52' 39.00	73° 53' 13.13
IW-4	132.59	259000.68	1015509.66	40° 52' 39.06	73° 53' 13.07
IW-5	133.18	259007.63	1015519.77	40° 52' 39.13	73° 53' 12.93
IW-6	133.91	258966.77	1015489.08	40° 52' 38.72	73° 53' 13.33
IW-7	133.80	258975.49	1015497.67	40° 52' 38.81	73° 53' 13.22
IW-8	132.98	258985.93	1015511.01	40° 52' 38.91	73° 53' 13.05
IW-9	133.39	258995.78	1015516.95	40° 52' 39.01	73° 53' 12.97
IW-10	133.20	259003.42	1015529.13	40° 52' 39.08	73° 53' 12.81
IW-11	133.60	258952.79	1015491.38	40° 52' 38.58	73° 53' 13.30
IW-12	133.69	258965.81	1015508.42	40° 52' 38.71	73° 53' 13.08
IW-13	132.95	258981.05	1015517.66	40° 52' 38.86	73° 53' 12.96
IW-14	132.83	258989.85	1015526.29	40° 52' 38.95	73° 53' 12.85
IW-15	132.74	258997.96	1015532.49	40° 52' 39.03	73° 53' 12.73
IW-16	133.71	258955.64	1015509.08	40° 52' 38.61	73° 53' 13.07
IW-17	133.08	258971.58	1015523.76	40° 52' 38.77	73° 53' 12.88
IW-18	133.11	258980.14	1015535.23	40° 52' 38.85	73° 53' 12.73
IW-20	133.55	258961.44	1015530.36	40° 52' 38.67	73° 53' 12.80
IW-21	133.27	258975.24	1015539.13	40° 52' 38.81	73° 53' 12.68
IW-22	132.86	258980.75	1015547.75	40° 52' 38.86	73° 53' 12.57
IW-23	132.86	258965.48	1015546.51	40° 52' 38.71	73° 53' 12.59
IW-24	133.44	258969.20	1015562.40	40° 52' 38.75	73° 53' 12.38

SOIL SAMPLES

Designation	Ground	Northing	Easting	Latitude	Longitude
NL-TI-1	134.42	258931.32	1015467.62	40° 52' 38.37	73° 53' 13.61
NL-TI-2	134.45	258935.32	1015453.04	40° 52' 38.41	73° 53' 13.80
NL-TI-3	134.41	258942.40	1015457.07	40° 52' 38.48	73° 53' 13.75
NL-TI-4	134.40	258938.73	1015464.49	40° 52' 38.45	73° 53' 13.65
NL-EP-BS-1 (11-12)	122.76	258993.15	1015522.52	40° 52' 39.00	73° 53' 12.90
NL-EP-BS-2 (11-12)	123.32	258984.87	1015529.83	40° 52' 38.90	73° 53' 12.80
NL-EP-EW-1 (11-12)	123.26	258996.16	1015525.04	40° 52' 39.01	73° 53' 12.86
NL-EP-EW-2 (11-12)	123.50	258989.79	1015529.68	40° 52' 38.95	73° 53' 12.80
NL-EP-EW-3 (11-12)	123.32	258985.34	1015533.38	40° 52' 38.91	73° 53' 12.76
NL-EP-EW-4 (6-7)	128.68	258999.51	1015527.26	40° 52' 39.05	73° 53' 12.84
NL-EP-EW-5 (7-8)	125.97	258993.10	1015532.04	40° 52' 38.98	73° 53' 12.77
EP-EW-6 (6-7)	127.27	258986.66	1015536.69	40° 52' 38.92	73° 53' 12.71
EP-NW-1 (11-12)	124.53	258994.28	1015516.41	40° 52' 39.00	73° 53' 12.98
NL-EP-NW-2 (11-12)	124.25	258995.48	1015518.38	40° 52' 39.01	73° 53' 12.95
NL-EP-NW-3 (11-12)	123.42	258998.22	1015521.18	40° 52' 39.03	73° 53' 12.92
NL-EP-NW-4 (7-8)	126.37	258995.97	1015513.95	40° 52' 39.01	73° 53' 13.01
NL-EP-NW-5 (7-8)	126.34	258998.09	1015515.74	40° 52' 39.03	73° 53' 12.99
NL-EP-NW-6 (6-7)	127.21	259002.73	1015517.88	40° 52' 39.18	73° 53' 12.96
NL-EP-SW-1 (11-12)	123.73	258979.39	1015527.94	40° 52' 38.85	73° 53' 12.83
NL-EP-SW-2 (11-12)	123.72	258983.70	1015533.94	40° 52' 38.89	73° 53' 12.75
NL-EP-SW-3 (6-7)	127.88	258976.70	1015528.63	40° 52' 38.82	73° 53' 12.82
NL-EP-SW-4 (7-8)	126.27	258983.25	1015537.25	40° 52' 38.88	73° 53' 12.71
NL-VF (10-10-5)	125.31	258994.66	1015504.96	40° 52' 39.00	73° 53' 13.13
NL-EP-WW-1 (11-12)	124.27	258990.65	1015520.12	40° 52' 38.96	73° 53' 12.93
NL-EP-WW-2 (11-12)	124.32	258982.38	1015524.83	40° 52' 38.88	73° 53' 12.87
NL-EP-WW-3 (6-7)	127.81	258988.35	1015517.33	40° 52' 38.94	73° 53' 12.97
NL-EP-WW-4 (7-8)	126.06	258980.65	1015523.87	40° 52' 38.86	73° 53' 12.88

MONITORING POINT

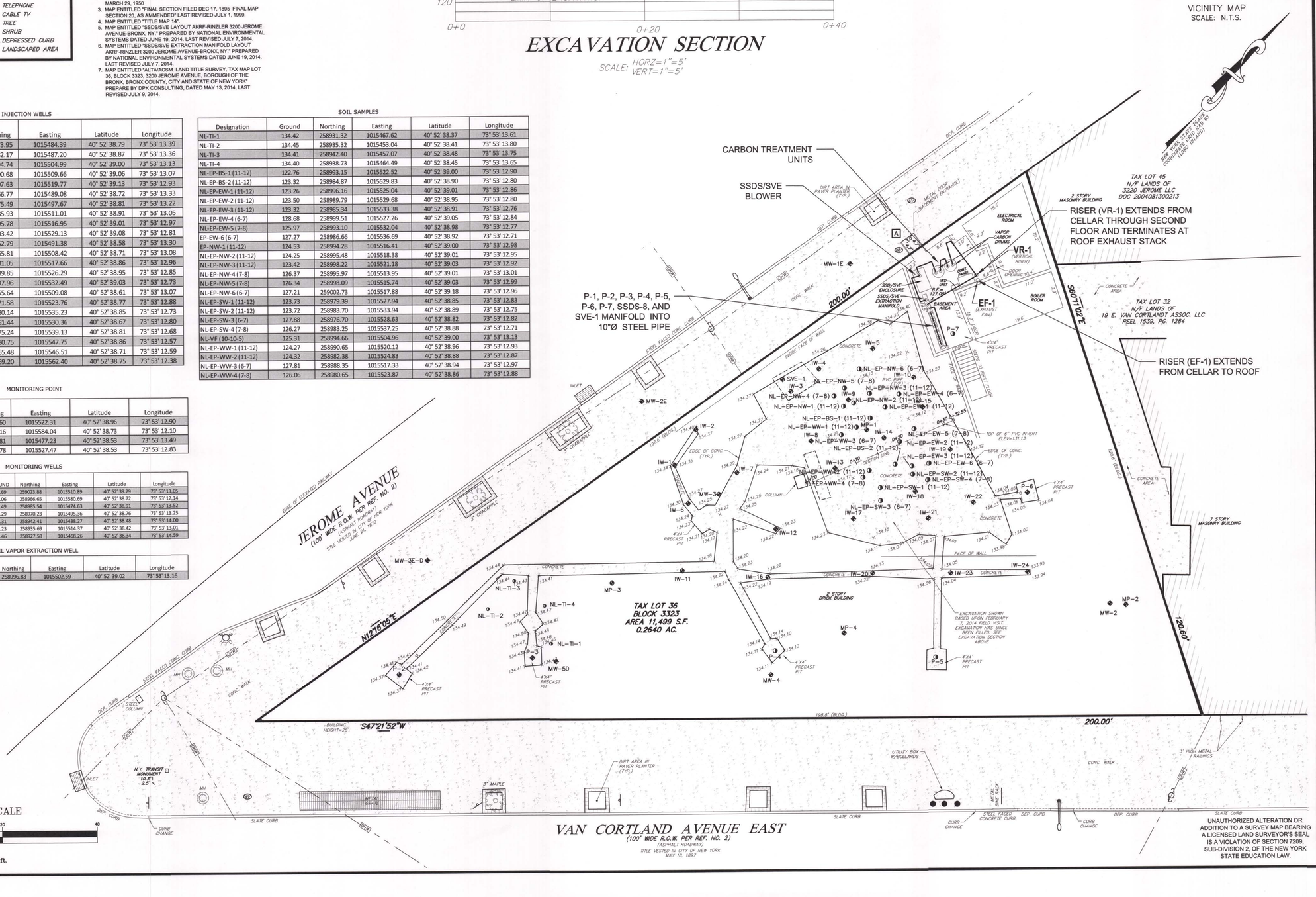
Designation	TOP OF Manhole	Northing	Easting	Latitude	Longitude
MP-1	134.14	258990.60	1015522.31	40° 52' 38.96	73° 53' 12.90
MP-2	134.03	258967.16	1015584.04	40° 52' 38.73	73° 53' 12.10
MP-3	134.30	258946.81	1015477.23	40° 52' 38.53	73° 53' 13.49
MP-4	134.21	258947.78	1015527.47	40° 52' 38.53	73° 53' 12.83

MONITORING WELLS

Designation	TOP OF PVC	RIM	GROUND	Northing	Easting	Latitude	Longitude
MW-1E	135.89	136.67	136.69	259023.88	1015510.89	40° 52' 39.29	73° 53' 13.05
MW-2	133.86	134.06	134.06	258966.65	1015580.69	40° 52' 38.72	73° 53' 12.14
MW-2E	136.20	136.47	136.49	258985.54	1015474.63	40° 52' 38.91	73° 53' 13.52
MW-3	134.00	134.29	134.29	258970.23	1015495.36	40° 52' 38.76	73° 53' 13.25
MW-3E-D	134.31	134.31	134.31	258942.41	1015438.27	40° 52' 38.48	73° 53' 14.00
MW-4	134.01	134.24	134.23	258935.69	1015514.37	40° 52' 38.42	73° 53' 13.01
MW-5D	134.24	134.47	134.46	258927.38	1015468.26	40° 52' 38.34	73° 53' 14.59

SOIL VAPOR EXTRACTION WELL

DESIGNATION	TOP OF PVC	RIM	Northing	Easting	Latitude	Longitude
SVE-1	134.24	134.29	258996.83	1015502.59	40° 52' 39.02	73° 53' 13.16



REV	DATE	DESCRIPTION	BY	CHKD

12/1/14
date

James J. Helser
Professional Land Surveyor
N.Y. Lic: 050932-1
N.J. Lic: 24GS05431100
JHELSER@DPKCONSULTING.NET

In consideration of the mutual covenants between the parties listed above and the undersigned, I declare that this plan is based on field survey made under my direct supervision on the date shown hereon and represents the conditions found on the date of the survey, except easements, if any, below and/or environmentally sensitive areas were not located or made known to me at the time of this survey. This survey is subject to the information contained in a current title report. In addition, underground and

SYMBOL LEGEND

	CONC. MONUMENT FND		MAIL BOX
	I.P. / I.B. FND		CABLE TV BOX
	TACK / STAKE FND		TELEPHONE BOX
	WETLAND FLAG		A/C UNIT
x 103.55	SPOT ELEVATIONS		TRANSFORMER
	TRAFFIC SIGNAL POLE	E	ELECTRIC METER
	UTILITY POLE	G	GAS METER
	GUY WIRE	W	WATER METER
	LIGHT POLE		WATER VALVE
	SIGN		GAS VALVE
	FIRE HYDRANT	CO	CLEAN OUT
	BOLLARD	SP	SPRINKLER HEAD
RD	ROOF DRAIN	XG	GAS
	MONITORING WELL	XW	WATER
	WELL	XE	ELECTRIC
	MANHOLE	XT	TELEPHONE
	"A"-INLET	XC	CABLE TV
	"B" INLET		TREE
	"E"-INLET		SHRUB
	YARD INLET	D.C.	DEPRESSED CURB
	FLARED END SECTION	L.S.A.	LANDSCAPED AREA

GENERAL NOTES:

1. FIELD SURVEY PERFORMED ON NOVEMBER 6, 2014 AND NOVEMBER 17, 2014.
2. THE UTILITIES SHOWN HAVE BEEN LOCATED FROM EVIDENCE OBSERVED ON THE SURFACE ONLY OR HAVE BEEN SHOWN GRAPHICALLY PER SUPPLIED MATERIALS. DPK CONSULTING MAKES NO GUARANTEES THAT THE UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN-SERVICE OR ABANDONED. DPK CONSULTING FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. DPK CONSULTING HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.
3. ELEVATIONS ARE BASED UPON REF. 1, REPORTED TO BE BOROUGH PF BRONX DATUM WHICH IS 2.608 FEET ABOVE MEAN SEA LEVEL DATUM.
4. NORTHING AND EASTING VALUES ARE IN THE NEW YORK LONG ISLAND STATE PLANE COORDINATE SYSTEM NAD 83. DETERMINED BY DIFFERENTIAL GPS USING THE NGS CORS NETWORK.

MAP REFERENCES:

1. MAP ENTITLED "MONITORING WELL LOCATION SURVEY, TAX LOT 36, TAX BLOCK 3323", PREPARED BY MONTROSE SURVEYING CO., LLP., DATED AUGUST 14, 2012, LAST REVISED JANUARY 8, 2013.
2. MAP ENTITLED "RECORD MAP SECTION 20," LAST REVISED MARCH 29, 1950
3. MAP ENTITLED "FINAL SECTION FILED DEC 17, 1895 FINAL MAP SECTION 20, AS AMMENDED" LAST REVISED JULY 1, 1999.
4. MAP ENTITLED "TITLE MAP 14".
5. MAP ENTITLED "SSDS/SVE LAYOUT AKRF-RINZLER 3200 JEROME AVENUE-BRONX, NY." PREPARED BY NATIONAL ENVIRONMENTAL SYSTEMS DATED JUNE 19, 2014, LAST REVISED JULY 7, 2014.
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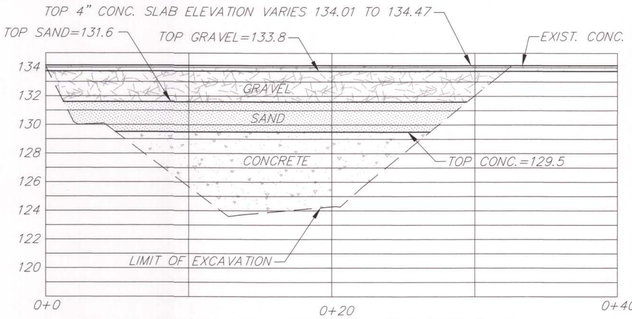
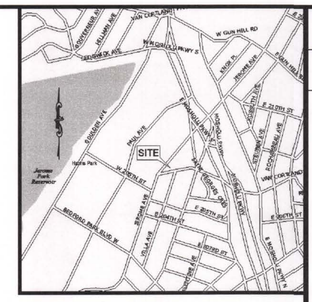
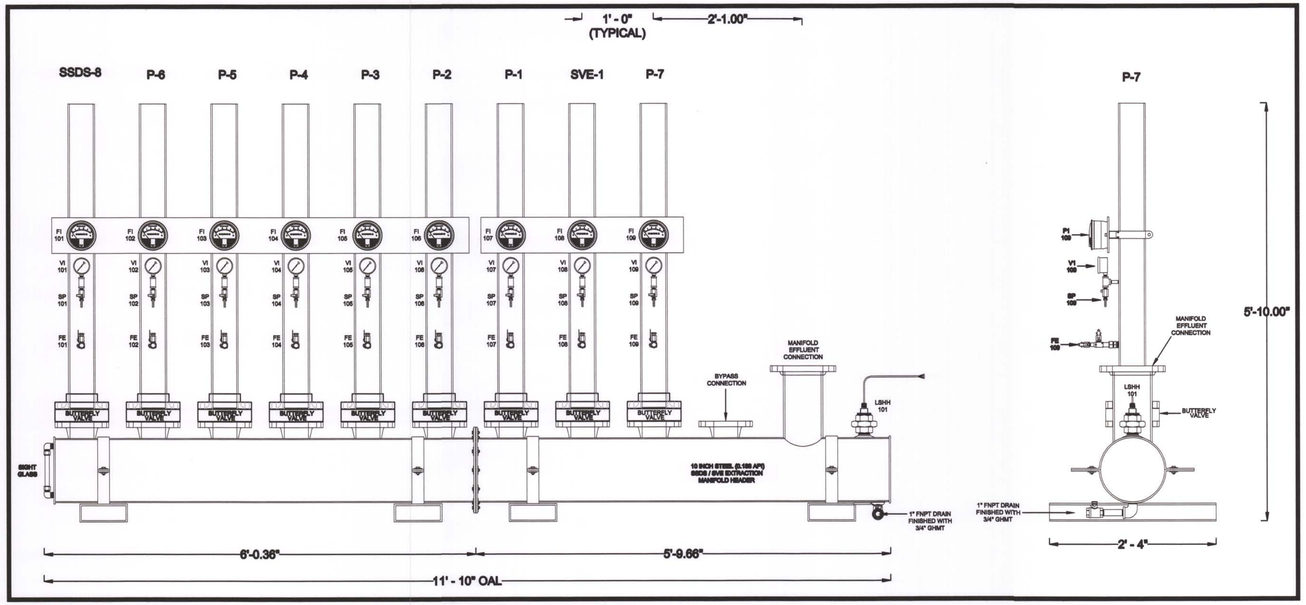


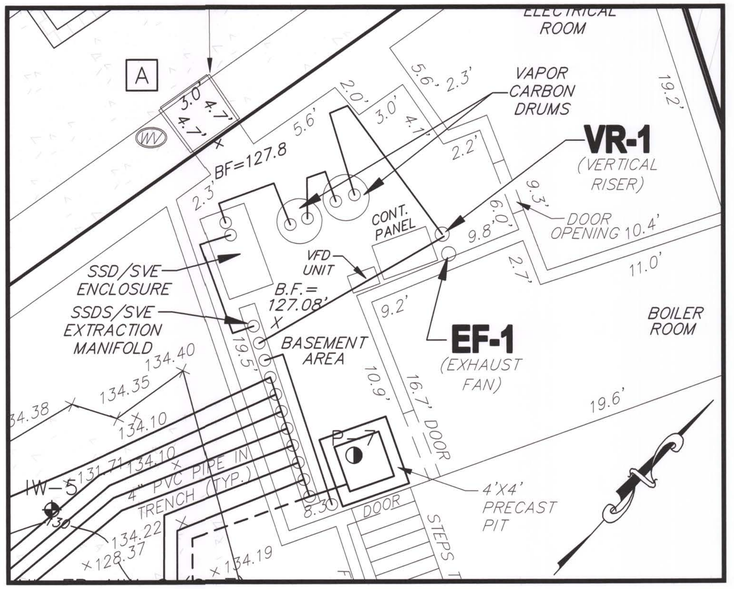
EXCAVATION SECTION

SCALE: HORZ=1"=5'
VERT=1"=5'

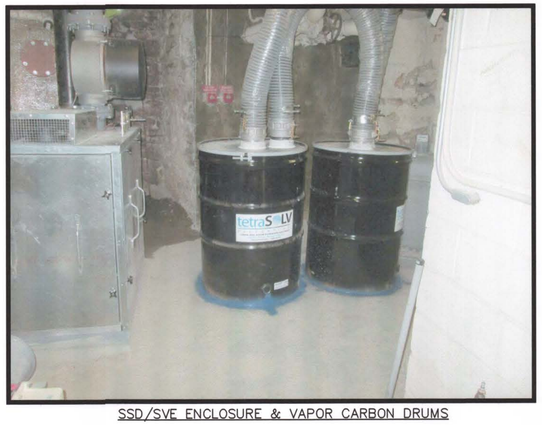

SITE
Jerome Park Reservoir
Jerome Park
W 230th St
W Gun Hill Rd
Bainbridge Ave
Jerome Ave
Mosholu Pkwy
Mosholu Pkwy S
Van Cortlandt Park South
Van Cortlandt Park East
Broadway
Independence Ave
Kingsbridge Rd
Bailey Ave
Fieldston Rd
Riverdale Ave
Henry Hudson Pkwy
Henry Hudson Pkwy Bridge
Spuyten Duyvil
Johnson Ave
Manhattan College Pkwy
Manhattan College
Van Cortlandt Park
Van Cortlandt Park Southeast
Van Cortlandt Park Northeast
Van Cortlandt Park Northwest
Van Cortlandt Park West
Van Cortlandt Park Southwest
Van Cortlandt Park Lake
Van Cortlandt Park Golf Course
Van Cortlandt Park Golf Course Clubhouse
Van Cortlandt Park Golf Course Parking
Van Cortlandt Park Golf Course Parking Lot
Van Cortlandt Park Golf Course Parking Lot
Van Cortlandt Park Golf Course Parking Lot



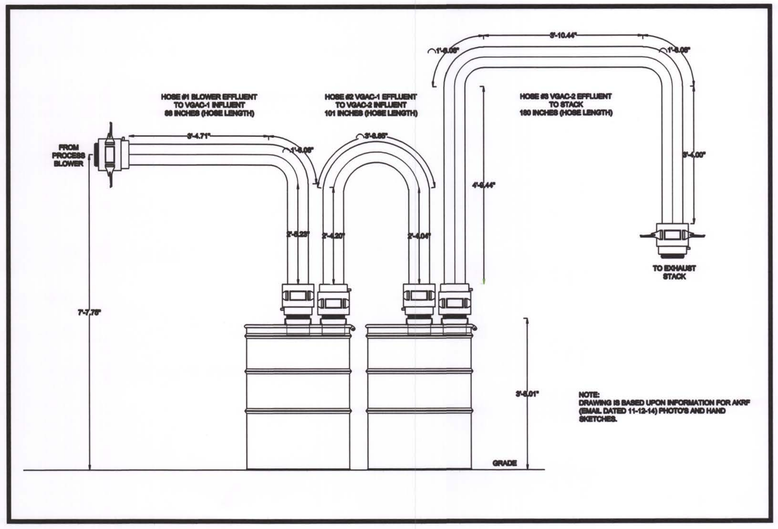
SSDS/SVE EXTRACTION MANIFOLD LAYOUT
SCALE: AS SHOWN



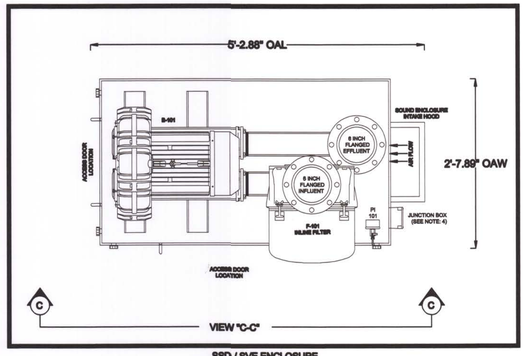
SSDS/SVE SYSTEM EQUIPMENT LAYOUT
SCALE: 1"=4'



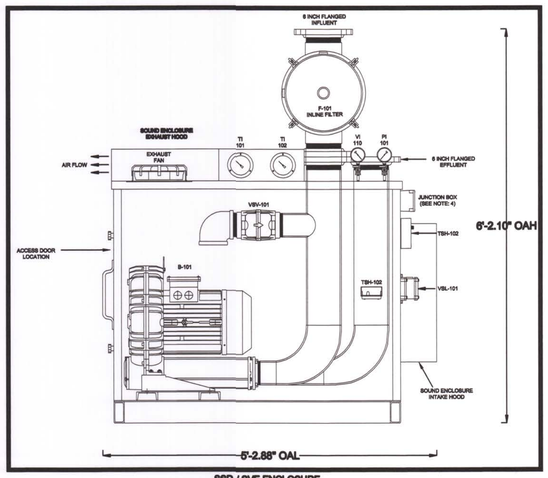
SSD/SVE ENCLOSURE & VAPOR CARBON DRUMS



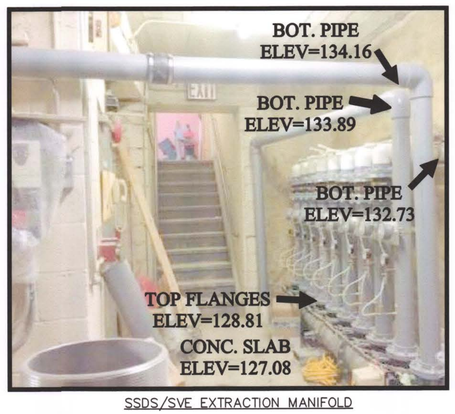
CARBON TREATMENT UNITS
SCALE: AS SHOWN



SSD / SVE ENCLOSURE
PLAN VIEW
SCALE: AS SHOWN



SSD / SVE ENCLOSURE
ELEVATIONAL VIEW "C-C"
SCALE: AS SHOWN



SSDS/SVE EXTRACTION MANIFOLD

UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

REV	DATE	DESCRIPTION	BY	CHK'D

12/1/14
date

James J. Heiser
Professional Land Surveyor
N.J. Lic. 24GS04331100
JHEISER@DPKCONSULTING.NET

In consideration of the mutual covenants between the client listed above and the undersigned, this survey is prepared in accordance with the client's instructions and to the best of my professional knowledge, information and belief correctly and accurately represents the property listed above. Underground utilities and/or determination of underground conditions which an accurate title search might disclose. This plan is made to provide relevant information to the above named parties for this transaction only and is not transferable, except as noted.

DPK CONSULTING
147 Union Ave, Ste. 1C, Middlesex, NJ 08846 P: 732-764-0100 F: 732-764-0990

DRAWN BY: R.A.O.
CHK'D BY: S.D.P.
SCALE: 1" = 10'
DATE: 12/1/2014

SURVEYED SAMPLE LOCATIONS AND AS-BUILT ENGINEERING CONTROLS

TAX MAP LOT 36
BLOCK 3323
3200 JEROME AVENUE
BOROUGH OF THE BRONX
BRONX COUNTY
CITY AND STATE OF NEW YORK

DRAWING FILE: 14-6089EE01
PROJECT NUMBER: 14-6089
SHEET 3 / 3
REV. 0

APPENDIX J

ENGINEERING CONTROL SYSTEM COMPONENT MANUAL

Operation & Maintenance Manual

NES PROJECT NUMBER: 14-151, August 2014
PROJECT NAME: SSDS/ SVE System Skid
3200 Jerome Avenue
Bronx, NY

Prepared for:

AKRF / Rinzler Family Limited Partnership

Sales: (508)226-1100 Option 2
Technical Support: (508)226-1100 Option 3

Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz

NES Project: 14-151
SSDS Skid

Operation & Maintenance Manual

SECTION 1 - COMPONENT SUMMARY & WARRANTY

COMPONENT SUMMARY TABLE

NES WARRANTY

SECTION 2 - MECHANICAL DRAWINGS & TABLES

M-1, PROCESS & INSTRUMENTATION DIAGRAM

TABLE 1, INSTRUMENT LIST

M-2, LAYOUT DRAWING

SECTION 3 - ELECTRICAL DRAWINGS & TABLES

HMI SCREEN SUMMARY & REMOTE ACCESS

TABLE 2 - INTERLOCKS

I-1, CONTROL PANEL INTERIOR / EXTERIOR LAYOUT

TABLE 3 - ELECTRICAL PANEL BOM

I-2, WIRING DIAGRAMS & TERMINAL DETAILS

E-1, ONE LINE DIAGRAM

TABLE 5- VFD SETTINGS

SECTION 4 - CONTROL & POWER COMPONENTS

SSDS BLOWER VFD, 15HP (LOOSE) - SQUARE D ATV61HD11M3X

PANEL ENCLOSURE - 24 X 20 X 12 - HAMMOND EN4SD242012GY

PROGRAMMABLE LOGIC CONTROLLER - ADI CO-01DR-D

HMI TOUCHSCREEN 8" COLOR - ADI EA7-T8C

WIRELESS CELLULAR MODEM (VERIZON) - SIERRA WIRELESS V2226E-VA

MODEM ANTENNA - WILSON 301125

SECTION 5 - INLET MANIFOLD / HEADER-MS COMPONENTS

BUTTERFLY VALVE, 4" - JOMAR 600-04DSPL

VACUUM INDICATOR, (-)80-0 IWC - DWYER LPG4-D7622N

FLOW ELEMENT PITOT TUBE, 4" - DWYER DS-300-4

FLOW INDICATOR MAGNEHELIC GAUGE, 0.05-0.2 IWC - DWYER 2000-00N

HEADER UTILITY PUMP, 1/10 HP - DAYTON 5UXL7

LEVEL SWITCH ASSEMBLY - FPI SENSOR L500

SECTION 6 - PROCESS COMPONENTS

BY-PASS MOV, BUTTERFLY VALVE BODY, 4" - CENTERLINE CV044352

BY-PASS MOV, VALVE ACTUATOR W/ BATTERY BACK-UP - APOLLO CS600WL2E

INLINE PARTICULATE FILTER, 6" - SOLBERG CT-275P-600C

SSDS BLOWER, 15HP - FPZ SCL K11-MS-15-3

SPARE SSDS BLOWER, 10HP (LOOSE) - FPZ SCL K11-MS-10-3

VACUUM RELIEF VALVE, 4" - FPZ VRL9

VAPOR CARBON VESSEL, 400LB 4X10 REACT MEDIA - TETRASOLV VR-400

INLET VACUUM INDICATOR, (-100)-0 IWC - DWYER LPG4-D7722N

INLET LOW VACUUM SWITCH, 4-20 IWC - DWYER 1950-20-2F

INLET TEMPERATURE INDICATOR, 0-150F - WEISS 35RB3-5211-05FT

DISCHAREGE PRESSURE INDICATOR, 0-25 IWC - AV 18C784

DISCHARGE TEMPERATURE INDICATOR, 0-180F - WEISS 35RB3-5211-05FT

DISCHARGE HIGH TEMPERATURE SWITCH, 0-225F - UNITED ELECTRIC B100-120

ENCLOSURE HIGH TEMPERATURE SWITCH, 55-175F - HONEYWELL T675A1425

SECTION 7 - VENTILATION FAN COMPONENTS -

ROOM VENTILATION FAN, RADIAL - S&P PV100

ROOM VENTILATION FAN, SPEED CONTROLLER, 5A, 120VAC - S&P SC 15 / WC-15

BLOWER ENCLOSURE VENTILATION FAN, RADIAL - EBM-PAPST W1G200-EC95-47

BLOWER ENCLOSURE VENT FAN THERMOSTAT - HONEYWELL T6031A

NES Project: 14-151
SSDS Skid

SECTION 1 - COMPONENT SUMMARY & WARRANTY

COMPONENT SUMMARY TABLE

NES WARRANTY

Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz

MAJOR COMPONENT SUMMARY

PROJECT NO: **14-151, AUGUST 2014 (REVISION A, 08/27/2014)**

PROJECT: **AKRF / RINZLER - SSD/SVE EQUIPMENT - 3200 JEROME AVE. BRONX, NY**

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER (IF APPLICABLE)
SECTION 4 - CONTROL & POWER COMPONENTS					
SSDS BLOWER VFD, 15HP (LOOSE)	VFD-101	1	SQUARE D	ATV61HD11M3X	6W1425000176
PANEL ENCLOSURE - 24 X 20 X 12	ENCLOSURE	1	HAMMOND	EN4SD242012GY	UL: CB-822823
PROGRAMMABLE LOGIC CONTROLLER	PLC	1	ADI	CO-01DR-D	144258054
HMI TOUCHSCREEN 8" COLOR	HMI	1	ADI	EA7-T8C	14407B035
WIRELESS CELLULAR MODEM (VERIZON)	WM	1	SIERRA WIRELESS	V2226E-VA	SN: 1416000791 / IP: 166.139.14.178
MODEM ANTENNA	WM	1	WILSON	301125	N/A
SECTION 5 - INLET MANIFOLD / HEADER-MS COMPONENTS					
BUTTERFLY VALVE, 4"		9	JOMAR	600-04DSPL	N/A
VACUUM INDICATOR, (-)80-0 IWC	VI-101 / VI-109	9	DWYER	LPG4-D7622N	N/A
FLOW ELEMENT PITOT TUBE, 4"	FE-101/FE-109	9	DWYER	DS-300-4	N/A
FLOW INDICATOR MAGNEHELIC GAUGE, 0.05-0.2 IWC	FI-101/FE-109	9	DWYER	2000-00N	W29Z JH / W29Z JH / W29Z JH / W29Z JH / W29Z JH / W29Z JH / W29Z JH / W29Z JH / W29Z JH
HEADER UTILITY PUMP, 1/10 HP	P-101	1	DAYTON	5UXL7	246407
LEVEL SWITCH ASSEMBLY	LSHH-101	1	FPI SENSOR	L500	N/A
SECTION 6 - PROCESS COMPONENTS					
BY-PASS MOV, BUTTERFLY VALVE BODY, 4"	MOV-101	1	CENTERLINE	CV044352	DA13228
BY-PASS MOV, VALVE ACTUATOR W/ BATTERY BACK-UP	MOV-101	1	APOLLO / METSO	CS600WL2-N-UP	V14070884
INLINE PARTICULATE FILTER, 6"	F-101	1	SOLBERG	CT-275P-600C	N/A
SSDS BLOWER, 15HP	B-101	1	FPZ	SCL K11-MS-15-3	U10391-2014
SSDS BLOWER MOTOR, 15HP	B-101	1	LAFERT	AM132MRA2	1051906
SPARE SSDS BLOWER, 10HP (LOOSE)		1	FPZ	SCL K11-MS-10-3	V10390-2014
SSDS BLOWER MOTOR, 10HP (LOOSE)		1	LAFERT	AM112MCA2	1034154
VACUUM RELIEF VALVE, 4"	VRV-101	1	FPZ	VRL9	N/A
VAPOR CARBON VESSEL, 400LB 4X10 REACT MEDIA	VGAC-101 / 102	2	TETRASOLV	VR-400	L0157 / L0158
INLET VACUUM INDICATOR, (-100)-0 IWC	VI-110	1	DWYER	LPG4-D7722N	N/A
INLET LOW VACUUM SWITCH, 4-20 IWC	VSL-101	1	DWYER	1950-20-2F	N/A
INLET TEMPERATURE INDICATOR, 0-150F	TI-101	1	WEISS	35RB3-5211-05FT	N/A
DISCHAREGE PRESSURE INDICATOR, 0-25 IWC	PI-101	1	AV	18C784	N/A
DISCHARGE TEMPERATURE INDICATOR, 0-180F	TI-102	1	WEISS	35RB3-5211-05FT	N/A
DISCHARGE HIGH TEMPERATURE SWITCH, 0-225F	TSH-101	1	UNITED ELECTRIC	B100-120	1431
ENCLOSURE HIGH TEMPERATURE SWITCH, 55-175F	TSH-102	1	HONEYWELL	T675A1425	N/A
SECTION 7 - VENTILATION FAN COMPONENTS					
ROOM VENTILATION FAN, RADIAL	EF-1	1	S&P	PV100	131148
ROOM VENTILATION FAN, SPEED CONTROLLER, 5A, 120VAC	SC	1	S&P	SC 15 / WC-15	96D8
BLOWER ENCLOSURE VENTILATION FAN, RADIAL	EF-2	1	EBM-PAPST	W1G200-EC95-47	N/A
BLOWER ENCLOSURE VENT FAN THERMOSTAT	TSTAT	1	HONEYWELL	T6031A	N/A

WARRANTY

All products not manufactured by RapidTech LLC d/b/a National Environmental Systems, carry the original manufacturer's warranty. Copies are available on request.

RapidTech LLC d/b/a National Environmental Systems, warrants its packaged and manufactured equipment against any defect in material or workmanship, under normal use and storage for a period of twelve (12) months from date of manufacture and invoice, regardless of system start-up date. In the event that products are found to be defective within the warranty period, RapidTech LLC d/b/a National Environmental Systems, sole obligation and remedy shall be the furnishing of replacements for any defective parts, and such replacement parts shall be furnished but not installed by RapidTech LLC d/b/a National Environmental Systems RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, WILL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES IN ANY CLAIM SUIT OR PROCEEDINGS ARISING UNDER WARRANTY, NOR WILL RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, ACCEPT ANY LIABILITY FOR CLAIMS FOR LABOR, LOSS OR PROFIT, REPAIRS OR OTHER EXPENSES INCIDENTAL TO REPLACEMENT.

The warranty requires that the purchaser complete all operations and maintenance as detailed in each section of the Operation & Maintenance Manual supplied with the purchased system. In addition installation must comply with nationally recognized electrical and mechanical standards as well as best engineering practices in effect at the time of purchase.

The product warranty expressed above is our only warranty and may not be verbally changed or modified by any representative of RapidTech LLC d/b/a National Environmental Systems All freight costs incurred in shipping parts to or from RapidTech LLC d/b/a National Environmental Systems, or to the manufacturer if necessary are at the expense of the customer.

RapidTech LLC dba National Environmental Systems, will invoice the cost of any replacement parts. These parts will be credited upon certification the original part was defective and the defective part was returned within one week of notifying RapidTech LLC d/b/a National Environmental Systems, of the malfunction. If the part is found to have been misused no credit will be issued. In order for RapidTech LLC d/b/a National Environmental Systems, to ship a replacement part on account, all outstanding invoices must be current.

RapidTech LLC d/b/a National Environmental Systems, expressly disclaims any warranties, expressed or implied, including any warranty of merchantability or fit for particular purpose or any warranty arising from a course of dealing or usage of trade. Except to the extent required by applicable law. RapidTech LLC d/b/a National Environmental Systems, shall not be liable, in tort, contract or otherwise, for any loss or damage, whether direct, consequential or incidental, of any person or entity arising in connections with the equipment.

SECTION 2 - MECHANICAL DRAWINGS & TABLES

M-1, PROCESS & INSTRUMENTATION DIAGRAM

TABLE 1, INSTRUMENT LIST

M-2, LAYOUT DRAWING

Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
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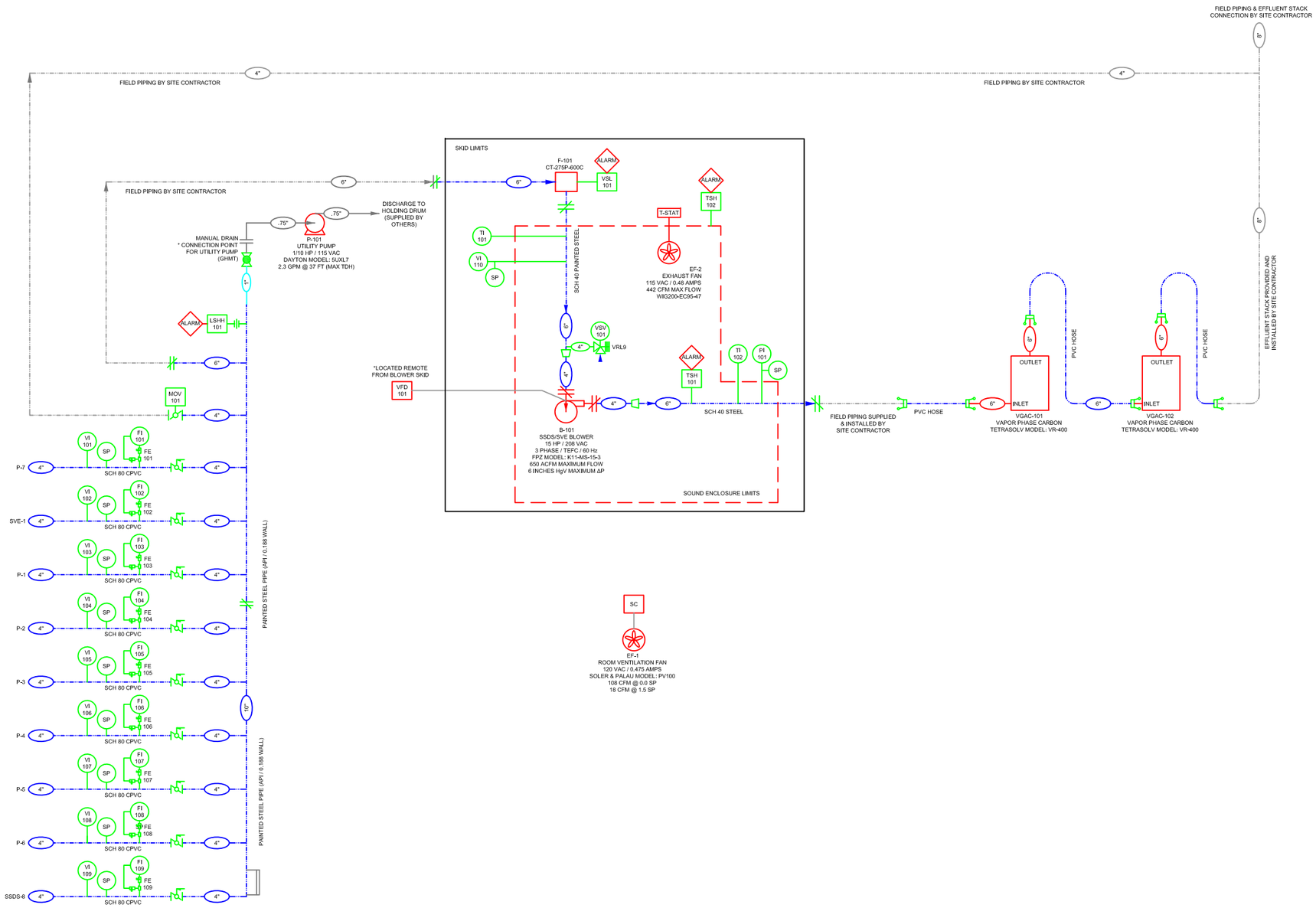

GENERAL NOTES

NOTES:
1. PROCESS & INSTRUMENTATION DIAGRAM IS A REPRESENTATIVE DRAWING SHOWING EQUIPMENT SPECIFICATIONS, PROCESS PIPING, VALVES AND INSTRUMENTATION NOT TO BE INTERPRETED AS A LAYOUT DRAWING DEPICTING PLUMBING LOCATION, CONNECTIONS, OR FITTINGS.
2. REFER TO TABLE 1 FOR INSTRUMENTATION LIST
3. REFER TO TABLE 2 FOR INTERLOCKS

INSTRUMENTATION ABBREVIATIONS

FE	FLOW ELEMENT
FI	FLOW INDICATOR
LSHH	LEVEL SWITCH HIGH-HIGH
MOV	MOTOR OPERATED VALVE
F	PARTICULATE FILTER
PI	PRESSURE INDICATOR
SC	SPEED CONTROL DEVICE
SP	SAMPLE PORT
TI	TEMPERATURE INDICATOR
TSH	TEMPERATURE SWITCH HIGH
VFD	VARIABLE FREQUENCY DRIVE
VI	VACUUM INDICATOR
VSL	VACUUM SWITCH LOW
VSV	VACUUM SAFETY VALVE

SYMBOLS

SC — SPEED CONTROL

FAN

OUTLET / INLET — VAPOR PHASE CARBON

GENERIC BLOWER

TRANSFER PUMP

INLET/INLINE FILTER

VFD — VARIABLE FREQUENCY DRIVE

ALARM — ALARM DESIGNATION

BALL VALVE/DRAIN VALVE

BUTTERFLY VALVE

RELIEF VALVE

UNION

PITOT TUBE

FIELD CONNECTION

FLANGED CONNECTION

XX / XXX — LOCALLY MOUNTED INSTRUMENT W / DISPLAY

XX / XXX — LOCALLY MOUNTED SWITCH

PIPE REDUCER / INCREASER

CAMLOCK FITTING

PIPE DESIGNATION

AIR LINE

WATER LINE

FIELD PIPING (SUPPLIED BY OTHERS)

REV	DESCRIPTION	DATE	APPR
A	AS BUILT	08-19-14	MJS
	REVISIONS		

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DRWN BY	CJJ	DATE 06-23-14
CHK BY	CJJ	DATE 08-28-14
APPR BY	KWB	DATE 08-28-14

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TITLE: SSD/SVE PROCESS DIAGRAM

AKRF-RINZLER
3200 JEROME AVENUE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	D	M-1	1 OF 1	A

TABLE 1
INSTRUMENTATION LIST

PROJECT NO: 14-151, AUGUST 2014 (REVISION A, 08/27/2014)

PROJECT: AKRF / RINZLER - SSD/SVE EQUIPMENT - 3200 JEROME AVE. BRONX, NY

TAG	ITEM	MODEL	MANUFACTURER	SPECIFICATION
VI-101 / VI-109	VACUUM INDICATOR, (-)80-0 IWC	LPG4-D7622N	DWYER	80 - 0 IWC VACUUM / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT CONNECTION
FE-101/FE-109	FLOW ELEMENT PITOT TUBE, 4"	DS-300-4	DWYER	4 INCH AVERAGING STYLE PITOT TUBE / STAINLESS STEEL CONSTRUCTION
FI-101/FE-109	FLOW INDICATOR MAGNEHELIC GAUGE, 0.05-0.2 IWC	2000-00N	DWYER	0.05 - 0.2 IWC RANGE / GLASS FILLED PLASTIC MOLDED ENCLOSURE / DIGITAL DISPLAY / 10 PSIG PRESSURE LIMITS / 20 - 120 F TEMPERATURE RANGE / 0.125 INCH CONNECTIONS / 4 INCH DIAL
LSHH-101	LEVEL SWITCH ASSEMBLY	L500	FPI SENSOR	1-FLOAT STYLE / STAINLESS STEEL CONSTRUCTION / 2 INCH NPT TOP CONNECTION / STAINLESS STEEL FLOATS - S.G. 0.60 / N.C. - HH / SPDT / 50W
VI-110	INLET VACUUM INDICATOR, (-100)-0 IWC	LPG4-D7722N	DWYER	100 - 0 IWC VACUUM / 2.5 INCH STEEL CASE / BRASS WETTED PARTS / 0.25 INCH BOTTOM MOUNT CONNECTION
VSL-101	INLET LOW VACUUM SWITCH, 4-20 IWC	1950-20-2F	DWYER	4 TO 20 IWC ADJUSTABLE / 0.6 MAX DEAD BAND / (-)40 TO 140 F TEMP RATING / 45IWC MAX PRESSURE / SPDT SWITCH TYPE / 15AMP @ 125 VAC SWITCH RATING / 0.125 INCH CONNECTION
TI-101	INLET TEMPERATURE INDICATOR, 0-150F	35RB3-5211-05FT	WEISS	0 - 150 F / 3.4 INCH STEM LENGTH / 3.5 INCH DIAL / BACK MOUNT CONNECTION / STAINLESS STEEL CONSTRUCTION
PI-101	DISCHAREGE PRESSURE INDICATOR, 0-25 IWC	18C784	AV	0 - 25 IWC RANGE / GLASS FILLED PLASTIC MOLDED ENCLOSURE / DIGITAL DISPLAY / 10 PSIG PRESSURE LIMITS / 20 - 120 F TEMPERATURE RANGE / 0.125 INCH CONNECTIONS / 4 INCH DIAL
TI-102	DISCHARGE TEMPERATURE INDICATOR, 0-180F	35RB3-5211-05FT	WEISS	0 - 180 F / 3.4 INCH STEM LENGTH / 3.5 INCH DIAL / BACK MOUNT CONNECTION / STAINLESS STEEL CONSTRUCTION
TSH-101	DISCHARGE HIGH TEMPERATURE SWITCH, 0-225F	B100-120	UNITED ELECTRIC	0 - 225 F ADJUSTABLE / POLYCARBONATE ENCLOSURE / NICKEL PLATED BRASS IMMERSION PROBE (3/8" DIA X 4-1/2" L) WITH 6 FEET OF CABLE / 0.5 INCH BOTTOM CONNECTION / SINGLE ACTUATION POINT
TSH-102	ENCLOSURE HIGH TEMPERATURE SWITCH, 55-175F	T675A1425	HONEYWELL	55 - 175 F ADJUSTABLE RANGE / 120 VAC / REMOTE CAPILLARY BULB / 120 VAC RATED / SPDT SWITCH

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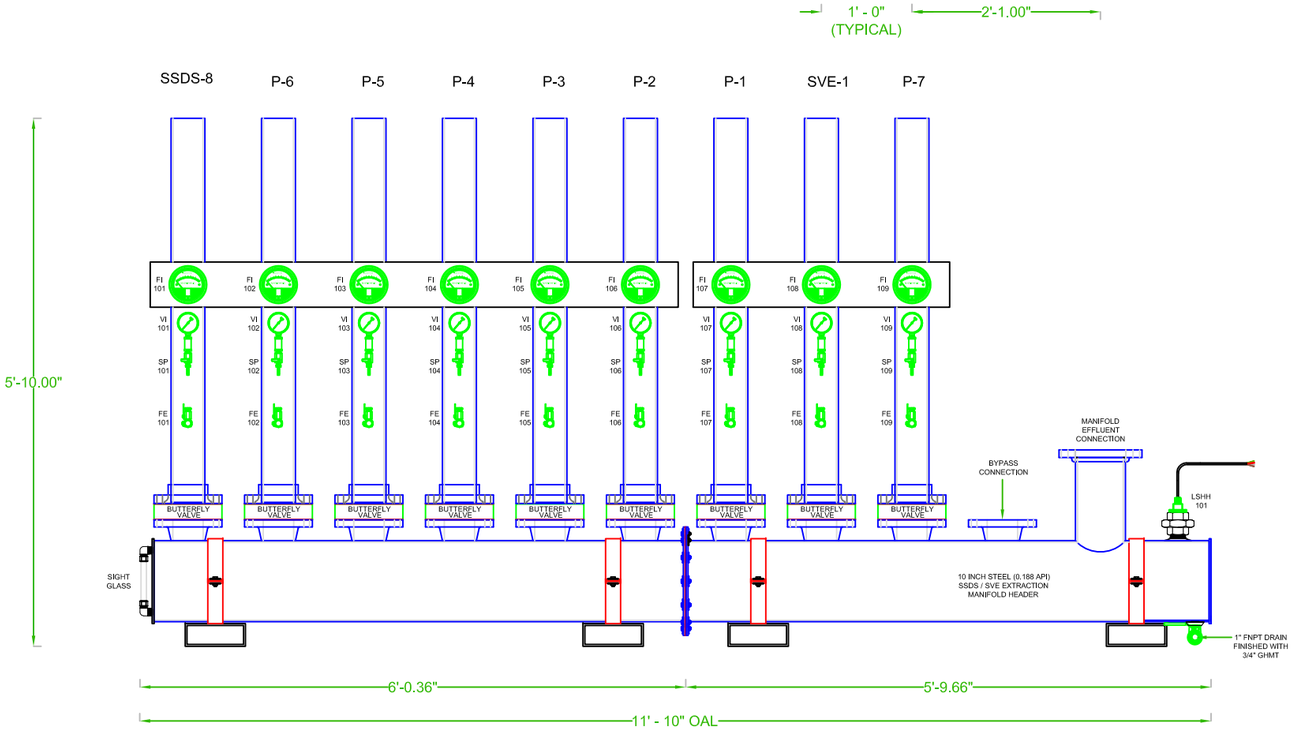
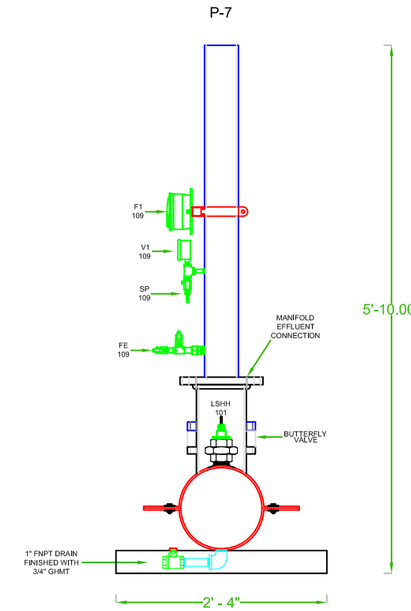


ELEVATIONAL VIEW



ELEVATIONAL VIEW
VIEW "A-A"

NOTES:

1. MANIFOLD HEADER CONSTRUCTED FROM 0.188" API CARBON STEEL AND PAINTED WITH RUSTOLEUM 7400 SERIES PAINT
2. MANIFOLD LEGS CONSTRUCTED FROM SCHEDULE 80 CPVC PIPE
3. REFER TO TABLE 1 FOR ADDITIONAL INFORMATION ON THE INSTRUMENTATION PROVIDED.
4. ALL INTERCONNECTING PIPING SUPPLIED BY SITE CONTRACTOR. SEE DWG M-1

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-19-14	MJS

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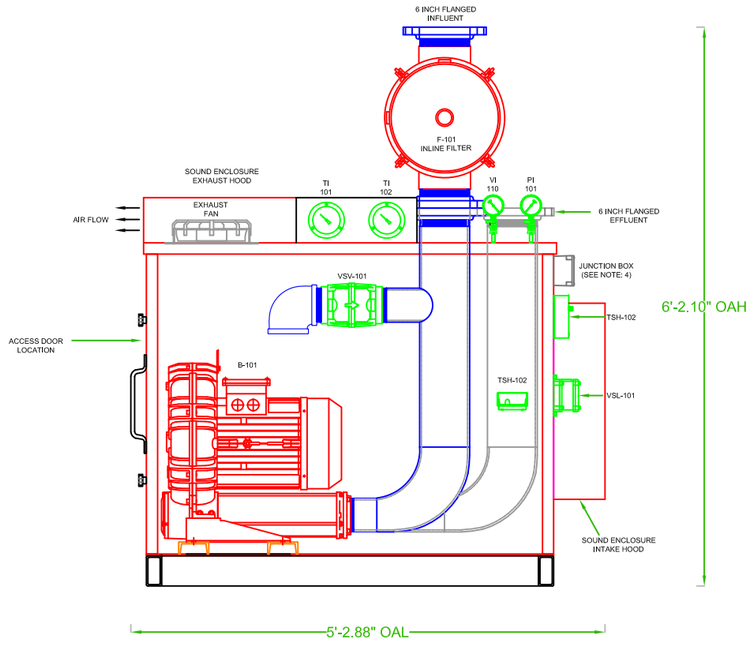
DRWN BY	MJS	DATE	06-23-14
CHK BY	CJJ	DATE	09-03-14
APPR BY	KWB	DATE	08-29-14

TITLE: SSD / SVE EXTRACTION MANIFOLD LAYOUT

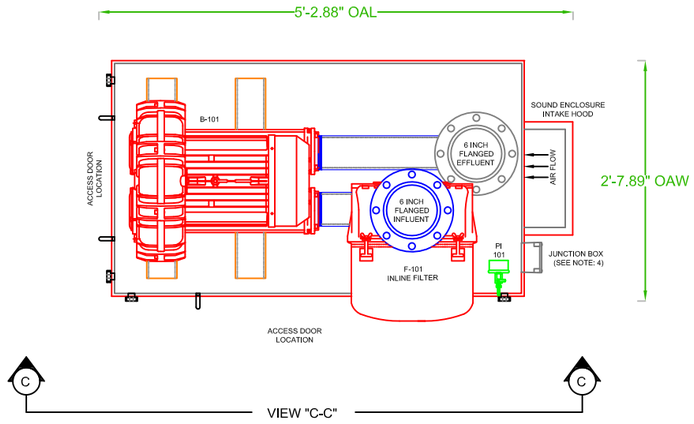
AKRF-RINZLER
3200 JEROME AVENUE - BRONX, NY.

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	D	M-2	1 OF 2	A



SSD / SVE ENCLOSURE
ELEVATIONAL VIEW "C-C"



VIEW "C-C"

SSD / SVE ENCLOSURE
PLAN VIEW

NOTES:

1. SSD / SVE ENCLOSURE IS DESIGNED FOR PLACEMENT IN A NON HAZARDOUS LOCATION.
2. NOT ALL EQUIPMENT SHOWN FOR DRAWING CLARITY
3. REFER TO TABLE 1 FOR ADDITIONAL INFORMATION ON THE INSTRUMENTATION PROVIDED.
4. JUNCTION BOX PROVIDED FOR ELECTRICAL CONNECTION TO SOUND ENCLOSURE VENTILATION FAN.
5. ALL INTERCONNECTING PIPING SUPPLIED BY SITE CONTRACTOR. SEE DWG M-1

REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-15-14	MJS

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DRWN BY	MJS	DATE 06-23-14
CHK BY	CJJ	DATE 08-29-14
APPR BY	KWB	DATE 08-29-14

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TITLE
SSD / SVE ENCLOSURE LAYOUT

AKRF-RINZLER
3200 JEROME AVENUE - BRONX, NY.

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	D	M-2	2 OF 2	A

SECTION 3 - ELECTRICAL DRAWINGS & TABLES

HMI SCREEN SUMMARY & REMOTE ACCESS

TABLE 2 - INTERLOCKS

I-1, CONTROL PANEL INTERIOR / EXTERIOR LAYOUT

TABLE 3 - ELECTRICAL PANEL BOM

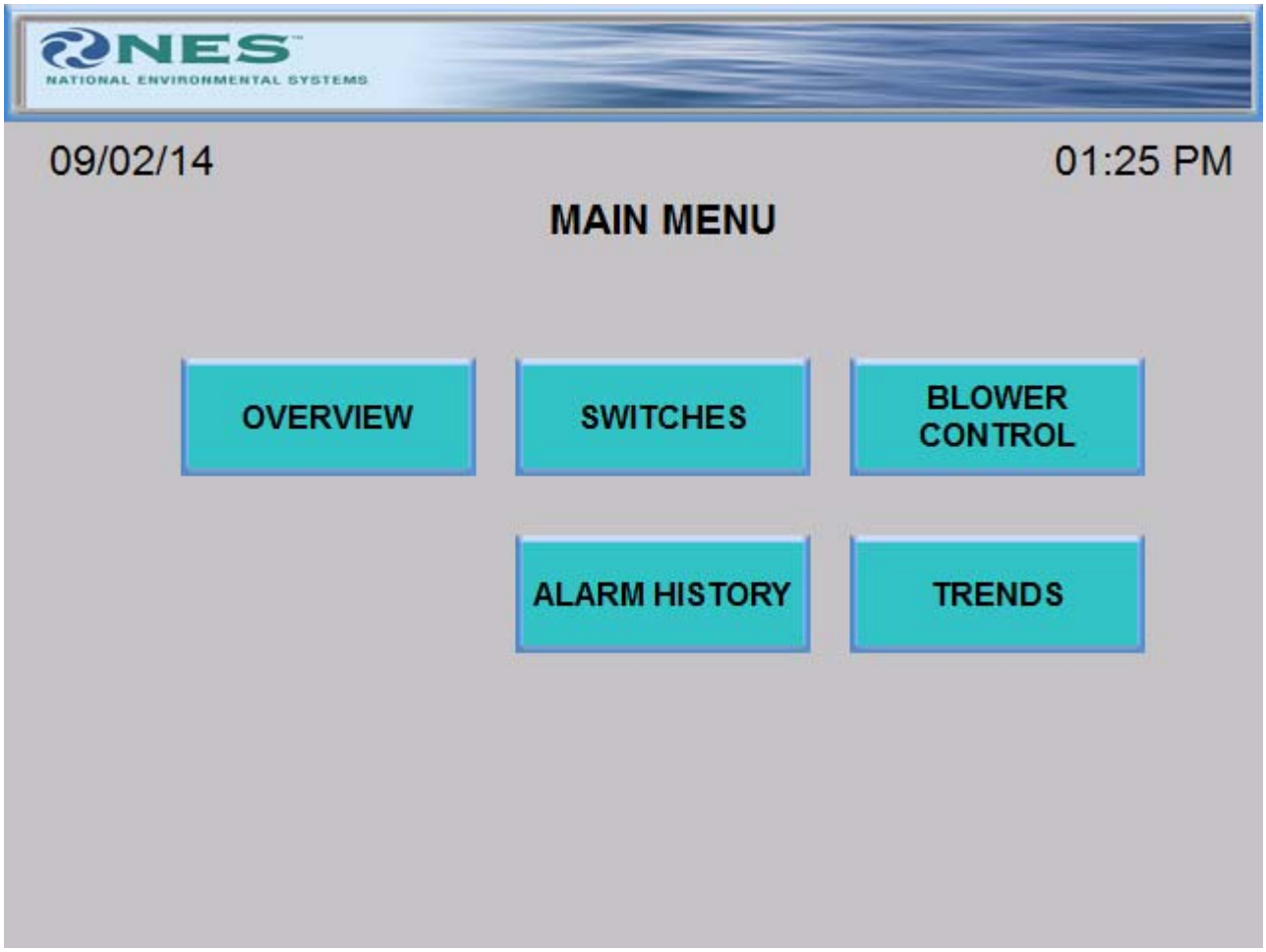
I-2, WIRING DIAGRAMS & TERMINAL DETAILS

E-1, ONE LINE DIAGRAM

TABLE 5- VFD SETTINGS

NES PROJECT: 14-151, REVISION A
Rinzler / AKRF – SVE & SSDS System Jerome Ave. Bronx, NY

HMI SCREEN SUMMARY & REMOTE ACCESS



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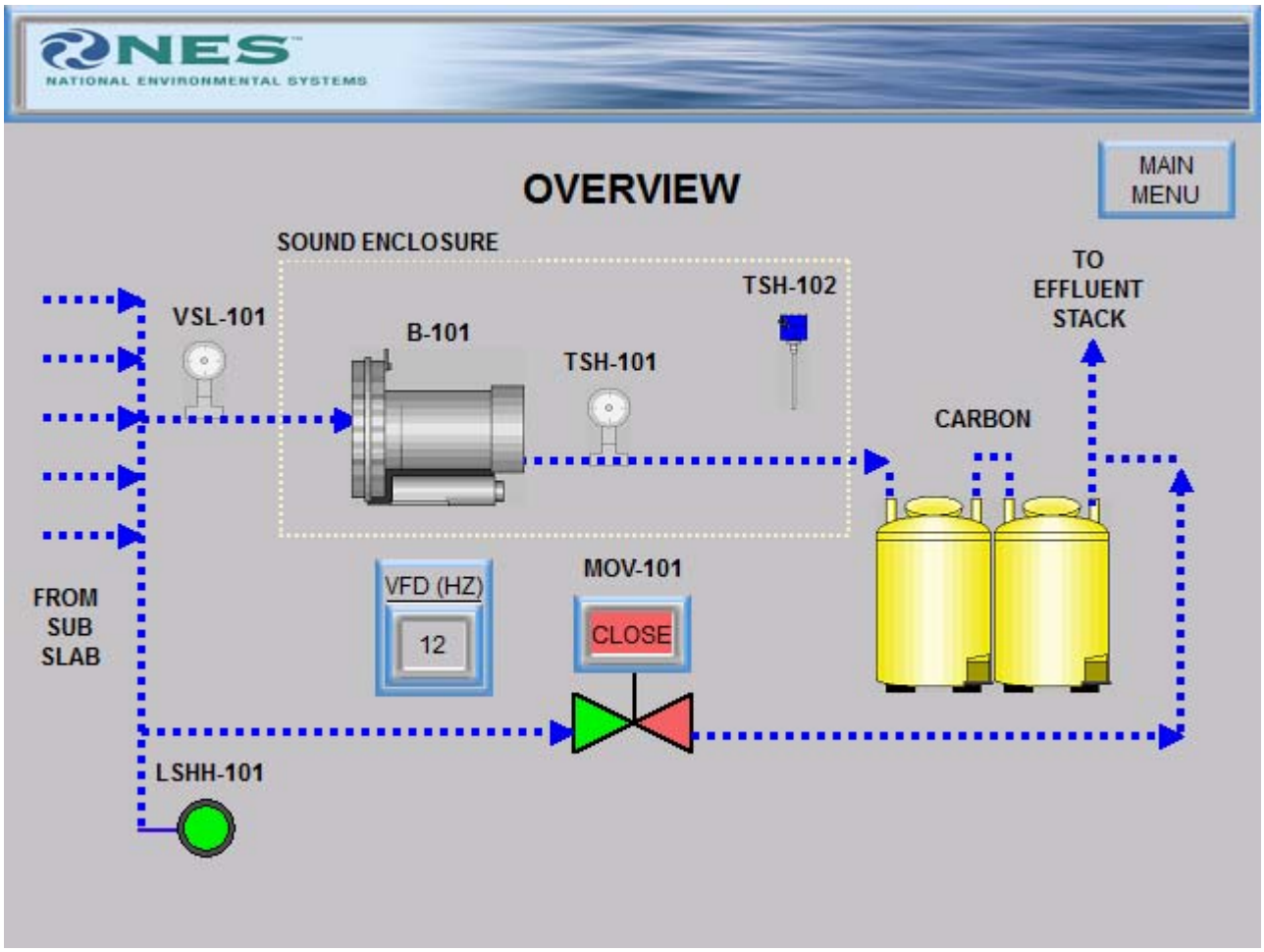
NES PROJECT: 14-151, REVISION A
Rinzler / AKRF – SVE & SSDS System Jerome Ave. Bronx, NY

HMI SCREEN SUMMARY & REMOTE ACCESS



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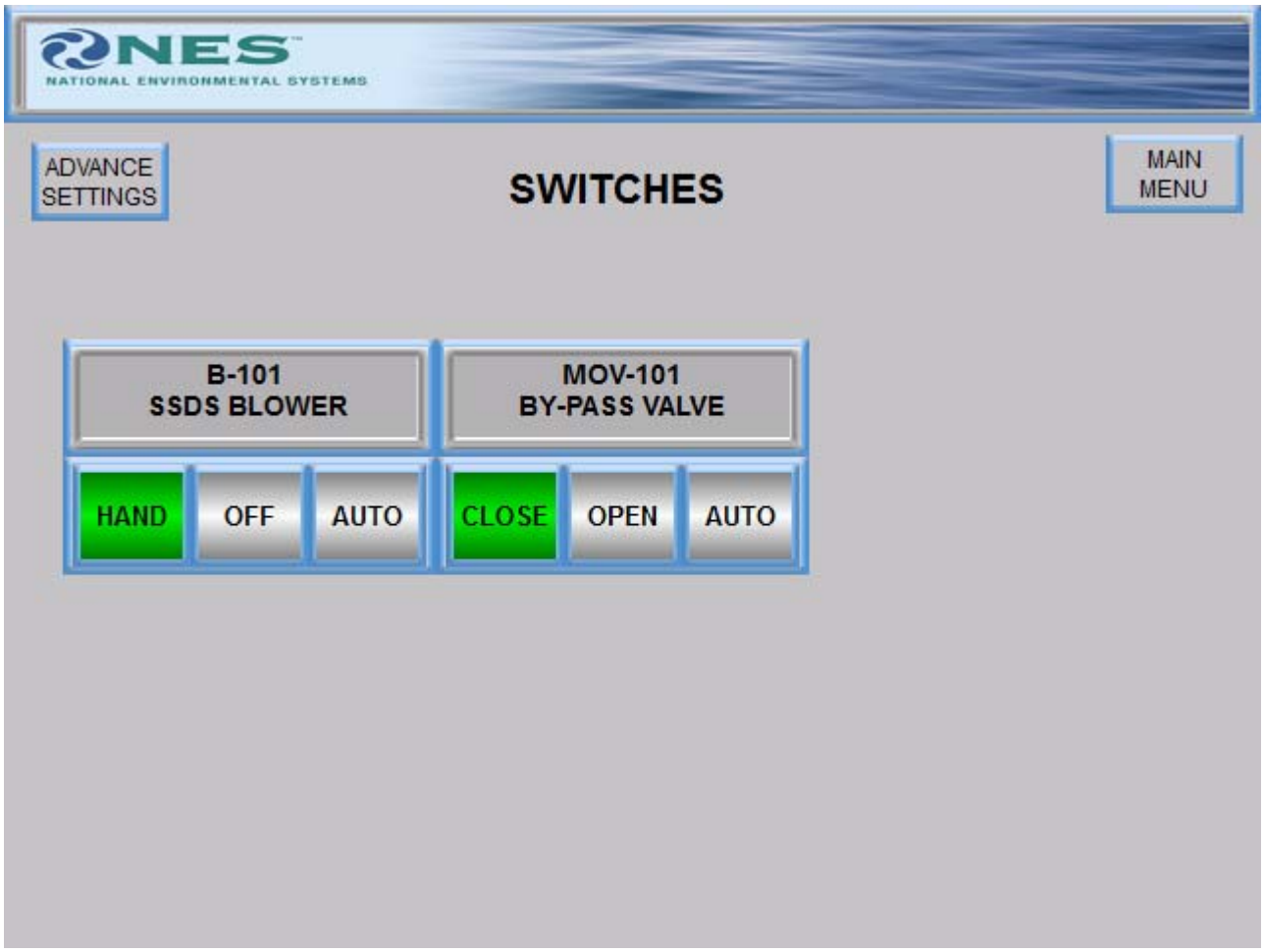
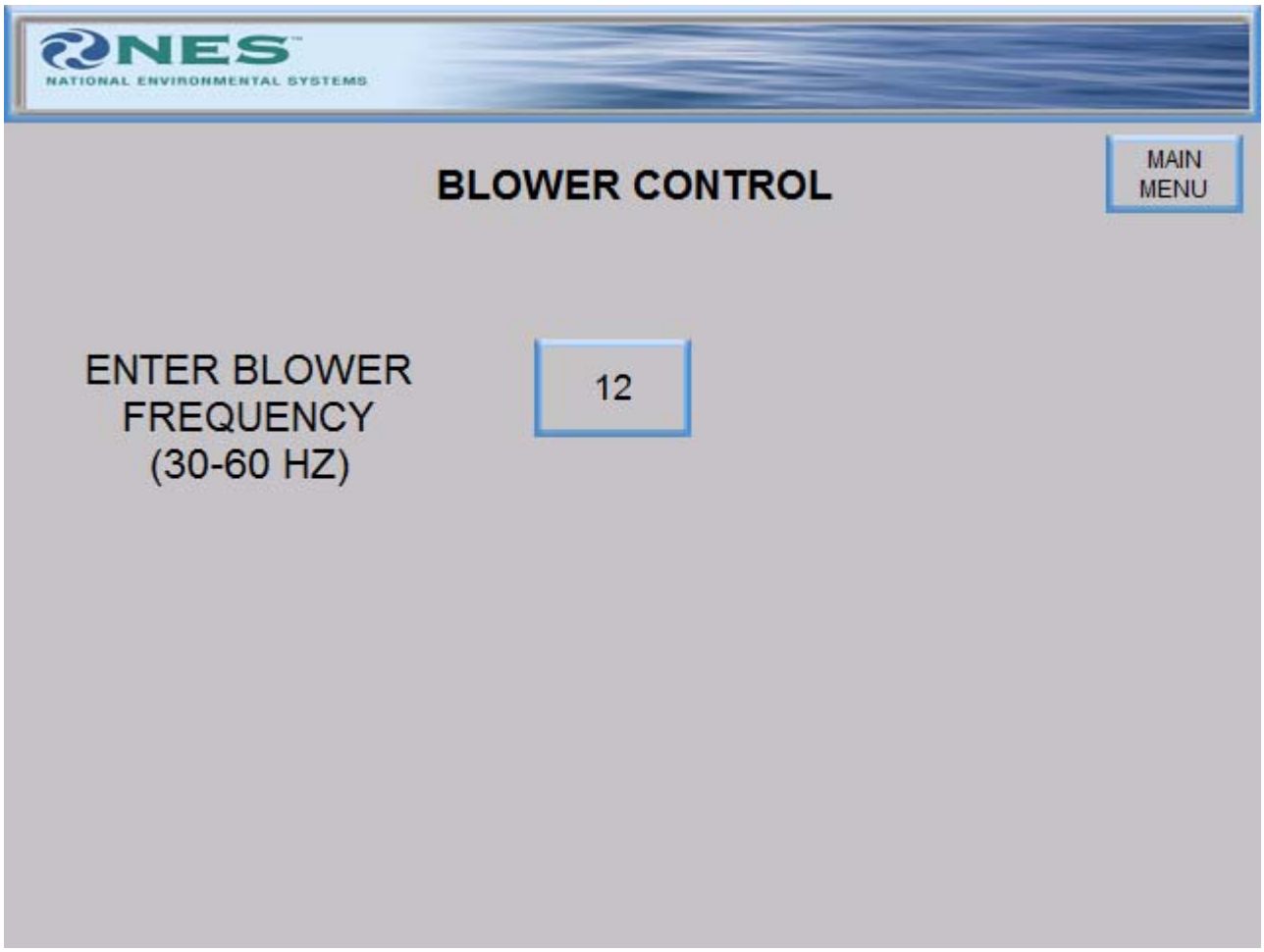
HMI SCREEN SUMMARY & REMOTE ACCESS



HMI SCREEN SUMMARY & REMOTE ACCESS



NES PROJECT: 14-151, REVISION A
Rinzler / AKRF – SVE & SSDS System Jerome Ave. Bronx, NY

HMI SCREEN SUMMARY & REMOTE ACCESS

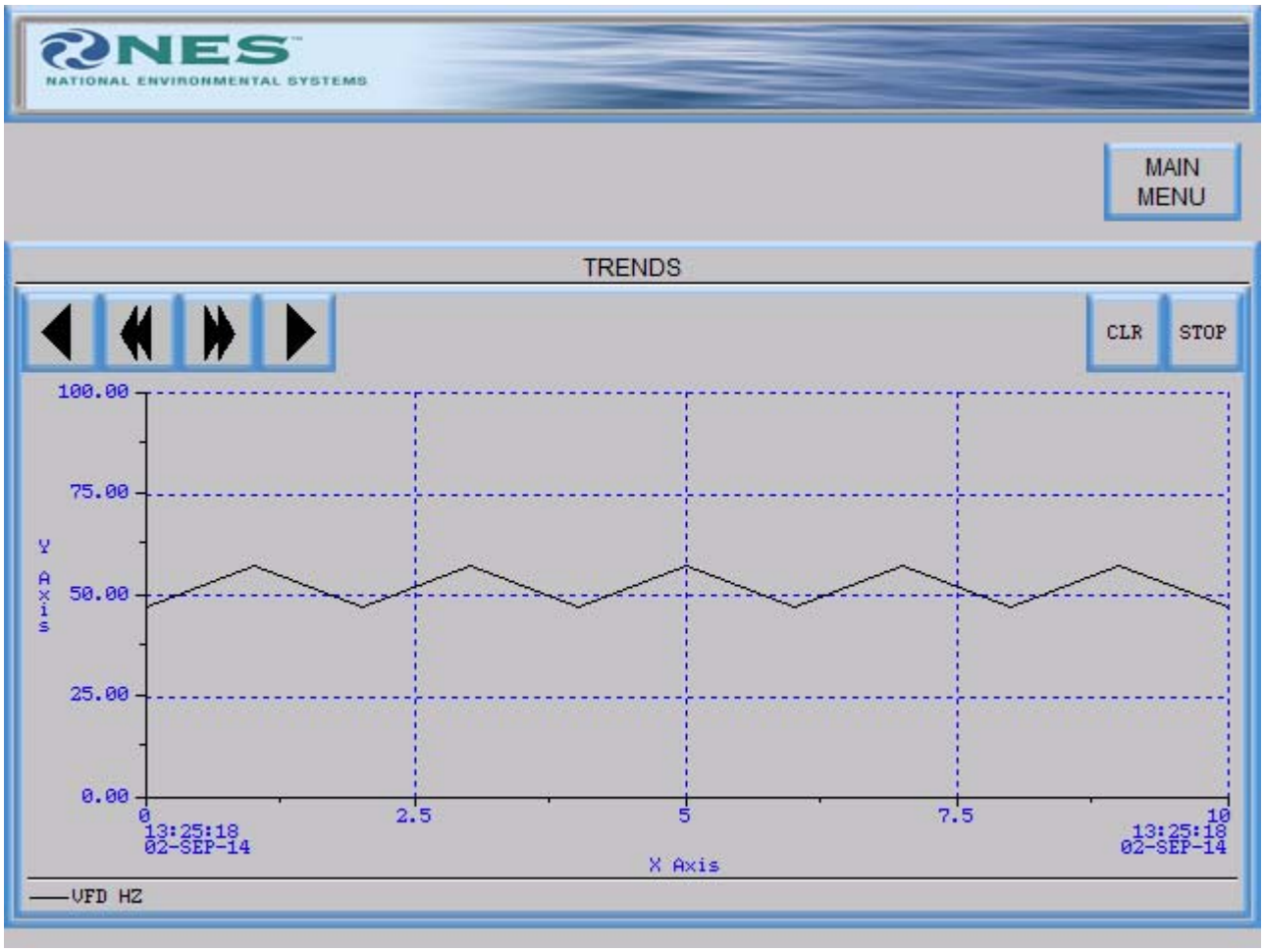


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TABLE 2

INTERLOCK SCHEDULE
NES 14-151, REVISION A (August 28, 2014) BY: RJD
AKRF - RINZLER
3200 JEROME AVENUE - BRONX, NY

Interlock	Interlock ID	Interlock Description	B-101, SVE Blower	MOV-101, By-Pass Valve	OPERATOR INTERFACE	Adjustable Set Point (HMI Screen Display)	Alarm Notification (HMI Screen Display)	Alarm Notification (Local Panel Display)	Manual Reset (Warning / Alarm)	Remote Alarm Notification	Alarm Log	Data Log (10 Minutes)	INSTRUMENT TYPE	NES FACTORY TEST SET POINT
		Emergency Stop	O	OP			Y	Y	Y	Y	Y		D	
1		No alarms present	I	CL									D	
2	LSHH-101	Inlet Manifold Collection Chamber High High Level Switch	O	OP			Y	Y	Y	Y	Y		D	
3	VSL-101	SSDS/SVE (B-101) Low Vacuum	O	OP			Y	Y	Y	Y	Y		D	4" IWC
4	TSH-101	SSDS / SVE (B-101) High Discharge Temperature	O	OP			Y	Y	Y	Y	Y		D	125 DegF
5	VFD1SPFREQ	SSDS/SVE Blower (B-101) Frequency Setpoint				Y						Y	A	
6	VFD1OPFREQ	SSDS/SVE Blower (B-101) Operating Frequency										Y	A	
7	TSH-102	Sound Enclosure High Internal Temperature	O	OP			Y	Y	Y	Y	Y		D	104 DegF
8	VFD FAULT	Variable Frequency Drive Fault	O	OP			Y	Y	Y	Y	Y			

Note:

HMI - Human Machine Interface

O - Off
I - On
I/O - On / Off Control
P- Proportional Control

OP - Open (30 second delay after SVE stops)
CL - Close

Y - Yes

A - Analog
D - Digital
L - Internal Logic

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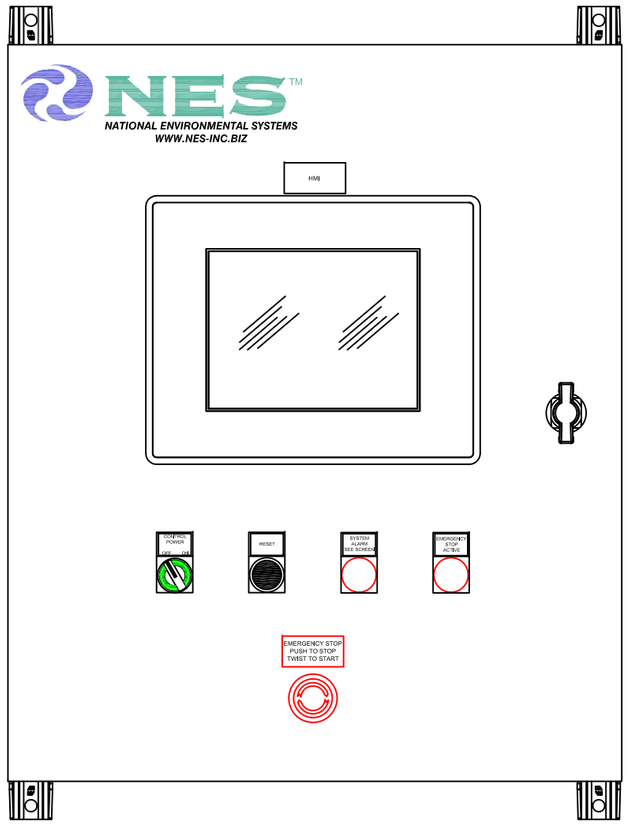
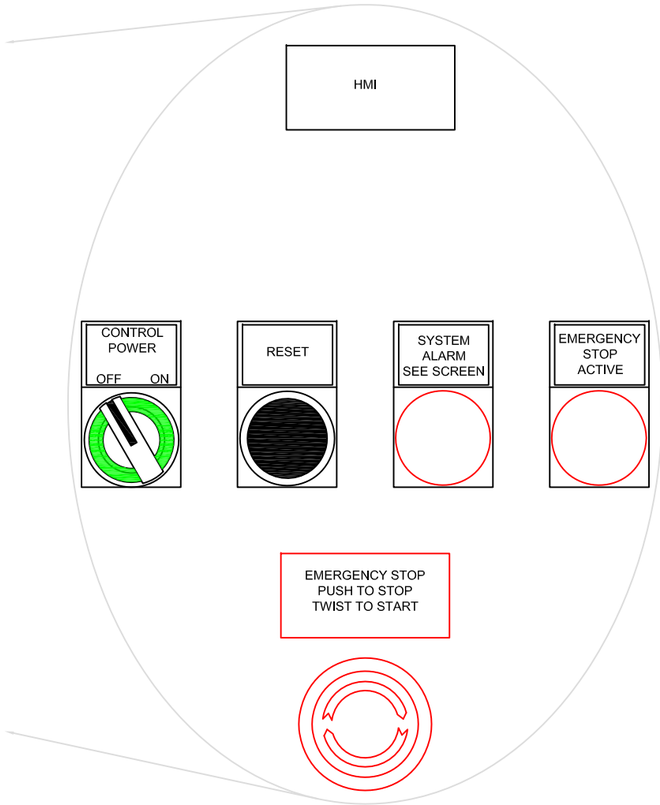
Phone: (508)226-1100; Fax: (508)226-1180; Email: Info@nes-inc.biz

CONTROL PANEL EXTERIOR

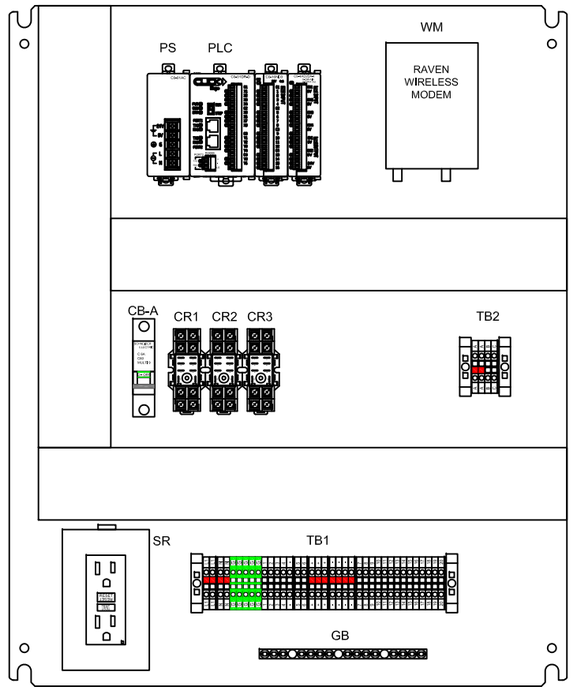


ENCLOSURE EXTERNAL DIMENSIONS: 24"L x 20"W x 12"D

OPERATOR DETAIL



CONTROL PANEL INTERIOR



LEGEND

CB-A - CONTROLS CIRCUIT BREAKER
CR - CONTROL RELAY
GB - GROUND BAR
HMI - HUMAN MACHINE INTERFACE
PLC - PROG. LOGIC CONT.
PS - POWER SUPPLY
SR - SERVICE RECEPTACLE
TB - TERMINAL BLOCK (SET)
WM - WIRELESS MODEM

NOTES:
1. REFER TO TABLE 3 FOR BILL OF MATERIALS
2. H/O/A'S CONTROLLED BY HMI SCREEN
3. CONTROL PANEL ASSEMBLY IS UL 508A LISTED

REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

REVISIONS

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DRWN BY	RJD
DATE	06-24-14
CHK BY	MJS
DATE	08-19-14
APPR BY	RJD
DATE	09-08-14

TITLE: CONTROL PANEL INTERIOR / EXTERIOR LAYOUT

AKRF-RINZLER
3200 JEROME AVENUE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-1	1 OF 1	A

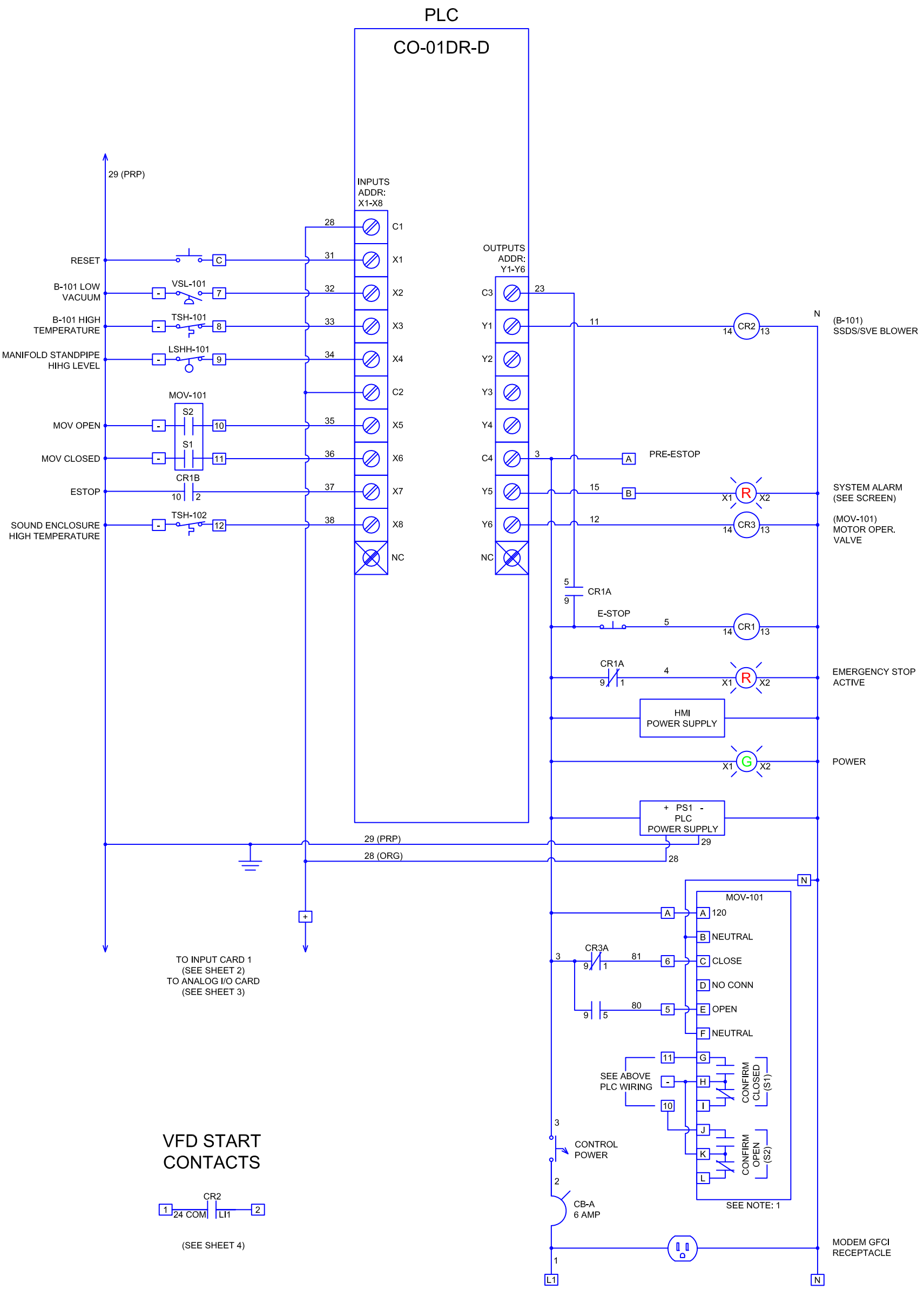
TABLE 3
PANEL BILL OF MATERIALS (BOM)

PROJECT NO: 14-151, AUGUST 2014 (REVISION A, 08/27/2014)

PROJECT: AKRF / RINZLER - SSD/SVE EQUIPMENT - 3200 JEROME AVE. BRONX, NY

TAG	QTY	ITEM	MODEL	MANUFACTURER
VFD-101	1	SSDS BLOWER VFD, 15HP (LOOSE)	ATV61HD11M3X	SQUARE D
ENCLOSURE	1	PANEL ENCLOSURE - 24 X 20 X 12	EN4SD242012GY	HAMMOND
ENCLOSURE	1	ENCLOSURE BACK-PANEL - 24 X 20	EP2420	HAMMOND
ENCLOSURE	1	ENCLOSURE MOUNTING FEET	EZPMFHD	HAMMOND
ENCLOSURE	1	ENCLOSURE LOCKING HANDLE	SCE-PLWKB	SAGINAW
PLC	1	PROGRAMMABLE LOGIC CONTROLLER	CO-01DR-D	ADI
PLC	1	PLC INPUT CARD 16PT DC	CO-16ND3	ADI
PLC	1	PLC OUTPUT CARD 8PT REL	CO-08TR	ADI
PLC	1	PLC ANALOG INPUT/OUTPUT CARD (4IN/2OUT)	CO-4AD2DA-1	ADI
PLC	1	PLC POWER SUPPLY	CO-01AC	ADI
HMI	1	PLC-HMI CONNECTOR CABLE	EA-2CBL	ADI
HMI	1	HMI TOUCHSCREEN 8" COLOR	EA7-T8C	ADI
HMI	1	HMI POWER SUPPLY	EA-AC	ADI
WM	1	WIRELESS CELLULAR MODEM (VERIZON)	V2226E-VA	SIERRA WIRELESS
WM	1	MODEM MOUNTING BRACKET	100-170-1015	SIERRA WIRELESS
WM	1	MODEM ANTENNA	301125	WILSON
SR	1	SERVICE RECEPTACLE, GFI	7599-I	LEVITON
SR	1	WEATHERPROOF BOX	IHD3-1	RED DOT
	1	PUSHBUTTON	ZB5AA2	SQUARE D
	1	2 POS SEL.SW. ILLUM GRN	ZB5AK1233	SQUARE D
	2	PILOT LIGHT RED (HEAD)	ZB5AV043	SQUARE D
	4	NAMEPLATE HOLDER	ZBZ33	SQUARE D
	4	NAMEPLATE BLANK (BLK/RED)	ZBY5101	SQUARE D
	2	CONTACT (NORMALLY OPEN)	ZBE101	SQUARE D
	1	CONTACTS (NORMALLY CLOSED)	ZBE102	SQUARE D
	2	RED LED W/LATCH MODULE	ZB5AVG4	SQUARE D
	2	MOUNTING LATCH (PB)	ZB5AZ009	SQUARE D
TB	35	TERMINAL GREY	NSYTRV22	SQUARE D
TB	5	GROUNDING TERMINAL BLOCK	NSYTRV22PE	SQUARE D
TB	8	END BARRIER	NSYTRAC22	SQUARE D
TB	4	END ANCHOR	NYSTRAABV35	SQUARE D
GB	1	GROUND BAR	PK15GTA	SQUARE D
ES	1	EMERGENCY STOP BUTTON	ZB5AS844	SQUARE D

PLC WIRING DIAGRAM



VFD START CONTACTS

(SEE SHEET 4)

NOTE:

1. MOV-1 BACK UP BATTERY MUST BE REMOVED TO FACILITATE ACCESS TO WIRE TERMINALS (A-L). NOTE THAT THE WIRING TERMINALS ARE OPPOSITE THE TERMINAL MARKINGS.

REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

REVISIONS

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DRWN BY	RJD
DATE	07-02-14
CHK BY	MJS
DATE	08-21-14
APPR BY	RJD
DATE	08-29-14

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508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

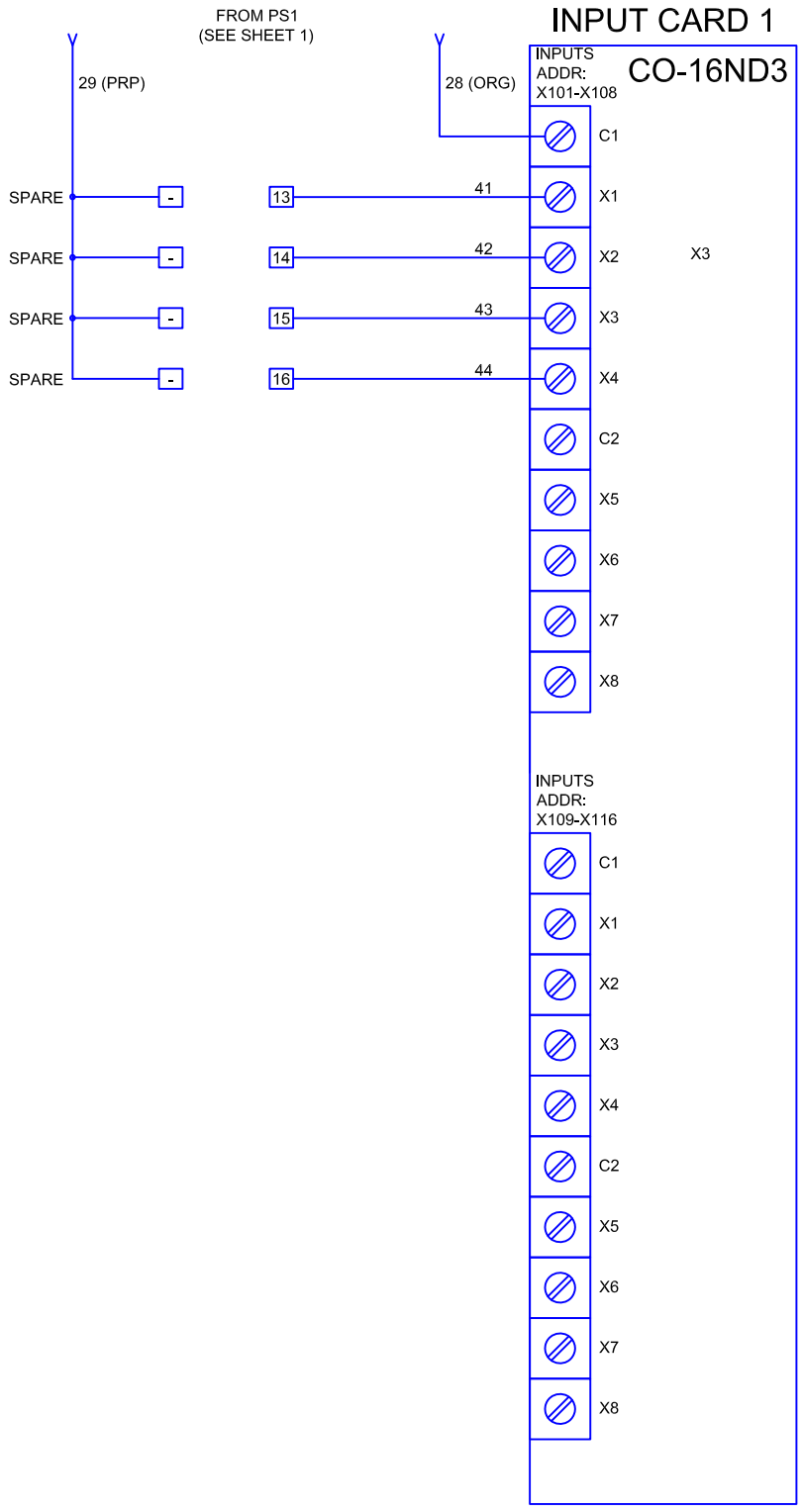
TITLE: PLC WIRING DIAGRAM

AKRF - RINZLER
3200 JEROME AVE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	1 OF 5	A

PLC WIRING DIAGRAM



REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

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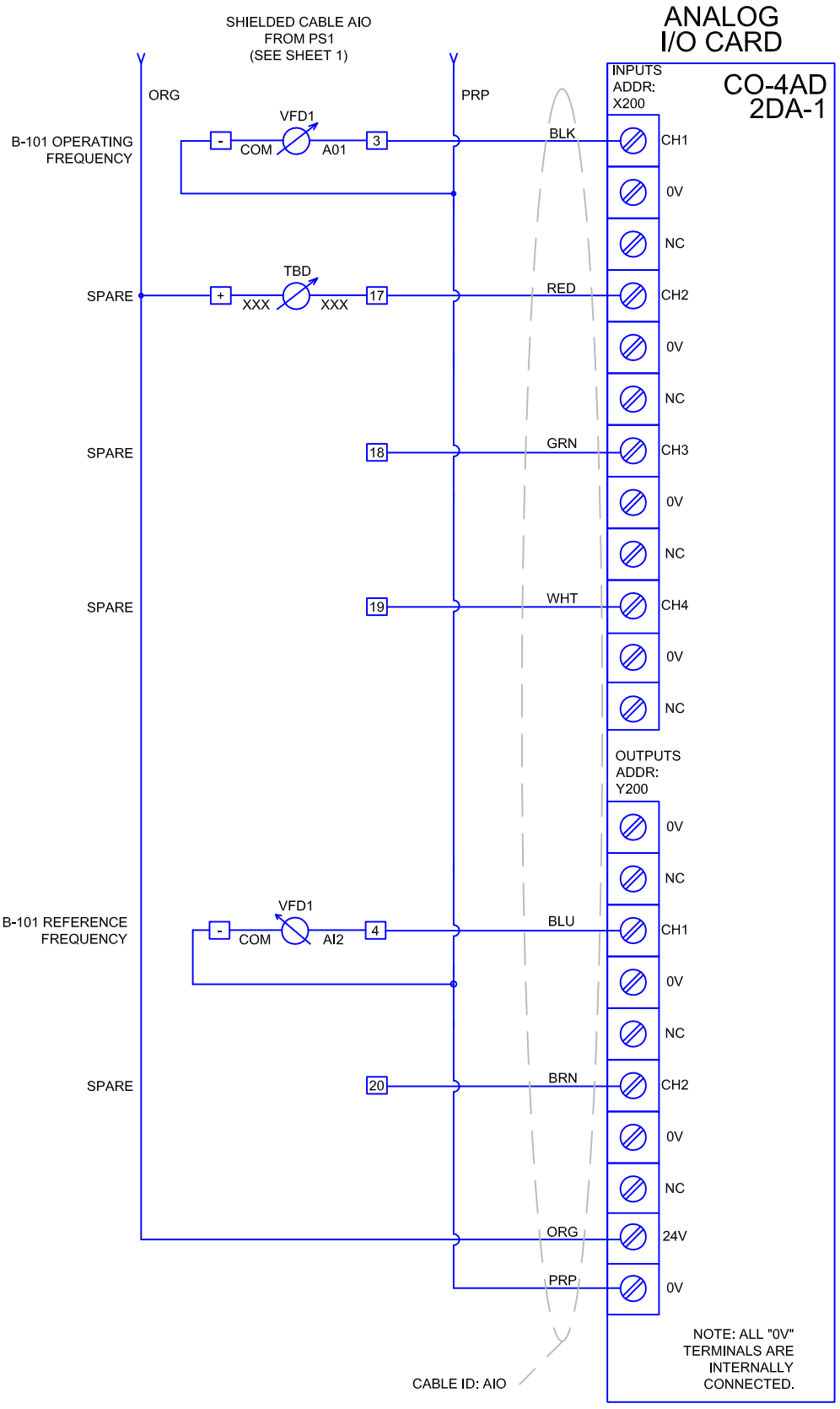
TITLE: PLC WIRING DIAGRAM

AKRF - RINZLER
3200 JEROME AVENUE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	2 OF 5	A

PLC WIRING DIAGRAM



REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

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CHK BY	MJS	DATE 08-21-14
APPR BY	RJD	DATE 08-29-14

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WWW.NES-INC.BIZ

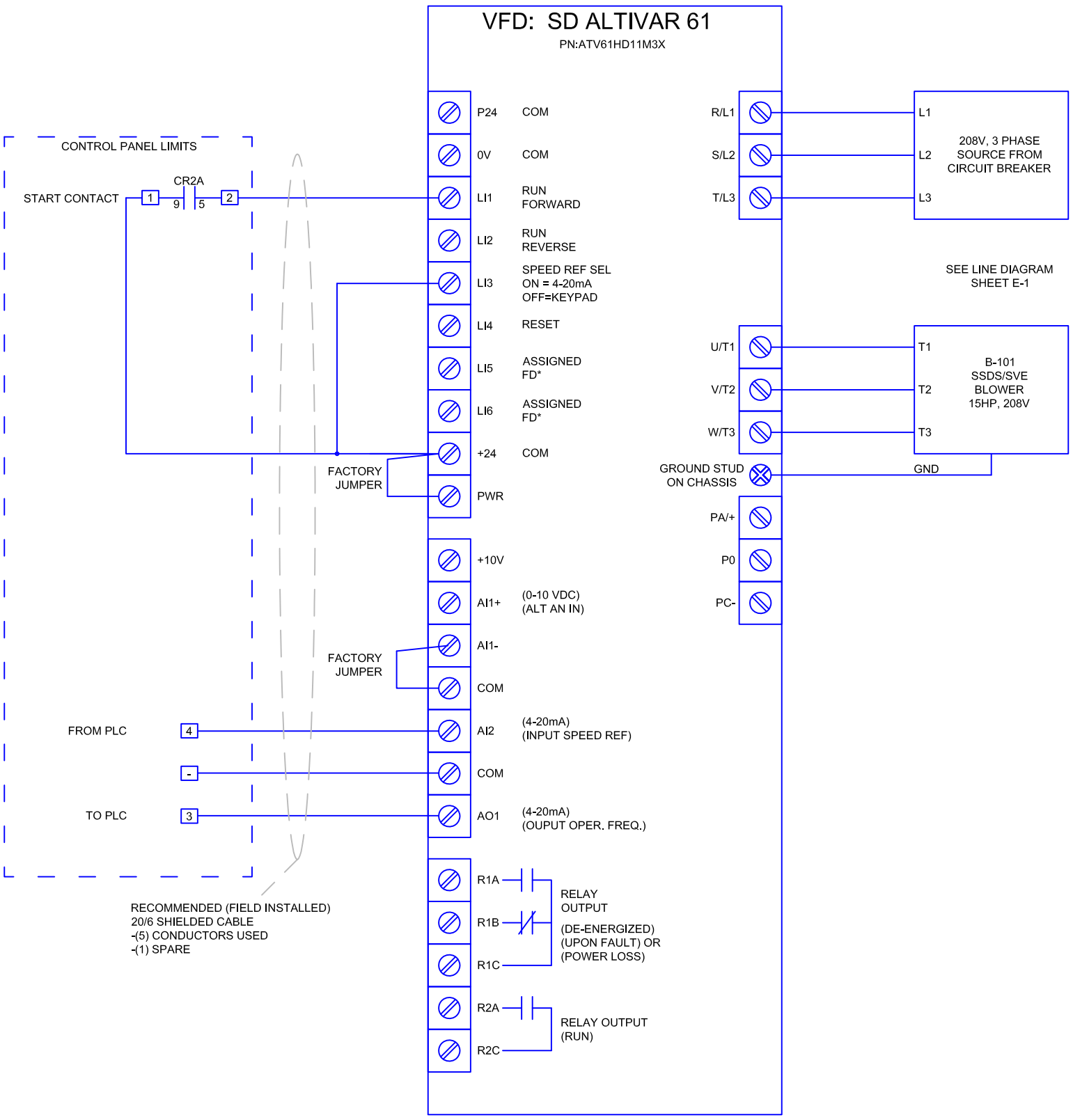
TITLE: PLC WIRING DIAGRAM

AKRF - RINZLER
3200 JEROME AVENUE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	3 OF 5	A

VFD1 WIRING DIAGRAM



REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

REVISIONS

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DRWN BY	RJD	DATE 07-02-14
CHK BY	MJS	DATE 08-21-14
APPR BY	RJD	DATE 08-29-14

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TITLE: VFD WIRING DIAGRAM

AKRF - KARTEN REALTY
3200 JEROME AVENUE - BRONX, NY

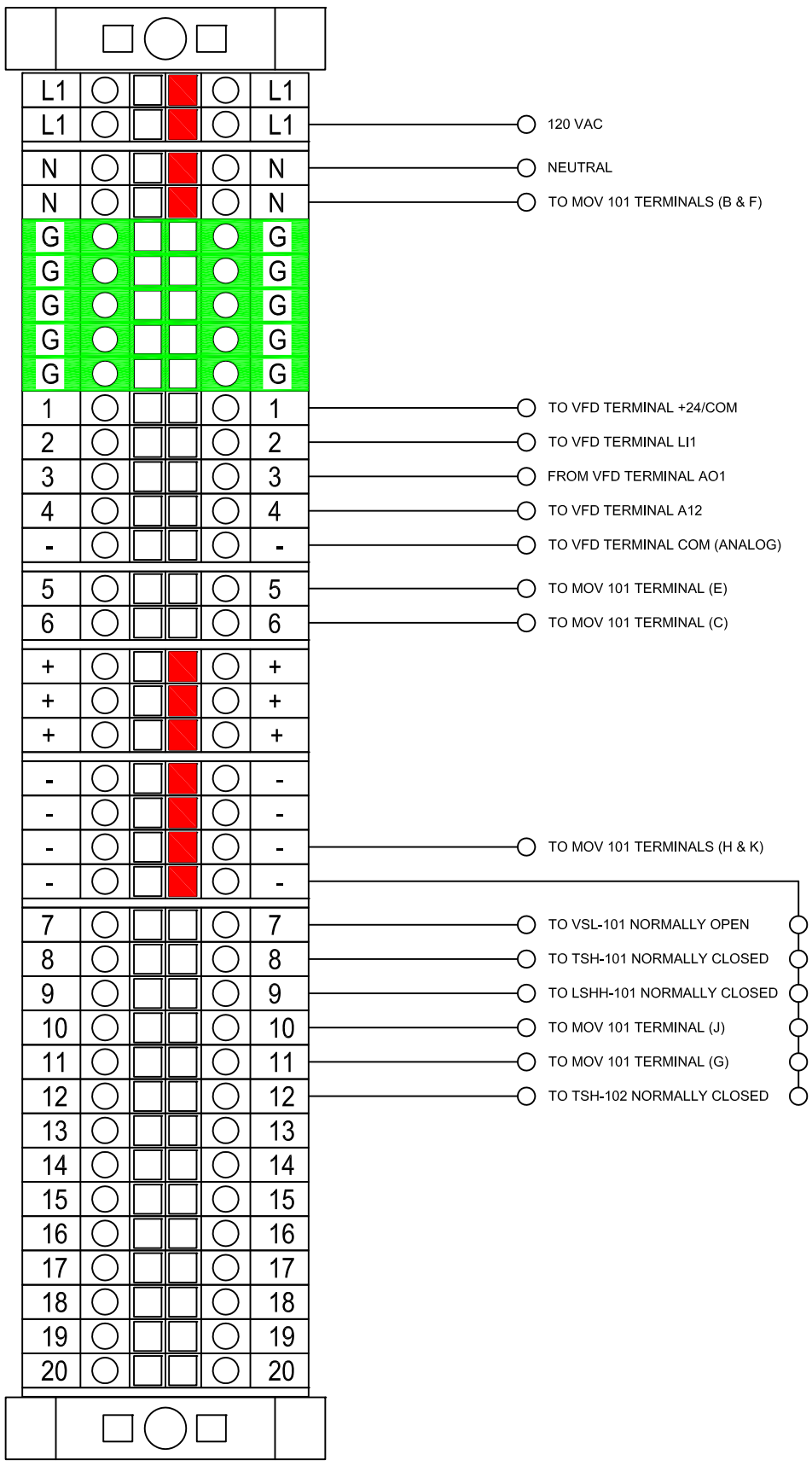
JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	4 OF 5	A

FIELD TERMINAL CONNECTIONS

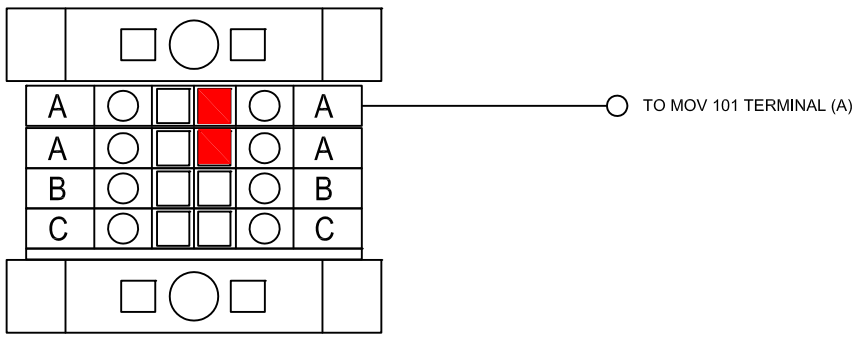
NON-I.S. TERMINALS TB1

NON-I.S. WIRING



NON-I.S. TERMINALS TB2

NON-I.S. WIRING



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REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

REVISIONS

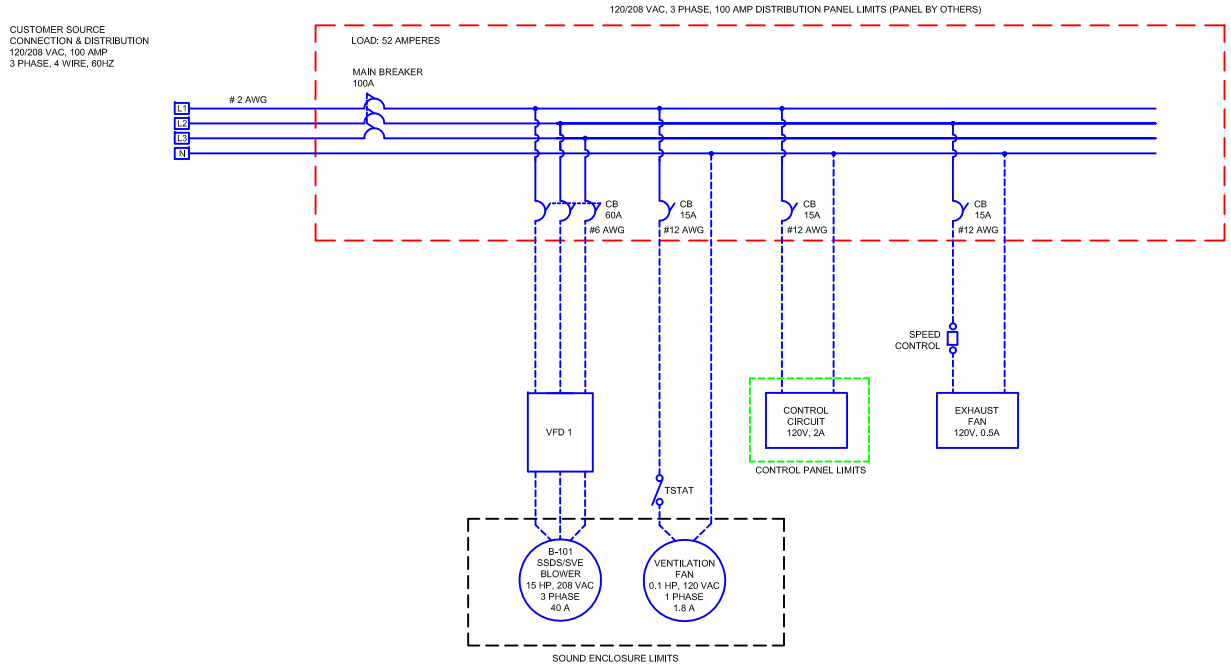
DRWN BY	RJD	DATE 07-02-14
CHK BY	MJS	DATE 08-21-14
APPR BY	RJD	DATE 08-29-14

TITLE: FIELD TERMINAL WIRING

AKRF - KARTEN REALTY
3200 JEROME AVENUE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	I-2	5 OF 5	A



NOTES:
1.) CONTROL PANEL UL 508 LISTED.
2.) GROUND CONDUCTORS NOT SHOWN. INSTALL ALL GROUNDS PER NEC ARTICLES 250.66, 250.122 , LOCAL ELECTRICAL CODES, AND PER THE AUTHORITY HAVING JURISDICTION.

LEGEND	
ABBREV.	DESCRIPTION
M	MOTOR STARTER
CB	CIRCUIT BREAKER
TSTAT	THERMOSTAT
AWG	AMERICAN WIRE GAUGE
VFD	VARIABLE FREQUENCY DRIVE
	CONTROL PANEL LIMITS
	120/208VAC DISTRIBUTION PANEL LIMITS
	NES SKID LIMITS
	WIRING BY OTHERS

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-11-14	EMB

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DRWN BY	RJD
DATE	06-24-14
CHK BY	MJS
DATE	08-19-14
APPR BY	RJD
DATE	08-28-14

TITLE: LINE DIAGRAM

AKRF - RINZLER
3200 JEROME AVENUE - BRONX, NY

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	C	E-1	1 OF 1	A

Configuration :		
Characteristics :		NES JOB 14-151 AKRF 3200 JEROME AVE
Reference	ATV61HD11M3*	
Hardware Type		B-101
Supply Voltage	200 / 240V three-phase	
Nominal Power	11 kW / 15 Hp	
Structure :		
Device	ATV61HD11M3*	
Serial Number	6W14 25 000 176	
Version	V6.6IEXX	
Vendor Name	Schneider Electric	
Control Board	VX4A7100/101	
Serial Number	XX X4 08 049 430	
Version	V6.6IE34	
Vendor Name	Schneider Electric	
Power Board		
Serial Number	XX X4 10 001 822	
Version	V2.8IE42	
Vendor Name	Schneider Electric	
Configuration :		
Software Release :	1.9.4.0	
Device Name :		

Parameter List :

Modified Configuration 1						
Code	**Long Label**	**Current Value**	**Default Value**	**Min Value**	**Max Value**	**Logical address**
LAC	Level of access control	Expert	Standard			3006
BFR	Std. motor frequency	60Hz NEMA	50Hz IEC			3015
TUS	Auto-tuning state	Customized	Not done			9609
NCR	Nominal motor current	40 A	36 A	13.5 A	64.8 A	9603
NSP	Nominal motor speed	3460 rpm	1766 rpm	0 rpm	60000 rpm	9604
TFR	Max. output frequency	60 Hz	72 Hz	10 Hz	600 Hz	3103
ITH	Motor thermal current	40 A	36 A	10.8 A	64.8 A	9622
ACC	Acceleration ramp time	5 s	3 s	0.1 s	999.9 s	9001
LSP	Low speed	30 Hz	0 Hz	0 Hz	60 Hz	3105
RSMS	Meas. stator resist. (sync)	590 mOhm	0 mOhm	0 mOhm	65535 mOhm	9680
PRT	Power Identification	IP20	Not ident.			3009
RSM	Measured stator resist.	55 mOhm	0 mOhm	0 mOhm	65535 mOhm	9640
IDM	Calculated magn. current	25.2 A	0 A	0 A	6553.5 A	9650
LFM	Calcul/meas. leak. induc.	0.68 mH	0 mH	0 mH	655.35 mH	9660
TRM	Calc. rotor time constant	127 ms	0 ms	0 ms	65535 ms	9665
NSL	Nominal motor slip	2.4 Hz	0 Hz	0 Hz	6553.5 Hz	9605
RSA	Cust stator resistance	61 mOhm	0 mOhm	0 mOhm	65535 mOhm	9642
IDA	Cust adjust magn. current	21.4 A	0 A	0 A	6553.5 A	9652
LFA	Cust leakage inductance	0.98 mH	0 mH	0 mH	655.35 mH	9662
TRA	Custom rotor t constant	198 ms	0 ms	0 ms	65535 ms	9667
CRL2	AI2 minimum value	4 mA	0 mA	0 mA	20 mA	4433
AO1	AO1 assignment	Motor freq.	No			5021
AOL1	AO1 min output value	4 mA	0 mA	0 mA	20 mA	4641
TCT	Type of 2 wire control	Level	Transition			11102
CHCF	Channel mode config.	Separate	Not separ.			8401
CD2	Control channel 2 config.	HMI	Modbus			8424
STT	Normal stop mode	Freewheel	Ramp stop			11201
FN4	F4 key assignment	No	T/K			13504

SECTION 4 - CONTROL & POWER COMPONENTS -

SSDS BLOWER VFD, 15HP (LOOSE) - SQUARE D ATV61HD11M3X

PANEL ENCLOSURE - 24 X 20 X 12 - HAMMOND EN4SD242012GY

PROGRAMMABLE LOGIC CONTROLLER - ADI CO-01DR-D

HMI TOUCHSCREEN 8" COLOR - ADI EA7-T8C

WIRELESS CELLULAR MODEM (VERIZON) - SIERRA WIRELESS V2226E-VA

MODEM ANTENNA - WILSON 301125

Product Data Sheet

ATV61HD11M3X

SPEEDDRIVE,15HP,230V,ATV61

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Ampere Rating	54A
Application	Variable Torque
Horsepower Rating	15HP
Motor Power Rating	11kW
Keypad Style	LCD Keypad
Conformal Coating	No
Embedded Communication	Modbus and CANopen
Integrated EMC Filter	None
Enclosure Rating	Open
Degree of Protection	IP20
Input Voltage	208/240VAC
Marketing Trade Name	Altivar 61
Output Voltage	Maximum output voltage equal to input voltage
Input Phase	3-Phase
Output Phase	3-Phase
Type 1 Conduit Entry Kit	Not Included
Type	ATV61

Notes:
Product does not contain an EMC filter.

Shipping and Ordering

Category	22137 -
Discount Schedule	CP4C
GTIN	00785901525615
Package Quantity	1
Weight	49 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.

Generated: 08/04/2014 14:24:35

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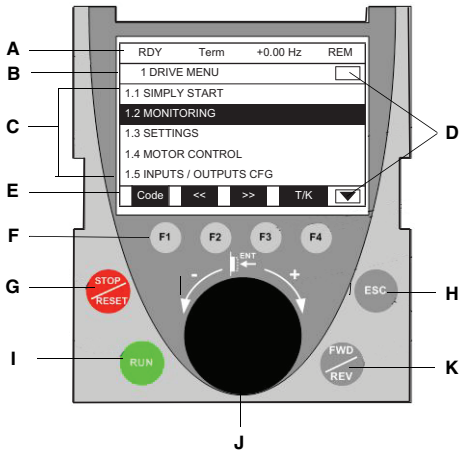
Altivar™ 61 Quick Reference Guide

8800HO0601R10/12
12/2012
Replaces 8800HO0601 04/2006

ALTIVAR 61 GRAPHIC DISPLAY TERMINAL



Description and Operation

A **Display status**—displays default settings: the drive's state, active control channels, frequency reference, and LOC/REM (T/K key status). The Display Status content can be configured.

B **Menu line**—displays the name of the current menu or submenu.

C **Submenus**—lists the submenus of the current menu.

D **Scroll boxes**—indicates (by arrow direction) whether there are additional submenus or levels to access. A blank box indicates that there are no additional submenus or levels to access.

E **Status line**—displays the functions assigned to function buttons F1–F4: **Code** (F1), **<<** (F2), **>>** (F3), **T/K** (F4). See the descriptions below.

F **Function buttons**—
F1: displays the code of the selected parameter or contextual Help
F2: navigates to the left or returns to the previous menu or submenu
F3: navigates to the right or advances to the next menu or submenu
F4: command and reference via the terminal or keypad

G **Stop/Reset** button—stops the drive controller and resets the faults when in HMI command mode.

H **ESC** button—exits a menu or parameter, or cancels a value to return to the previous value in the memory.

I **Run** button—runs the motor with the current setting. Starts the drive controller if in HMI command mode.

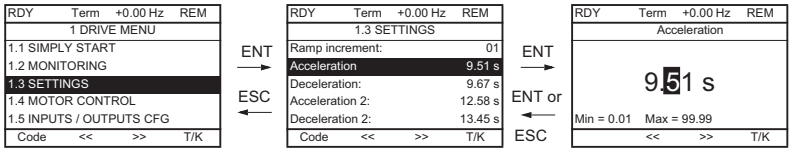
J **Navigation** button/dial—pressing the button saves a value or enters a menu or parameter. Turning the dial clockwise increases a value or advances to the next menu item or line. Turning the dial counter-clockwise decreases a value or backs up to the previous menu item or line. In HMI mode, the dial acts as a speed reference control.

K **FWD/REV** button—reverses the rotation direction of the motor (if configured to allow reverse for HMI command mode).

NOTE: Refer to the Altivar 61 programming manual for detailed information about the display terminal operations.

PROGRAMMING PARAMETERS

Example of accessing the acceleration ramp setting



Changing a parameter

1. Use the navigation dial to vertically scroll the DRIVE MENU list, press ENT (navigation button) to select the submenu.
2. Select the parameter to change and press ENT.
3. Use F1 and F2 to scroll horizontally, then select the digit to change (the digit is highlighted).
4. Turn the navigation dial clockwise to increase the digit or counter-clockwise to decrease the digit.
5. Press ENT to save the change or press the ESC button to cancel the change.

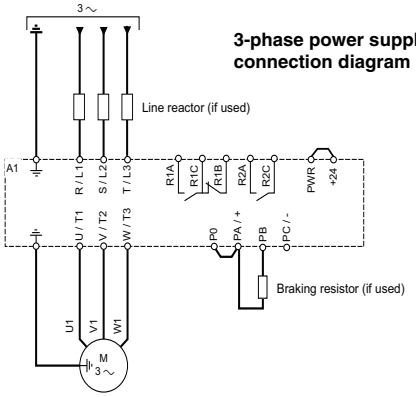
MACRO CONFIGURATION PARAMETERS

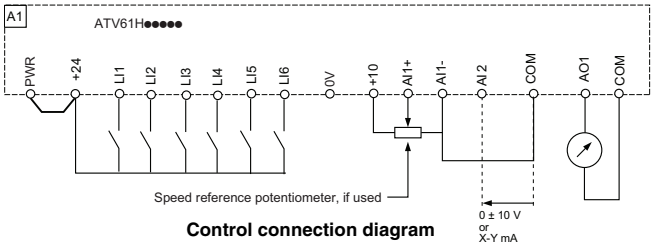
Input/output	[Start/Stop]	[Gen. Use]	[PID regul.]	[Network C.]	[Pumps.Fans]
AI1	[Ref.1 channel]	[Ref.1 channel]	[Ref.1 channel] (PID reference)	[Ref.2 channel] ([Ref.1 channel] = integrated Modbus)	[Ref.1 channel]
AI2	[No]	[Summing ref. 2]	[PID feedback]	[No]	[Ref.1B channel]
AO1	[No]	[No]	[No]	[No]	[No]
R1	[No drive flt]	[No drive flt]	[No drive flt]	[No drive flt]	[No drive flt]
R2	[No]	[No]	[No]	[No]	[Drv running]
LI1 (2-wire)	[Forward]	[Forward]	[Forward]	[Forward]	[Forward]
LI2 (2-wire)	[Fault reset]	[Reverse]	[Fault reset]	[Fault reset]	[No]
LI3 (2-wire)	[No]	[Jog]	[PID integral reset]	[Ref. 2 switching]	[Ref 1B switching]
LI4 (2-wire)	[No]	[Fault reset]	[2 preset PID ref.]	[Forced local]	[Fault reset]
LI5 (2-wire)	[No]	[No]	[4 preset PID ref.]	[No]	[No]
LI6 (2-wire)	[No]	[No]	[No]	[No]	[No]
LI1 (3-wire)	Stop	Stop	Stop	Stop	Stop
LI2 (3-wire)	[Forward]	[Forward]	[Forward]	[Forward]	[Forward]
LI3 (3-wire)	[Fault reset]	[Reverse]	[Fault reset]	[Fault reset]	[No]
LI4 (3-wire)	[No]	[Jog]	[PID integral reset]	[Ref. 2 switching]	[Ref 1B switching]
LI5 (3-wire)	[No]	[Fault reset]	[2 preset PID ref.]	[Forced local]	[Fault reset]
LI6 (3-wire)	[No]	[No]	[4 preset PID ref.]	[No]	[No]
Option cards					
LI7 to LI14	[No]	[No]	[No]	[No]	[No]
LO1 to LO4	[No]	[No]	[No]	[No]	[No]
R3/R4	[No]	[No]	[No]	[No]	[No]
AI3, AI4	[No]	[No]	[No]	[No]	[No]
RP	[No]	[No]	[No]	[No]	[No]
AO2	[I motor]	[I motor]	[I motor]	[I motor]	[I motor]
AO3	[No]	[No]	[PID Output]	[No]	[No]
Graphic display terminal keys					
F1 key	[No]	[No]	[No]	[No]	[No]
F2, F3 keys	[No]	[No]	[No]	[No]	[No]
F4 key	[T/K] (Control via graphic display terminal)	[T/K] (Control via graphic display terminal)	[T/K] (Control via graphic display terminal)	[T/K] (Control via graphic display terminal)	[T/K] (Control via graphic display terminal)

NOTE: The Macro-Configuration factory setting is [Pumps.Fans].

In 3-wire control, the assignment of inputs LI1 to LI7 shifts.

TYPICAL CONNECTIONS





NOTE: Altivar 61 drive controllers come standard with a graphic keypad display terminal as well as a 7-segment, 4-digit integrated display terminal. The lower horsepower Altivar 61 drives can be ordered without the graphic keypad display terminal.

Schneider Electric

Altivar™ 61 Quick Reference Guide

MAIN MENU

1 DRIVE MENU
2 ACCESS LEVEL
3 OPEN / SAVE AS
4 PASSWORD
5 LANGUAGE
6 MONITORING CONFIG.
7 DISPLAY CONFIG.

1 DRIVE MENU

1.1 SIMPLY START
1.2 MONITORING
1.3 SETTINGS
1.4 MOTOR CONTROL
1.5 INPUTS/OUTPUTS CFG
1.6 COMMAND
1.7 APPLICATION FUNCT.
1.8 FAULT MANAGEMENT
1.9 COMMUNICATION
1.10 DIAGNOSTICS
1.11 IDENTIFICATION
1.12 FACTORY SETTINGS
1.13 USER MENU
1.14 PROGRAMMABLE CARD

2 ACCESS LEVEL

Basic
Standard
Advanced
Expert

3 OPEN / SAVE AS

OPEN
SAVE AS

4 PASSWORD

Status	:	Unlocked
PIN code 1	:	OFF
PIN code 2	:	OFF
Upload rights	:	Permitted
Download rights	:	Unlock drv

5 LANGUAGE

English
Français
Deutsch
Italiano
Espanol
Chinese
Русский (Russian)
Türkçe (Turkish)

6 MONITORING CNFG

6.1 PARAM. BAR SELECT
6.2 MONITOR SCREEN TYPE
6.3 COM MAP. CONFIG.

7 DISPLAY CONFIG

7.1 USER PARAMETERS
7.2 USER MENU
7.3 PARAMETER ACCESS
7.4 KEYPAD PARAMETERS

1.1 SIMPLY START

2/3 wire control	:	2 wire
Macro config.	:	Pumps.Fans
Customized Macro		
Std. mot. freq	:	60Hz NEMA
Input phase loss		
Rated motor Power	:	1.0HP
Rated motor volt.	:	460V
Rated motor current	:	1.6A
Rated motor freq.	:	60.0Hz
Rated motor speed	:	1725rpm
Max. frequency	:	72.0Hz
Auto.tuning	:	No
Auto.tuning status	:	Not done
Output Ph rotation	:	ABC
Mot. therm. Current	:	1.6A
Acceleration	:	3.00S
Deceleration	:	3.00S
Low speed	:	0.0Hz
High speed	:	60.0Hz

1.2 MONITORING

I/O MAP
COMMUNICATION MAP

Alarm groups	:	—
HMI Frequency ref.	:	0.0Hz
Frequency ref.	:	0.0Hz
Output Frequency	:	0.0Hz
Measured output fr	:	0.0Hz
Motor current	:	0.0A
Motor speed	:	0 rpm
Motor voltage	:	0V
Motor power	:	0%
Motor torque	:	0.0%
Mains voltage	:	0V
Motor thermal state	:	0%
Drv. thermal state	:	38%
Input Power	:	No meas.
Consumption	:	0Wh
Run time	:	0s
Power on time	:	0h
Proc. Operat. Time	:	0h
IGBT alarm counter	:	0s
Config. Active	:	Config. n° 0
Local / Remote	:	Remote

ALARMS
OTHER STATUS

6.1 PARAM. BAR SELECT MONITORING

Alarm groups
Frequency ref.
Output frequency
Measured output fr.
Pulse in. work. freq.
Motor current
Motor speed
Motor voltage
Motor power
Motor torque
Mains voltage
Motor thermal state
Drv. Thermal state
DBR thermal state
Input Power
Consumption
Run time
Power on time
IGBT alarm counter
PID reference
PID feedback
PID error
PID Output
Config. Active
Utilized param. Set
Local / Remote

6.2 MONITOR SCREEN TYPE

Display value type	:	Digital
PARAMETER SELECTION		

6.3 COM. MAP CONFIG.

Word 1 add. select.	:	0
Format word 1	:	Hex
Word 2 add. select	:	0
Format word 2	:	Hex
Word 3 add. select	:	0
Format word 3	:	Hex
Word 4 add. select	:	0
Format word 4	:	Hex

7.1 USER PARAMETERS

Return Std name	:	No

PARAMETER SELECTION
CUSTOMIZED SELECTION
USER MENU NAME
DEVICE NAME
SERVICE MESSAGE
CONFIGURATION 0
CONFIGURATION 1
CONFIGURATION 2
SERIAL NUMBER

7.2 USER MENU

PARAMETER SELECTION
SELECTED LIST

7.3 PARAMETER ACCESS

PROTECTION
VISIBILITY

7.4 KEYPAD PARAMETERS

KEYPAD CONTRAST
KEYPAD STAND-BY
POWER UP MENU

1.3 SETTINGS

Ramp increment	:	0.1
Acceleration	:	3.00s
Deceleration	:	3.00s
Low Speed	:	0.0Hz
High Speed	:	50.0Hz
Mot.therm. Current	:	2.0A
Speed prop. Gain	:	40%
Speed time integral.	:	100%
K speed loop filter	:	0
IR compensation	:	100%
Slip compensation	:	100%
Auto DC inj. Level 1	:	1.6A
Auto DC inj. Time 1	:	0.5s
Auto DC inj. Level 2	:	1.1A
Auto DC inj. Time 2	:	0.0s
Switching freq.	:	12.0kHz
Current Limitation	:	2.7A
Motor fluxing	:	No
Low speed time out	:	0.0s
Current threshold	:	2.3A
Low I Threshold	:	0.0A
Jog frequency	:	10Hz
Jog delay	:	0.5s
High torque thd	:	+100%
Low torque thd	:	+50%
Freq. threshold	:	50.0Hz
Low Freq. Threshold	:	0.0Hz
Freq. threshold 2	:	50.0Hz
2 Freq. Threshold	:	0.0Hz
Freewheel stop Thd	:	0.0Hz
Motor therm. level	:	100%
High Freq. Ref. Thr.	:	0.0Hz
Low Freq. Ref. Thr.	:	0.0Hz
Skip Freq.	:	0.0Hz
Skip Freq. 2	:	0.0Hz
3rd Skip Frequency	:	0.0Hz

1.4 MOTOR CONTROL

Std. mot. freq	:	60Hz NEMA
Rated motor power	:	1.0HP
Rated motor volt.	:	460V
Rated motor current	:	1.6A
Rated motor freq.	:	60.0Hz
Rated motor speed	:	1725rpm
Max frequency	:	72.0Hz
Auto tuning	:	No
Automatic autotune	:	No
Auto tuning state	:	Not done
Output Ph rotation	:	ABC
Motor control type	:	V/F 2pts
U0	:	0V
Vector Control 2pt.	:	No
Power Identification	:	IP20
Stator R measured	:	5881mOhm
Idr	:	1.0A
Lfr	:	34.08mH
T2r	:	74ms
Nominal motor slip	:	3.4Hz
Poles pair number	:	2
Cust stator resist	:	5881mOhm
Idw	:	1.0A
Lfw	:	34.08mH
Cust. Rotor t const	:	906ms
Sinus filter	:	No
Switching freq.	:	12kHz
Current Limitation	:	2.7A
Noise Reduction	:	Yes
Motor surge limit.	:	No
Braking level	:	785V
Braking balance	:	No

1.5 INPUTS/OUTPUTS CFG

2/3 wire control	:	2 wire
2 wire type	:	Transition
Reverse assign.	:	No

LI1 CONFIGURATION
LI2 CONFIGURATION
LI3 CONFIGURATION
LI4 CONFIGURATION
LI5 CONFIGURATION
LI6 CONFIGURATION

Reference template	:	Standard

AI1 CONFIGURATION
AI2 CONFIGURATION
Virtual AI1
R1 CONFIGURATION
R2 CONFIGURATION
DO1 CONFIGURATION
A01 CONFIGURATION
ALARM GRP1 DEFINITION
ALARM GRP2 DEFINITION
ALARM GRP3 DEFINITION

1.6 COMMAND

Ref.1 channel	:	AI1
RV Inhibition	:	No
Stop Key priority	:	Yes
Profile	:	Not separ.
Ref.2 switching	:	ch1 active
Ref.2 channel	:	No
Copy channel 1<>2	:	No
F1 key assignment	:	No
F2 key assignment	:	No
F3 key assignment	:	No
F4 key assignment	:	T/K
HMI cmd.	:	Bumpless

1.7 APPLICATION FUNCT.

Reference Switch
Ref. Operations
Ramp
Stop Configuration
Auto DC Injection
JOG
Preset Speeds
+/- Speed
+/- Speed Around Ref.
Memo Reference
Fluxing By LI
PID Regulator
PID Preset References
Sleeping / Wake Up
Torque Limitation
2nd Current Limit.
Line Contactor Command
Output Contactor Command
Damper Management
Param. Set Switching
Multimotors / Config.
Auto Tuning By LI
No Flow Detection
Flow Limitation
DC Bus Supply

1.8 FAULT MANAGEMENT

PTC Management
Fault Reset
Automatic Restart
Catch On The Fly
Motor Thermal Prot.
Output Phase Loss
Input Phase Loss
Drive Overheat
Thermal Alarm Stop
External Fault
Undervoltage Mgt
IGBT Tests
4-20mA Loss
Fault Inhibiton
Com. Fault Management
Torque Or I Lim. Detec.
Frequency Meter
DB Res. Protection
Auto Tuning Fault
Cards Pairing
Process Underload
Process Overload
Damper Fault Mgt.
Fallback Speed
Ramp Divider
DC Injection

1.9 COMMUNICATION

Com.Scanner Input
Com. Scanner Output
MODBUS HMI
MODBUS Network
CANopen
Forced Local

1.10 DIAGNOSTICS

Fault History
Current Fault List
More Fault Info
Test Procedures
Service Message

1.11 IDENTIFICATION

ATV61H075N4
0.75kW / 1HP
380 / 480V
Appl. Software V1.1 IE 02
MC Software V1.1 IE 05
6W054100156
Product V1.1 IE02
OPTION 1
No option
OPTION 2
No option
GRAPHIC TERMINAL
GRAPHIC S
V1.1E04
12WOP4200
ENCODER
No

1.12 FACTORY SETTINGS

Config. Source	:	Macro-Conf

Parameter Group List
Goto FACTORY SETTINGS

Save config	:	No

1.13 USER MENU

This menu is accessible only if Display Config. menu 7.2 has been customized.

1.14 PROGRAMMABLE CARD

This menu is accessible only if a Controller Inside card is installed.

NOTE:

- The key drive settings to monitor are highlighted in yellow. Refer to the Altivar 61 programming manual for additional programming instructions.
- All menu levels are accessible through the Expert access level.

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 material.
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1-888-778-2733 / www.Schneider-Electric.us

Altivar 61

Variable speed drive controllers
for asynchronous motors

Simplified manual

0.5–60 hp (0.37–45 kW) / 200–240 V
1–100 hp (0.75–75 kW) / 380–480 V

Retain for future use

a brand of Schneider Electric

Telemecanique

Before you begin

Read and understand these instructions before performing any procedure on this drive controller.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

- Read and understand this manual before installing or operating the Altivar 61 drive controller. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical standards in force concerning protective grounding of all equipment.
- Many parts of this variable speed drive controller, 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.
- Install and close all the covers before applying power or starting and stopping the drive controller.
- Before servicing the variable speed drive controller:
  - Disconnect all power.
  - Place a “DO NOT TURN ON” label on the variable speed drive controller disconnect.
  - Lock the disconnect in the open position.
- Disconnect all power, including external control power that may be present, before servicing the drive controller. WAIT 15 MINUTES for the DC bus capacitors to discharge. Then follow the DC bus voltage measurement procedure on page 10 to verify that the DC voltage is less than 45 V. The drive controller LEDs are not accurate indicators of the absence of DC bus voltage.

Electric shock will result in death or serious injury.

CAUTION

IMPROPER DRIVE OPERATION

- If, for a prolonged period of time, voltage is not applied to the drive controller, the performance of its electrolytic capacitors will be reduced.
- If it is stopped for a prolonged period, turn the drive controller on every two years for at least 5 hours to restore the performance of the capacitors, then check its operation. It is recommended that the drive controller not be connected directly to the line voltage. The voltage should be increased gradually using an adjustable AC source.

Failure to follow these instructions can result in equipment damage.

Product Support

For more information, call, fax, or write:

Square D AC Drives Technical Support Group
P.O. Box 27446
Raleigh, NC 27611-7446

The Technical Support Group is staffed from 8 am to 6 pm Eastern time for product selection, start-up assistance, or diagnosis of product problems and advice for the correct course of action. **Emergency phone support** is available 24 hours a day, 365 days a year.

Toll free:	1-888-778-2733 (1-888-SquareD)
E-mail:	drive.products.support@us.schneider-electric.com
Fax Line:	919-217-6508

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Electromagnetic Compatibility, Wiring 20
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Graphic Display Terminal 23
Integrated Display Terminal 25
[1.1 SIMPLY START] (SIM-) Menu 26
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Setting Up the Drive Controller

■ 1 Take delivery of the drive controller

- Ensure that the catalog number printed on the label is the same as that on the purchase order.
- Remove the drive controller from its packaging and ensure that it has not been damaged in transit.

■ 2 Check the line voltage

- Ensure that the line voltage is compatible with the voltage range of the drive controller.

■ 3 Mount the drive controller (page **6**)

- Mount the drive controller according to the instructions in this document.
- Install any internal and external options.

■ 4 Wire the drive controller (page **11**).

- Connect the motor, ensuring that its connections correspond to the voltage.
- With power off, connect the line supply.
- Connect the control wiring.
- Connect the speed reference.

Steps 1 to 4 must be performed with the power off.

■ 5 Energize drive controller with no inputs active.

- Removing the control terminal card ensures no active inputs.
- See page 13 for control terminal card removal procedure.

■ 6 Select the language (page **23**),

if the controller is equipped with a graphic display terminal.

■ 7 Configure the menu [SIMPLY START] (SIM-) (page **26**)

- 2-wire or 3-wire control
- Macro configuration
- Motor parameters

☞ **Optimize performance**

- Motor thermal current
- Acceleration and deceleration ramps
- Speed variation range

■ 8 Start.

Note:

- To optimize performance, refer to the auto-tuning section, page **29.**

☞ ***Note: Ensure that the wiring of the drive controller is compatible with its configuration.***

Receiving, Handling, and Storage

Handling and storage

Refer to “Dimensions and Weights” on page 8.
To protect the drive controller prior to installation, handle and store the device in its packaging. Ensure that the ambient conditions are acceptable.

⚠ WARNING

DAMAGED PACKAGING

If the packaging appears damaged, it can be dangerous to open it or handle it.

Failure to follow this instruction can result in death or serious injury.

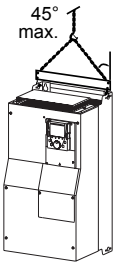
⚠ WARNING

DAMAGED EQUIPMENT

Do not operate or install any drive controller that appears damaged.

Failure to follow this instruction can result in death or serious injury.

Handling on installation



Altivar 61 drive controllers up to ratings ATV61HD15M3X and ATV61HD18N4 can be removed from their packaging and installed without a handling device.

A hoist must be used for higher ratings; for this reason the controllers are fitted with handling lugs.

⚠ WARNING

RISK OF TOPPLING

Do not stand the drive controller upright. Keep the drive controller on the pallet until it is installed.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Before you begin

You must observe the following precautions.

CAUTION

INCOMPATIBLE LINE VOLTAGE

Before turning on and configuring the drive controller, ensure that the line voltage is compatible with the supply voltage range shown on the drive controller nameplate. The controller may be damaged if the line voltage is not compatible.

Failure to follow this instruction can result in equipment damage.

⚠ DANGER

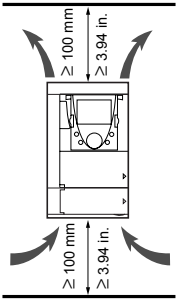
UNINTENDED EQUIPMENT OPERATION

- Before turning on and configuring the Altivar 61 drive controller, check that the PWR (POWER REMOVAL) input is deactivated (at state 0) in order to prevent unintended operation.
- Before turning the controller on or upon exiting the configuration menus, ensure that the inputs assigned to the run command are deactivated (at state 0) since they can cause the motor to start immediately.
- Refer to the characteristics and functions table in the Control Terminals section for more information about the Power Removal Input.

Failure to follow these instructions will result in death or serious injury.

The Power Removal function takes priority over any run command.
For use as an emergency stop, this function requires the use of connection diagrams conforming to category 3 of standard EN 954-1 and safety integrity level 2 according to IEC/EN 61508. Consult the ATV61 installation manual on the CD-ROM supplied with the drive controller.

Mounting and Temperature Conditions



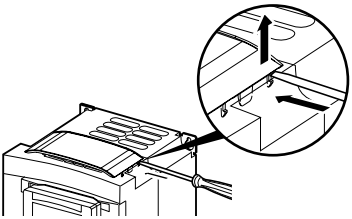
Install the drive controller vertically, ±10°.
Do not place it close to heating elements.
Leave sufficient free space to ensure that the air required for cooling purposes can circulate from the bottom to the top of the unit.

Free space in front of the drive controller: 10 mm (0.39 in.) minimum.

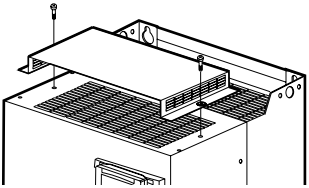
Where IP20 protection is adequate, we recommend that you remove the protective cover on top of the drive controller, as shown below.

Removing the protective cover

ATV61H 075M3 to D15M3X and ATV61H 075N4 to D18N4

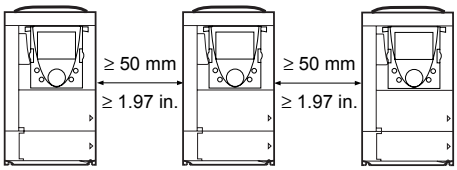


ATV61H D18M3X to D45M3X and ATV61H D22N4 to D75N4

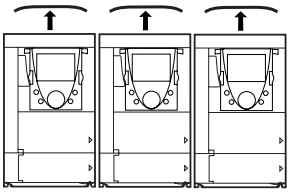


2 types of mounting are possible:

Type A mounting:
Free space ≥ 50 mm (≥ 1.97 in.) on each side, with protective cover in place.



Type B mounting:
Drive controllers mounted side by side, with the protective cover removed (the degree of protection becomes IP20).



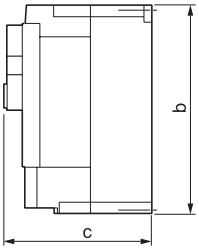
With these types of mounting, the drive controller can be used without derating up to an ambient temperature of 50°C (122°F), with the factory-set switching frequency. For other temperatures and other switching frequencies, consult the CD-ROM supplied with the drive controller.

Dimensions and Weights

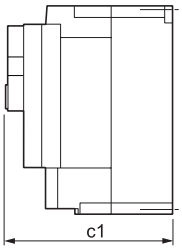
Refer to the Dimensions table on page 9.

With graphic display terminal

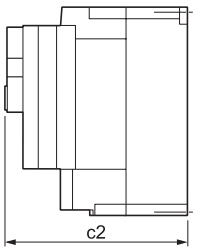
No option card

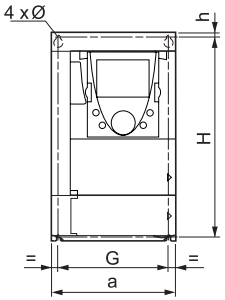


1 option card *(1)*



2 option cards *(1)*

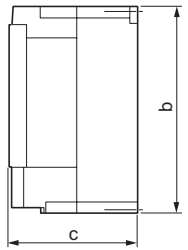




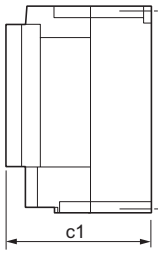
(1) For the addition of I/O extension cards, communication cards, or the "Controller Inside" programmable card.

Without graphic display terminal

No option card

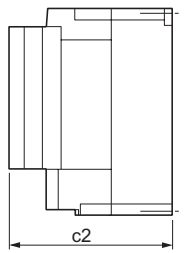


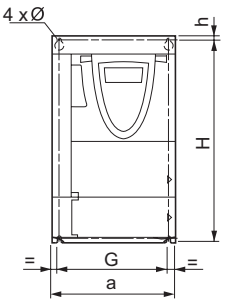
1 option card *(1)*



For a drive without a graphic display terminal, dimensions c, c1 and c2 are reduced by 26 mm (1.01 in.). The other dimensions are unchanged.

2 option cards *(1)*





(1) For the addition of I/O extension cards, communication cards, or the "Controller Inside" programmable card.

Dimensions

ATV61H…	Dimensions, mm (in.)										Weight
	a	b	c	c1	c2	G	H	h	Ø	Screws	kg (lb)
075M3, U15M3, 075N4, U15N4, U22N4	130 (5.12)	230 (9.05)	175 (6.89)	198 (7.80)	221 (8.70)	113.5 (4.47)	220 (8.66)	5 (0.20)	5 (0.20)	M4	3 (6.61)
U22M3, U30M3, U40M3, U30N4, U40N4	155 (6.10)	260 (10.23)	187 (7.36)	210 (8.27)	233 (9.17)	138 (5.43)	249 (9.80)	4 (0.16)	5 (0.20)	M4	4 (8.82)
U55M3, U55N4, U75N4	175 (6.89)	295 (11.61)	187 (7.36)	210 (8.27)	233 (9.17)	158 (6.22)	283 (11.14)	6 (0.24)	5 (0.20)	M4	5.5 (12.13)
U75M3, D11N4	210 (8.27)	295 (11.61)	213 (8.39)	236 (9.29)	259 (10.20)	190 (7.48)	283 (11.14)	6 (0.24)	6 (0.24)	M5	7 (15.43)
D11M3X, D15M3X, D15N4, D18N4	230 (9.05)	400 (15.75)	213 (8.39)	236 (9.29)	259 (10.20)	210 (8.26)	386 (15.20)	8 (0.31)	6 (0.24)	M5	9 (19.84)
D18M3X, D22M3X, D22N4	240 (9.45)	420 (16.54)	236 (9.29)	259 (10.20)	282 (11.10)	206 (8.11)	403 (15.87)	11 (0.45)	6 (0.24)	M5	30 (66.14)
D30N4, D37N4	240 (9.45)	550 (21.65)	266 (10.47)	289 (11.38)	312 (12.28)	206 (8.11)	531.5 (20.93)	11 (0.45)	6 (0.24)	M5	37 (81.57)
D30M3X, D37M3X, D45M3X	320 (12.60)	550 (21.65)	266 (10.47)	289 (11.38)	312 (12.28)	280 (11.02)	524 (20.93)	20 (0.79)	9 (0.35)	M8	37 (81.57)
D45N4, D55N4, D75N4	320 (12.60)	630 (24.80)	290 (11.42)	313 (12.32)	334 (13.15)	280 (11.02)	604.5 (23.80)	15 (0.59)	9 (0.35)	M8	45 (99.21)

DC Bus Voltage Measurement Procedure

Before working on the drive controller, turn it off and wait 15 minutes to allow the DC bus to discharge. Then measure the DC bus voltage.

Measuring the DC bus voltage

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Read and understand the instructions on page 2 before performing this procedure.

Failure to follow this instruction will result in death or serious injury.

The DC bus voltage can exceed 1,000 V ⎓. Use a properly rated voltage-sensing device when performing this procedure. To measure the DC bus voltage:

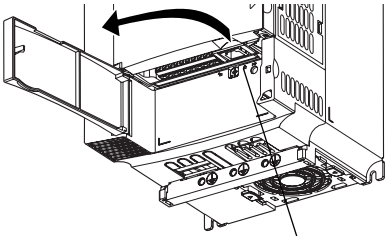
1 Disconnect the drive controller power supply.

2 Wait 15 minutes to allow the DC bus to discharge.

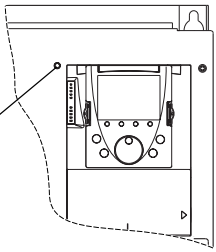
3 Measure the voltage of the DC bus between the PA/+ and PC/– terminals to ensure that the voltage is less than 45 V ⎓.

4 If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive controller.

ATV61H 075M3 to D15M3X and ATV61H 075N4 to D18N4



ATV61H D18M3X to D45M3X and ATV61H D22N4 to D75N4



Red LED indicating that the DC bus is turned on (The drive controller LEDs are not accurate indicators of the absence of DC bus voltage.)

Wiring

Power

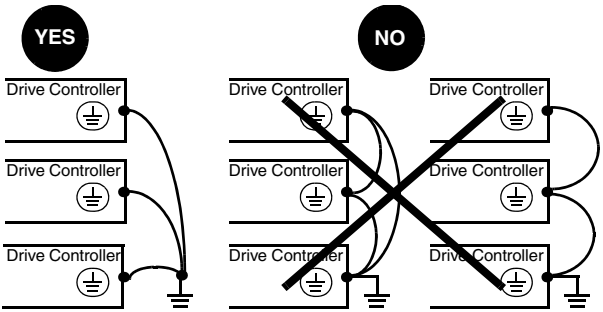
Ground the drive controller to local and national code requirements. A minimum wire size of 6 AWG may be required to meet standards limiting leakage current.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

Ground equipment using the provided ground connecting point as shown in the figure below. The drive panel must be properly grounded before power is applied.

Failure to follow this instruction will result in death or serious injury.



- Ensure that the resistance of the protective ground is 1 Ω or less.
- If connecting several drive controllers to the protective ground, 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

EQUIPMENT DAMAGE

- The ATV61 controller 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 ATV61 drive controller.
- If replacing another drive controller, verify that all wiring connections to the ATV61 controller comply with all wiring instructions in this manual.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

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. Choose a suitable model integrating:

- HF current filtering
- A time delay that prevents 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—for example, residual current devices with reinforced immunity from the s.i range (Merlin Gerin brand).

If the installation includes several drive controllers, provide one residual current device per controller.

⚠ WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The Canadian Electricity Code and the National Electrical Code require branch circuit protection. Use the fuses recommended on the drive controller nameplate to achieve published short-circuit current ratings.
- Do not connect the drive controller to a power feeder whose short-circuit capacity exceeds the controller short-circuit current rating listed on the controller nameplate.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

CAUTION

IMPROPER USE OF A BRAKING RESISTOR

Wire the thermal protection contact on the resistor so that the drive controller power supply is disconnected immediately in the event of a fault (refer to the manual supplied with the resistor).

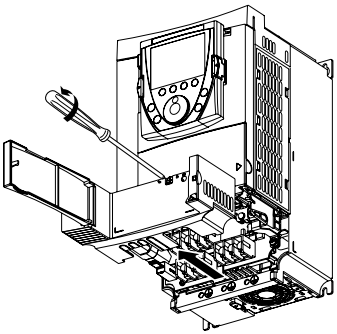
Failure to follow this instruction can result in equipment damage.

Power Terminals

Access to the power terminals

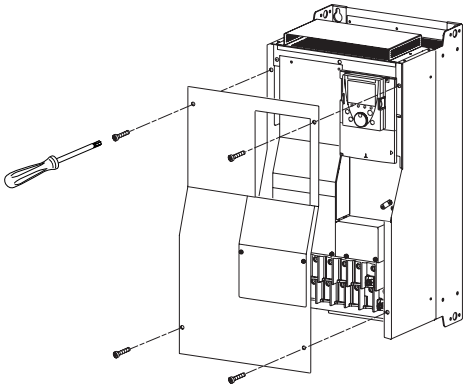
ATV61 H075M3 to HD15M3X and ATV61 H075N4 to HD18N4

Unlock the power-section access flap, and remove it as shown below.



ATV61 HD18M3X to HD45M3X and ATV61 HD22N4 to HD75N4

To access the power terminals, remove the front panel as shown below.



Functions of power terminals

Terminals	Function
⏚	Protective ground connection terminal
R/L1 – S/L2 – T/L3	Power section line supply
PO	DC bus +polarity
PA/+	Output to braking resistor (+polarity)
PB	Output to braking resistor
PC/–	DC bus –polarity
U/T1 – V/T2 – W/T3	Outputs to the motor

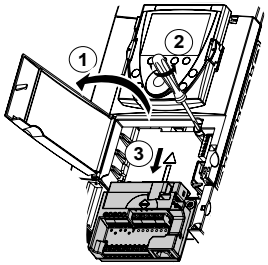
Remove the link between PO and PA/+ only if a DC choke has been added. The PO and PA/+ terminal screws must always be fully tightened, since a high current flows through the commoning link.

Characteristics of power terminals

ATV61H…	Maximum wire size			Tightening torque
	mm²	AWG	kcmils	N•m (lb-in)
075M3–U40M3, 075N4–U40N4	4	10		1.4 (12.3)
U55M3, U55N4, U75N4	6	8		3 (26.5)
U73M3, D11N4	16	4		3 (26.5)
D11M3X, D15M3X, D15N4, D18N4	25	3		5.4 (47.7)
D18M3X, D22M3X, D22N4, D30N4, D37N4	50	1/0		12 (106.2)
D30M3X, D37M3X, D45M3X, D45N4, D55N4, D75N4	150		300	41 (360)

Control Terminals

Access to the control terminals



1 To access the control terminals, open the cover on the front panel of the control section.

2 To make it easier to wire the drive control section, the control terminal card can be removed:
- Undo the screw until the spring is fully extended.
- Remove the card by sliding it downwards.

Maximum wire size: 2.5 mm² (14 AWG)

Max. tightening torque: 0.6 N•m (5.3 lb-in)

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- The accidental grounding of logic inputs configured for Sink Logic can result in unintended activation of drive controller 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.

CAUTION

IMPROPERLY SECURED TERMINAL CARD

When replacing the control terminal card, it is essential to fully tighten the captive screw.

Failure to follow this instruction can result in equipment damage.

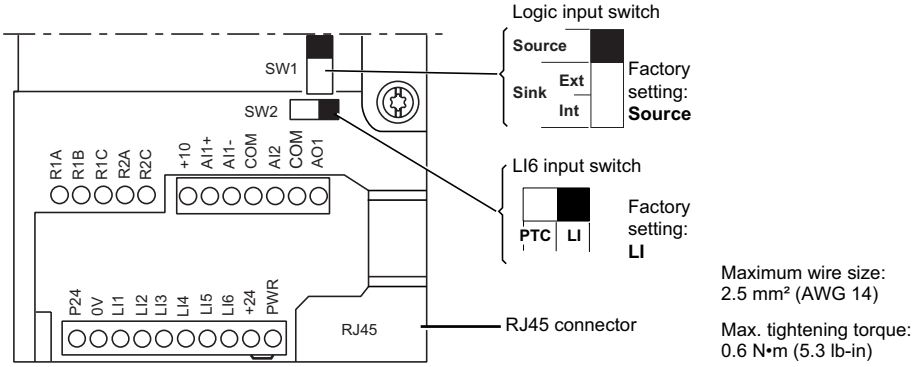
Characteristics and functions of the control terminals

Terminals	Function	Electrical characteristics
R1A R1B R1C	1 relay logic output, one N.C. contact and one N.O. contact with common point (R1A to R1C is N.O.; R1B to R1C is N.C.)	Minimum switching capacity: 3 mA for 24 V ⎓ Maximum switching capacity: • on resistive load (cos φ = 1): 5 A for 250 V ∿ or 30 V ⎓ • on inductive load (cos φ = 0.4 and L/R = 7 ms): 2 A for 250 V ∿ or 30 V ⎓ Max. response time: 7 ms ±0.5 ms Electrical service life: 100,000 operations
R2A R2C	1 relay logic output one N.O. contact	
+10	+10 V ⎓ power supply for reference potentiometer 1–10 kΩ	• +10 V ⎓ (10.5 V ±0.5 V) • 10 mA max.
AI1+ AI1–	Differential analog input AI1	• –10 to +10 V ⎓ (max. safe voltage 24 V) • Reaction time: 2 ms ±0.5 ms, 11-bit resolution + 1 sign bit • Accuracy ±0.6% for Δθ = 60 °C (140 °F), linearity ±0.15% of max. value
COM	Analog I/O common	0 V
AI2	Depending on the software configuration: Analog voltage or current input	• Analog input 0 to +10 V ⎓ (max. safe voltage 24 V), impedance 30 kΩ • Analog input X–Y mA, X and Y programmable from 0 –20 mA, impedance 250 Ω • Reaction time: 2 ms ±0.5 ms • 11-bit resolution, accuracy ±0.6% for Δθ = 60 °C (140 °F), linearity ±0.15% of max. value
COM	Analog I/O common	0 V
NOTE: Δθ = temperature change		

Characteristics and functions of the control terminals *(continued)*

Terminals	Function	Electrical characteristics			
AO1	Depending on the software configuration: Analog voltage or current output	• Analog output 0 to +10 V ⎓, min. load impedance 50 kΩ • Analog output X–Y mA, X and Y can be programmed from 0–20 mA, max. load impedance 500 Ω • 10-bit resolution, reaction time: 2 ms ±0.5 ms • Accuracy ±1% for Δθ = 60 °C (140 °F), linearity ±0.2% of max. value			
P24	Input for external +24 V ⎓ control power supply	• +24 V ⎓ (min. 19 V, max. 30 V) • Power 30 W			
0V	Logic input common and 0V of external P24 power supply	0 V			
LI1 LI2 LI3 LI4 LI5	Programmable logic inputs	• +24 V ⎓ (max. 30 V) • Impedance 3.5 kΩ • Reaction time: 2 ms ± 0.5 ms	**SW1 Switch**	**State 0**	**State 1**
			Source (factory setting)	< 5 V ⎓	> 11 V ⎓
			Sink Int or Sink Ext	> 16 V ⎓	< 10 V ⎓
LI6	Depending on the position of the SW2 switch: LI (Programmable logic input) or PTC (Input for PTC probes)	SW2 = LI (factory setting): • Same characteristics as logic inputs LI1 to LI5 SW2 = PTC: • Trip threshold 3 kΩ, reset threshold 1.8 kΩ • Short-circuit detection threshold < 50 Ω			
+24	Logic input power supply	SW1 switch in Source or Sink Int position: • Internal +24 V ⎓ power supply (min. 21 V, max. 27 V), protected against short-circuits and overloads • 200 mA max. SW1 switch in Sink Ext position: • Input for external +24 V ⎓ power supply for the logic inputs			
PWR	Power Removal safety function input.	• 24 V ⎓ (max. 30 V) • Impedance 1.5 kΩ • State 0 if < 2 V, state 1 if > 17 V • Reaction time: 10 ms			
	When PWR is not connected to 24V, the motor cannot be started (compliance with functional safety standard EN 954-1 and IEC/EN 61508)				
NOTE: Δθ = temperature change					

Arrangement of the control terminals



Note: The ATV61 controller is supplied with a link between the PWR and +24 terminals.

Logic I/O option card terminals (VW3A3201)

Characteristics and functions of the terminals

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- The accidental grounding of logic inputs configured for Sink Logic can result in unintended activation of drive controller 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.

Maximum wire size: 1.5 mm² (16 AWG). Max. tightening torque: 0.25 N•m (2.21 lb-in)
R3A to LI10: Same characteristics as for the control card.

Characteristics and functions of the logic I/O option card terminals

Terminals	Function	Electrical characteristics
R3A R3B R3C	Common point C/O contact R3C of programmable relay R3	• Minimum switching capacity: 3 mA for 24 V ⎓ • Maximum switching capacity on resistive load: 5 A for 250 V ∿ or 30 V ⎓ • Maximum switching capacity on inductive load (cos φ = 0.4 L/R = 7 ms): 2 A for 250 V ∿ or 30 V ⎓ • Reaction time: 7 ms ±0.5 ms • Service life: 100,000 operations
–10	–10 V ⎓ power supply for reference potentiometer 1 to 10 kΩ	• –10 V ⎓ (–10.5 V ±0.5 V) • 10 mA max
+24	Logic input power supply	SW3 switch in Source or Sink Int position • +24 V ⎓ power supply (min. 21 V, max. 27 V), protected against short-circuits and overloads • Max. current available for customers 200 mA (This current corresponds to the total consumption on the control card +24 and the option cards +24) SW3 switch in Sink Ext position • Input for external +24 V ⎓ power supply for the logic inputs
LI7 LI8 LI9 LI10	Programmable logic inputs	• +24 V ⎓ power supply (max. 30 V) • Impedance 3.5 kΩ • Reaction time 2 ms ± 0.5 ms SW3 Switch: Source (factory setting) — State 0: < 5 V ⎓ — State 1: > 11 V ⎓ SW3 Switch: Sink Int or Sink Ext — State 0: > 16 V ⎓ — State 1: < 10 V ⎓
0V	0 V	0 V
TH1+ TH1–	PTC probe input	• Trip threshold 3 kΩ, reset threshold 1.8 kΩ • Short-circuit detection threshold < 50 Ω
LO1 LO2	Open collector programmable logic outputs	• +24 V ⎓ (max. 30 V) • Max. current 200 mA for internal power supply and 200 mA for external power supply • Reaction time: 2 ms ±0.5 ms
CLO	Logic output common	
0V	0 V	0 V

Extended I/O option card terminals (VW3A3202)

Characteristics and functions of the terminals

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- The accidental grounding of logic inputs configured for Sink Logic can result in unintended activation of drive controller 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.

Maximum wire size: 1.5 mm² (16 AWG). Max. tightening torque: 0.25 N•m (2.21 lb-in)
R4A to LI14: Same characteristics as for the control card.

Characteristics and functions of the extended I/O option card terminals

Terminals	Function	Electrical characteristics
R4A R4B R4C	Common point C/O contact R4C of programmable relay R4	• Minimum switching capacity: 3 mA for 24 V ⎓ • Maximum switching capacity on resistive load: 5 A for 250 V ∿ or 30 V ⎓ • Maximum switching capacity on inductive load (cos φ = 0.4 L/R = 7 ms): 1.5 A for 250 V ∿ or 30 V ⎓ • Reaction time 10 ms ±1 ms • Service life: 100,000 operations
–10	–10 V ⎓ power supply for reference potentiometer 1 to 10 kΩ	• –10 V ⎓ (–10.5 V ±0.5 V) • 10 mA max.
AI3 +	+ polarity of the current differential analog input AI3	• Analog input X–Y mA, X and Y can be programmed from 0 to 20 mA, impedance 250 Ω • Reaction time: 5 ms ±1 ms • 11-bit resolution + 1 sign bit, accuracy ±0.6% for Δθ = 60°C (140°F) • Linearity ±0.15% of max. value
AI3 -	– polarity of the current differential analog input AI3	
AI4	Depending on the software configuration: Analog current input or Analog voltage input	• Analog input 0 to +10 V ⎓ (max. safe voltage 24 V), impedance 30 kΩ • Analog input X–Y mA, X and Y can be programmed from 0 to 20 mA, impedance 250 Ω • Reaction time: 5 ms ±1 ms • 11-bit resolution, accuracy ±0.6% for Δθ = 60°C (140°F), linearity ±0.15% of max. value
COM	Analog I/O common	0 V
AO2 AO3	Depending on the software configuration: Analog voltage outputs or Analog current outputs	• 0–10 V ⎓ or –10/+10 V ⎓ bipolar analog output depending on software configuration, load impedance greater than 50 kΩ • Analog current output X–Y mA, X and Y can be programmed from 0 to 20 mA, max. load impedance 500 Ω • 10-bit resolution • Reaction time 5 ms ±1 ms, accuracy ±1% for Δθ = 60 °C (140 °F), linearity ±0.2%
+24	Logic input power supply	SW4 switch in Source or Sink Int position • +24 V ⎓ output (min. 21 V, max. 27 V), protected against short-circuits and overloads • Max. current available for customers 200 mA (This current corresponds to the total consumption on the control card +24 and the option cards +24) SW4 switch in Sink Ext position • Input for external +24 V ⎓ power supply for the logic inputs
NOTE: Δθ = temperature change		

Characteristics and functions of the extended I/O option card terminals *(continued)*

Terminals	Function	Electrical characteristics			
LI11 LI12 LI13 LI14	Programmable logic inputs	• +24 V ⎓ (max. 30 V) • Impedance 3.5 kΩ • Reaction time: 5 ms ±1 ms	SW4 Switch	State 0	State 1
			Source (factory setting)	< 5 V ⎓	> 11 V ⎓
			Sink Int or Sink Ext	> 16 V ⎓	< 10 V ⎓
0V	Logic input common	0 V			
TH2 + TH2 -	PTC probe input	• Trip threshold 3 kΩ, reset threshold 1.8 kΩ • Short-circuit detection threshold < 50 Ω			
RP	Frequency input	• Frequency range 0...30 kHz • Cyclic ratio: 50% ±10% • Maximum sampling time: 5 ms ±1 ms • Maximum input voltage 30 V, 15 mA • Add a resistor if the input voltage is greater than 5 V (510 Ω for 12 V, 910 Ω for 15 V, 1.3 kΩ for 24 V) • State 0 if < 1.2 V, state 1 if > 3.5 V			
LO3 LO4	Open collector programmable logic outputs	• +24 V ⎓ (max. 30 V) • Max. current 20 mA for internal power supply and 200 mA for external power supply • Reaction time 5 ms ±1 ms			
CLO	Logic output common				
0V	0 V	0 V			
NOTE: $\Delta\theta$ = temperature change					

Connection diagrams

SW3/SW4 logic I/O switch

DANGER

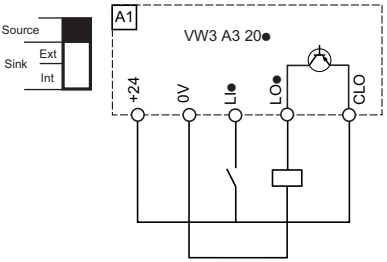
UNINTENDED EQUIPMENT OPERATION

- The accidental grounding of logic inputs configured for Sink Logic can result in unintended activation of drive controller 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.

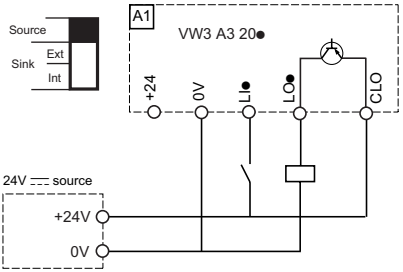
• Switch in Source position

SW3 or SW4



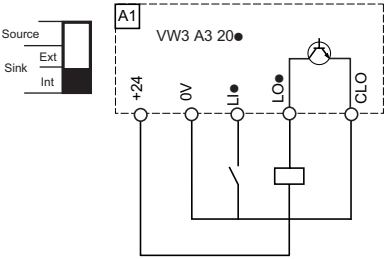
• Switch in Source position and use of an external +24 V ⎓ source

SW3 or SW4



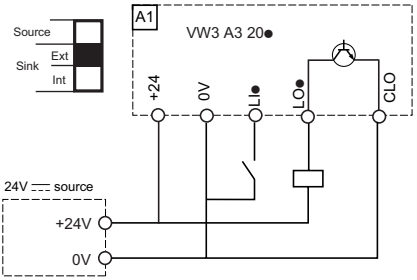
• Switch in Sink Int position

SW3 or SW4



• Switch in Sink Ext position

SW3 or SW4

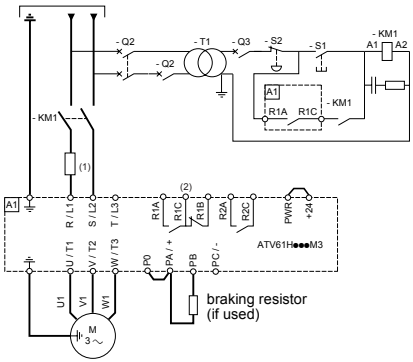


Connection Diagrams

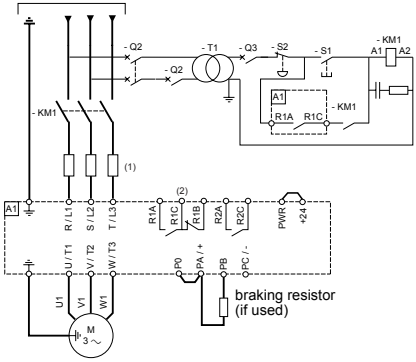
Connection diagrams conforming to standard EN 954-1 category 1, with line contactor

To operate the drive controller (ATV61H 075M3 to U75M3) on a single phase supply, you must inhibit the input phase loss fault. If this fault is set to its factory configuration, the drive controller will stay locked in fault mode.

Single phase power supply



3-phase power supply



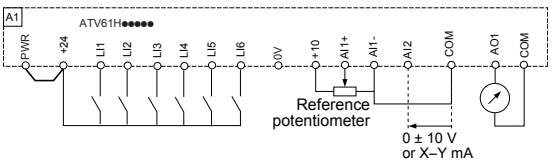
(1) Line choke, if used (required in single phase operation for ATV61H U40M3 to U75M3 drive controllers)
(2) Fault relay contacts, for remote signaling of drive controller status

Note:
- Install interference suppressors on all inductive circuits near the drive controller or coupled to the same circuit (relays, contactors, solenoid valves, etc.).
- If the PWR input has been wired up, use shielded cable.

Associated components: Refer to the catalog.

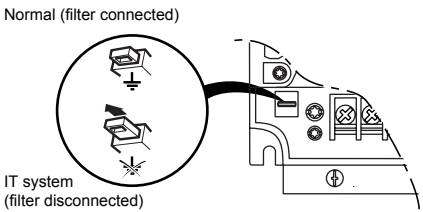
Control connection diagrams

Control card connection diagram



For other types of diagram (external 24 V power supply, negative logic, etc), consult the CD-ROM supplied with the drive controller.

Operation on an IT and DELTA System



IT system: Isolated or Isolated, impedance grounded neutral and Delta.
Use a permanent insulation monitor compatible with non-linear loads, such as a Merlin Gerin type XM200 or equivalent.
Altivar 61 drive controllers feature built-in RFI filters. These filters can be isolated from ground for operation on an IT system, as illustrated opposite:
Remove the jumper located to the left of the power terminals.

CAUTION
EQUIPMENT DAMAGE When the filters are disconnected, the drive controller switching frequency must not exceed 4 kHz. Refer to the programming manual on the CD-ROM supplied with the drive controller to adjust parameter SFr . **Failure to follow this instruction can result in equipment damage.**

Electromagnetic Compatibility, Wiring

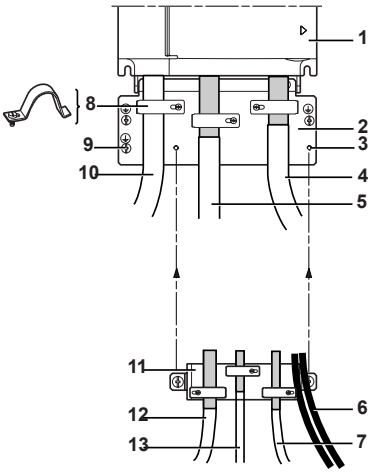
Principle and best practices

- Grounds between the drive controller, motor, and cable shielding must have high-frequency equipotentiality.
- Use shielded cables with shielding connected to ground at both ends for the motor cables, braking resistor (if used), and control-signal wiring. Metal ducting or conduit can be used for part of the shielding length, provided there is no break in continuity.
- 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 (0.98 and 1.97 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 controller output.
- If using an additional input filter, mount it under the drive controller and connect it directly to the line supply via an unshielded cable. Link 10 on the drive controller is then via the filter output cable.
- The HF equipotential ground connection between the drive controller, motor, and cable shielding does not eliminate the need to connect the PE protective conductors (green-yellow) to the appropriate terminals on each unit.

Installation diagram

ATV61H 075M3 to D15M3X and ATV61H 075N4 to D18N4

- Attach and ground the shielding of cables **4**, **5**, **7**, **12** and **13** as close as possible to the drive controller:
  - Strip the cable to expose the shielding.
  - Use stainless metal cable clamps on the parts from which the shielding has been stripped, to attach them to the metal sheet **2** and the control EMC flange **11**.
  - The shielding must be clamped tightly enough to the metal sheet to ensure proper contact.



1 Altivar 61 drive controller

2 Sheet steel grounded plate supplied with the drive controller

3 Tapped holes for installing the control EMC plate

4 Shielded cable for connecting the motor

5 Shielded cable for connecting the braking resistor (if used)

6 Unshielded wires for the relay contact output

7 Shielded cables for connecting the Power Removal safety function input

8 Metal clamps

9 Connection to the protective ground

10 Unshielded power supply wires or cable

11 Control EMC plate, to be mounted on the machine ground **2**

12 Shielded cables for connecting the control-signal cables. For applications requiring several conductors, use cables with a small cross-section (0.5 mm^2 / 20 AWG)

13 Shielded cables for connecting the encoder

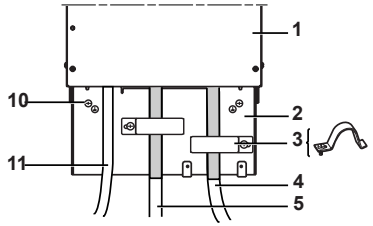
NOTE: All shields must be continuous.

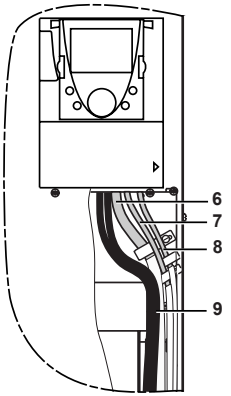
Electromagnetic Compatibility, Wiring (continued)

Installation diagram

ATV61H D18M3X to D45M3X and ATV61H D22N4 to D75N4

Attach and ground the shielding of cables **4**, **5**, **6**, **7** and **8** as close as possible to the drive controller:
- Strip the cable to expose the shielding.
- Use stainless metal cable clamps to attach the parts from which the shielding has been stripped.
- The shielding must be clamped tightly enough to the metal sheet to ensure proper contact.





1 Altivar 61 drive controller

2 Sheet steel grounded plate supplied with the drive controller

3 Metal clamps

4 Shielded cable for connecting the motor

5 Shielded cable for connecting the braking resistor (if used)

6 Shielded cables for connecting the control-signal cables. For applications requiring several conductors, use cables with a small cross-section (0.5 mm^2 / 20 AWG)

7 Shielded cables for connecting the Power Removal safety function input

8 Shielded cables for connecting the encoder

9 Unshielded wires for the relay contact output

10 Connection to the protective ground

11 Unshielded power supply wires or cable

NOTE: All shields must be continuous.

Setup—Preliminary Recommendations

Drive controller settings (factory configuration)

The Altivar 61 drive controller is factory-set for the following operating conditions:
- Macro-configuration: Pumps/fans
- **Motor** frequency: 50 Hz
- Energy-saving variable torque applications
- Normal stop mode on deceleration ramp
- Stop mode in the event of a fault: freewheel
- Linear, acceleration and deceleration ramps: 3 seconds
- Low speed: 0 Hz
- High speed: 50 Hz
- Motor thermal current = rated drive controller current
- Standstill injection braking current = 0.7 x rated drive controller current, for 0.5 seconds
- No automatic starts after a fault
- Switching frequency 2.5 kHz to 12 kHz depending on drive controller rating
- Logic inputs:
  - LI1: forward (1 operating direction), 2-wire control on transition
  - LI2: inactive (not assigned)
  - LI3: switching of 2nd speed reference
  - LI4: fault reset
  - LI5, LI6: inactive (not assigned)
- Analog inputs:
  - AI1: 1st speed reference 0–10 V
  - AI2: 2nd speed reference 0–20 mA
- Relay R1: The contact opens in the event of a fault (or drive controller off)
- Relay R2: The contact closes when the drive controller is running
- Analog output AO1: 0–20 mA, motor frequency

For programming instructions, consult the ATV61 programming manual located on the CD-ROM included with the drive controller.

Option card factory settings

The option card inputs/outputs are not factory-set.

Power switching via line contactor

CAUTION
EQUIPMENT DAMAGE • Avoid operating the contactor frequently (premature aging of the filter capacitors). • Cycle times < 60 s can result in damage to the pre-charge resistor. **Failure to follow these instructions can result in equipment damage.**

Starting

Important:

In factory settings mode, the motor can be supplied with power only if the Forward, Reverse, and DC Injection Stop commands are reset:
- On power-up
- On manual fault reset
- After a stop command

If the commands have not been reset, the drive controller displays nSt and does not start.

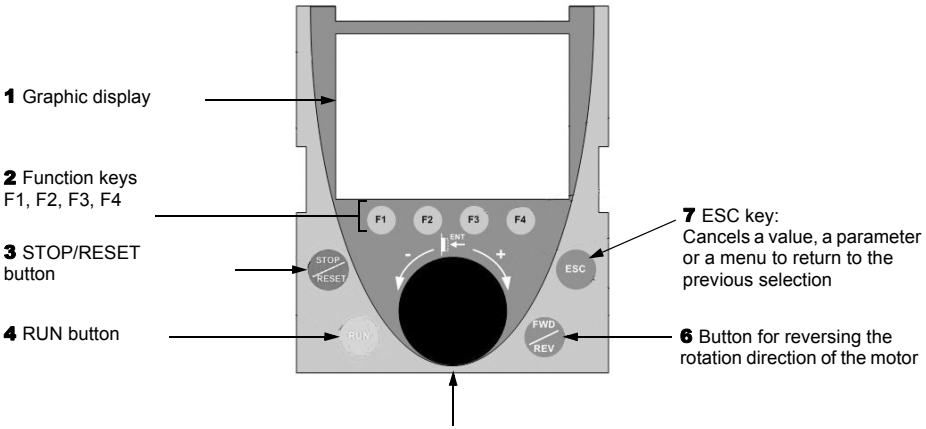
Test on a low-power motor or without a motor, using motors in parallel

Consult the CD-ROM supplied with the drive controller.

Graphic Display Terminal

Although the graphic display terminal is optional for low-power controllers, it is a standard component on high-power controllers (see catalog). The graphic display terminal can be disconnected and connected remotely (on the door of an enclosure, for example) using the cables and accessories available as options (see catalog).

Description of graphic display terminal



5 Navigation button:

- Press (ENT):
  - To save the current value
  - To enter the selected menu or parameter
- Turn CW/CCW:
  - To increment or decrement a value
  - To go to the next or previous line
  - To increase or decrease the reference if control via the graphic display terminal is activated

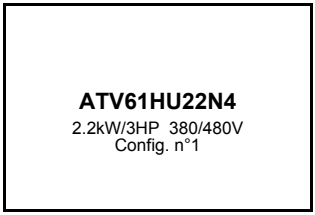
Note: Buttons 3, 4, 5 and 6 can be used to control the drive controller directly, if control via the graphic display terminal is activated.

Drive controller state codes:

- ACC: Acceleration
- CLI: Current limiting
- CTL: Controlled stop on input phase loss
- DCB: DC injection braking in progress
- DEC: Deceleration
- FLU: Motor fluxing in progress
- FRF: Drive controller at fallback speed
- FST: Fast stop
- NLP: No line power (no line supply on L1, L2, L3)
- NST: Freewheel stop
- OBR: Auto-adapted deceleration
- PRA: Power Removal function active (drive controller locked)
- RDY: Drive controller ready
- RUN: Drive controller running
- SOC: Controlled output cut in progress
- TUN: Auto-tuning in progress
- USA: Undervoltage alarm

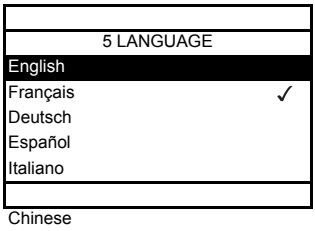
The first time the drive controller is powered up, the user is automatically guided through the menus as far as [1. DRIVE MENU].
The parameters in the [1.1 SIMPLY START] submenu must be configured and auto-tuning performed before the motor is started up.

Only the [1.1 SIMPLY START] menu is described in this document. To find out the content of the other menus, consult the CD-ROM supplied with the drive controller.



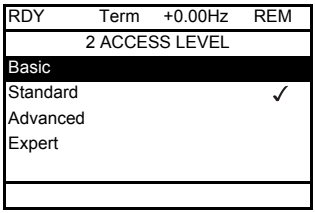
Displayed for 3 seconds following power-up

3 seconds

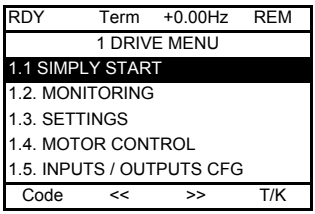


Switches to [5 LANGUAGE] menu automatically.

Select the language and press ENT.

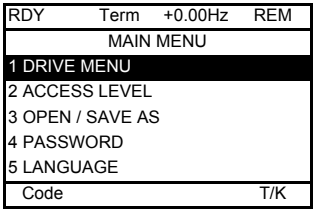


Switches to [2 ACCESS LEVEL] menu
(consult the CD-ROM supplied with the drive controller)
Select the access level and press ENT.



Switches to [1 DRIVE MENU]
(consult the CD-ROM supplied with the drive controller)

ESC

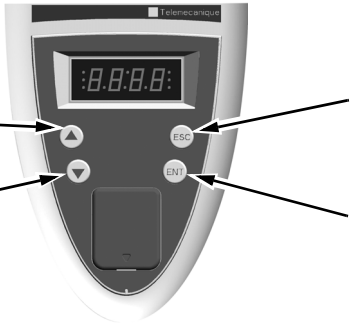


Press ESC to return to [MAIN MENU]

Integrated Display Terminal

Low-power Altivar 61 drives (see catalog) feature an integrated display terminal with a 7-segment 4-digit display. The graphic display terminal described on page 23 can also be connected to these drive controllers as an option.

Functions of the display and the keys



- Returns to the previous menu or parameter, or increases the displayed value
- Goes to the next menu or parameter, or decreases the displayed value
- Exits a menu or parameter, or cancels the displayed value to return to the previous value in the memory
- Enters a menu or parameter, or saves the displayed parameter or value

Note:
- Pressing ▲ or ▼ does not store the choices.
- Press and hold down (>2 s) ▲ or ▼ to scroll through the data quickly.

Save and store the selection: ENT

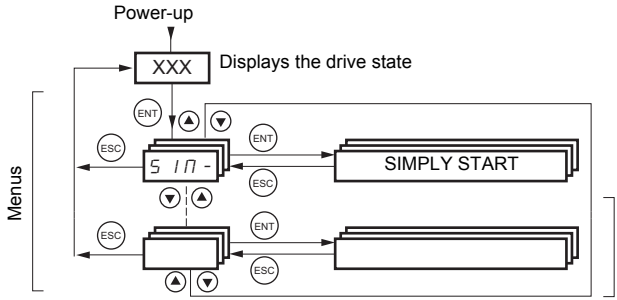
The display flashes when a value is stored.

Normal display, with no fault present and no startup:

- 4 3. 0: Display of the parameter selected in the SUP menu (default selection: motor frequency)
- CL 1: Current limit
- CtL: Controlled stop on input phase loss
- dCb: DC injection braking in progress
- FLU: Motor fluxing in progress
- FrF: Drive at fallback speed
- FSt: Fast stop
- nLP: No line power (no line supply on L1, L2, L3)
- nSt: Freewheel stop.
- Obr: Auto-adapted deceleration
- PrA: Power Removal function active (drive locked)
- rdy: Drive ready
- run: Drive running
- SOC: Controlled output cut in progress
- tUn: Auto-tuning in progress
- USA: Undervoltage alarm

The display flashes to indicate the presence of a fault.

Access to Menus



A dash appears after menu and submenu codes to differentiate them from parameter codes.
Examples : SIM- menu, ACC parameter.

[1.1 SIMPLY START] (SIM-) Menu

With integrated display terminal

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Changes to parameters in other menus may change the [1.1 SIMPLY START] (SIM-) parameter settings.
- Read and understand the ATV61 Programming Manual before configuring parameter values.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The [1.1 SIMPLY START] (SIM-) menu can be used to quickly configure key parameters to get the drive controller and motor running.
Modifying parameters in other menus may modify the parameter settings in the [1.1 SIMPLY START] (SIM-) menu. As an example, configuration of motor parameters in [1.4 MOTOR CONTROL] (drC-) will be reflected in the [1.1 SIMPLY START] (SIM-) parameters.

The [1.1-SIMPLY START] (SIM-) menu can be used for quick startup, which is sufficient for the majority of applications.

Note: The parameters of the [1.1 SIMPLY START] (SIM-) menu must be entered in the order in which they appear, as the later ones are dependent on the first ones.
For example [2/3 wire control] (tCC) must be configured before any other parameters.

Macro configuration

Macro configuration provides a means of speeding up the configuration of functions for a specific field of application.

Selecting a macro configuration assigns the Inputs/Outputs in this macro configuration.

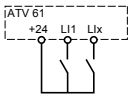
Input/ output	**[Start/Stop]**	**[Gen. Use]**	**[PID regul.]**	**[Network C.]**	**[Pumps.Fans]**
AI1	[Ref.1 channel]	[Ref.1 channel]	[Ref.1 channel] (PID reference)	[Ref.2 channel] ([Ref.1 channel] = integrated Modbus)	[Ref.1 channel]
AI2	[No]	[Summing ref. 2]	[PID feedback]	[No]	[Ref.1B channel]
AO1	[Motor freq.]	[Motor freq.]	[Motor freq.]	[Motor freq.]	[Motor freq.]
R1	[No drive flt]	[No drive flt]	[No drive flt]	[No drive flt]	[No drive flt]
R2	[No]	[No]	[No]	[No]	[Drv running]
LI1 (2-wire)	[Forward]	[Forward]	[Forward]	[Forward]	[Forward]
LI2 (2-wire)	[Fault reset]	[Reverse]	[Fault reset]	[Fault reset]	[No]
LI3 (2-wire)	[No]	[Jog]	[PID integral reset]	[Ref. 2 switching]	[Ref 1B switching]
LI4 (2-wire)	[No]	[Fault reset]	[2 preset PID ref.]	[Forced local]	[Fault reset]
LI5 (2-wire)	[No]	[Torque limitation]	[4 preset PID ref.]	[No]	[No]
LI6 (2-wire)	[No]	[No]	[No]	[No]	[No]
LI1 (3-wire)	Stop	Stop	Stop	Stop	Stop
LI2 (3-wire)	[Forward]	[Forward]	[Forward]	[Forward]	[Forward]
LI3 (3-wire)	[Fault reset]	[Reverse]	[Fault reset]	[Fault reset]	[No]
LI4 (3-wire)	[No]	[Jog]	[PID integral reset]	[Ref. 2 switching]	[Ref 1B switching]
LI5 (3-wire)	[No]	[Fault reset]	[2 preset PID ref.]	[Forced local]	[Fault reset]
LI6 (3-wire)	[No]	[Torque limitation]	[4 preset PID ref.]	[No]	[No]

The assignment of inputs LI1 to LI6 differs in 3-wire control.

Note: All these can be modified, adjusted and reassigned: consult the CD-ROM supplied with the drive controller.

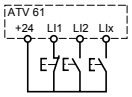
Code	Name/Description	Adjustment range	Factory setting
tCC	❑ **[2/3 wire control]**		[2 wire] (2C)
2C 3C	☐ **[2 wire]** (2C) ☐ **[3 wire]** (3C)		

2-wire control: This is the input state (0 or 1) or edge (0 to 1 or 1 to 0), which controls running or stopping.



Example of source wiring:
LI1: forward
LIx: reverse

3-wire control
(Pulse control): A forward or reverse pulse is sufficient to command starting, a stop pulse is sufficient to command stopping.



Example of source wiring:

LI1: stop
LI2: forward
LIx: reverse

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

To change the assignment of [2/3 wire control] (tCC) press the ENT key for 2 s.
The following function will be returned to factory settings: [2 wire type] (tCt), as will the functions assigning the logic inputs (consult the CD-ROM with the drive controller).
The macro configuration selected will also be reset if it has been customized (loss of custom settings).
Check that this change is compatible with the wiring diagram used.

Failure to follow this instruction can result in death or serious injury.

CFG	❑ **[Macro configuration]**		[Pumps.Fans] (PnF)
StS GEn PId nEt PnF	☐ **[Start/Stop]** (StS): Start/stop ☐ **[Gen. Use]** (GEn): General use ☐ **[PID regul.]** (PId): PID regulation ☐ **[Network C.]** (nEt): Communication bus ☐ **[Pumps.Fans]** (PnF): Pumps/fans		

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

To change the assignment of [Macro configuration] (CFG) press the ENT key for 2 s.
Check that the selected macro configuration is compatible with the wiring diagram used.

Failure to follow this instruction can result in death or serious injury.

CCFG	❑ **[Customized macro]**		
	Read-only parameter, visible only if at least one macro configuration parameter has been modified.		
YES	☐ **[Yes]** (YES)		

Code	Name/Description	Adjustment range	Factory setting
bFr	❑ **[Standard mot. freq]**		[50 Hz IEC] (50)
50 60	☐ **[50 Hz IEC] (50)**: IEC ☐ **[60 Hz NEMA] (60)**: NEMA This parameter modifies the presets of the following parameters: [Rated motor power] (nPr), [Rated motor volt.] (UnS), [Rated mot. current] (nCr), [Rated motor freq.] (FrS), [Rated motor speed] (nSP) and [Max frequency] (tFr), see below; and [Mot. therm. current] (ItH) and [High speed] (HSP), see page 30.		
IPL	❑ **[Input phase loss]**		According to drive controller rating
nO YES	☐ **[Ignore]** (nO): Fault ignored, to be used when the drive controller is supplied via a single phase supply or by the DC bus. ☐ **[Freewheel]** (YES): Fault with freewheel stop. If one phase is lost, the drive controller switches to fault mode [Input phase loss] (IPL); but if 2 or 3 phases are lost, the drive controller continues to operate until it trips on an undervoltage fault. This parameter is only accessible in this menu on ATV61H037M3 to HU75M3 drive controllers (used with a single phase supply).		
nPr	❑ **[Rated motor power]**	According to drive controller rating	According to drive controller rating
	Rated motor power given on the nameplate, in kW if [Standard mot. freq] (bFr) = [50 Hz IEC] (50), in HP if [Standard mot. freq] (bFr) = [60 Hz NEMA] (60).		
UnS	❑ **[Rated motor volt.]**	According to drive controller rating	According to drive rating and [Standard mot. freq] (bFr)
	Rated motor voltage given on the nameplate. ATV61●●●M3: 100 to 240 V ATV61●●●N4: 200 to 480 V		
nCr	❑ **[Rated mot. current]**	0.25 to 1.1 or 1.2 Hz according to rating (1)	According to drive rating and [Standard mot. freq] (bFr)
	Rated motor current given on the nameplate.		
FrS	❑ **[Rated motor freq.]**	10 to 500 or 1000 Hz according to rating	50 Hz
	Rated motor frequency given on the nameplate. The factory setting is 50 Hz, or preset to 60 Hz if [Standard mot. freq] (bFr) is set to 60 Hz.		
nSP	❑ **[Nom motor speed]**	0 to 60000 RPM	According to drive controller rating
	Rated motor speed given on the nameplate. 0 to 9999 rpm then 10.00 to 60.00 krpm on the integrated display terminal. If, rather than the rated speed, the nameplate indicates the synchronous speed and the slip in Hz or as a %, calculate the rated speed as follows: • Nominal speed = Synchronous speed x $\frac{100 - \text{slip as a \%}}{100}$ or • Nominal speed = Synchronous speed x $\frac{50 - \text{slip in Hz}}{50}$ (50 Hz motors) or • Nominal speed = Synchronous speed x $\frac{60 - \text{slip in Hz}}{60}$ (60 Hz motors)		
tFr	❑ **[Max frequency]**	10 to 1000 Hz	60 Hz
	The factory setting is 60 Hz, or preset to 72 Hz if [Standard mot. freq] (bFr) is set to 60 Hz. The maximum value is limited by the following conditions: • It must not exceed 10 times the value of [Rated motor freq.] (FrS) • Values between 500 Hz and 1000 Hz are possible only in V/F control and for powers limited to 37 kW (50 HP) for ATV61H●●● and 45 kW (60 HP) for ATV61W●●●. In this case configure [Motor control type] (Ctt) before [Max frequency] (tFr).		

(1) "In" corresponds to the rated controller current indicated in the Installation Manual and on the controller nameplate.

Code	Name/Description	Factory setting
tUn	❑ **[Auto tuning]**	[No] (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 this instruction will result in death or serious injury.

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

- The following motor parameters must be correctly configured before starting auto tuning: [Rated motor volt.] (UnS), [Rated motor freq.] (FrS), [Rated mot. current] (nCr), [Rated motor speed] (nSP), and [Rated motor power] (nPr).
- If one or more of these parameters is modified after auto tuning has been performed, Auto tuning (tUn) will be set to [No] and the procedure must be repeated.

Failure to follow this instruction can result in injury or equipment damage.

nO
YES
dOnE

☐ **[No]** (nO): Auto-tuning not performed.
☐ **[Yes]** (YES) : Auto-tuning is performed as soon as possible, then the parameter automatically changes to [Done] (dOnE).
☐ **[Done]** (dOnE): Use of the values given the last time auto-tuning was performed.
Caution:
- It is essential that all motor parameters—[Rated motor volt.] (UnS), [Rated motor freq.] (FrS), [Rated mot. current.] (nCr), [Rated motor speed] (nSP), [Rated motor power] (nPr)—are configured correctly before starting auto-tuning.
  If one or more of these parameters is modified after auto-tuning has been performed, [Auto tuning] (tUn) will return to [No] (nO) and the procedure must be repeated.
- Auto-tuning is performed only if no stop command has been activated. If a freewheel stop or fast stop function has been assigned to a logic input, this input must be set to 1 (active at 0).
- Auto-tuning takes priority over any run or prefluxing commands, which will take effect after the auto-tuning sequence.
- If auto-tuning fails, the drive controller displays [No] (nO) and, depending on the configuration of [Autotune fault mgt] (tnL) (consult the CD-ROM supplied with the drive controller), may switch to [Auto-tuning] (tnF) fault mode.
- Auto-tuning may last for 1 to 2 seconds. Do not interrupt; wait for the display to change to [Done] (dOnE) or [No] (nO).

Note: During auto-tuning the motor operates at rated current.

tUS	❑ **[Auto tuning status]**	[Not done] (tAb)

(for information only, cannot be modified)
tAb
PEnd
PrOG
FAIL
dOnE
☐ **[Not done]** (tAb): The default stator resistance value is used to control the motor.
☐ **[Pending]** (PEnd): Auto-tuning has been requested but not yet performed.
☐ **[In Progress]** (PrOG): Auto-tuning in progress.
☐ **[Failed]** (FAIL): Auto-tuning failed.
☐ **[Done]** (dOnE): The stator resistance measured by the auto-tuning function is used to control the motor.

PHr	❑ **[Output Ph rotation]**	[ABC] (AbC)

AbC
ACb
☐ **[ABC]** (AbC): Forward
☐ **[ACB]** (ACb): Reverse
This parameter can be used to reverse the rotation direction of the motor without reversing the wiring.

Parameters that can be changed while running or stopped

Code	Name/Description		Factory setting
ItH	❑ **[Mot. therm. current]**	0 to 1.1 or 1.2 In (1) according to rating	According to drive controller rating
	Motor thermal protection current, to be set to the rated current indicated on the nameplate.		
ACC	❑ **[Acceleration]**	0.1 to 999.9 s	3.0 s
	Time to accelerate from 0 to the [Rated motor freq.] (FrS) (page 28). Make sure that this value is compatible with the inertia being driven.		
dEC	❑ **[Deceleration]**	0.1 to 999.9 s	3.0 s
	Time to decelerate from the [Rated motor freq.] (FrS) (page 28) to 0. Make sure that this value is compatible with the inertia being driven.		
LSP	❑ **[Low speed]**		0
	Motor frequency at minimum reference, can be set between 0 and [High speed] (HSP).		
HSP	❑ **[High speed]**		50 Hz
	Motor frequency at maximum reference, can be set between [Low speed] (LSP) and [Max frequency] (tFr). The factory setting changes to 60 Hz if [Standard mot. freq] (bFr) = [60 Hz] (60).		

(1) “In” corresponds to the rated controller current indicated in the installation manual and on the controller nameplate.

Faults and Troubleshooting

Drive controller does not start, no fault displayed

- If the display does not light up, check the power supply to the drive controller.
- If the drive controller displays [Freewheel] (nSt) or [Fast stop] (FSt):
  The Fast Stop and Freewheel functions prevent the drive controller from starting if the corresponding logic inputs are not powered up. This is normal—these functions are active at zero so that the drive controller will stop safely if there is a wire break.
- Make sure that the run command input or inputs are activated according to the selected control mode:
  - [2/3 wire control] (tCC) parameter, described on page 27
  - [2 wire type] (tCt) parameter, described in the ATV61 programming manual (provided on the CD-ROM supplied with the drive controller).

Faults that cannot be reset automatically

⚠ DANGER

LOSS OF PERSONNEL AND EQUIPMENT PROTECTION

- Enabling the fault inhibition parameter (InH) will disable the drive controller protection features.
- InH should not be enabled for typical applications of this equipment.
- InH should be enabled only in extraordinary situations where a thorough risk analysis demonstrates that the presence of adjustable speed drive protection poses a greater risk than personnel injury or equipment damage.

Failure to follow these instructions will result in death or serious injury.

The cause of the fault must be removed before resetting by turning off and then back on.
AI2F, EnF, SOF, SPF and tnF faults can also be reset remotely by means of a logic input or control bit (consult the CD-ROM supplied with the drive controller).
EnF, InFA, InFb, SOF, SPF and tnF faults can be inhibited and cleared remotely by means of a logic input or control bit (consult the CD-ROM supplied with the drive controller).

Faults that cannot be reset automatically

Fault	Name	Probable cause	Remedy
AI2F	[AI2 input]	• AI2 signal out of range	• Check the wiring of analog input AI2 and the value of the signal.
bOF	[DBR overload]	• Incorrect DB resistor settings	• Check the size of the resistor and wait for it to cool down. • Check parameters [DB Resistor Power] (brP) and [DB Resistor value] (brU) (consult the CD-ROM supplied with the drive controller).
bUF	[DB unit sh. Circuit]	• Short-circuit output from braking unit	• Check the wiring of the braking unit and the resistor. • Check the braking resistor.
CrF1	[Precharge]	• Charging relay control fault or charging resistor damaged	• Turn the drive controller off and then back on again. • Check the internal connections. • Contact Schneider Electric Product Support.
CrF2	[Thyr. soft charge]	• DC bus charging fault (thyristors)	
EEF1	[Control Eeprom]	• Internal memory fault, control card	• Check the environment (electromagnetic compatibility). • Turn off, reset, return to factory settings. • Contact Schneider Electric Product Support.
EEF2	[Power Eeprom]	• Internal memory fault, power card	
FCF1	[Out. contact. stuck]	• The output contactor remains closed although the opening conditions have been met	• Check the contactor and its wiring. • Check the feedback circuit.
HdF	[IGBT desaturation]	• Short-circuit or grounding at the drive controller output	• Check the cables connecting the drive controller to the motor, and the motor insulation. • Perform the diagnostic tests via the [1.10 DIAGNOSTICS] menu.

Faults that cannot be reset automatically *(continued)*

Fault	Name	Probable cause	Remedy
ILF	[internal com. link]	• Communication fault between option card and drive controller	• Check the environment (electromagnetic compatibility). • Check the connections. • Check that no more than 2 option cards (max. permitted) have been installed on the drive controller. • Replace the option card. • Contact Schneider Electric Product Support.
InF1	[Rating error]	• The power card is different from the card stored	• Check the catalog reference of the power card.
InF2	[Incompatible PB]	• The power card is incompatible with the control card	• Check the catalog reference of the power card and its compatibility.
InF3	[Internal serial link]	• Communication fault between the internal cards	• Check the internal connections. • Contact Schneider Electric Product Support.
InF4	[Internal MFG area]	• Internal data inconsistent	• Contact Schneider Electric Product Support to have the drive controller recalibrated.
InF6	[Internal-option]	• The option installed in the controller is not recognized	• Check the catalog reference and compatibility of the option.
InF7	[Internal-hard init.]	• Initialization of the drive controller is incomplete	• Turn off and reset.
InF8	[Internal-ctrl supply]	• The control section power supply is incorrect	• Check the control section power supply.
InF9	[Internal-I measure]	• The current measurements are incorrect	• Replace the current sensors or the power card. • Contact Schneider Electric Product Support.
InFA	[Internal-mains circuit]	• The input stage is not operating correctly	• Perform the diagnostic tests via the [1.10 DIAGNOSTICS] menu. • Contact Schneider Electric Product Support.
InFb	[Internal-th. sensor]	• The drive controller temperature sensor is not operating correctly	• Replace the temperature sensor. • Contact Schneider Electric Product Support.
InFC	[Internal-time meas.]	• Fault on the electronic time measurement component	• Contact Schneider Electric Product Support.
InFE	[internal- CPU]	• Internal microprocessor fault	• Turn off and reset. Contact Schneider Electric Product Support.
OCF	[Overcurrent]	• Motor parameters not correct • Excessive inertia or load • Mechanical locking	• Check the parameters. • Check the size of the motor, controller, and load. • Check the state of the mechanism.
PrF	[Power removal]	• Fault with the drive's Power Removal safety function	• Contact Schneider Electric Product Support.
SCF1	[Motor short circuit]	• Short-circuit or grounding at the drive controller output • Significant earth leakage current at the controller output if several motors are connected in parallel	• Check the cables connecting the drive controller to the motor, and the insulation of the motor • Perform the diagnostic tests via the [1.10 DIAGNOSTICS] menu. • Reduce the switching frequency. • Connect chokes in series with the motor.
SCF2	[Impedant sh. circuit]		
SCF3	[Ground short circuit]		
SOF	[Overspeed]	• Instability • Overhauling load	• Check the motor, gain and stability parameters. • Add a braking resistor. • Check the size of the motor, controller, and load.
tnF	[Auto-tuning]	• Special motor, or motor power not suitable for the drive controller • Motor not connected to the drive controller	• Check that the motor and drive controller are compatible. • Check that the motor is present during auto-tuning. • If an output contactor is being used, close it during auto-tuning.

Faults that can be reset with the automatic restart function, after the cause has been removed

⚠ DANGER

LOSS OF PERSONNEL AND EQUIPMENT PROTECTION

- Enabling the fault inhibition parameter (InH) will disable the drive controller protection features.
- InH should not be enabled for typical applications of this equipment.
- InH should be enabled only in extraordinary situations where a thorough risk analysis demonstrates that the presence of adjustable speed drive protection poses a greater risk than personnel injury or equipment damage.

Failure to follow these instructions will result in death or serious injury.

These faults can also be reset by turning the drive controller off then on again or by means of a logic input or control bit (consult the CD-ROM supplied with the drive controller).
APF, CnF, COF, EPF1, EPF2, FCF2, LFF2, LFF3, LFF4, nFF, ObF, OHF, OLC, OLF, OPF1, OPF2, OSF, OtF1, OtF2, OtFL, PHF, PtF1, PtF2, PtFL, SLF1, SLF2, SLF3, SPIF, SSF, tJF, and ULF faults can be inhibited and cleared remotely by means of a logic input or control bit (consult the CD-ROM supplied with the drive controller).

Faults that can be reset with the automatic restart function

Fault	Name	Probable cause	Remedy
APF	[Application fault]	• "Controller Inside" card fault	• Check the card programming. Refer to the card documentation.
CnF	[Com. network]	• Communication fault on communication card	• Check the environment (electromagnetic compatibility). • Check the wiring. • Check the time-out. • Replace the option card. • Contact Schneider Electric Product Support.
COF	[CAN com.]	• Interruption in communication on the CANopen bus	• Check the communication bus. • Check the time-out. • Refer to the CANopen user's manual.
EPF1	[External flt-LI/Bit]	• Fault triggered by an external device, depending on user	• Check the device which caused the fault, and reset.
EPF2	[External fault com.]	• Fault triggered by a communication network	• Check for the cause of the fault and reset.
FCF2	[Out. contact. open.]	• The output contactor remains open although the closing conditions have been met	• Check the contactor and its wiring. • Check the feedback circuit.
LCF	[input contactor]	• The drive controller is not turned on even though [Mains V. time out] (LCt) has elapsed.	• Check the contactor and its wiring. • Check the time-out. • Check the line/contactor/controller connection.
LFF2 LFF3 LFF4	[AI2 4-20mA loss] [AI3 4-20mA loss] [AI4 4-20mA loss]	• Loss of the 4–20 mA reference on analog input AI2, AI3 or AI4	• Check the connection on the analog inputs.
nFF	[No Flow Fault]	• Zero fluid	• Check and correct the cause of the fault. • Check the zero fluid detection parameters (consult the CD-ROM supplied with the drive controller).
ObF	[Overbraking]	• Braking ramp too short • Overhauling load	• Increase the deceleration time. • Install a braking resistor if necessary. • Activate the [Dec ramp adapt.] (brA) function (consult the CD-ROM supplied with the drive controller), if it is compatible with the application.

Faults that can be reset with the automatic restart function *(continued)*

Fault	Name	Probable cause	Remedy
OHF	[Drive overheat]	• Ambient temperature too high • Drive ventilation blocked • Drive cooling fan failure	• Check the motor load, the drive ventilation, and the ambient temperature. Wait for the controller to cool down before restarting.
OLC	[Proc.Overload Flt]	• Process overload (consult the programming manual on the CD-ROM)	• Check and remove the cause of the overload. • Check the parameters of the [PROCESS UNDERLOAD] (OLd-) function (consult the CD-ROM supplied with the controller).
OLF	[Motor overload]	• Motor power rating too small for the application • Overload setting incorrect for the motor full-load rating • Output phase failure (see OPF1)	• Check the setting of the motor thermal protection. Check the motor load. Wait for the motor to cool down before restarting.
OPF1	[1 motor phase loss]	• Loose connection causing loss of one phase at controller output	• Check the connections from the drive controller to the motor.
OPF2	[3 motor phase loss]	• Motor not connected or motor power too low • Output contactor open • Instantaneous instability in the motor current	• Check the connections from the drive controller to the motor. • If an output contactor is being used, consult the CD-ROM supplied with the drive controller. • Test on a low-power motor or without a motor: In factory settings mode, motor phase loss detection is active [Output Phase Loss] (OPL) = [Yes] (YES). To check the drive controller in a test or maintenance environment without having to switch to a motor with the same rating as the drive controller (particularly useful in the case of high-power drive controllers), deactivate motor phase loss detection [Output phase loss] (OPL) = [No] (nO). • Check and optimize the parameters [Rated motor volt.] (UnS) and [Rated mot. current.] (nCr) and perform an [Auto tuning] (tUn).
OSF	[Mains overvoltage]	• Line voltage too high • Disturbed line supply	• Check the line voltage.
OTF1	[PTC1 overheat]	• Overheating of the PTC1 probes detected	• Check the motor load and motor size. • Check the motor ventilation. • Wait for the motor to cool before restarting. • Check the type and state of the PTC probes.
OTF2	[PTC2 overheat]	• Overheating of the PTC2 probes detected	
OTFL	[PTC=LI6 overheat]	• Overheating of PTC probes detected on input LI6.	
PTF1	[PTC1 probe]	• PTC1 probes open or short-circuited	• Check the PTC probes and the wiring between them and the motor/controller.
PTF2	[PTC2 probe]	• PTC2 probes open or short-circuited	
PTFL	[LI6=PTC probe]	• PTC probes on input LI6 open or short-circuited	
SCF4	[IGBT short circuit]	• Power component fault	• Perform a test via the [1.10 DIAGNOSTICS] menu. • Contact Schneider Electric Product Support.

Faults that can be reset with the automatic restart function *(continued)*

Fault	Name	Probable cause	Remedy
SCFS	[Motor short circuit]	• Short-circuit at drive controller output	• Check the cables connecting the controller to the motor, and the motor insulation. • Perform a test via the [1.10 DIAGNOSTICS] menu. • Contact Schneider Electric Product Support.
SLF1	[Modbus com.]	• Interruption in communication on the Modbus bus	• Check the communication bus. • Check the time-out. • Refer to the Modbus User's Manual
SLF2	[PowerSuite com.]	• Fault communicating with PowerSuite™ software	• Check the PowerSuite -connecting cable. • Check the time-out.
SLF3	[HMI com.]	• Fault communicating with the graphic display terminal	• Check the terminal connection. • Check the time-out.
SPIF	[PI Feedback]	• PID feedback below the lower limit	• Check the PID function feedback. • Check the PID feedback supervision threshold and time delay (consult the CD-ROM supplied with the drive controller).
SSF	[Torque/current lim]	• Switch to torque limitation	• Check if there are any mechanical problems. • Consult the CD-ROM supplied with the drive controller.
tJF	[IGBT overheat]	• Drive controller overheated	• Check the size of the load, motor, and controller. • Reduce the switching frequency. • Wait for the drive controller to cool before restarting.
ULF	[Proc. Underload Flt]	• Process underload	• Check and remove the cause of the underload. • Consult the CD-ROM supplied with the drive controller.

Faults that can be reset as soon as their causes are removed

⚠ DANGER

LOSS OF PERSONNEL AND EQUIPMENT PROTECTION

- Enabling the fault inhibition parameter (InH) will disable the drive controller protection features.
- InH should not be enabled for typical applications of this equipment.
- InH should be enabled only in extraordinary situations where a thorough risk analysis demonstrates that the presence of adjustable speed drive protection poses a greater risk than personnel injury or equipment damage.

Failure to follow these instructions will result in death or serious injury.

The USF fault can be inhibited and cleared remotely by means of a logic input or control bit ([Fault inhibit assign.] (InH), consult the CD-ROM supplied with the drive controller).

Faults that can be reset as soon as their causes are removed

Fault	Name	Probable cause	Remedy
CFF	[Incorrect config.]	• Option card changed or removed • The current configuration is inconsistent	• Check that there are no card errors. • If the option card was changed or removed deliberately, consult the CD-ROM supplied with the drive controller. • Return to factory settings or retrieve the backup configuration, if it is valid (consult the CD-ROM supplied with the drive controller).
CFI	[Invalid config.]	• Invalid configuration. The configuration loaded in the controller via the bus or network is inconsistent.	• Check the configuration loaded previously. • Load a compatible configuration.
HCF	[Cards pairing]	• The [CARDS PAIRING] (PPI-) function has been configured and a drive card has been changed	• Consult the CD-ROM supplied with the drive controller.
PHF	[Input phase loss]	• Controller incorrectly supplied or a fuse blown • Failure of one phase • 3-phase ATV61 used on a single phase line supply • Unbalanced load This protection operates only with the drive controller on load	• Check the power connection and the fuses. • Use a 3-phase mains supply • Disable the fault by [Input phase loss] (IPL) = [No] (nO).
PrtF	[Power Ident]	• The [Power Identification] (Prt) parameter is incorrect. • Control card replaced by a control card configured on a drive controller with a different rating	• Enter the correct parameter (reserved for Schneider Electric product support). • Check that there are no card errors. • If the control card was changed deliberately, consult the CD-ROM supplied with the drive controller.
USF	[Undervoltage]	• Line supply too low • Transient voltage dip • Damaged pre-charge resistor	• Check the voltage and the voltage parameter (consult the CD-ROM supplied with the drive controller). • Replace the pre-charge resistor. • Contact Schneider Electric Product Support.

30072-451-60B

30072-451-60B

5-2006

HAMMOND MANUFACTURING

Quality Products. Service Excellence.

Type 4 Mild Steel Wallmount Enclosure *Eclipse Series*

Hinge Door with Quarter Turn/Handle

Panel Sold Separately

Application

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

Standards

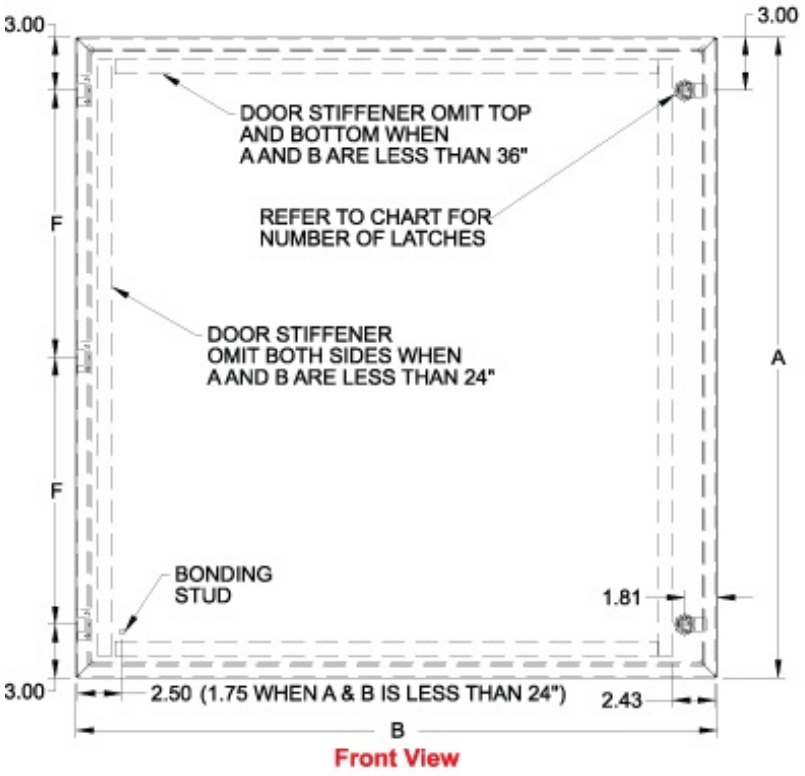
- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
  - NEMA Type 3R, 4, and 12
  - IEC 60529, IP66

Construction

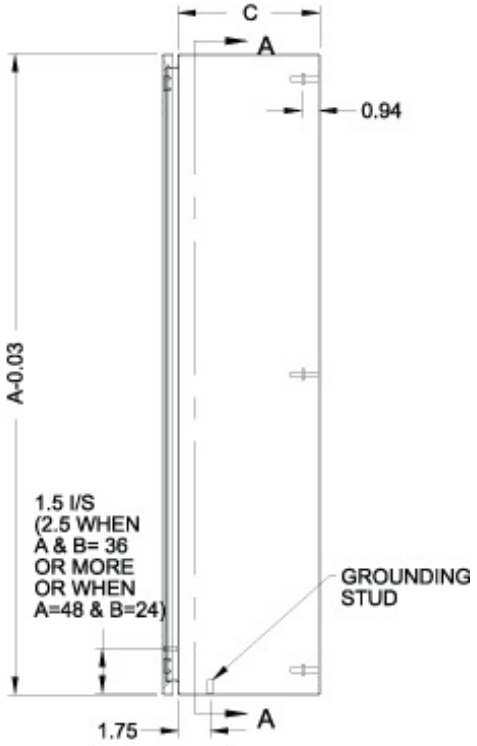
- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

Finish

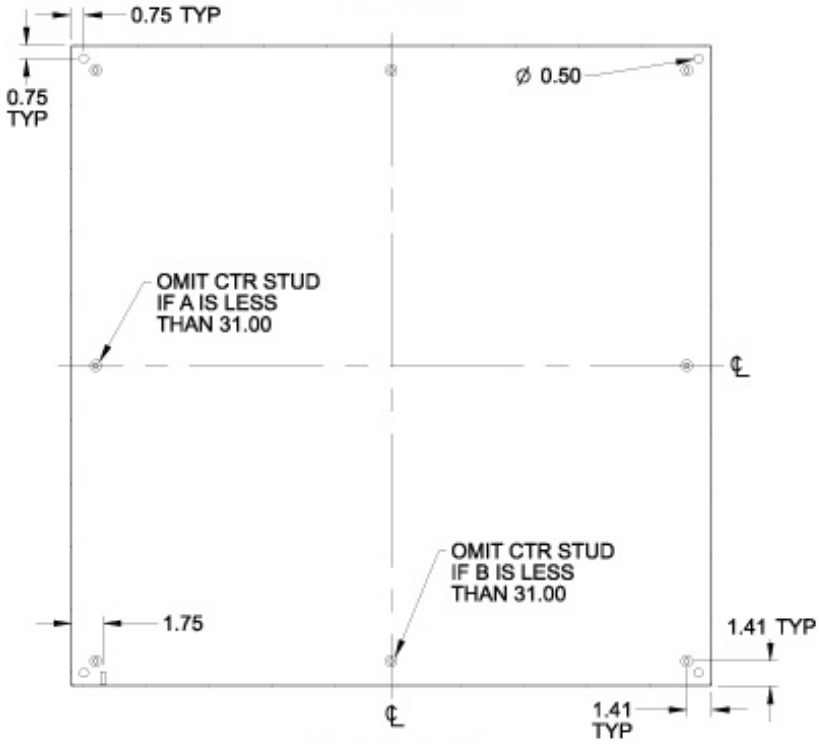
- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).



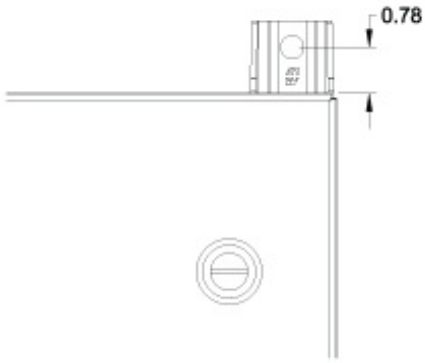
Front View



Side View



SECTION A-A



Mounting Foot Detail

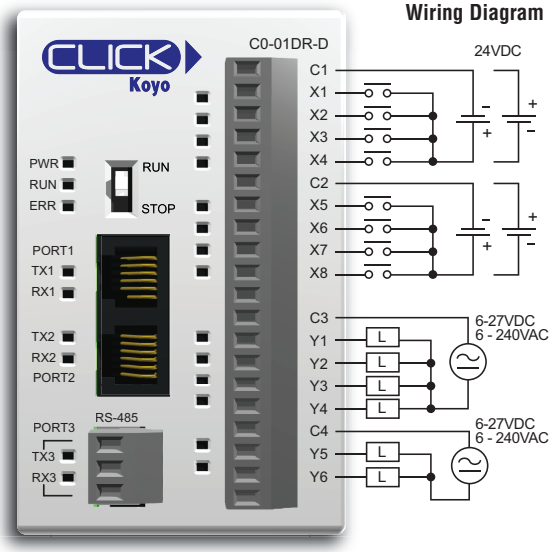
Part No. (ANSI 61 Gray)	Part No. (RAL 7035 Light Gray)	Overall Dimensions A	B	C	Door/Body Gauge	Latches Qty	Type	Opt. Panel Part No.	Panel Size D	E	# Hinges	F	Ship Wt. (lbs)
EN4SD12126GY	**EN4SD12126LG**	12.00	12.00	6.00	16	1	Qtr Turn	**EP1212**	10.20	10.20	2	6.00	12
EN4SD12246GY	**EN4SD12246LG**	12.00	24.00	6.00	16	1	Qtr Turn	**EP1224**	10.20	22.20	2	18.00	24
EN4SD16126GY	**EN4SD16126LG**	16.00	12.00	6.00	16	1	Qtr Turn	**EP1612**	14.20	10.20	2	10.00	16
EN4SD16166GY	**EN4SD16166LG**	16.00	16.00	6.00	16	1	Qtr Turn	**EP1616**	14.20	14.20	2	10.00	19
EN4SD16206GY	**EN4SD16206LG**	16.00	20.00	6.00	16	1	Qtr Turn	**EP1620**	14.20	18.20	2	10.00	22
EN4SD20126GY	**EN4SD20126LG**	20.00	12.00	6.00	16	1	Qtr Turn	**EP2012**	18.20	10.20	2	14.00	20

EN4SD242410GY	**EN4SD242410LG**	24.00	24.00	10.00	14	2	Qtr. Turn	**EP2424**	22.20	22.20	2	18.00	45
EN4SD243010GY	**EN4SD243010LG**	24.00	30.00	10.00	14	2	Qtr. Turn	**EP2430**	22.20	28.20	2	18.00	53
EN4SD302010GY	**EN4SD302010LG**	30.00	20.00	10.00	14	2	Qtr. Turn	**EP3020**	28.20	18.20	3	12.00	47
EN4SD302410GY	**EN4SD302410LG**	30.00	24.00	10.00	14	2	Qtr. Turn	**EP3024**	28.20	22.20	3	12.00	53
EN4SD303010GY	**EN4SD303010LG**	30.00	30.00	10.00	14	2	Qtr. Turn	**EP3030**	28.20	28.20	3	12.00	75
EN4SD362410GY	**EN4SD362410LG**	36.00	24.00	10.00	14	2	Qtr. Turn	**EP3624**	34.20	22.20	3	15.00	70
EN4SD363010GY	**EN4SD363010LG**	36.00	30.00	10.00	14	2	Qtr. Turn	**EP3630**	34.20	28.20	3	15.00	84
EN4SD363610GY	**EN4SD363610LG**	36.00	36.00	10.00	14	2	Qtr. Turn	**EP3636**	34.20	34.20	3	15.00	100
EN4SD423010GY	**EN4SD423010LG**	42.00	30.00	10.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	107
EN4SD423610GY	**EN4SD423610LG**	42.00	36.00	10.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	117
EN4SD482410GY	**EN4SD482410LG**	48.00	24.00	10.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	95
EN4SD483010GY	**EN4SD483010LG**	48.00	30.00	10.00	14	1	3-point	**EP4830**	46.20	28.20	4	14.00	120
EN4SD483610GY	**EN4SD483610LG**	48.00	36.00	10.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	125
EN4SD603610GY	**EN4SD603610LG**	60.00	36.00	10.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	150
EN4SD201612GY	**EN4SD201612LG**	20.00	16.00	12.00	16	1	Qtr Turn	**EP2016**	18.20	14.20	2	14.00	32
EN4SD202012GY	**EN4SD202012LG**	20.00	20.00	12.00	16	1	Qtr Turn	**EP2020**	18.20	18.20	2	14.00	34
EN4SD242012GY	**EN4SD242012LG**	24.00	20.00	12.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	38
EN4SD242412GY	**EN4SD242412LG**	24.00	24.00	12.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	47
EN4SD302412GY	**EN4SD302412LG**	30.00	24.00	12.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	57
EN4SD303012GY	**EN4SD303012LG**	30.00	30.00	12.00	14	2	Qtr Turn	**EP3030**	28.20	28.20	3	12.00	80
EN4SD362412GY	**EN4SD362412LG**	36.00	24.00	12.00	14	2	Qtr Turn	**EP3624**	34.20	22.20	3	15.00	62
EN4SD363012GY	**EN4SD363012LG**	36.00	30.00	12.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	91
EN4SD363612GY	**EN4SD363612LG**	36.00	36.00	12.00	14	2	Qtr Turn	**EP3636**	34.20	34.20	3	15.00	104
EN4SD423012GY	**EN4SD423012LG**	42.00	30.00	12.00	14	1	3-point	**EP4230**	40.20	28.20	4	12.00	111
EN4SD423612GY	**EN4SD423612LG**	42.00	36.00	12.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	121
EN4SD482412GY	**EN4SD482412LG**	48.00	24.00	12.00	14	1	3-point	**EP4824**	46.20	22.20	4	14.00	98
EN4SD483612GY	**EN4SD483612LG**	48.00	36.00	12.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603612GY	**EN4SD603612LG**	60.00	36.00	12.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	165
EN4SD723012GY	**EN4SD723012LG**	72.00	30.00	12.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	190
EN4SD723612GY	**EN4SD723612LG**	72.00	36.00	12.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	195
EN4SD242016GY	**EN4SD242016LG**	24.00	20.00	16.00	16	1	Qtr Turn	**EP2420**	22.20	18.20	2	18.00	52
EN4SD242416GY	**EN4SD242416LG**	24.00	24.00	16.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	66
EN4SD302416GY	**EN4SD302416LG**	30.00	24.00	16.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	85
EN4SD363016GY	**EN4SD363016LG**	36.00	30.00	16.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	102
EN4SD423616GY	**EN4SD423616LG**	42.00	36.00	16.00	14	1	3-point	**EP4236**	40.20	34.20	4	12.00	140
EN4SD483616GY	**EN4SD483616LG**	48.00	36.00	16.00	14	1	3-point	**EP4836**	46.20	34.20	4	14.00	148
EN4SD603616GY	**EN4SD603616LG**	60.00	36.00	16.00	14	1	3-point	**EP6036**	58.20	34.20	4	18.00	200
EN4SD723016GY	**EN4SD723016LG**	72.00	30.00	16.00	14	2	Qtr Turn, 5-point	**EP7230**	70.20	28.20	5	16.50	215
EN4SD723616GY	**EN4SD723616LG**	72.00	36.00	16.00	14	2	Qtr Turn, 5-point	**EP7236**	70.20	34.20	5	16.50	217
EN4SD242420GY	**EN4SD242420LG**	24.00	24.00	20.00	14	2	Qtr Turn	**EP2424**	22.20	22.20	2	18.00	70
EN4SD302420GY	**EN4SD302420LG**	30.00	24.00	20.00	14	2	Qtr Turn	**EP3024**	28.20	22.20	3	12.00	82
EN4SD363020GY	**EN4SD363020LG**	36.00	30.00	20.00	14	2	Qtr Turn	**EP3630**	34.20	28.20	3	15.00	117

Standard CPU Module Specifications

C0-01DR-D <--->

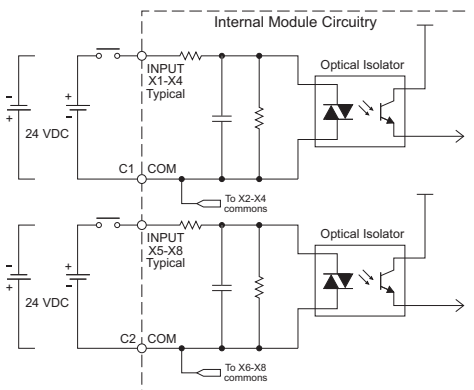
8 DC Input/6 Relay Output Micro PLC



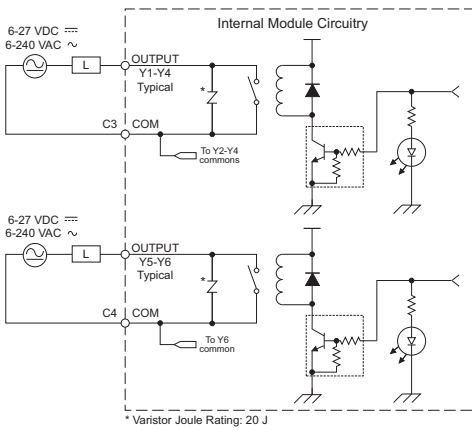
Wiring Diagram

NOTE: When using Standard CPUs, you must use CLICK programming software version V1.20 or later.

Equivalent Input Circuit



Equivalent Output Circuit



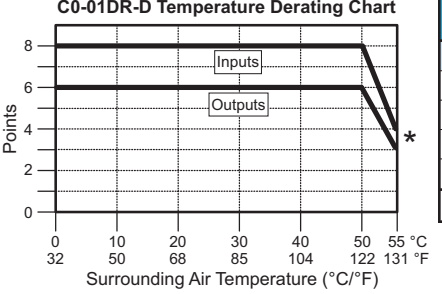
* Varistor Joule Rating: 20 J

C0-01DR-D Built-in I/O Specifications - Inputs	
Inputs per Module	8 (Sink/Source)
Operating Voltage Range	24 VDC
Input Voltage Range	21.6-26.4 VDC
Input Current	X1-2: Typ 5 mA @ 24 VDC X3-8: Typ 4 mA @ 24 VDC
Maximum Input Current	X1-2: 6.0 mA @ 26.4 VDC X3-8: 5.0 mA @ 26.4 VDC
Input Impedance	X1-2: 4.7 kΩ @ 24 VDC X3-8: 6.8 kΩ @ 24 VDC
ON Voltage Level	X1-2: > 19 VDC X3-8: > 19 VDC
OFF Voltage Level	X1-2: < 4 VDC X3-8: < 7 VDC
Minimum ON Current	X1-2: 4.5 mA X3-8: 3.5 mA
Maximum OFF Current	X1-2: 0.1 mA X3-8: 0.5 mA
OFF to ON Response	X1-2: Typ 5 µs Max 20 µs X3-8: Typ 2 ms Max 10 ms
ON to OFF Response	X1-2: Typ 5 µs Max 20 µs X3-8: Typ 3 ms Max 10 ms
Status Indicators	Logic Side (8 points, green LED)
Commons	2 (4 points/common) Isolated

C0-01DR-D Built-in I/O Specifications - Outputs	
Outputs per Module	6
Operating Voltage Range	6-240 VAC (47-63 Hz), 6-27 VDC
Output Voltage Range	5-264 VAC (47-63 Hz), 5-30 VDC
Output Type	Relay, form A (SPST)
Maximum Current	1 A/point; C3: 4 A/common, C4: 2 A/common
Minimum Load Current	5 mA @ 5 VDC
Maximum Inrush Current	3 A for 10 ms
OFF to ON Response	< 15 ms
ON to OFF Response	< 15 ms
Status Indicators	Logic Side (6 points, red LED)
Commons	2 (4 points/com & 2 points/com) Isolated

General Specifications	
Current Consumption at 24VDC	140 mA
Terminal Block Replacement Part No.	C0-16TB
Weight	5.6 oz (160 g)

C0-01DR-D Temperature Derating Chart



* Use every other input/output.

Typical Relay Life (Operations) at Room Temperature	
Voltage & Load Type	**Load Current: 1 A**
30 VDC Resistive	300,000 cycles
30 VDC Solenoid	50,000 cycles
250 VAC Resistive	500,000 cycles
250 VAC Solenoid	200,000 cycles
ON to OFF = 1 cycle	

ZipLink Pre-Wired PLC Connection Cables and Modules for CLICK PLC

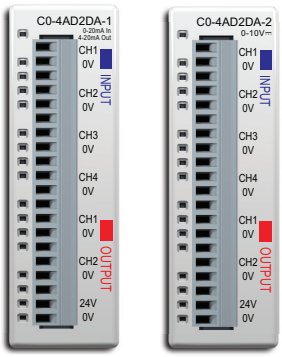
ZL-RTB20
20-pin feed-through connector module

20-pin connector cable
ZL-C0-CBL20 (0.5 m length)
ZL-C0-CBL20-1 (1.0 m length)
ZL-C0-CBL20-2 (2.0 m length)

Choosing the I/O Type / Specifications

Analog I/O Modules (continued)

Analog Combo I/O Modules



C0-4AD2DA-1 **C0-4AD2DA-2**

Analog Combo I/O Modules			
Part Number	**Analog Input Type**	**Analog Output Type**	**External Power Required**
C0-4AD2DA-1	4 channel, current (0-20 mA), 13 bit	2 channel, current sourcing (4-20 mA), 12 bit	24 VDC
C0-4AD2DA-2	4 channel, voltage (0-10 V), 13 bit	4 channel, voltage (0-10 V), 12 bit	24 VDC

General Specifications For All CLICK PLC Products

These general specifications apply to all CLICK CPUs, optional I/O modules, and optional power supply products. Please refer to the appropriate I/O temperature derating charts under both the CPU and I/O module specifications to determine best operating conditions based on the ambient temperature of your particular application.

General Specifications	
Power Input Voltage Range	20-28 VDC
Maximum Power Consumption	5 W (No 5 V use from communication port)
Maximum Inrush Current	30 A (less than 1ms)
Acceptable External Power Drop	Max 10 ms
Operating Temperature	Analog, analog combo I/O modules only: 32°F to 140°F (0°C to 60°C); All other modules: 32°F to 131°F (0°C to 55°C), IEC 60068-2-14 (Test Nb, Thermal Shock)
Storage Temperature	–4°F to 158°F (–20°C to 70°C) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)
Ambient Humidity	30% to 95% relative humidity (non–condensing)
Environmental Air	No corrosive gases. Environmental pollution level is 2 (UL840)
Vibration	MIL STD 810C, Method 514.2, EC60068-2-6 JIS C60068-2-6 (Sine wave vibration test)
Shock	MIL STD 810C, Method 516.2, IEC60068-2-27, JIS C60068-2-27
Noise Immunity	Comply with NEMA ICS3-304, Impulse noise 1µs, 1000V EN61000-4-2 (ESD), EN61000-4-3 (RFI), EN61000-4-4 (FTB) EN61000-4-5 (Surge), EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity) RFI: No interference measured at 150 and 450 MHz (5w/15cm)
Emissions	EN55011:1998 Class A
Agency Approvals	UL508 (File No. E157382, E316037); CE (EN61131-2)
Other	RoHS

CLICK Specifications

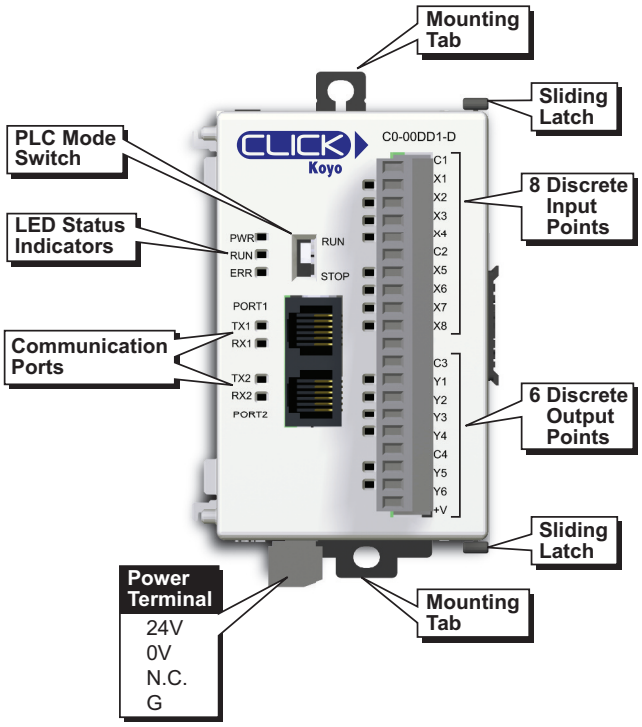
CPU Module Specifications

CPU Module Specifications			
	Basic CPU	**Standard CPU**	**Analog CPU**
Control Method	Stored Program/Cyclic execution method	Stored Program/Cyclic execution method	Stored Program/Cyclic execution method
I/O Numbering System	Fixed in Decimal	Fixed in Decimal	Fixed in Decimal
Ladder Memory (steps)	8000	8000	8000
Total Data Memory (words)	8000	8000	8000
Contact Execution (boolean)	< 0.6us	< 0.6us	< 0.6us
Typical Scan (1k boolean)	1-2 ms	1-2 ms	1-2 ms
RLL Ladder Style Programming	Yes	Yes	Yes
Run Time Edits	No	No	No
Scan	Variable / fixed	Variable / fixed	Variable / fixed
CLICK Programming Software for Windows	Yes	Yes	Yes
Built-in Communication Ports	Yes (two RS-232 ports)	Yes (two RS-232 ports and one RS-485 port)	Yes (two RS-232 ports and one RS-485 port)
FLASH Memory	Standard on CPU	Standard on CPU	Standard on CPU
Built-in Discrete I/O points	8 inputs, 6 outputs	8 inputs, 6 outputs	4 inputs, 4 outputs
Built-in Analog I/O Channels	No	No	2 inputs, 2 outputs
Number of Instructions Available	21	21	21
Control Relays	2000	2000	2000
System Control Relays	1000	1000	1000
Timers	500	500	500
Counters	250	250	250
Interrupt	Yes (external: 8 / timed: 4)	Yes (external: 8 / timed: 4)	Yes (external: 4 / timed: 4)
Subroutines	Yes	Yes	Yes
For/Next Loops	Yes	Yes	Yes
Math (Integer and Hex)	Yes	Yes	Yes
Drum Sequencer Instruction	Yes	Yes	Yes
Internal Diagnostics	Yes	Yes	Yes
Password Security	Yes	Yes	Yes
System Error Log	Yes	Yes	Yes
User Error Log	No	No	No
Memory Backup	Super Capacitor	Super Capacitor + Battery	Super Capacitor + Battery
Battery Backup	No	Yes (battery sold separately; part # D2-BAT-1)	Yes (battery sold separately; part # D2-BAT-1)
Calendar/Clock	No	Yes	Yes
I/O Terminal Block Replacement	ADC p/n C0-16TB	ADC p/n C0-16TB	ADC p/n C0-16TB
Communication Port & Terminal Block Replacement	N/A	ADC p/n C0-03TB	ADC p/n C0-03TB
24 VDC Power Terminal Block Replacement	ADC p/n C0-4TB	ADC p/n C0-4TB	ADC p/n C0-4TB

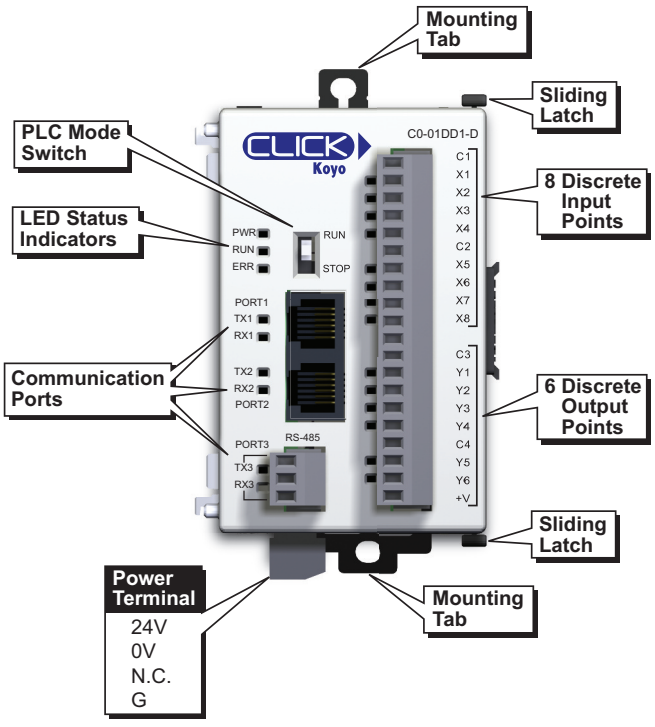
CLICK Specifications

CPU Features

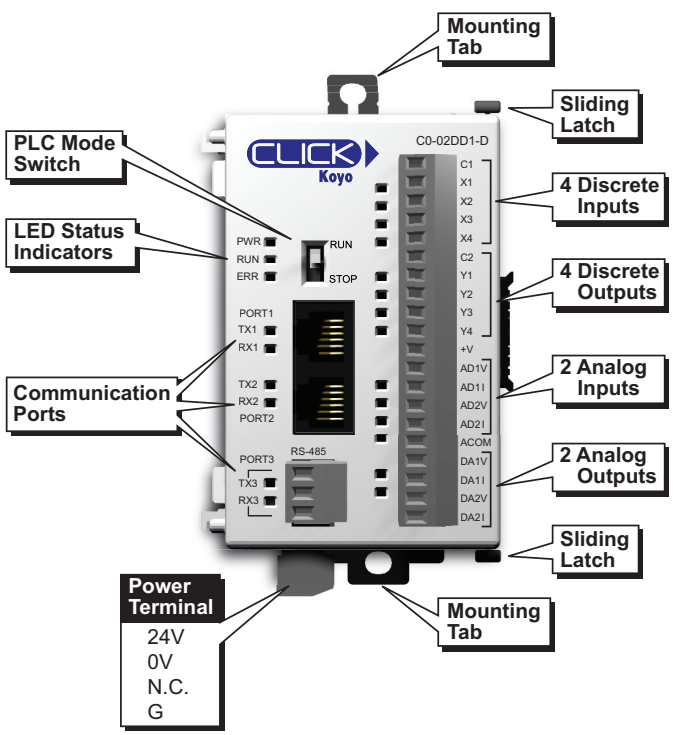
Basic CPUs



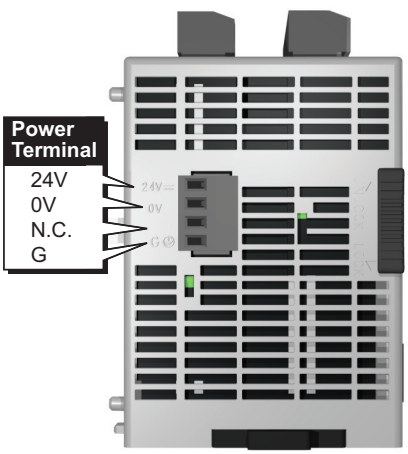
Standard CPUs



Analog CPUs



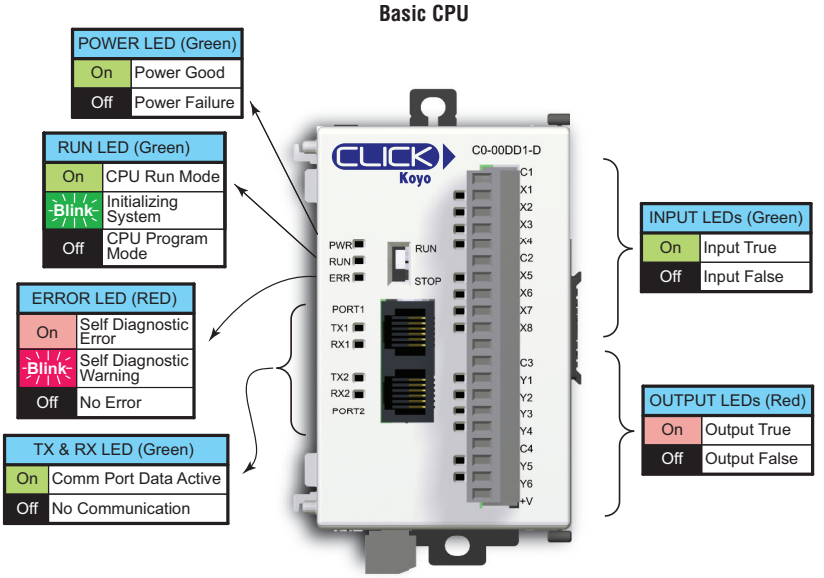
Bottom of CPU (Same on all models)



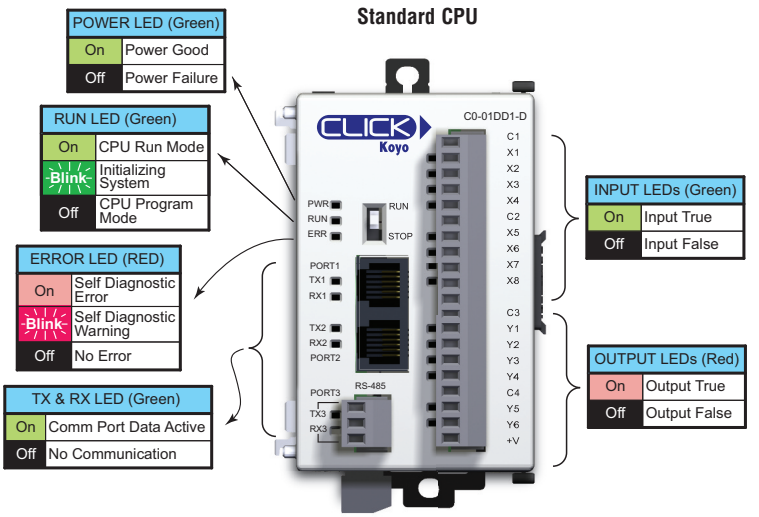
CLICK Specifications

CPU LED Status Indicators

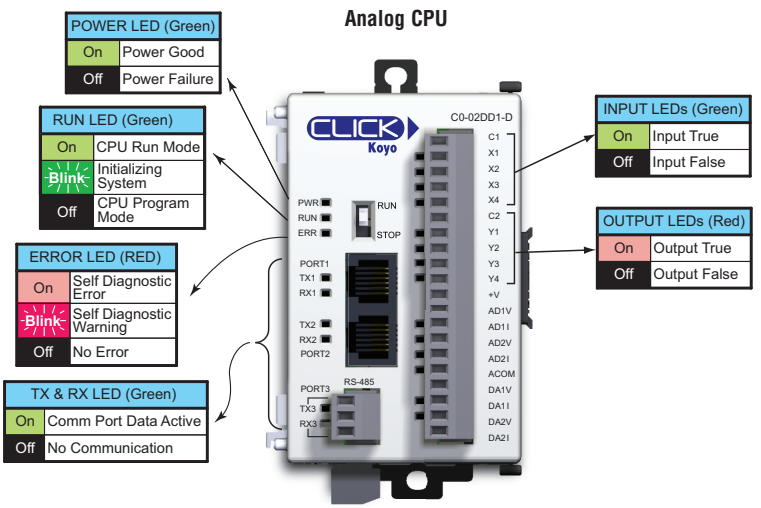
Basic CPU



Standard CPU



Analog CPU



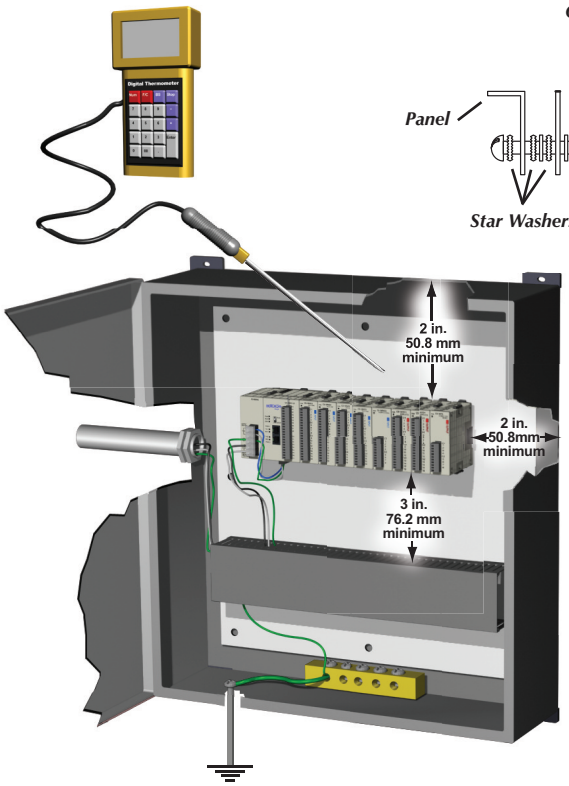
Product Dimensions and Installation

It is important to understand the installation requirements for your CLICK system. Your knowledge of these requirements will help ensure that your system operates within its environmental and electrical limits.

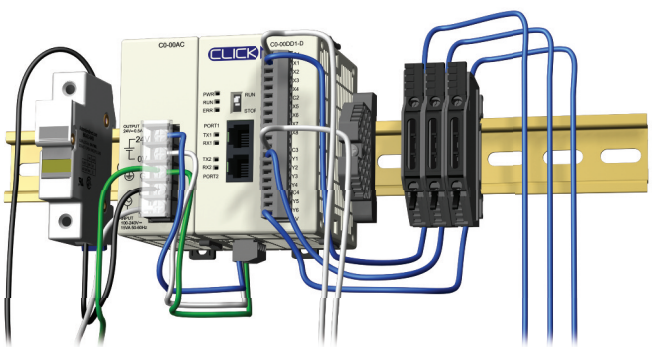
Plan for Safety

This catalog should never be used as a replacement for the user manual.

You can purchase, download free, or view online the user manuals for these products. Manual C0-USER-M is the user manual for the CLICK PLC. This user manual contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

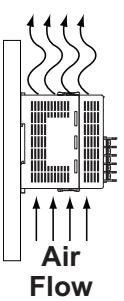


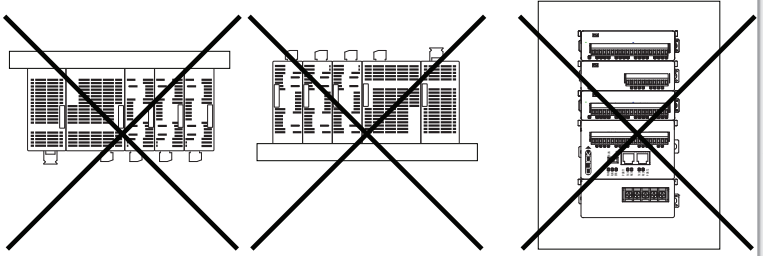
NOTE: THERE IS A MIMIMUM CLEARANCE REQUIREMENT OF 2 INCHES(51 MM) BETWEEN THE CLICK PLC AND THE PANEL DOOR OR ANY DEVICES MOUNTED IN THE PANEL DOOR. THE SAME CLEARANCE IS REQUIRED BETWEEN THE PLC AND ANY SIDE OF THE ENCLOSURE. A MINIMUM CLEARANCE OF 3 INCHES (76 MM) IS REQUIRED BETWEEN THE PLC AND A WIREWAY OR ANY HEAT PRODUCING DEVICE.



Mounting Orientation

CLICK PLCs must be mounted properly to ensure ample airflow for cooling purposes. It is important to follow the unit orientation requirements and to verify that the PLC's dimensions are compatible with your application. Notice particularly the grounding requirements and the recommended cabinet clearances.



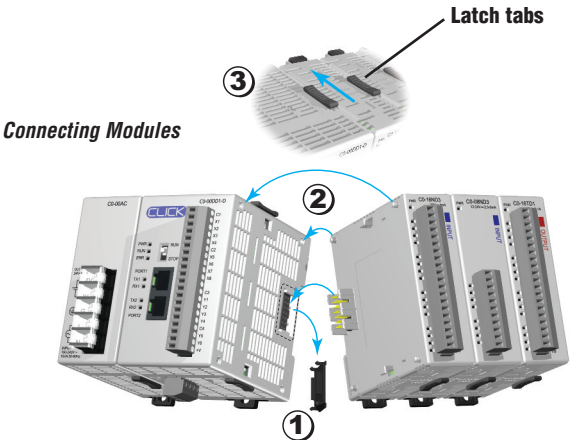


Product Dimensions and Installation

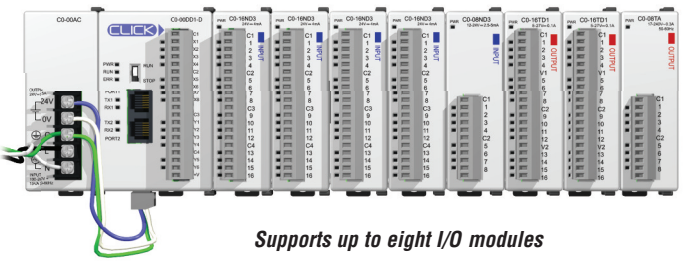
Connecting the Modules Together

CLICK CPUs, I/O modules and power supplies connect together using the extension ports that are located on the side panels of the modules (no PLC backplane/base required).

1. Remove extension port covers and slide the latch tabs forward.
2. Align the module pins and connection plug, and press the I/O module onto the right side of the CPU.
3. Slide the latch tabs backward to lock the modules together.



Connecting Modules



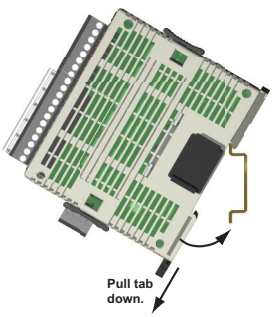
Supports up to eight I/O modules

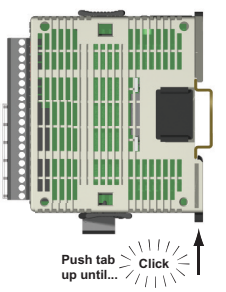
Mounting

The CLICK PLC system, which includes the CLICK power supplies, CPU modules, and I/O modules, can be mounted in one of two ways.

1. DIN rail mounted
2. Surface mounted using the built-in upper and lower mounting tabs.

DIN Rail Mounting





Surface Mounting

Unit Dimensions

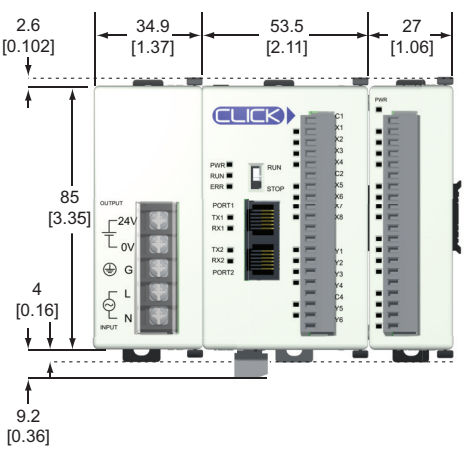
These diagrams show the outside dimensions of the CLICK power suppy, CPU, and I/O modules. The CLICK PLC system is designed to be mounted on standard 35mm DIN rail, or it can be surface mounted.

Allow proper spacing from other components within an enclosure.

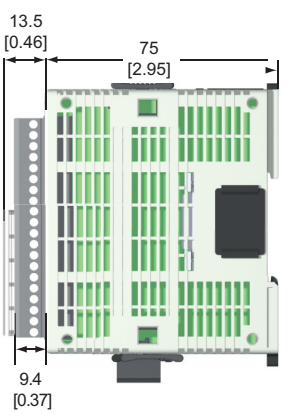
Maximum system:

Power Supply + CPU + 8 I/O modules.

Power Supply Module **CPU Module** **I/O Module**



Unit Dimensions mm [inches]

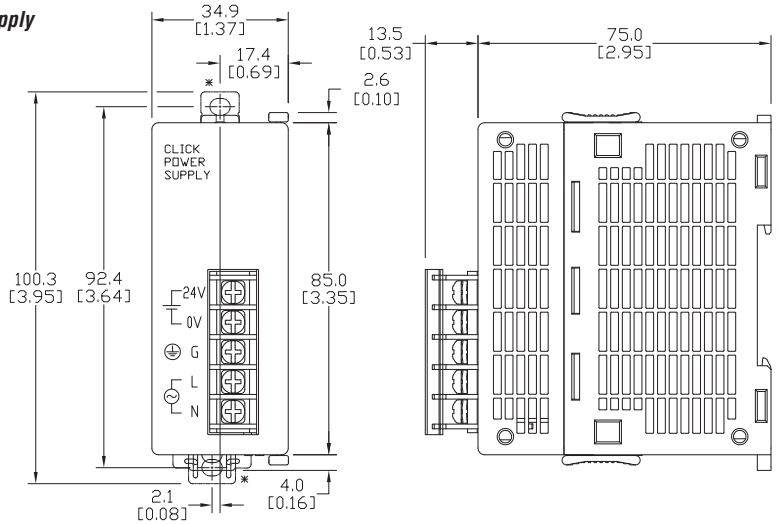


Product Dimensions and Installation

Unit Dimensions

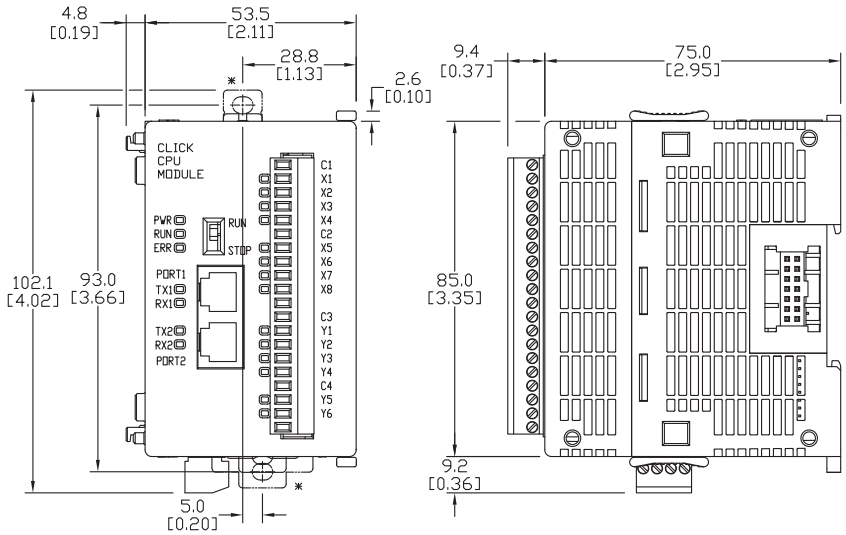
mm [inches]

Power Supply



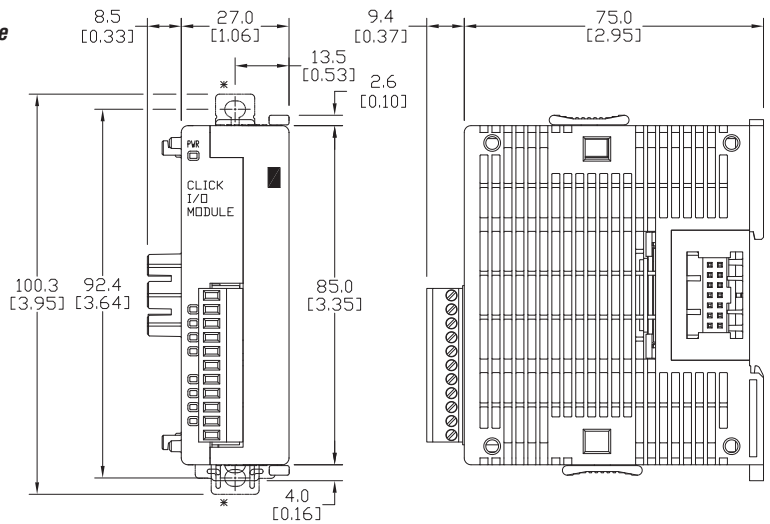
*Use size M4 screws for tab mounting.

CPU Module



*Use size M4 screws for tab mounting.

I/O Module

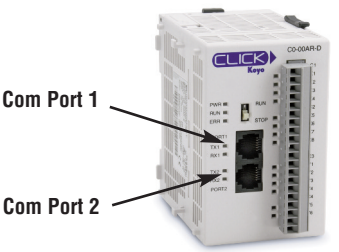


*Use size M4 screws for tab mounting.

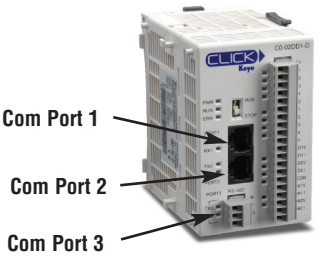
Networking the CLICK PLC

Built-in Communications Ports

All CPUs have two built-in RS-232 communications ports. Standard and Analog CPUs also have one built-in RS-485 communications port. One RS-232 port supports the Modbus RTU protocol only and can be used as the programming port. The other ports support either Modbus RTU or ASCII protocol. Both RS-232 ports supply 5 VDC, so you can connect a monochrome C-more Micro HMI panel without an additional power supply.



Basic CPU



Standard and Analog CPUs

LED Status Indicators

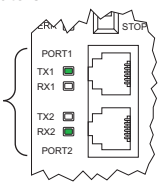
There are LED indicators located to the left of each communication port to indicate when the port is transmitting or receiving.

Basic CPUs

Port 1 & 2 LED Status Indicators

TX1 and TX2 (Green)	
On	The Comm Port is sending data.
Off	The Comm Port is not sending data.

RX1 and RX2 (Green)	
On	The Comm Port is receiving data.
Off	The Comm Port is not receiving data.

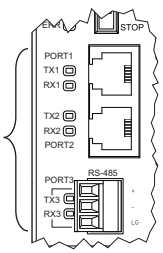


Standard and Analog CPUs

Port 1, 2, & 3 LED Status Indicators

TX1, TX2 and TX3 (Green)	
On	The Comm Port is sending data.
Off	The Comm Port is not sending data.

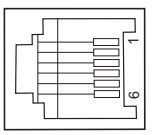
RX1, RX2 and RX3 (Green)	
On	The Comm Port is receiving data.
Off	The Comm Port is not receiving data.



Com Port 1 Specifications
Use: Programming Port
Physical: 6 pin, RJ12, RS-232
Communication speed (baud): 38400 (fixed)
Parity: Odd
Station Address: 1
Data length: 8 bits
Stop bit: 1
Protocol: Modbus RTU (slave only)

Port 1

6 pin RJ12 Phone Type Jack

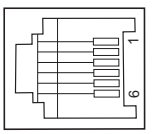


Port 1 Pin Descriptions		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive data (RS-232)
4	TXD	Transmit data (RS-232)
5	NC	No connection
6	0V	Power (-) connection (GND)

Com Port 2 Specifications	Default
Use: Serial Communication	-
Physical: 6 pin, RJ12, RS-232	-
Communication speed (baud): 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	38400
Parity: odd, even, none	Odd
Station Address: 1 to 247	1
Data length: 8 bits (Modbus RTU) or 7, 8 bits (ASCII)	8 bits
Stop bit: 1,2	1
Protocol: Modbus RTU (master/slave) or ASCII in/out	Modbus RTU

Port 2

6 pin RJ12 Phone Type Jack

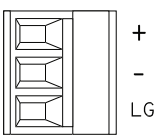


Port 2 Pin Descriptions		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive data (RS-232)
4	TXD	Transmit data (RS-232)
5	RTS	Request to send
6	0V	Power (-) connection (GND)

Com Port 3 Specifications	Default
Use: Serial Communication	-
Physical: 3 pin, RS-485	-
Communication speed (baud): 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	38400
Parity: odd, even, none	Odd
Station Address: 1 to 247	1
Data length: 8 bits (Modbus RTU) or 7, 8 bits (ASCII)	8 bits
Stop bit: 1,2	1
Protocol: Modbus RTU (master/slave) or ASCII in/out	Modbus RTU

Port 3

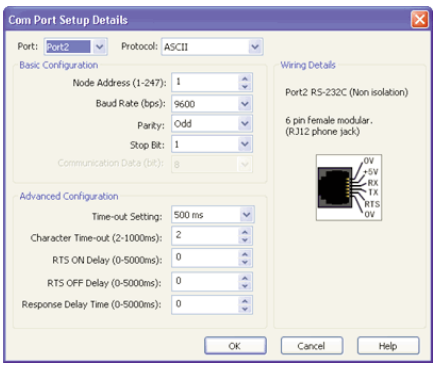
RS-485



Port 3 Pin Descriptions		
1	+ (plus)	Signal A (RS-485)
2	- (minus)	Signal B (RS-485)
3	LG	Logic Ground(0 V)

Port Setup

Use CLICK programming software to easily configure the communication ports.

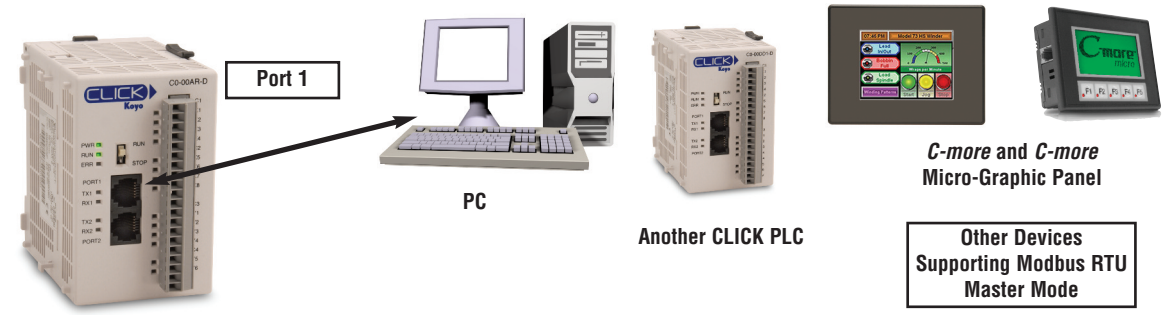


Networking the CLICK PLC

Typical Serial Communication Applications

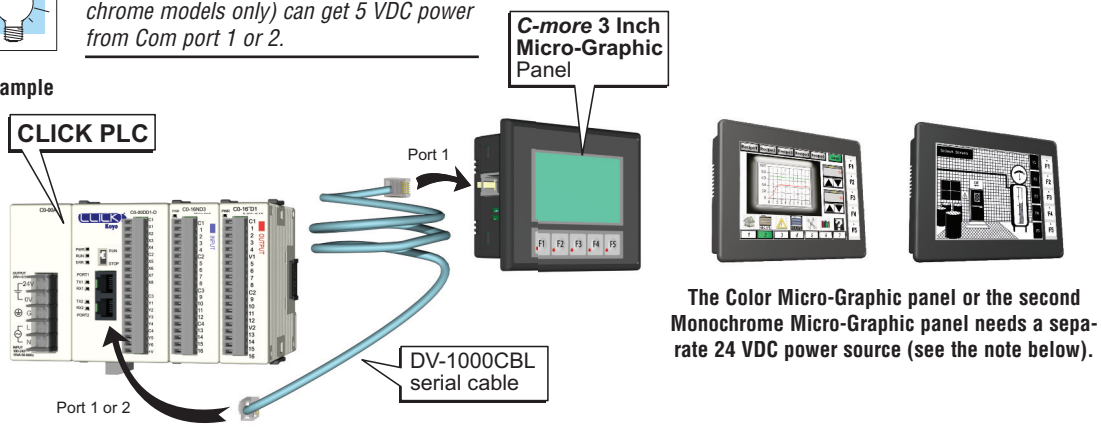
The diagrams on these two pages illustrate the typical uses for the CLICK CPU's communication ports.

Port 1 (RS-232) – Modbus RTU Slave Mode Only



C-more Micro-Graphic panels (mono-chrome models only) can get 5 VDC power from Com port 1 or 2.

Example



NOTE: CLICK's Port 1 and Port 2 can provide 5 VDC to power the panel, but not at the same time. If a C-more Micro-Graphic panel is connected to both ports, then at least one of the panels must be powered by a C-more Micro DC power adapter, EA-MG-P1 or EA-MG-SP1, or another 24 VDC power source. Color C-more Micro-Graphic panels must also be powered from a separate 24 VDC source.

Do not use the following *Direct*LOGIC devices with CLICK's Port 1 or 2:

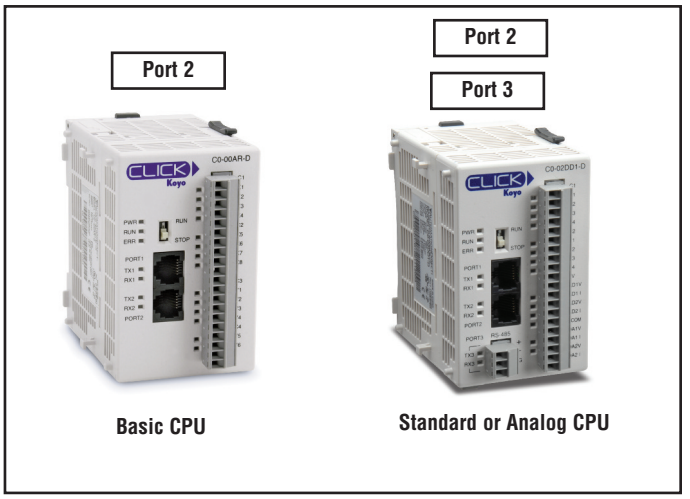
Warning: The following *Direct*LOGIC PLC devices cannot be used with a CLICK CPU's Port 1 or Port 2:
Handheld Programmer for DL05, DL06, DL105, DL205 & D3-350 CPUs, p/n D2-HPP
Handheld Programmer for DL405 CPUs, p/n D4-HPP-1
Timer/Counter Access for DL05, DL06, DL105, DL205, DL405 & D3-350 CPUs, p/n DV-1000

Networking the CLICK PLC

Port 2 (RS-232) – Modbus RTU or ASCII

Port 3 (RS-485; Standard and Analog CPUs Only) – Modbus RTU or ASCII

All CPUs have RS-232 port 2, but only Standard and Analog CPUs have RS-485 port 3.
Ports 2 and 3 allow networking to similar devices.



Modbus RTU

Modbus RTU Master Devices

PC

Another CLICK PLC

C-more and *C-more* Micro-Graphic Panel

See Note on previous page about connecting a C-more Micro-Graphic panel to Port 1 or 2.

Other Devices Supporting Modbus RTU Master Mode

ASCII

Devices that SEND ASCII messages

Barcode Reader

Weigh Scale

Other devices that can send ASCII data.

Devices that RECEIVE ASCII messages

Serial Printer

Serial Text Display

Other devices that can receive ASCII data.

Modbus RTU Slave Devices

Another CLICK PLC

SOLO Temperature Controller (Port 3 Only)

Other Devices Supporting Modbus RTU Slave Mode

Power Supplies

Power Supplies

The CLICK PLC family offers two 24 VDC power supplies. They are identical except for the output current.

It is not mandatory to use one of these CLICK power supplies for the CLICK PLC system. You can use any other 24 VDC power supply that Automationdirect.com offers, including the PSP24-DC12-1 12 VDC to 24 VDC converter shown below.

C0-00AC Power Supply

Limited auxiliary AC power supply allows you to power the 24 VDC CLICK C0 series CPUs with 100-240 VAC supply power. The 0.5A DC power supply is capable of controlling the CPU plus a limited configuration based on the power budget of each I/O module. The C0-00AC is a low-cost solution for applications requiring only minimal I/O and power consumption. This power supply will not support a fully-populated CLICK PLC system with all possible I/O module combinations.

C0-01AC Power Supply

Expanded auxiliary AC power supply allows you to power the 24 VDC CLICK C0 series CPUs with 100-240 VAC supply power. The 1.3A DC power supply is capable of supporting a fully-populated CLICK PLC system with all possible I/O module combinations, with no concerns for exceeding the power budget.

PSP24-DC12-1 DC-DC Converter

With this DC-DC converter you can operate the CLICK PLC with 12 VDC input power.

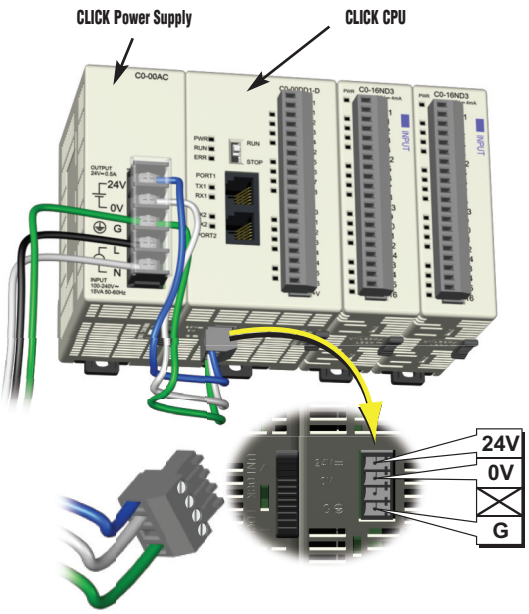
PSP24-DC12-1

CLICK 24 VDC Power Supply Ratings	
Part Number	**Output Current**
C0-00AC	0.5 A
C0-01AC	1.3 A

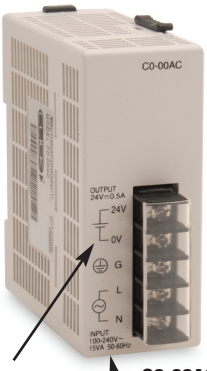
C0-00AC Power Supply Specifications	
Input Voltage Range	85-264 VAC
Input Frequency	47-63 Hz.
Input Current (typical)	0.3 A @ 100 VAC, 0.2 A @ 200 VAC
Inrush Current	30 A
Output Voltage Range	23-25 VDC
Output Current	0.5 A
Over Current Protection	@ 0.65 A (automatic recovery)
Weight	5.3 oz (150g)

C0-01AC Power Supply Specifications	
Input Voltage Range	85-264 VAC
Input Frequency	47-63 Hz.
Input Current (typical)	0.9 A @ 100 VAC, 0.6 A @ 200 VAC
Inrush Current	30 A
Output Voltage Range	23-25 VDC
Output Current	1.3 A
Over Current Protection	@ 1.6 A (automatic recovery)
Weight	6.0 oz (170g)

PSP24-DC12-1 DC-DC Converter Specifications	
Input Voltage Range	9.5-18 VDC
Input Power (no load)	1.0 W max.
Startup Voltage	8.4 VDC
Undervoltage Shutdown	7.6 VDC
Output Voltage Range	24-28 VDC (adjustable)
Output Current	1.0 A
Short Circuit Protection	Current limited at 110% typical
Weight	7.5. oz (213g)



24 VDC power is supplied to the CPU module through wiring connected from the power supply output to the 4-pin 24 VDC input connector located on the bottom of the CPU module.



24 VDC Output Power Terminals (for CLICK PLC, I/O or field device, etc.)

C0-00AC

85-264 VAC Power Source Input Terminals

24 VDC Output Power Terminals (for CLICK PLC, I/O or field device, etc.)

C0-01AC

85-264 VAC Power Source Input Terminals

Power Budgeting

Power Budgeting

There are two areas to be considered when determining the power required to operate a CLICK PLC system. The first area is the power required by the CLICK CPU, along with the internal logic side power that the CPU provides to its own I/O and any connected I/O modules that are powered through the CPU's expansion port; plus any device, such as a C-more Micro-Graphic panel, that is powered through one of the CPU's communication ports.

The second area is the power required by all externally connected I/O devices. This should be viewed as the field side power required. The field side power is dependent on the voltage used for a particular input or output device as it relates to the wired I/O point, and the calculated load rating of the connected device.

It is strongly recommended that the power source for the logic side be separate from the power source for the field side to help eliminate possible electrical noise.

Power budgeting requires the calculation of the total current that the 24 VDC power source needs to provide to CLICK's logic side, and also a separate calculation of the total current required for all devices operating from the field side of the PLC system.

See the Power Budgeting Example shown to the right. The table shows current requirements for a CLICK CPU, two I/O modules, and a C-more Micro. Use the total amperage values to select a proper sized power supply.

Power Budgeting Using the CLICK Programming Software

The CLICK Programming software can also be used for power budgeting. Based on the amperage rating of the power supply selected in the first column, your power budget is calculated by subtracting each consecutive module's power consumption from the total available power budget. If you exceed the maximum allowable power consumption the power budget row is highlighted in red.

CLICK 24 VDC Power Supply
C0-00AC or C0-01AC

Other 24 VDC Power Supply
Example: PSP24-60S

CPU Current Consumption (mA)		
Part Number	Power Budget 24 VDC (logic side)	External 24 VDC (field side)
Basic CPU Modules		
C0-00DD1-D	120	60
C0-00DD2-D	120	0
C0-00DR-D	120	0
C0-00AR-D	120	0
Standard CPU Modules		
C0-01DD1-D	140	60
C0-01DD2-D	140	0
C0-01DR-D	140	0
C0-01AR-D	140	0
Analog CPU Modules		
C0-02DD1-D	140	60
C0-02DD2-D	140	0
C0-02DR-D	140	0

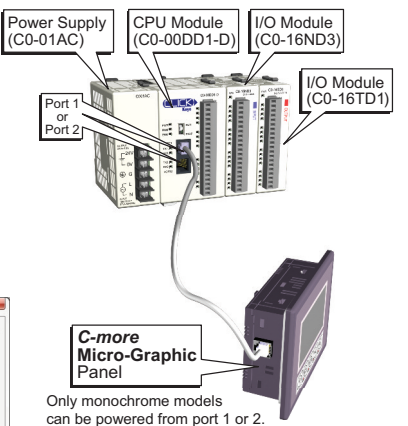
I/O Module Current Consumption (mA)		
Part Number	Power Budget 24 VDC (logic side)	External 24 VDC (field side)
Discrete Input Modules		
C0-08ND3	30	0
C0-08ND3-1	30	0
C0-16ND3	40	0
C0-08NE3	30	0
C0-16NE3	40	0
C0-08NA	30	0
Discrete Output Modules		
C0-08TD1	50	15
C0-08TD2	50	0
C0-16TD1	80	100
C0-16TD2	80	0
C0-08TA	80	0
C0-04TRS	100	0
C0-08TR	100	0

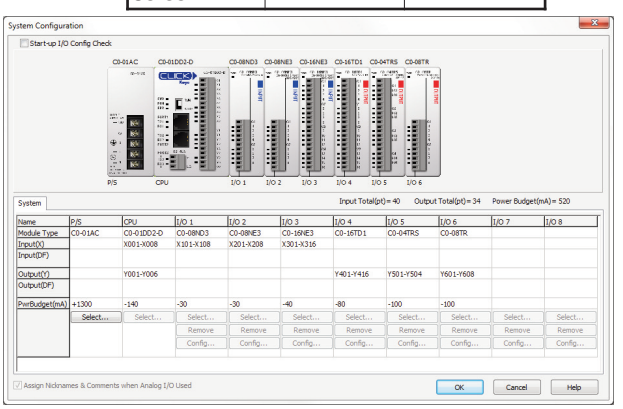
I/O Module Current Consumption (continued) (mA)		
Part Number	Power Budget 24 VDC (logic side)	External 24 VDC (field side)
Discrete Combo I/O Modules		
C0-16CDD1	80	50
C0-16CDD2	80	0
C0-08CDR	80	0
Analog Input Modules		
C0-04AD-1	20	65
C0-04AD-2	23	65
C0-04RTD	25	0
C0-04THM	25	0
Analog Output Modules		
C0-04DA-1	20	145
C0-04DA-2	20	85
Analog Combo I/O Modules		
C0-4AD2DA-1	25	75
C0-4AD2DA-2	20	65
C-more Micro-Graphic Panel		
Monochrome only	90	0

Power Budgeting Example

Current Consumption (mA) Example		
Part Number	Power Budget 24 VDC (logic side)	External 24 VDC (field side)
C0-00DD1-D	120	60
C0-16ND3	40	0
C0-16TD1	80	100
C-more Micro	90	0
Total:	330	160 *

* Plus calculated load of connected I/O devices.





Wiring System for CLICK PLCs

Wiring Solutions using the *ZIP*Link Wiring System

*ZIP*Links eliminate the normally tedious process of wiring between devices by utilizing prewired cables and DIN rail mount connector modules. It's as simple as plugging in a cable connector at either end or terminating wires at only one end. Prewired cables keep installation clean and efficient, using half the space at a fraction of the cost of standard terminal blocks.

*ZIP*Links are available in a variety of styles to suit your needs, including feedthrough connector module. *ZIP*Links are available for all Basic and Standard CLICK CPU modules and most discrete and analog I/O modules. Pre-printed I/O-specific adhesive label strips for quick marking of *ZIP*Link modules are provided with *ZIP*Link cables.

Solution 1: CLICK CPU and I/O Modules to *ZIP*Link Connector Modules

When looking for quick and easy I/O-to-field termination, a *ZIP*Link connector module used in conjunction with a prewired *ZIP*Link cable, consisting of an I/O terminal block at one end and a multi-pin connector at the other end, is the best solution.

Using the PLC CPU and I/O Modules to *ZIP*Link Connector Modules selector tables located in this section,

1. Locate your CPU or I/O module.
2. Select a *ZIP*Link Module.
3. Select a corresponding *ZIP*Link Cable.

Solution 2: CLICK CPU and I/O Modules to 3rd Party Devices

When wanting to connect I/O to another device within close proximity of the I/O modules, no extra terminal blocks are necessary when using the *ZIP*Link Pigtail Cables. *ZIP*Link Pigtail Cables are prewired to an I/O terminal block with color-coded pigtail with soldered-tip wires on the other end.

Using the I/O Modules to 3rd Party Devices selector tables located in the *ZIP*Link section,

1. Locate your CPU or I/O module.
2. Select a *ZIP*Link Pigtail Cable that is compatible with your 3rd party device.

Solution 3: GS Series and DuraPulse Drives Communication Cables

Need to communicate via Modbus RTU to a drive or a network of drives?

*ZIP*Link cables are available in a wide range of configurations for connecting to PLCs and *Sure*Servo, *Sure*Step, Stellar Soft Starter and AC drives. Add a *ZIP*Link communications module to quickly and easily set up a multi-device network.

Using the Drives Communication selector tables located in the *ZIP*Link section,

1. Locate your Drive and type of communications.
2. Select a *ZIP*Link cable and other associated hardware.

Solution 4: Serial Communications Cables

*ZIP*Link offers communications cables for use with CLICK CPUs that can also be used with other communications devices. Connections include a 6-pin RJ12 connector which can be used in conjunction with the RJ12 Feedthrough module.

Using the Serial Communications Cables selector table located in the *ZIP*Link section,

1. Locate your connector type
2. Select a cable.

ZIPLink Wiring System for CLICK PLCs

CLICK PLC CPU Module ZIPLink Selector				
PLC		ZIPLink		
CPU Module	# of Terms	Component	Module Part No.	Cable Part No.
C0-00DD1-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-00DD2-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-00DR-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-00AR-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-01DD1-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-01DD2-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-01DR-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-01AR-D	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-02DD1-D	20	No ZIPLinks are available for analog CPU modules.		
C0-02DD2-D	20			
C0-02DR-D	20			

CLICK PLC Discrete Input Module ZIPLink Selector				
I/O Module		ZIPLink		
Input Module	# of Terms	Component	Module Part No.	Cable Part No.
C0-08ND3	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-08ND3-1	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-08NE3	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-08NA	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-16ND3	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
		Sensor	ZL-LTB16-24	ZL-C0-CBL20*
C0-16NE3	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
		Sensor	ZL-LTB16-24	ZL-C0-CBL20*

CLICK PLC Discrete Output Module ZIPLink Selector				
I/O Module		ZIPLink		
Output Module	# of Terms	Component	Module Part No.	Cable Part No.
C0-08TD1	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-08TD2	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-08TR	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-08TA	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-16TD1	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
		Fuse	ZL-RFU20[2]	ZL-C0-CBL20*
		Relay (sinking)	ZL-RRL16-24-1	ZL-C0-CBL20*
C0-16TD2	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
		Fuse	ZL-RFU20[2]	ZL-C0-CBL20*
		Relay (sourcing)	ZL-RRL16-24-2	ZL-C0-CBL20*
C0-04TRS[1]	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*

[1] ***Note: The C0-04TRS relay output is derated not to exceed 2A per point maximum when used with the ZIPLink wiring system.***

[2] ***Note: Fuses (5 x 20 mm) are not included. See Edison Electronic Fuse section for (5 x 20 mm) fuse. S500 and GMA electronic circuit protection for fast-acting maximum protection. S506 and GMC electronic circuit protection for time-delay performance. Ideal for inductive circuits.***
To ensure proper operation, do not exceed the voltage and current rating of ZIPLink module. ZL-RFU20 = 2A per circuit.

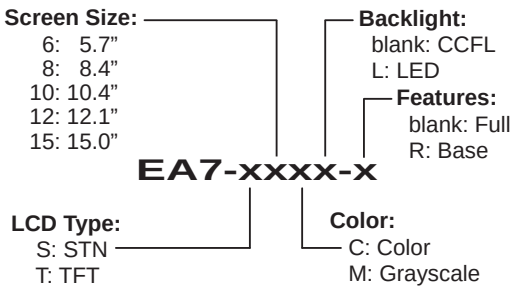
CLICK PLC Combo I/O Module ZIPLink Selector				
I/O Module		ZIPLink		
Combo Module	# of Terms	Component	Module Part No.	Cable Part No.
C0-16CDD1	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-16CDD2	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-08CDR	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*

CLICK PLC Analog I/O Module ZIPLink Selector				
I/O Module		ZIPLink		
Analog Module	# of Terms	Component	Module Part No.	Cable Part No.
C0-04AD-1	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-04AD-2	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-04RTD	20	No ZIPLinks are available for RTD and thermocouple modules.		
C0-04THM	11			
C0-04DA-1	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-04DA-2	11	Feedthrough	ZL-RTB20	ZL-C0-CBL11*
C0-4AD2DA-1	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*
C0-4AD2DA-2	20	Feedthrough	ZL-RTB20	ZL-C0-CBL20*

**** Select the cable length by replacing the * with: Blank = 0.5m, -1 = 1.0m, or -2 = 2.0m.***

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

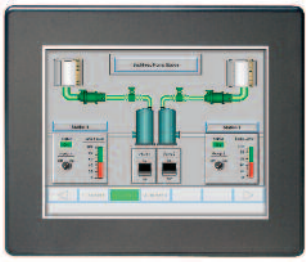
Specification \ Model	8" TFT color w/ full features	10" TFT color w/ full features	12" TFT color w/ full features	15" TFT color w/ full features
Part Number	***EA7-T8C***	***EA7-T10C***	***EA7-T12C***	***EA7-T15C***
Price	<--->	<--->	<--->	<--->
Display Actual Size and Type	8.4" TFT color	10.4" TFT color	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.



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Features

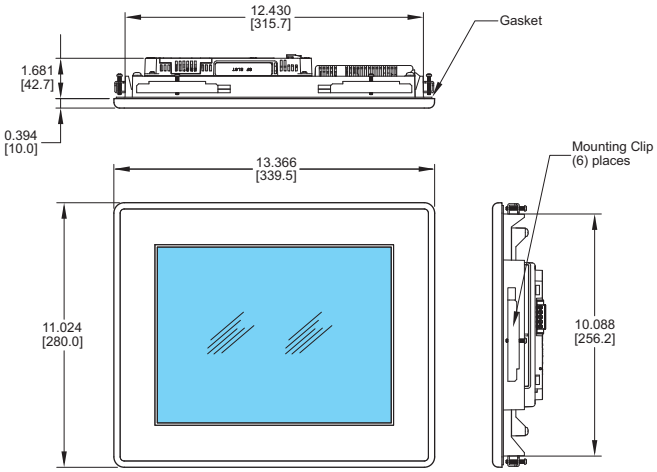
- 12.1" diagonal color TFT (Thin Film Transfer) LCD display with 64K colors
- 800 x 600 pixel resolution
- 260 NITS display brightness
- 50,000 hour average backlight lifetime, user replaceable
- Analog resistive (4096 X 4096) touch screen allowing unlimited touch areas
- USB port B (program/download) 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

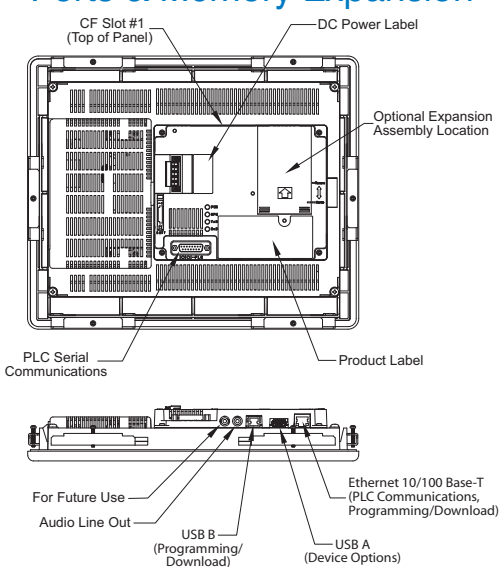
PLC Drivers	
Serial	**Avail.**
Productivity3000	Yes
AutomationDirect CLICK	Yes
Direct LOGIC K-sequence	Yes
Direct NET	Yes
Modbus (Koyo Addressing)	Yes
Allen-Bradley DF1 Full & Half Duplex	Yes
Allen-Bradley PLC5 DF1	Yes
Allen-Bradley DH-485	Yes
Allen-Bradley DF1 Full & Half Duplex - Tag Based (ControlLogix™ 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

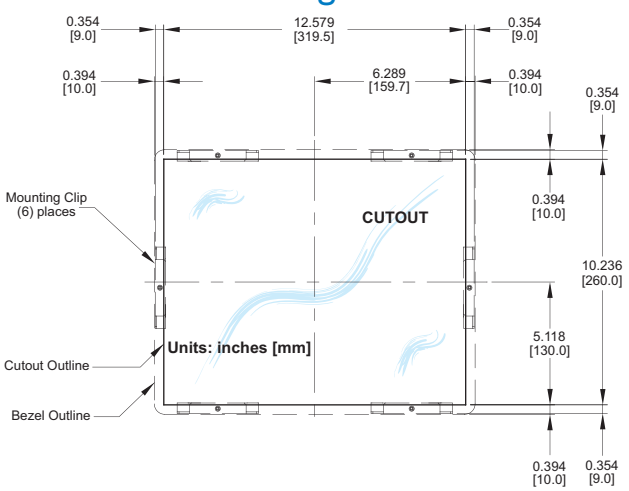
inches / [mm]



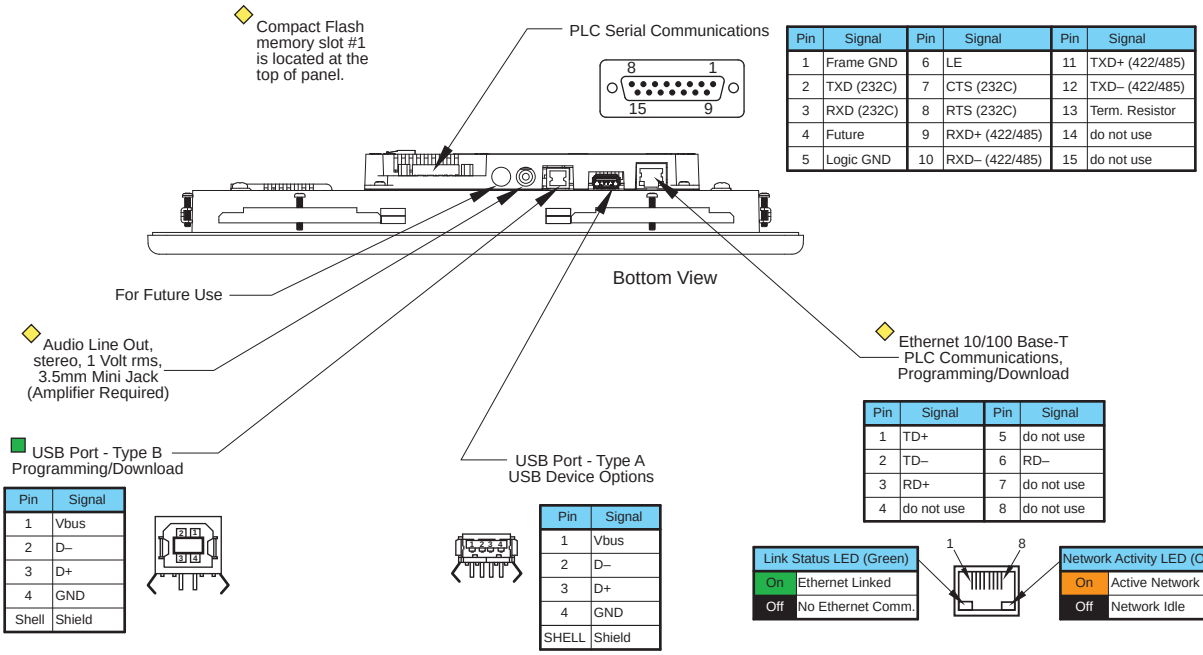
Ports & Memory Expansion



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)
DirectLOGIC	DL05/DL06	all	K-Sequence
			DirectNET
			Modbus (Koyo addressing)
		H0-ECOM/H0-ECOM100	DirectLOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			DirectNET
		D2-250/D2-250-1/D2-260	K-Sequence
			DirectNET
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 Using DCM	DirectNET
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	DirectLOGIC Ethernet
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	DirectNET
		D3-340	DirectNET
		D3-350	K-Sequence
			DirectNET
			Modbus (Koyo addressing)
		D3-350 DCM	DirectNET
			Modbus (Koyo addressing)
	DL405	D4-430	K-Sequence
			DirectNET
		D4-440	K-Sequence
			DirectNET
		D4-450	K-Sequence
			DirectNET
			Modbus (Koyo addressing)
		All with DCM	DirectNET
			Modbus (Koyo addressing)
		H4-ECOM/H4-ECOM100	DirectLOGIC 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, DirectLOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WinPLC (RS-232C)	***EA-2CBL***	<--->
DirectLOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	***EA-2CBL-1***	<--->
DirectLOGIC PLC RJ-11 port, D3-340 (RS-232C)	***EA-3CBL***	<--->
DirectLOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	***EA-4CBL-1***	<--->
DirectLOGIC 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

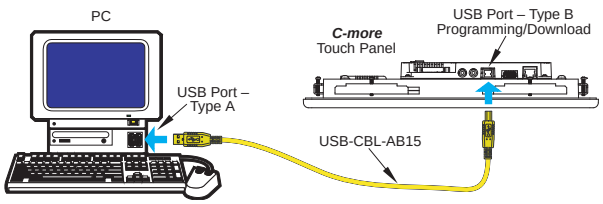
Using the *C-more* Programming Software for project development, the touch panel can be connected to a PC (personal computer) in one of several ways:

- 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).

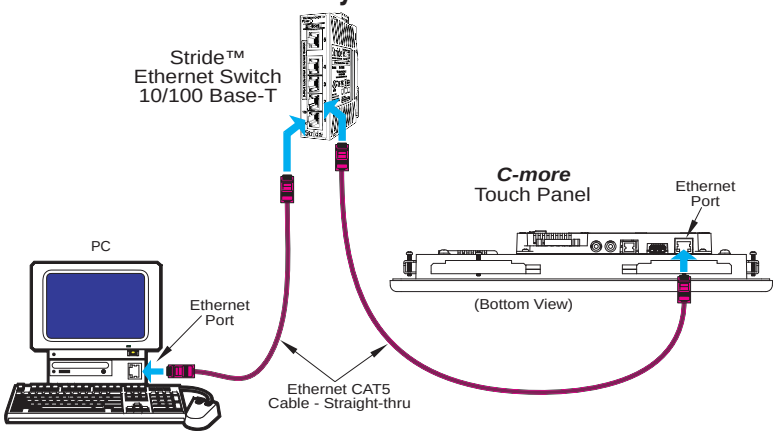
Following are the minimum system requirements for running *C-more* Programming Software (p/n EA-PGMSW) on a PC:

- 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.

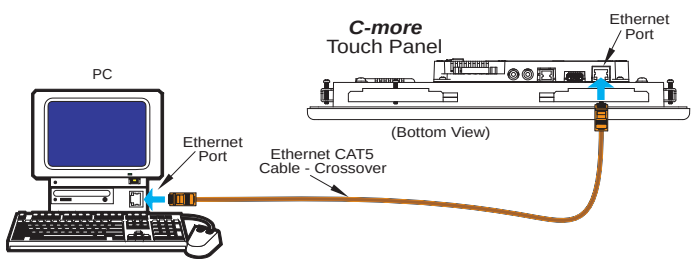
USB Connectivity



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.

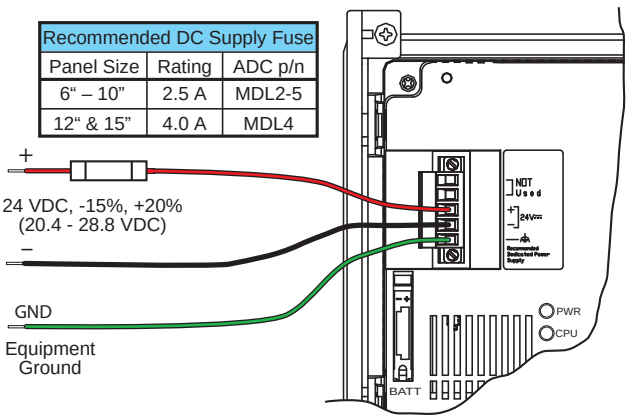
C-more Power Connection Wiring

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

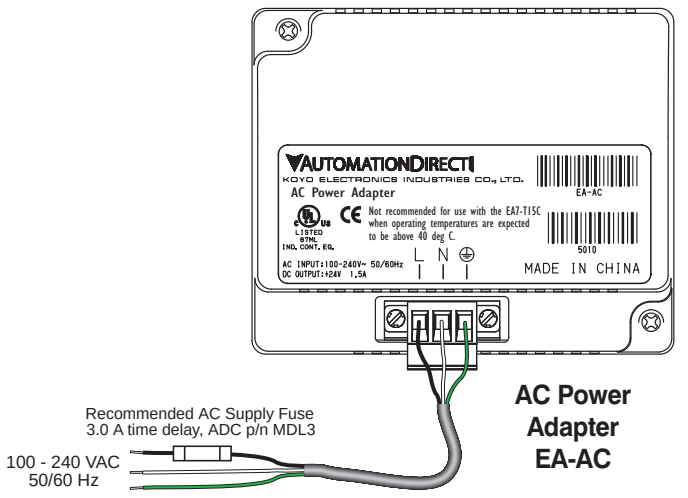
Recommended DC Supply Fuse		
Panel Size	Rating	ADC p/n
6" – 10"	2.5 A	MDL2-5
12" & 15"	4.0 A	MDL4



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)

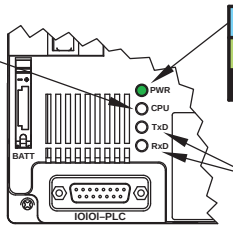
AC Wiring



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.

This publication is based on information that was available at the time it was printed.

At Automationdirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without obligation. This publication may also discuss features that may not be available in certain revisions of the product.

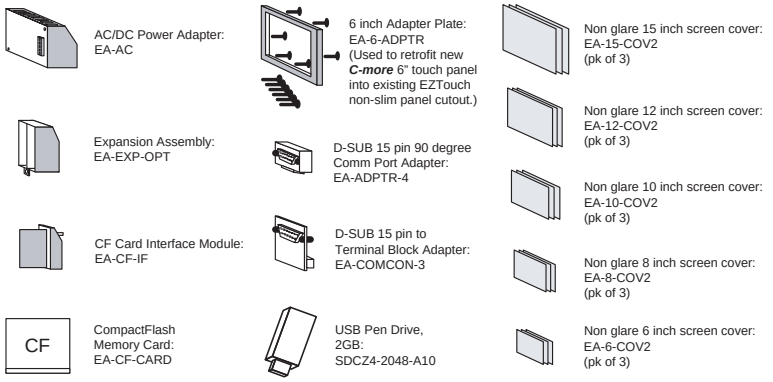
C-more Accessories

Accessories

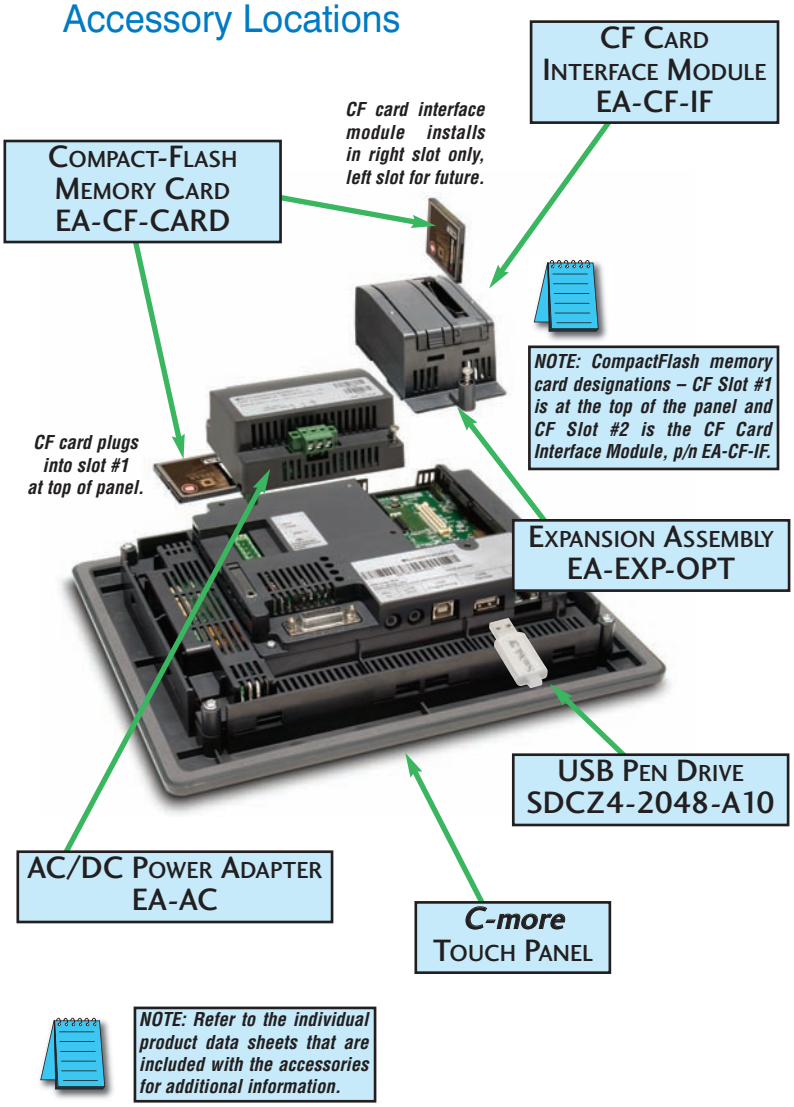
The C-more touch panels can be enhanced with the accessories below:

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



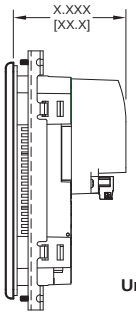
C-more Accessories

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 **<--->**

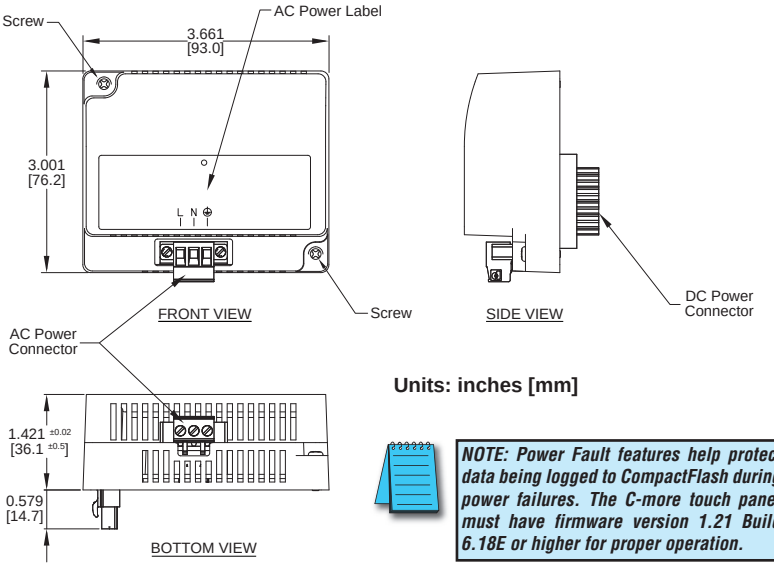
Overall Panel Depth w/ EA-AC Installed



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 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

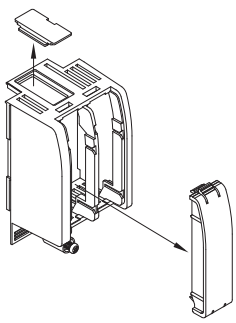
Expansion Assembly

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.

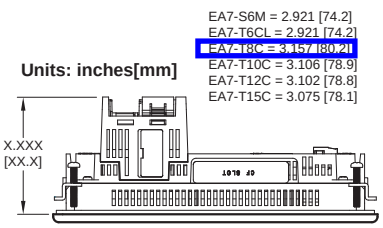
The optional Expansion Assembly can be installed on the rear of all but the 6-inch base models. This attachable assembly currently allows installation of an additional CompactFlash card with the use of the CF Card Interface Module.

Part No. EA-EXP-OPT

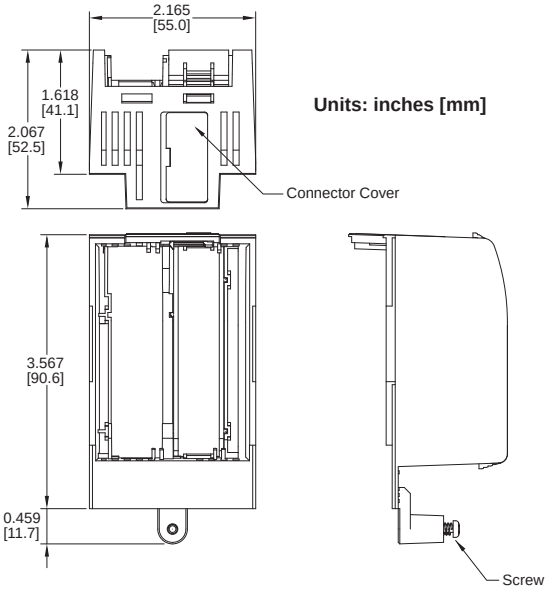
<--->



Overall Panel Depth w/ EA-EXP-OPT Installed



Dimensions



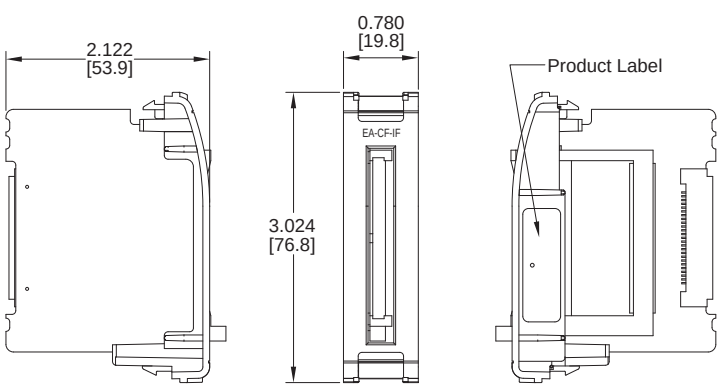
CF Card Interface Module

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

C-more Accessories

6” Adapter Plate

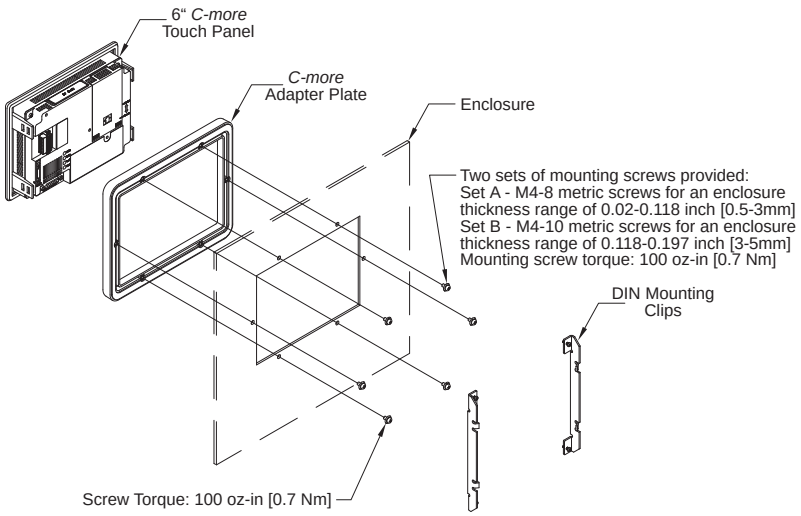
The adapter plate simplifies the retrofit of a new *C-more* 6” touch panel into an existing cabinet cutout for an EZTouch (units sold by AutomationDirect) 6” wide bezel touch panel, such as our part number EZ-S6C-K, EZ-S6C-F, EZ-S6M-R or EZ-S6M-F.

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.

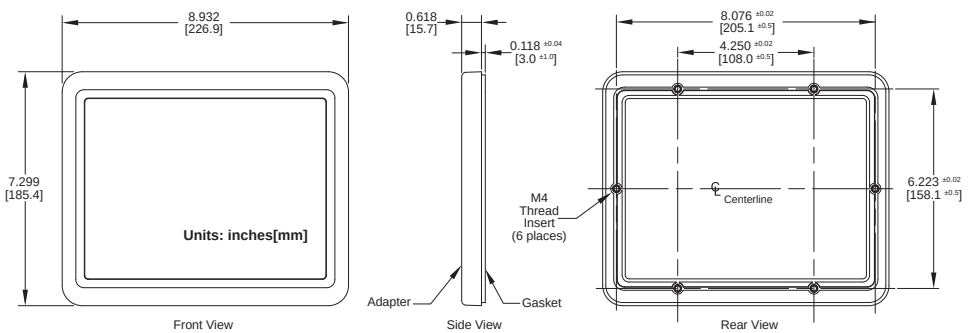
Part No. EA-6-ADPTR

<--->

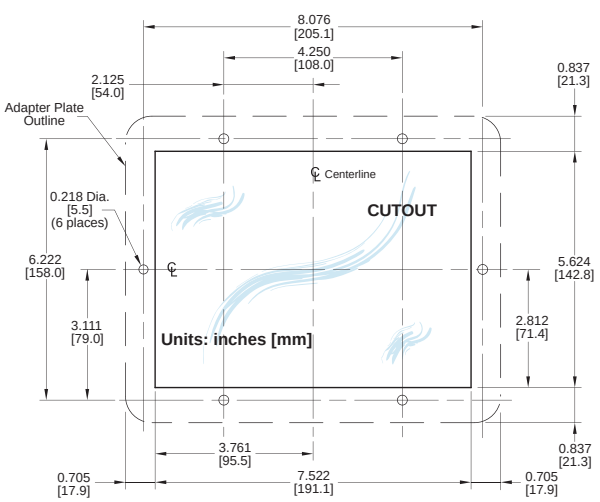
Mounting Details



Dimensions



Cutout Dimensions



C-more Accessories

D-SUB 15-pin 90-degree Communication Port Adapter

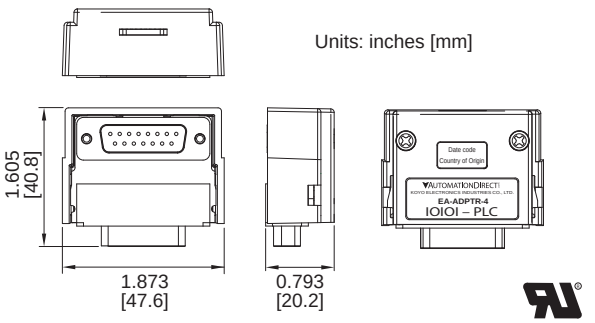
The EA-ADPTR-4 adapter plugs into the 15-pin serial port on the rear of the panel to allow a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements. 15-pin straight through pin-out. UL Recognized.

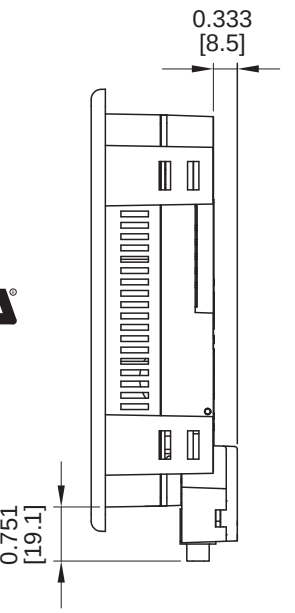
Part No.
EA-ADPTR-4

<---->

Dimensions

Units: inches [mm]





D-SUB 15-pin to Terminal Block Adapter

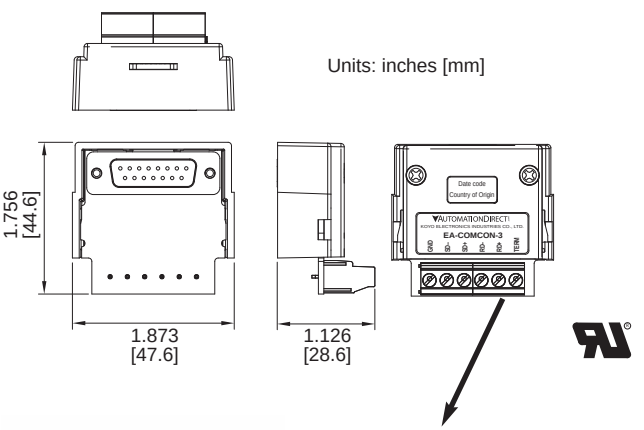
The EA-COMCON-3 adapter plugs into the 15-pin serial port on the rear of the panel to allow wire terminal connections for an RS-422/RS-485/DH-485 PLC communication cable. UL Recognized.

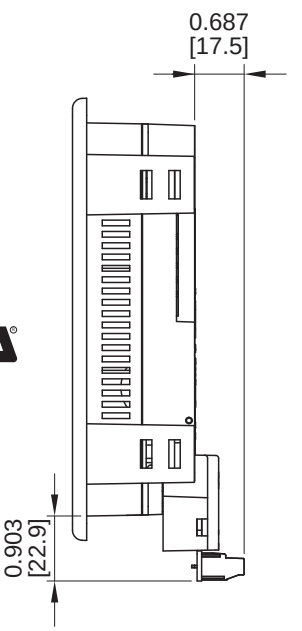
Part No.
EA-COMCON-3

<---->

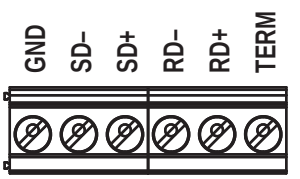
Dimensions

Units: inches [mm]





Terminals



C-more Accessories

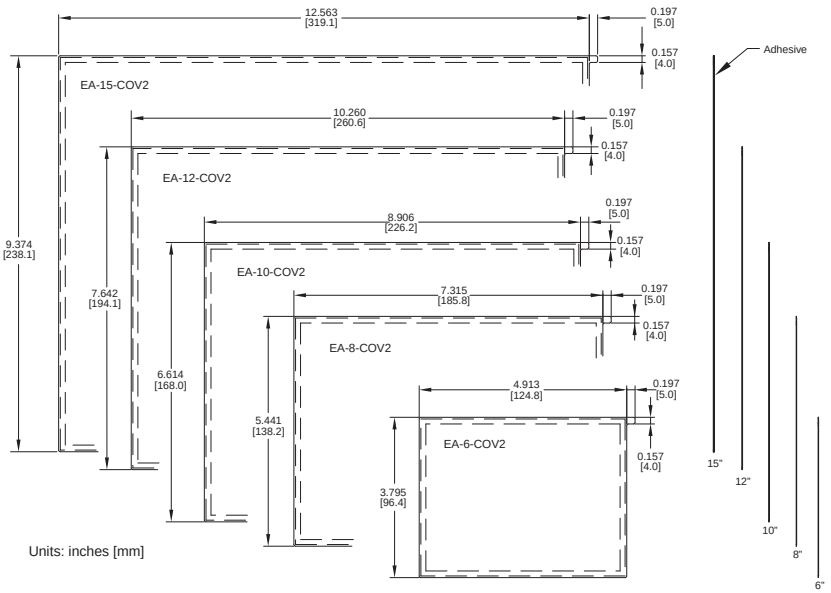
Non-glare Screen Covers (in packages of 3)

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

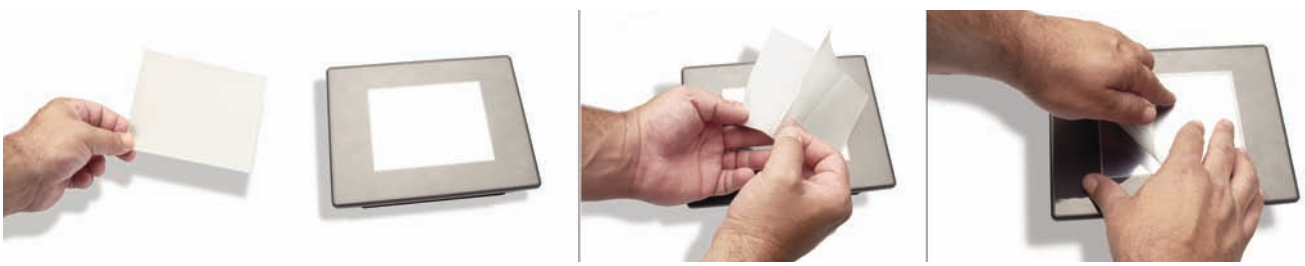
EA-6-COV2 <--->
EA-8-COV2 <--->
EA-10-COV2 <--->
EA-12-COV2 <--->
EA-15-COV2 <--->

Dimensions



Units: inches [mm]

Installation



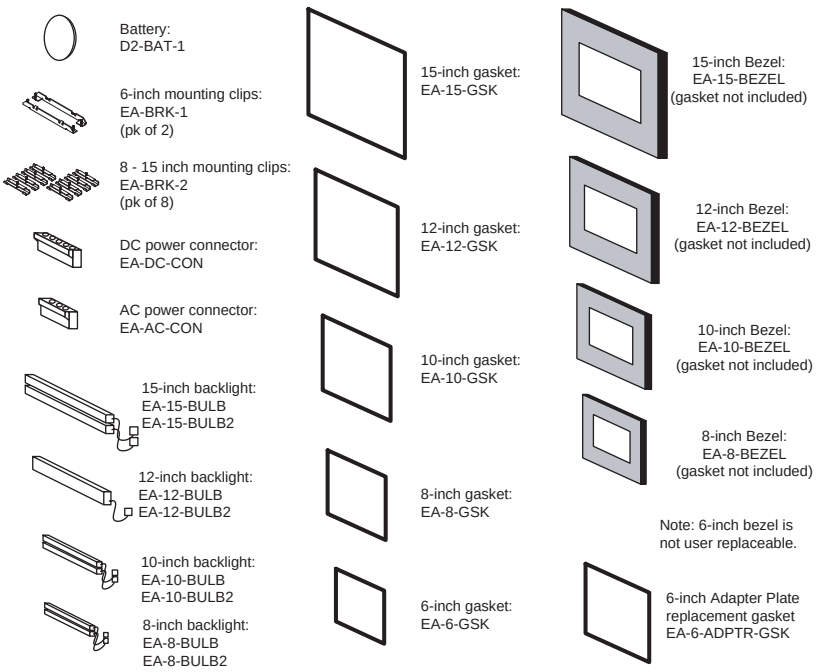
NOTE: The Protective Cover ships with a thin protective sheet on the face of the cover that needs to be carefully removed. If your panel is not clear, the protective sheet may not have been removed.

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.

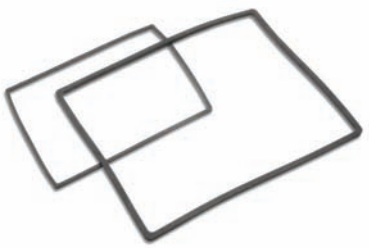
8"-15" Panel Mounting Clips
Part No. EA-BRK-2

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

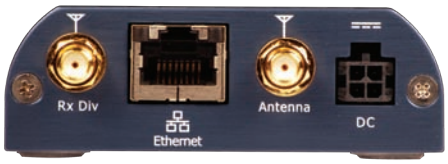
STANDARDS/APPROVALS
- FCC
- Industry Canada
- Class I Div 2
- RoHS
- Carrier Specific Approvals
- PTCRB
- CE
- A-Tick

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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SIERRA WIRELESS™ | AirLink™

Wilson Electronics
Say Goodbye to Dropped Calls

General Mobile External Antennas

Stay Connected on the Road with Wilson Electronics Mobile Antennas

Designed for use with our mobile signal boosters, Wilson Electronics wide range of mobile antennas offers top performance and multiple mounting options. Our best-selling magnet-mount antennas install in seconds and are transferable between vehicles. For a more permanent installation, users can choose from glass- or NMO-mount options.

301103 • 301125 • 301128 • 301703 • 304202
Magnet-Mount Antenna

301113 • 301126 • 301131 • 301132
Mini Magnet-Mount Antenna

FEATURES

- Perfect for cars, vans and light trucks
- Mobile and indoor use

SPECIFICATIONS

	Magnet-Mount Antennas					Mini Magnet-Mount Antennas			
Part Number	HOT 301103	301125	301128	301703	304202	301113	301126	301131 WHITE	301132 WHITE
Frequency Range (MHz)	Refer to table on page 40								
Impedance	50 ohms								
Antenna Gain	Refer to table on page 40								
Signal Pattern	Omni								
Polarization	Vertical								
Ground Plane	Metal ground plane required								
Connector	FME Female	SMA Male	TNC Male	FME Female	FME Female	FME Female	SMA Male	FME Male	N Male
Material	Whip - Stainless Steel					Whip - Plastic Coated Steel Wire			
Coax Cable	RG174 - 10 feet / 3.05 meters								
Height	12.25 inches / 31.12 cm					4.175 inches / 10.60 cm			
Mount	Rare earth magnet					Rare earth magnet			

Wilson Electronics
Say Goodbye to Dropped Calls

Antenna Frequency Specific Gain Chart (dBi)

		FREQUENCY IN MHz					
		700-800	824-894	880-960	1710-1880	1850-1990	2110-2170
MAGNET MOUNT ANTENNAS	301103	1.9	5.1	3.1	-4.0	6.1	2.3
	301125	1.9	5.1	3.1	-4.0	6.1	2.3
	301128	1.9	5.1	3.1	-4.0	6.1	2.3
	304202	1.9	5.1	3.1	-4.0	6.1	2.3
	301703	-1.9	4.8	4.6	0.3	4.1	0.6
MINI MAGNET MOUNT ANTENNAS	301113	1.7	2.1	0.5	2.2	3.1	1.4
	301126	1.7	2.1	0.5	2.2	3.1	1.4
	301131	1.7	2.1	0.5	2.2	3.1	1.4
	301132	1.7	2.1	0.5	2.2	3.1	1.4
DUAL BAND TRUCKER ANTENNAS	301101		5.1			6.1	
	301701			5.1	6.1		
RV TRUCKER W/SPRING ANTENNAS	301119	3.1	4.1	2.0	-1.8	5.1	-2.6
	301133	3.1	4.1	2.0	-1.8	5.1	-2.6
GLASS MOUNT ANTENNAS	301102	1.8	3.5	2.8	-1.5	4.8	1.0
	304201	1.8	3.5	2.8	-1.5	4.8	1.0
MINI GLASS MOUNT ANTENNAS	301114		1.4			2.4	
NMO ANTENNAS	301104	2.0	4.9	0.0	-3.1	5.9	1.3
	301112	2.4	5.5	-0.9	-1.2	5.5	1.7
	304203	3.7	4.4	4.3	-4.1	3.7	0.3
	301105	4.1	1.4	2.4	-3.5	-7.0	-10.2
DUAL BAND LOW PROFILE ANTENNAS	301106	3.4	2.2	1.2	1.4	3.2	4.3
	301127	3.4	2.2	1.2	1.4	3.2	4.3
	301208	-0.8	1.5	1.2	2.4	3.4	1.2
	301209	-0.8	1.5	1.2	2.4	3.4	1.2
YAGI ANTENNAS	301111	10.0	10.8	8.8	-16.4	-14.9	-13.8
	301124	-18.7	-23.4	-21.6	9.1	12.5	-10.6
	301129	-0.9	10.1	-7.9	-10.3	-11.9	-8.7
	301142	-3.6	3.7	10.1	-12.1	-10.2	-13.4
	304411	7.3	8.1	7.4	9.2	10.6	10.4
	304475	7.3	8.1	7.4	9.2	10.6	10.4
DOME ANTENNAS	301121	-2.5	2.5	-0.5	3.5	4.1	1.5
	301123	3.3	5.4	-2.3	-4.3	0.5	-8.0
MARINE ANTENNAS	301130	3.4	4.1	3.5	3.1	5.1	0.2
PANEL ANTENNAS	301135	5.2	4.4	4.2	10.1	10.6	8.2
	301155	5.2	4.4	4.2	10.1	10.6	8.2
	304451	5.2	4.4	4.2	10.1	10.6	8.2
	304471	5.2	4.4	4.2	10.1	10.6	8.2
	304452	5.2	4.4	4.2	10.1	10.6	8.2
	304472	5.2	4.4	4.2	10.1	10.6	8.2
	304453	5.2	4.4	4.2	10.1	10.6	8.2
	304473	5.2	4.4	4.2	10.1	10.6	8.2
ULTRA SLIM ANTENNAS	301143	-5.7	-6.8	-9.5	3.1	3.9	5.0
	301149	-5.7	-6.8	-9.5	3.1	3.9	5.0
CRADLE PLUS - PHONE CRADLE	301146	-5.0	0.7	-0.8	2.3	2.6	1.5
	301148	-5.0	0.7	-0.8	2.3	2.6	1.5
EXTERIOR BUILDING ANTENNAS	301141	0.7	4.0	3.6	-1.7	5.5	4.7
	301201	3.2	4.1	2.7	0.6	5.1	-7.5
	301202	3.2	4.1	2.7	0.6	5.1	-7.5

Cellular Data Cards

Adapter plugs into the adapter port on the end of the cellular data card or plugs in as an antenna replacement for data cards with this feature. Check the model for a specific adapter type.

For information about Wilson's cellular adapters for modems and data cards visit www.WilsonElectronics.com

Dual-Band Magnet Mount Installation Instructions

1. Antenna Adapter Required *(Sold Separately)*

In order to attach your antenna to your cell phone you will need an adapter. The adapter connects the phone to the antenna cable and transfers power to and from the antenna. If you need help locating an adapter for your phone, call Wilson toll-free at 1-866-294-6996.

2. Installing the Magnet Mount Antenna

Attach the Magnet Mount Antenna to any metal area on top of the roof of the vehicle. The best location is clear of obstacles and as high on the vehicle as possible. Although small, the rare earth magnet is quite strong and won't fall off at high speeds. Make sure the area under the magnet is clean so as not to damage the vehicle's paint and to ensure a strong connection. Bring the cable into the vehicle through a door frame - the cable is protected by the doors rubber molding. **Do not run the cable through a window** because when the window is rolled up and the door is opened the antenna's cable will be pulled - this is likely to destroy your antenna and/or scratch your paint. Connect the magnet mount antenna's cable to the adapter cable.

1

2

Item List

- Various examples of Adapters are shown - yours may vary.
(Adapter Sold Separately)

Items for Magnet Mount
1 - Magnet Mount Antenna
2 - Antenna Adapter ***(Sold Separately)***

Technical Support

Additional help may be obtained at tech@wilsonelectronics.com or by calling Toll-Free 866-294-1660 Monday through Friday between 7:00 AM and 6:00 PM Mountain Time. Wilson Electronics is closed Saturday, Sunday, and Holidays.

90 Day Warranty

The Wilson Electronics Dual-Band Magnet Mount is warranted for 90 days against defects in workmanship and/or materials and will be repaired or replaced, at the discretion of the manufacturer, to the original purchaser with dated sales receipt. The antenna and a copy of the receipt must be sent to the factory at purchaser's expense where it will be repaired or replaced and returned shipping paid. Warranty does not cover damages caused by abuse, misuse, negligence, improper installation, etc. These are considered to be avoidable circumstances and are not covered by warranty. All Wilson warranties are limited to the specific Wilson product only and do not include phone, vehicle or other external product.

Wilson
Electronics, Inc.
1-866-294-6996
wilsonelectronics.com
info@wilsonelectroincs.com

Part # 103019 DBMM 003 / 09.06.07

SECTION 5 - INLET MANIFOLD / HEADER-MS COMPONENTS -

BUTTERFLY VALVE, 4" - JOMAR 600-04DSPL

VACUUM INDICATOR, (-)80-0 IWC - DWYER LPG4-D7622N

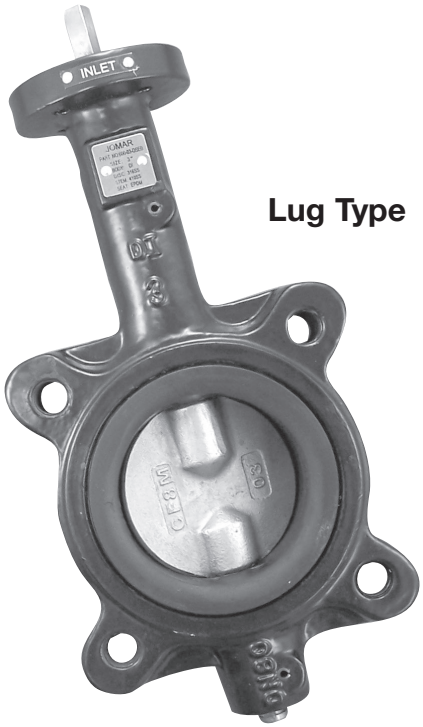
FLOW ELEMENT PITOT TUBE, 4" - DWYER DS-300-4

FLOW INDICATOR MAGNEHELIC GAUGE, 0.05-0.2 IWC - DWYER 2000-00N

HEADER UTILITY PUMP, 1/10 HP - DAYTON 5UXL7

LEVEL SWITCH ASSEMBLY - FPI SENSOR L500

Ductile Iron Body, 316 SS Disc, Lug Type Butterfly Valve



Lug Type

Description

Jomar butterfly valves are standard with epoxy coated, ductile iron bodies, and also phenolic backed cartridge type seats. Accompanied by precision machined 316SS disc, and 410SS stem, they offer lower operating torques, bubble tight shut-off, and extended seat life. Jomar butterfly valves are bi-directional and suited for dead end service. Jomar butterfly valves are standard with an extended neck, which makes them ideal for applications where insulation is required. Jomar butterfly valves are manufactured to ISO 5211 standards and have direct mount capabilities.

Specifications

Designed for commercial and industrial applications up to 225 PSI. Easily accepts actuator with ISO 5211 mounting flange.

- Available in EPDM, PTFE, Buna, or Viton seats
- Meets API 609 & MSS SP-67
- Seat to flange seal eliminates the need for flange gaskets
- Series 600 Lug bodies are bi-directional for dead end service:
  With downstream flange, pressure ratings are 2”- 12” = 175psi, 14”- 24” = 150psi.
  With no downstream flange, bi-directional, dead end service rating is:
  2”- 12”= 75psi, 14”- 24”= 50psi
- Epoxy coated finish
- Ideal for mounting pnuematic/electrical actuators
- Square stem for direct mount

Accessories

- 10 position locking lever handle
- Gear operators
- Electrical and pnuematic actuators

Warranty

The Company, for a period of one year from the date of shipment, warrants each product or system of its own manufacture to the original purchaser to be free from defects in material and workmanship under normal use, service and maintenance.

Architect/Engineer approval	
Job Name	Date
Model Specified	Quantity
Variations Specified	
Customer/Wholesaler	
Contractor	
Architect	

Note: Information subject to change without notice.

Jomar Valve
7243 Miller Drive
Warren, MI 48092
Phone: 800-325-5690
Fax: 800-628-4194
www.jomarvalve.com

BFV-Lug
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Ductile Iron Body, 316 SS, Lug Type Butterfly Valve

Description

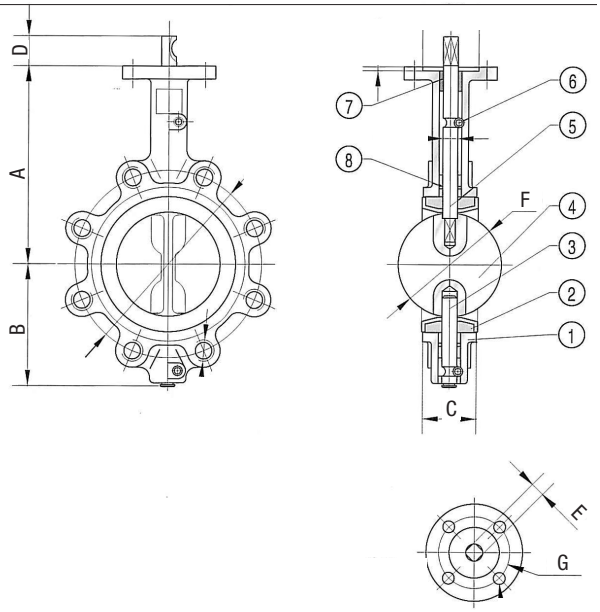
Jomar Butterfly Valves come standard with phenolic backed cartridge type seats. Accompanied with precision machined 316 SS disc, offers low operating torque, bubble-tight shut-off and longer seat life.

Material Specification

No.	Part Name	Materials
1	Body	Ductile Iron
2	Seat	EPDM / PTFE / BUNA / VITON
3	Lower Stem	410 Stainless Steel
4	Disc	316 Stainless Steel
5	Upper Stem	410 Stainless Steel
6	Locating Pin	Cast Steel
7	Bushing	PTFE
8	O-ring	EPDM

Dimensions in Inches

Computer No.	Valve Size	A	B	C	D	E	F	G	Weight	CV
600-02DS_B	2"	6.34	3.15	1.65	1.20	.35	2.07	1.97	8.38	135
600-0212DS_B	2-1/2"	6.89	3.50	1.76	1.20	.35	2.54	1.97	9.26	220
600-03DS_B	3"	7.13	3.74	1.78	1.20	.35	3.10	1.97	10.36	302
600-04DS_B	4"	7.87	4.49	2.05	1.20	.43	4.10	2.76	19.84	600
600-05DS_B	5"	8.39	5.00	2.14	1.20	.55	4.86	2.76	24.03	1022
600-06DS_B	6"	8.90	5.47	2.20	1.20	.55	6.13	2.76	31.31	1579
600-08DS_B	8"	10.24	6.89	2.39	1.77	.67	7.98	4.02	40.12	3136
600-10DS_B	10"	11.50	7.99	2.58	1.77	.87	9.87	4.02	59.08	5340
600-12DS_B	12"	13.27	9.53	3.03	1.77	.87	11.88	4.02	88.18	8250



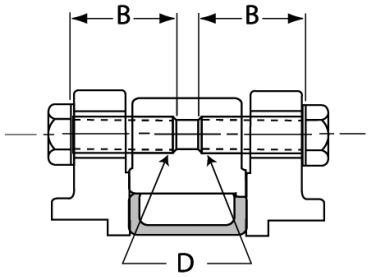
DIAGONAL SQUARE HEAD

Part Name	Material	Temperature F	Temperature C
Seat (Soft Seal)	Buna-N (NBR)	+10 to 180	-12 to 82
	Buna-N, Food Grade	+10 to 180	-12 to 82
	EPDM	-30 to 250	-35 to 121
	EPDM, Food Grade	-30 to 225	-35 to 107
	EPDM, Heat-Resistant	+30 to 300	-2 to 150
	Viton	+10 to 275	-12 to 135
	Viton, High Temp	+10 to 400	-12 to 204
	Neoprene	+20 to 200	-7 to 93
	Hypalon	0 to 275	-18 to 135
	Silicon	-70 to 425	-57 to 218
	PTFE over EPDM	-20 to 250	-29 to 121
	PURE PTFE	-100 to 400	-74 to 204

DIM	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
B	1-1/2	1-1/2	1-1/2	1-3/4	1-3/4	2	2	2-1/4	2-1/2
D	5/8 -11UNC	5/8 -11UNC	5/8 -11UNC	5/8 -11UNC	3/4 -10UNC	3/4 -10UNC	3/4 -10UNC	7/8 -9UNC	7/8 -9UNC

Flow in Gpm @ 1PSI P @ Various Disc Angles

Size	10°	20°	30°	40°	50°	60°	70°	80°	Full 90°Open
2"	0.1	5	12	24	45	64	90	125	135
2.5"	0.2	8	20	37	65	98	144	204	220
3"	0.3	12	22	39	70	116	183	275	302
4"	0.5	17	36	78	139	230	364	546	600
5"	0.8	29	61	133	237	392	620	930	1022
6"	2	45	95	205	366	605	958	1437	1579
8"	3	89	188	408	727	1202	1903	2854	3136
10"	4	151	320	694	1237	2047	3240	4859	5340
12"	5	234	495	1072	1911	3162	5005	7505	8250



Note: Information subject to change without notice.

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www.jomarvalve.com

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Butterfly Lever

10-Position, Lockable Lever Handle

Description

Ten-position locking lever handles fit Jomar 600 series (Lug) and 900 series (Wafer) butterfly valves. Available in sizes 2" - 12".

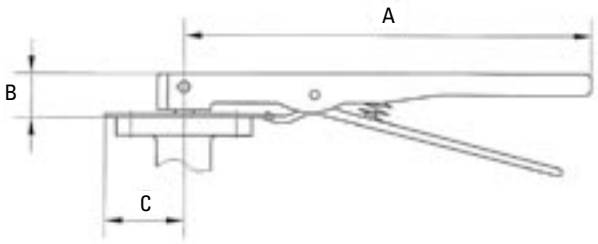
Lever Handle

Dimensions in Inches

Computer No.	Size	A	B	C	Weight
BLH2-3	2"-3"	10.64	1.26	2.05	2.00
BLH4	4"	10.64	1.26	2.05	2.00
BLH5-6	5" - 6"	10.64	1.26	2.05	2.00
BLH8	8"	14.18	1.77	2.96	4.30
BLH10-12	10" - 12"	19.70	1.77	2.96	5.84

Warranty

The Company, for a period of one year from the date of shipment, warrants each product or system of its own manufacture to the original purchaser to be free from defects in material and workmanship under normal use, service and maintenance.



Architect/Engineer approval

Job Name _____ Date _____

Model Specified _____ Quantity _____

Variations Specified _____

Customer/Wholesaler _____

Contractor _____

Architect _____

Note: Information subject to change without notice.

Jomar International Ltd.
7243 Miller Drive
Warren, MI 48092
Phone: 800-325-5690
Fax: 800-628-4194
www.jomar.com

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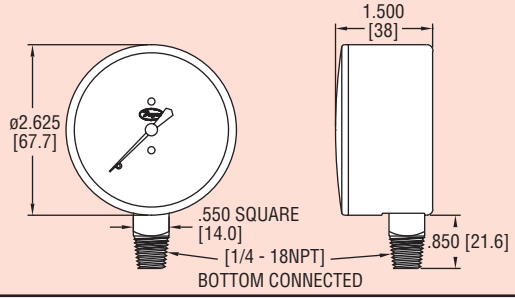
Series LPG4

2.5″ Low Pressure Gage

1.5% Full-Scale Accuracy in a 2-1/2″ Gage



Our **Series LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

SPECIFICATIONS
Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% full-scale.

Pressure Limit: 100% of range scale.
Temperature Limits:
Process: -40 to 160°F (-40 to 70°C);
Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

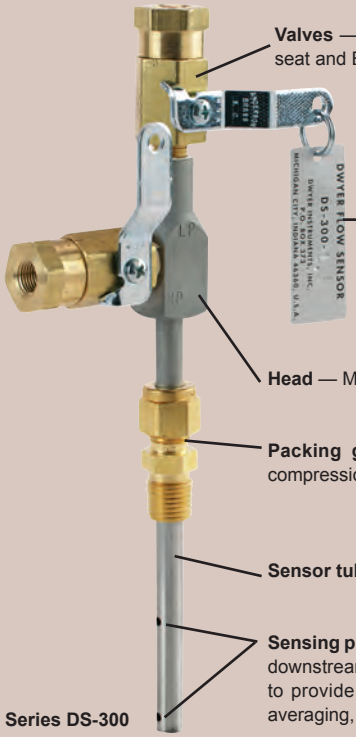
Model	Range	Model	Range
LPG4-D7122N	-10 to 0 in w.c. (-2.5 to 0 kPa)	LPG4-D8322N	0 to 40 in w.c. (0 to 10 kPa)
LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	LPG4-D8422N	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	LPG4-D8522N	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	LPG4-D8622N	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	LPG4-D8722N	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	LPG4-D8922N	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	LPG4-D9022N	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-160 to 0 in w.c. (-40 to 0 kPa)	LPG4-D9122N	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	LPG4-D9222N	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	LPG4-D9322N	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	LPG4-D9422N	-30 to 0 to 50 in w.c. (-7.5 to 0 to 14.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	LPG4-D9522N	-40 to 0 to 60 in w.c. (-10 to 0 to 0.15 kPa)

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

Series DS

In-Line Flow Sensors

Use with the Dwyer® Differential Pressure Gages or Transmitters



Valves — Standard, brass with TFE seat and Buna-N O-ring

Nameplate — Stainless steel permanently attached with split ring. Includes complete size and model information.

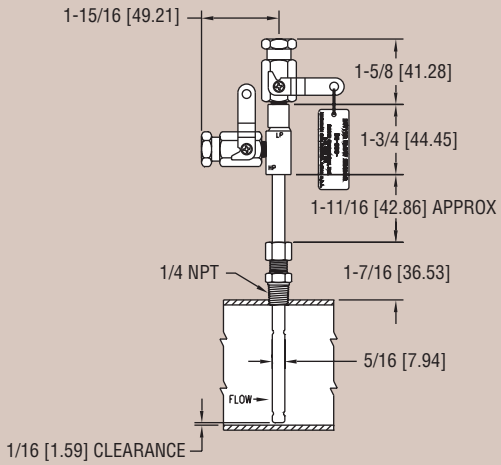
Head — Machined stainless steel.

Packing gland — Parker CPI brass compression fitting.

Sensor tube — 304 SS.

Sensing ports — Multiple upstream and downstream ports sized and positioned to provide effective accurate pressure averaging, even at lower velocities.

Series DS-300



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.

Series DS-300

Model	Description
DS-300-1″	1″ pipe size
DS-300-1-1/4″	1-1/4″ pipe size
DS-300-1-1/2″	1-1/2″ pipe size
DS-300-2″	2″ pipe size
DS-300-2-1/2″	2-1/2″ pipe size
DS-300-3″	3″ pipe size
DS-300-4″	4″ pipe size
DS-300-6″	6″ pipe size
DS-300-8″	8″ pipe size
DS-300-10″	10″ pipe size

Series DS-400

Model	Description
DS-400-6″	6″ pipe size
DS-400-8″	8″ pipe size
DS-400-10″	10″ pipe size
DS-400-12″	12″ pipe size
DS-400-14″	14″ pipe size
DS-400-16″	16″ pipe size
DS-400-18″	18″ pipe size
DS-400-20″	20″ pipe size
DS-400-24″	24″ pipe size

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″

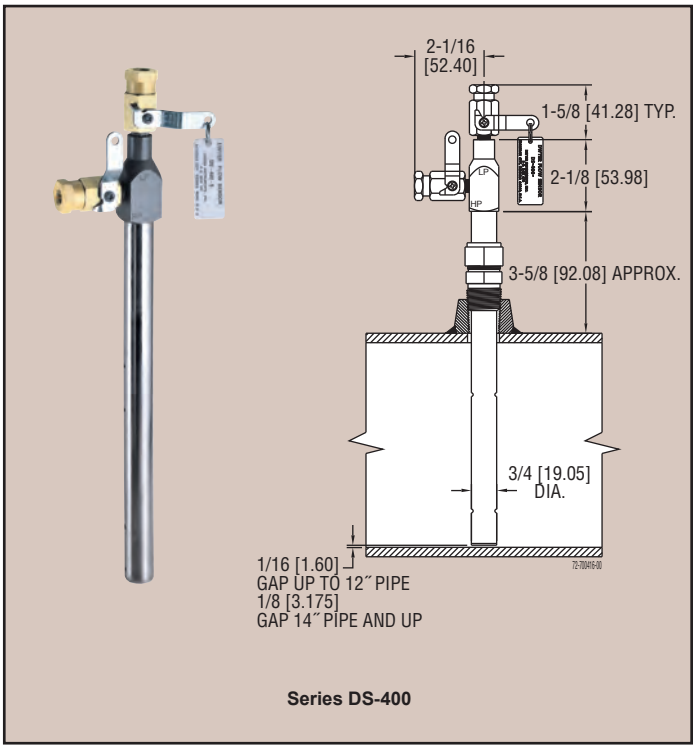
How To Order

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



Series 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

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 page 15 for complete information on the Capsuhelic® gage

Capsuhelic® Gage Shown Installed In A-471 Portable Kit

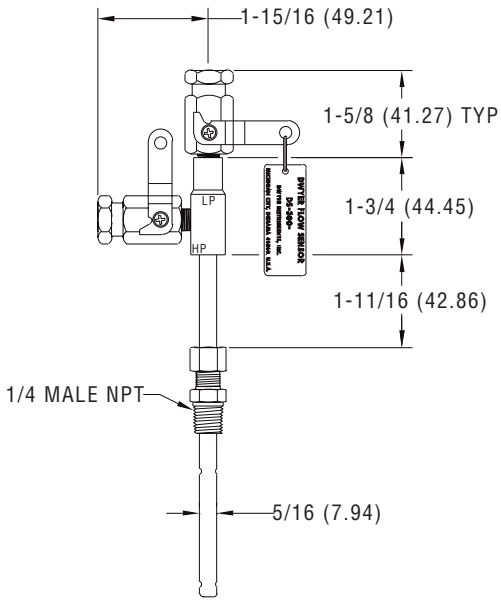
Series 631B Capsuhelic® Wet/Wet Differential Pressure Transmitter

Low pressure transmitter for use with DS-300/400 flow sensors. Use Series 631B Capsuhelic® Wet/Wet Differential Pressure Transmitter.

See page 65 for additional details.

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

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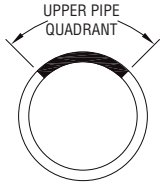
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

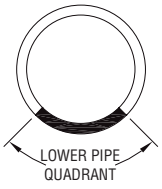
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4˝ x 3/8˝) will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16˝ to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

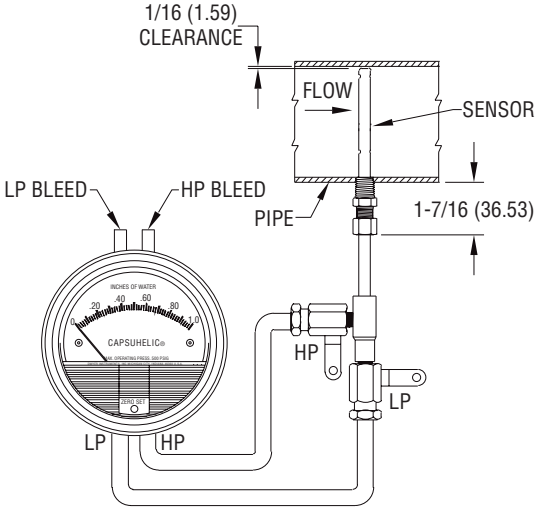
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

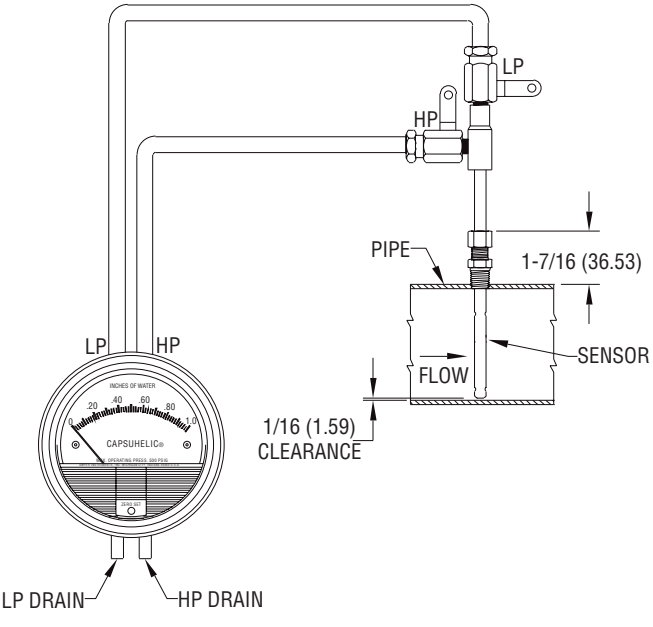
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

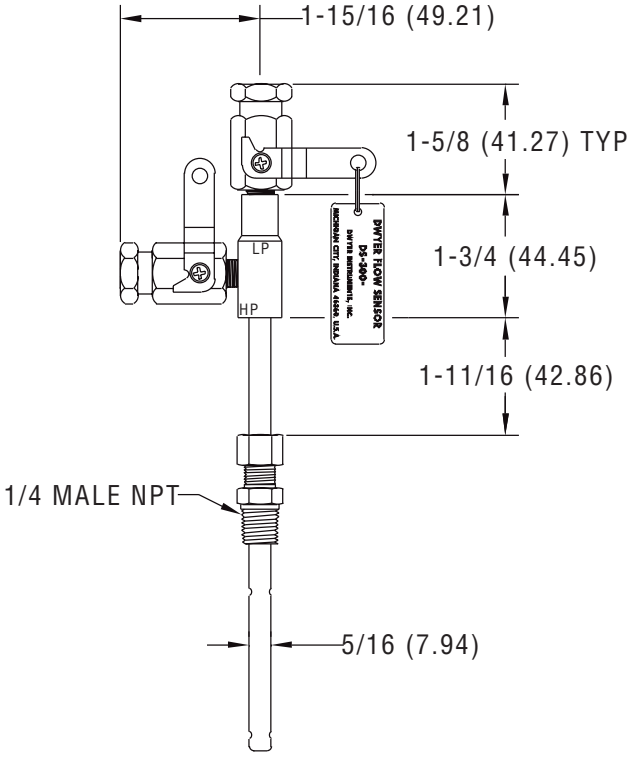
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 “Flow of Fluids Through Valves, Fittings and Pipe.” It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient “K”	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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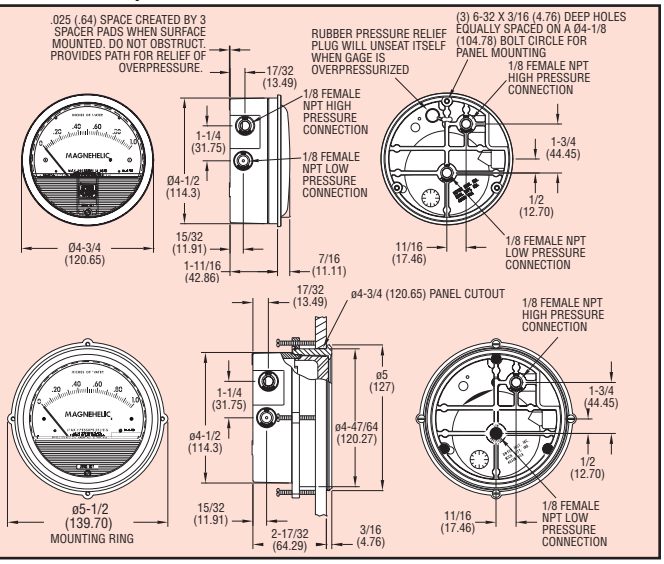
Series 2000

Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%

RoHS



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 page 7 for more information on mounting accessories.

Flush, Surface or Pipe Mounted

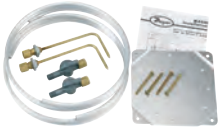
Enclosure Mounted

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.



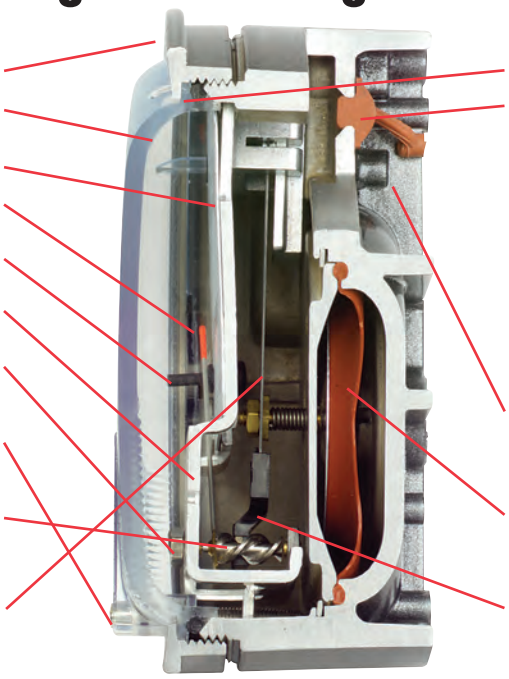
Model A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings 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

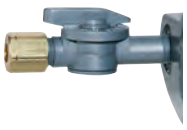
Model	Range in W.C./ Velocity F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2005AV	0-5.0/2000-8800
2010AV	0-10/2000-12500

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.

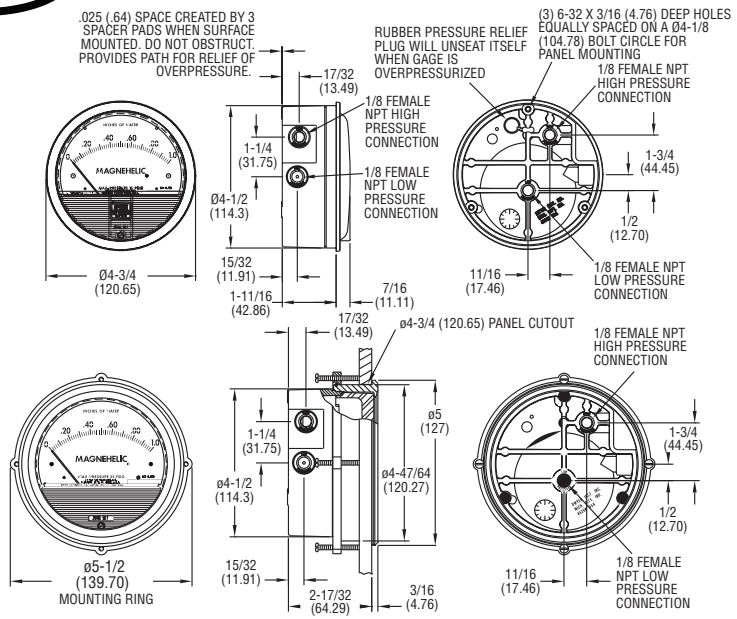
ACCESSORIES
A-321, Safety Relief Valve
A-448, 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-135, Rubber gasket for panel mounting
A-401, Plastic Carry Case



A-310A 3-Way Vent Valves
In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

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.

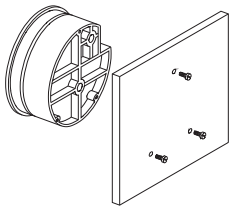
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.

Note: May be used with hydrogen when ordering Buna-N diaphragm. Pressure must be less than 35 psi.

INSTALLATION

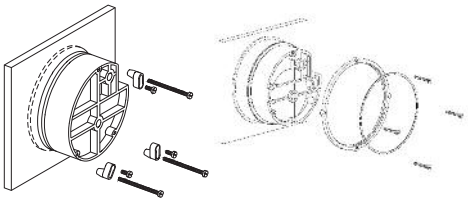
Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will 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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Please read and save these instructions. *Read this operating manual carefully before starting to assemble, install, operate or maintain the product. Follow all the safety information to protect yourself and others. Please make sure to comply with instructions. Any failure to follow the safety instructions could cause serious personal injury and/or property destruction. Keep these Instructions for future reference.*

Dayton® Utility Flexible Impeller Pumps

Description

Dayton Utility Flexible Impeller Pumps are self-priming pumps, have a wide range of applications in general commercial and industrial applications where there are non-abrasive, nonflammable liquids compatible with the pump material make-up. The pumps are designed for transferring liquids, emptying or filling tanks, sinks or basins. The pumps can be used to pump bilge water, but the pump must not be located in the bilge area. Self-priming to 7 ft, if the impeller is initially wet (primed). The maximum liquid temperature of pump is 140F, the minimum liquid temperature of pump is 40F. Carrying handle included.

Figure1

NOTE: Pump is NOT RECOMMENDED for use with soap detergents, gasoline, waste oil, fuel oil, flammable, explosive or combustible liquids or other fluids not compatible with pump component materials. Do not use pump in enclosed areas. Intermittent duty only (15 minutes per hour).

Performance

		Dimensions (inch)			GPM at Total Feed of Head						Shutoff (ft)*
Motor HP	Model	L	W	H	5	10	20	30	40	50	
1/10	5UXL7	6.75	4.00	4.50	5.20	4.43	3.05	1.41	--	--	37.3
1/10	5UXL8	6.10	4.00	4.21	3.72	3.32	2.31	1.15	--	--	36.7
1/10	5UXL9	6.75	4.00	4.50	5.20	4.43	3.05	1.41	--	--	37.3
1/10	5UXN0	6.10	4.00	4.21	3.72	3.32	2.31	1.15	--	--	36.7

(*) Shut-off, to convert to PSI, divide by 2.31

NOTE: All dimensions have a tolerance of ±1/8".

Specifications

		Pump Detail				Pump Material	
Model	Volts	Max. Amps	RPM	Length Cord (FT)	Inlet/Outlet (In.)	Body Material	Impeller
5UXL7	115V	1.6	4000	6	3/8 ID; 3/4 OD Garden Hose	Nickel-Plated Brass	Buna-N
5UXL8	12VDC	6.5 to 10	4000	7	3/8 ID; 3/4 OD Garden Hose	Nickel-Plated Brass	Buna-N
5UXL9	115V	1.6	4000	6	3/8 ID; 3/4 OD Garden Hose	Stainless Steel	Buna-N
5UXN0	12VDC	6.5 to 10	4000	7	3/8 ID; 3/4 OD Garden Hose	Stainless Steel	Buna-N

Form 5S6590

Printed in China
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Version 2

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01/2014
FORM # 579

Dayton® Utility Flexible Impeller Pumps

ENGLISH

Unpacking

When unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing, or damaged parts. Two extra impellers and gaskets are included with pump.

General Safety Information

1. Know the pump application, limitations and potential hazards.

⚠ WARNING ***Explosion Hazards!***

Don't used to pump flammable or explosive fluids such as gasoline, fuel oil and kerosene, etc. Don't use in flammable or explosive atmospheres. Failure to follow this can cause accidents.

⚠ CAUTION ***Caution indicates a potentially hazardous situation, which, if not avoided, MAY result in minor or moderate injury.***

⚠ DANGER ***Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or serous injury.***

2. Make certain that the power source conforms to the requirements of your pump.
3. When wiring an electrically driven pump, follow all electrical and safety codes, as well as the most recent National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA) in the United States.
4. All wiring should be performed by a qualified electrician.
5. Protect electrical cord from sharp objects, hot surfaces, oil and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.
6. Make sure the wire size is of adequate to minimize voltage drop at the motor.
7. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.
8. Provide adequate protection and guarding around moving parts.
9. Fasten the discharge line before starting the pump.

⚠ CAUTION ***An unsecured discharge line will whip, possibly causing injuries or damages.***

10. Provide a means of pressure relief for pumps whose discharge line can be shut-off or obstructed.
11. Personal Safety:
    a. Wear safety glasses at all times when working with pumps.
    b. Make work area and shop child safe–utilize master switches and locks, and remove all keys.
    c. Keep work area well-lighted.
    d. Keep others at a safe distance away while at working.
    e. Keep work area clean and tidy, and put all unused tools and equipment away.

⚠ WARNING ***Do not touch or handle motor with wet hands, or when standing in water.***

12. The pump is not submersible and is intended for open-air use only.
13. Disconnect power before servicing a motor or its load. If the power disconnect is out-of-sight, lock it in the open position and tag it to prevent the power from being unexpectedly turned on.
14. Release all pressure within the system before servicing any component.
15. Drain all liquids from the system before servicing.
16. Check hoses for weak or worn condition before each use, making certain that all connections are secure.
17. Periodically inspect pump and system components. Pump should be checked daily, weekly, monthly, etc., for proper operation.

Installation & Operation

⚠ WARNING ***In any installations where property damage and/or personal injury might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup systems (s) should be used. In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the unit. This pump is not suitable for many liquids.***

1. Place the pump as closely as possible to the source of liquid and power, the pump should not be more than 7 feet above liquid source.
2. Use reinforced plastic or fabric tubing, hose, or metal pipe for the suction side of the pump. Discharge piping should never be larger than suction piping!
3. Ensure both inlet and discharge hose are as straight as possible. Coils in the hoses can develop friction loss and prevent the unit from running effectively.
4. Attach suction line piping to the suction inlet and discharge line piping to the discharge outlet.
5. The pump MUST always be primed. To prime the pump by filling the pump housing with the liquid that is being pumped. Also try to fill the suction hose with as much liquid as possible.

Models: 5UXL7 thru 5UXL9 and 5UXN0

Installation& Operation (continued)

6. Install a foot valve if the suction line is longer than 7 feet.
7. When used in a boat, pump should not be installed in the bilge.
8. 5UXL7 and 5UXL9 should always be plugged into a GFCI (Ground Fault Circuit Interrupter). Consult your local Electrician for installation and availability.
9. 5UXL8 and 5UXN0, connect to a power supply by clamping the power-leads' alligator clips to a 12V DC battery (red to positive; black to negative).
10. Pumps are self-priming and should start pumping within 30 seconds after pump is started. Running the impeller dry for as short as 30 seconds can ruin the impeller. Keep suction line as short as possible.

NOTE: Do not operate pump dry. Impeller and lip seal damage will result.

11. Protect pump from extreme heat, cold, and humidity. This unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations.
12. The motor is designed to be used in a clean, dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104F (40C). For outdoor installations motor must be protected by a cover that does not block airflow to and around the motor.
13. Do not run at heads greater than 35 feet (15psig).

Maintenance

⚠ CAUTION ***Make certain the unit is disconnected from the power source before attempting to service or remove any component!***

1. Always drain pump when not in use.
2. Only qualified electricians or servicemen should attempt to repair this unit. Improper repair and/or assembly can cause an electrical shock hazard.

IMPELLER REPLACEMENT:

1. Remove the 4 cover mounting screws, cover plate, gasket and the impeller .
2. Inspect the inside of the pump body and clean, if necessary.
3. To ease installation of the impeller, lightly grease the inside of the pump housing with Vaseline petroleum jelly or similar lubricant other types of grease could damage the impeller.
4. Line up the flat area on the motor shaft with the flat area on the inside of the impeller insert.
5. Grease the new impeller with vaseline petroleum jelly or similar lubricant and align the flat on the inside of the impeller, Using a clockwise twist to bend the impeller blades in the direction of the motor rotation, push the impeller into the pump body.
6. Replace gasket provided with Repair Kit, and install cover plate.
7. Tighten all screws evenly and snugly. DO NOT over-tighten.

Troubleshooting Chart

Symptom	Possible Cause (s)	Corrective Action
Pump will not run	1. No electricity 2. Impeller jammed 3. Motor overheated	1. Determine that outlet is for correct voltage 2. Clear obstruction 3. If motor has Automatic Thermal Protector. Wait for fifteen minutes for motor to cool, then restart. Liquid may be too hot.
Pump runs but no fluid is pumped.	1. Faulty suction piping 2. Defective impeller 3. Suction lift too high 4. Discharge height too great 5. Clogged inlet 6. Pump too far from liquid	1. Repair or replace 2. Replace 3. Lower pump 4. Lower the height 5. Clean or replace 6. Relocate
Pump will not prime or retain prime after operating.	1. Air leak in suction line 2. Defective impeller 3. Gasket leaking 4. Suction lift too high 5. Hose kinked 6. Hose fitting not tight on head 7. Inadequate impeller lubrication	1. Repair or replace. 2. Replace 3. Replace 4. Lower pump 5. Straighten hose 6. Tighten hose 7. Lubricate through inlet or outlet of pump head.
Flow rate is low	1. Piping or hose is fouled or damaged 2. Clogged impeller 3. Worn cam or impeller 4. Voltage incorrect	1. Clean or replace 2. Clear obstruction 3. Replace 4. Supply correct voltage
Shaft seal leaks	1. Pump head loose on motor	1. Repair
Motor runs too hot	1. Voltage incorrect 2. Excessive discharge pressure 3. Impeller swollen 4. Liquid too viscous 5. Plugged or kinked discharge 6. Insufficient air flow on motor	1. Supply correct voltage 2. Reduce pressure 3. Replace 4. Reduce viscosity of liquid 5. Examine and repair 6. Be sure ample fresh air is available at the motor.

For Repair Parts, call 1-800-Grainger

24 hours a day – 365 days a year

Please provide following information:

-Model number
-Serial number (if any)
-Part description and number as shown in parts list

ENGLISH

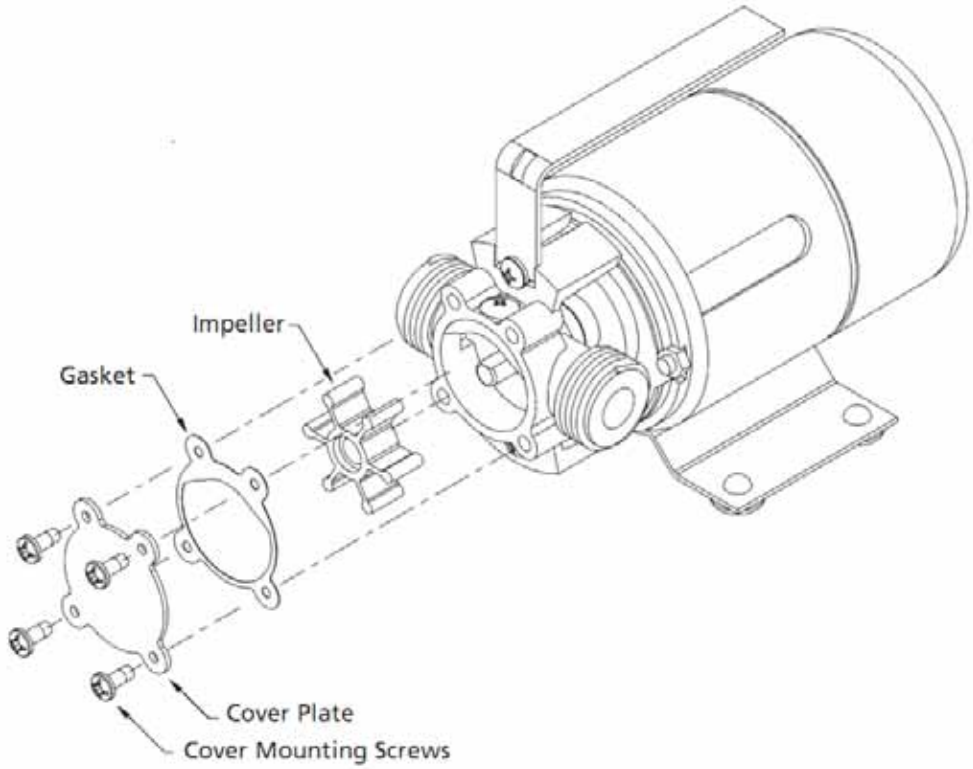

Figure 2 – Repair parts for illustration

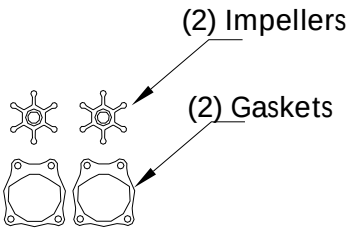

Figure 3—Repair Kit 5UXN2

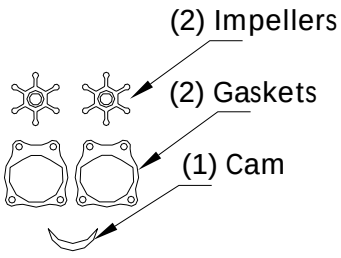

Figure 4—Repair Kit 5UXN1

NOTE：Repair Kits 5UXN1 and 5UXN2 fit pumps 5UXL7, 5UXL8, 5UXL9 and 5UXN0

Dayton® Utility Flexible Impeller Pumps

ENGLISH

DAYTON ONE-YEAR LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *All Dayton® product models covered in this manual are warranted by Dayton Electric Mfg. Co. ("Dayton") to the original user against defects in workmanship or materials under normal use for one year after date of purchase. If the Dayton product is part of a set, only the portion that is defective is subject to this warranty. Any product or part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton or Dayton's designee designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced with a new or reconditioned product or part of equal utility or a full refund given, at Dayton's or Dayton's designee's option, at no charge. For limited warranty claim procedures, see "Warranty Service" below. This warranty is void if there is evidence of misuse, mis-repair, mis-installation, abuse or alteration. This warranty does not cover normal wear and tear of Dayton products or portions of them, or products or portions of them which are consumable in normal use. This limited warranty gives purchasers specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.*

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LIMITATION OF LIABILITY. *TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, DAYTON'S LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES IS EXPRESSLY DISCLAIMED. DAYTON'S LIABILITY IN ALL EVENTS IS LIMITED TO AND SHALL NOT EXCEED THE PURCHASE PRICE PAID.*

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CONSUMERS ONLY. *CERTAIN ASPECTS OF DISCLAIMERS ARE NOT APPLICABLE TO CONSUMER PRODUCTS SOLD TO CONSUMERS; (A) SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU; (B) ALSO, SOME JURISDICTIONS DO NOT ALLOW A LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU; AND (C) BY LAW, DURING THE PERIOD OF THIS LIMITED WARRANTY, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE APPLICABLE TO CONSUMER PRODUCTS PURCHASED BY CONSUMERS, MAY NOT BE EXCLUDED OR OTHERWISE DISCLAIMED.*

THIS LIMITED WARRANTY ONLY APPLIES TO UNITED STATES PURCHASERS FOR DELIVERY IN THE UNITED STATES.

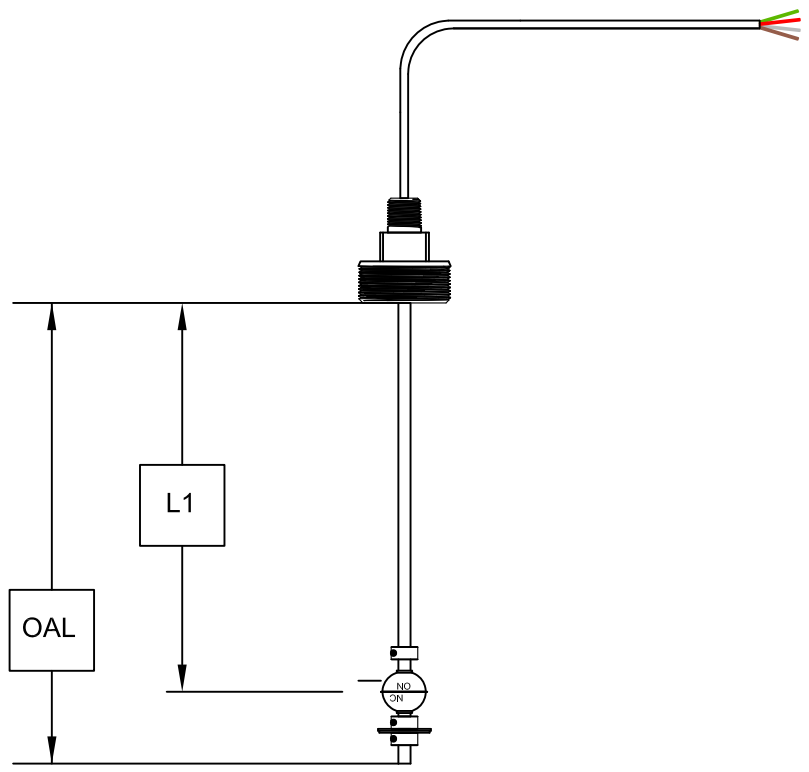
WARRANTY SERVICE

To obtain warranty service if you purchased the covered product directly from W.W. Grainger, Inc. ("Grainger"), (i) write or call or visit the local Grainger branch from which the product was purchased or another Grainger branch near you (see www.grainger.com for a listing of Grainger branches); or (ii) contact Grainger by going to www.grainger.com and clicking on the "Contact Us" link at the top of the page, then clicking on the "Email us" link; or (iii) call Customer Care (toll free) at 1-888-361-8649. To obtain warranty service if you purchased the covered product from another distributor or retailer, (i) go to www.grainger.com for Warranty Service; (ii) write or call or visit a Grainger branch near you; or (iii) call Customer Care (toll free) at 1-888-361-8649. In any case, you will need to provide, to the extent available, the purchase date, the original invoice number, the stock number, a description of the defect, and anything else specified in this Dayton One-Year Limited Warranty. You may be required to send the product in for inspection at your cost. You can follow up on the progress of inspections and corrections in the same ways. Title and risk of loss pass to buyer on delivery to common carrier, so if product was damaged in transit to you, file claim with carrier, not retailer, Grainger or Dayton. For warranty information for purchasers and/or delivery outside the United States, please use the following applicable contact information:

Dayton Electric Mfg. Co.,
100 Grainger Parkway, Lake Forest, IL 60045 U.S.A.
or call ***+1-888-361-8649***

Notes

L1	RED	NORMALLY CLOSED	HIGH-HIGH (1)
	BLACK		COMMON



HOUSING	
CONDUIT CONNECTION	$\frac{1}{2}$ NPT
FITTING AND STEM MATERIAL	STAINLESS STEEL
FITTING SIZE	2 INCH NPT
FLOAT STOP	SNAP RING
FLOAT MATERIAL	STAINLESS STEEL
SWITCH TYPE	SPST
SWITCH RATING	50 WATT

OAL - 11.875 INCHES
L1 - 10 INCHES
CABLE LENGTH - 120 INCHES

REV	DESCRIPTION	DATE	APPROVED
A	AS BUILT	08-19-14	MJS

REVISIONS

CONFIDENTIALITY NOTICE:
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DRWN BY	DATE
CJJ	07-08-14
CHK BY	DATE
KWB	08-28-14
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
1 POSITION LEVEL SENSOR

AKRF-RINZLER
3200 JEROME AVENUE - BRONX, NY.

JOB NO. 14-151

SCALE	SIZE	DWG NO.	SHEET	REV
NTS	B	M-3	1 OF 1	A

SECTION 6 - PROCESS COMPONENTS -

BY-PASS MOV, BUTTERFLY VALVE BODY, 4" - CENTERLINE CV044352

BY-PASS MOV, VALVE ACTUATOR W/ BATTERY BACK-UP - APOLLO CS600WL2E

INLINE PARTICULATE FILTER, 6" - SOLBERG CT-275P-600C

SSDS BLOWER, 15HP - FPZ SCL K11-MS-15-3

SPARE SSDS BLOWER, 10HP (LOOSE) - FPZ SCL K11-MS-10-3

VACUUM RELIEF VALVE, 4" - FPZ VRL9

VAPOR CARBON VESSEL, 400LB 4X10 REACT MEDIA - TETRASOLV VR-400

INLET VACUUM INDICATOR, (-100)-0 IWC - DWYER LPG4-D7722N

INLET LOW VACUUM SWITCH, 4-20 IWC - DWYER 1950-20-2F

INLET TEMPERATURE INDICATOR, 0-150F - WEISS 35RB3-5211-05FT

DISCHAREGE PRESSURE INDICATOR, 0-25 IWC - AV 18C784

DISCHARGE TEMPERATURE INDICATOR, 0-180F - WEISS 35RB3-5211-05FT

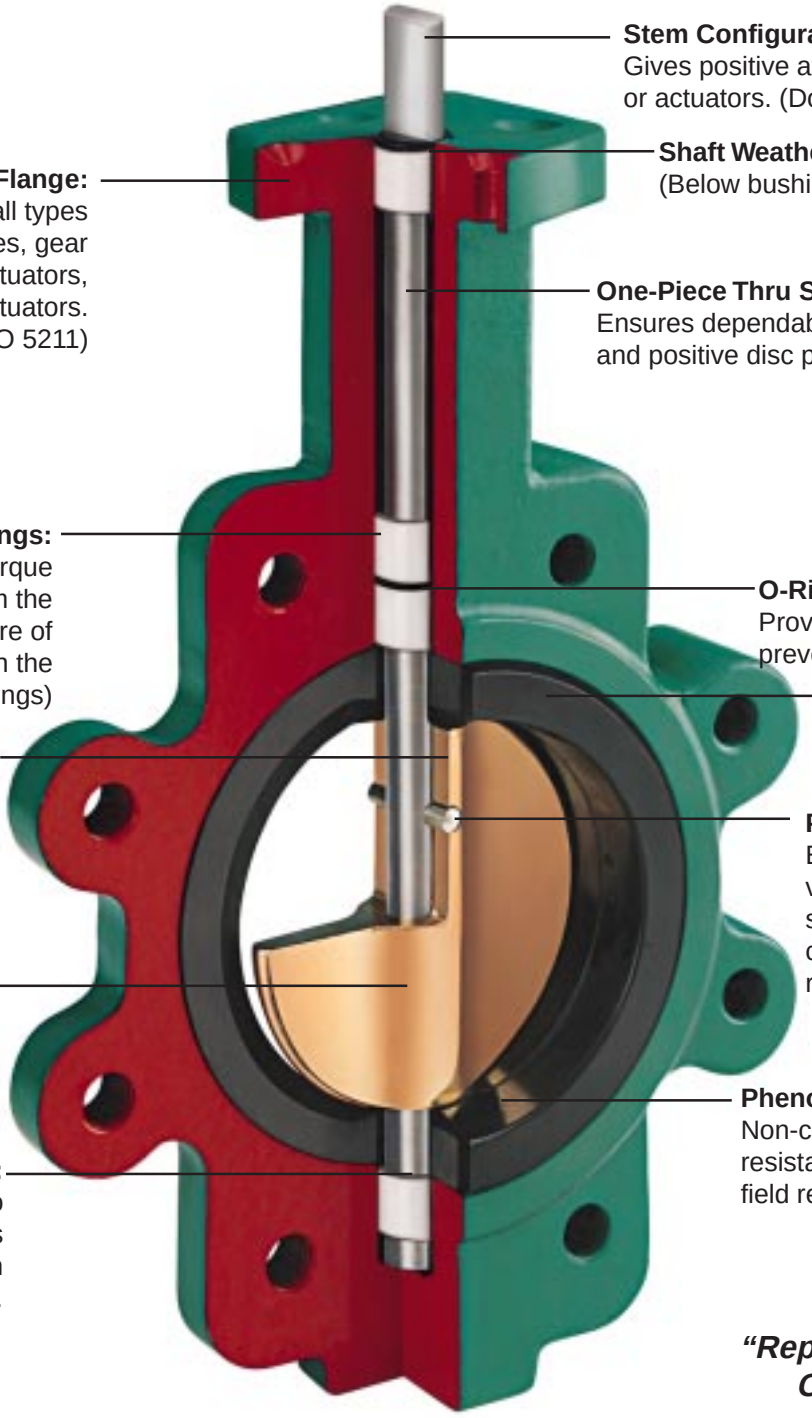
DISCHARGE HIGH TEMPERATURE SWITCH, 0-225F - UNITED ELECTRIC B100-120

ENCLOSURE HIGH TEMPERATURE SWITCH, 55-175F - HONEYWELL T675A1425

For over 40 years, Center Line has manufactured resilient seated butterfly valves. Today, Center Line continues to manufacture these butterfly valves as its primary product. Industries using Center Line resilient seat valve products include:

- HVAC
- Chemical/Petrochemical Processing
- Food and Beverage Industry
- Power and Utilities
- Pulp and Paper Industry

Quality is designed into the Series 200 butterfly valve, utilizing the phenolic-backed cartridge seat pioneered by Center Line. These valves feature precision-machined parts insuring years of dependable operation. With many body/trim combinations, there is a Series 200 valve to meet your application.



Stem Configuration: Gives positive attachment for handles or actuators. (Double "D", 2" - 24")

Shaft Weather Seal: (Below bushing on some models)

Actuator Flange: Accommodates all types of actuators; handles, gear operators, electric actuators, and pneumatic actuators. (2" - 24" per ISO 5211)

One-Piece Thru Shaft: Ensures dependability and positive disc positioning.

Bushings: Stem bushing reduces torque and isolates the stem from the valve body, preventing seizure of the stem due to corrosion in the stem journal. (4 Bushings)

O-Ring: Provides further prevention of stem leakage

Seat Face: Negates need for flange gaskets.

Smooth Finished Disc Flats: These "mate" with seat flats to give a highly efficient seal; prevents leakage into shaft areas.

Precision Taper Pin: Ensure positive, vibration proof, shaft to disc connection. Field replaceable.

Precision Profile Disc: Provides bubble-tight shut-off and assures minimum torque and longer seat life.

Phenolic Backed Seat: Non-collapsible, stretch resistant, blow out proof, field replaceable.

Supported Shaft Seal: Bonding of elastomer to phenolic backing ring protects against distortion, a common cause of shaft leakage.

"Representative Cutaway"

*Series 200 Butterfly Valves

- Available in sizes 2" to 48".
- Available in Wafer or Lug style body (2" to 30").
- Full flange style body for 36" to 48" valves.
- Wafer body features four alignment holes.
- Pressure ratings for tight shut-off at temperatures up to the maximum limit of the seat material:
  - 2" to 12" — 200 psi, 125 psi for PTFE seat.
  - 14" to 48" — 150 PSI.
- Ideal for on-off or throttling services.

(*Note: Series 200 formally known as “A” & “LT”)

- Available with handles (2" to 12"), manual gear operators (2" to 48"), and electric or pneumatic actuators (2" to 48").
- Refer to Crane actuator bulletins for details of pneumatic and electric actuators.
- Designed to comply with MSS SP-67.
- Compatible with ANSI 125/150 flanges.
- Valves 2" to 20" meet the intent and have passed the AWWA C-504-87 Section 5 proof of design tests.
- Type approval certification from ABS for marine applications (2" to 14").
- Bi-directional dead-end capability to 200 psi (2" to 12") and 150 psi (14" to 24") is available.
- Operators mounted perpendicular to pipe.

Valve Seating Torques (In-Lbs.)

Valve Size	Standard Disc Differential Pressure								Undercut Diff. Press.	
	50 PSI ΔP Bushing		100 PSI ΔP Bushing		150 PSI ΔP Bushing		200 PSI ΔP Bushing		75 PSI ΔP Bushing	
	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE
2"	106	100	117	106	129	111	140	117	-	-
2 1/2"	152	150	166	163	181	176	195	189	-	-
3"	213	207	230	220	248	232	265	244	-	-
4"	321	290	386	323	450	357	515	390	-	-
5"	481	423	598	481	715	540	832	598	-	-
6"	692	599	878	691	1,063	783	1,248	875	-	-
8"	1,326	1,060	1,716	1,183	2,106	1,307	2,496	1,430	1,124	819
10"	2,239	1,671	3,010	1,872	3,780	2,074	4,550	2,275	1,363	909
12"	3,959	2,568	4,953	2,795	5,948	3,023	6,942	3,250	2,457	1,445
14"	4,881	2,640	6,226	3,070	7,570	3,500	-	-	4,400	2,300
16"	7,020	4,260	8,580	4,880	10,140	5,500	-	-	5,900	3,600
18"	10,105	6,287	12,202	7,243	14,300	8,200	-	-	8,300	5,500
20"	13,923	8,360	16,582	9,180	19,240	10,000	-	-	11,100	6,700
24"	23,617	15,427	26,953	16,813	30,290	18,200	-	-	17,300	12,100
30"	39,721	27,313	43,391	29,407	47,060	31,500	-	-	27,300	21,100

All torques shown on the chart were derived from test data using water at 60°F. For torques using dry gases, multiply these numbers by 1.6. For torques involving other media, please consult the factory.

There is no safety factor included in the numbers shown on this chart. For actuator sizing, Center Line recommends that these values be multiplied by 1.2 for single valve applications, and 1.5 for 3-way ("tee") applications.

Under certain conditions, hydrodynamic torque can meet or exceed seating and unseating torques. When designing valve systems, hydrodynamic torque must be considered to help insure correct selection for the application.

Seat Temperature Ratings

Material	Temperature Ratings °F
Buna-N	+10 to 180
Abrasive Resistant Buna-N	+10 to 180
Neoprene	+20 to 200
EPDM (2"- 16")	-30 to 275
EPDM (18" & Above)	-30 to 225
EPDM, Food Grade (2" - 12")	-30 to 225
Hypalon	0 to 275
Viton®	+10 to 275
High Temp. Viton®*	+10 to 400
PTFE over Buna-N (125 psi, 2" - 12")	+40 to 250
PTFE over Buna-N (75 psi, 2" -12")	+40 to 275

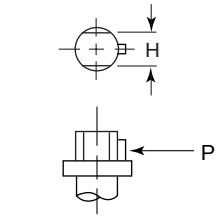
Although elastomers have an effective operating temperature range, when used in valves, these ranges may have to be modified. The temperature ranges shown in the table have been adjusted accordingly.

For Low Temperature: While the seat materials selected for use in Center Line butterfly valves are capable of withstanding lower temperatures without damage, the durometer of the elastomer is changed. This "hardening" of the seat may increase the operating torque beyond the structural limits of the stem and/or the disc to stem configuration.

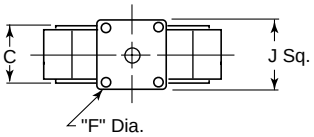
For High Temperature: When using High Temperature Viton®, the operating pressure of the valve is reduced above 275°F.

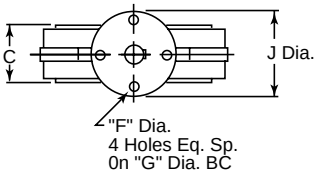
C_V Values – Valve Sizing Coefficients (US-GPM @ 1ΔP)

Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
2"	0.06	3	7	15	27	44	70	105	115
2 1/2"	0.10	6	12	25	45	75	119	178	196
3"	0.20	9	18	39	70	116	183	275	302
4"	0.30	17	36	78	139	230	364	546	600
5"	0.50	29	61	133	237	392	620	930	1022
6"	0.80	45	95	205	366	605	958	1437	1579
8"	2	89	188	408	727	1202	1903	2854	3136
10"	3	151	320	694	1237	2047	3240	4859	5340
12"	4	234	495	1072	1911	3162	5005	7507	8250
14"	6	338	715	1549	2761	4568	7230	10844	11917
16"	8	464	983	2130	3797	6282	9942	14913	16388
18"	11	615	1302	2822	5028	8320	13168	19752	21705
20"	14	791	1647	3628	6465	10698	16931	25396	27908
24"	22	1222	2587	5605	9989	16528	26157	39236	43116
30"	37	2080	4406	9546	17010	28147	44545	66818	73426

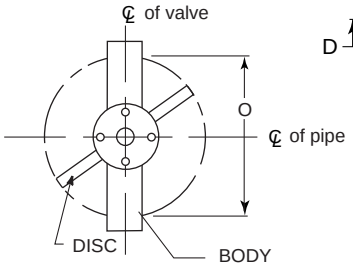


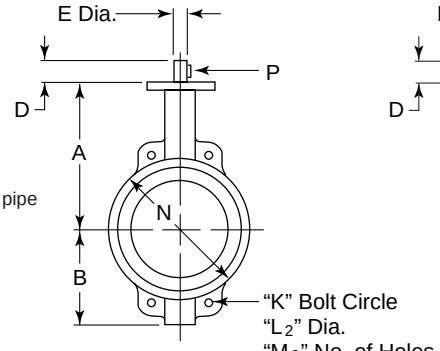
For 2"-24" Valves

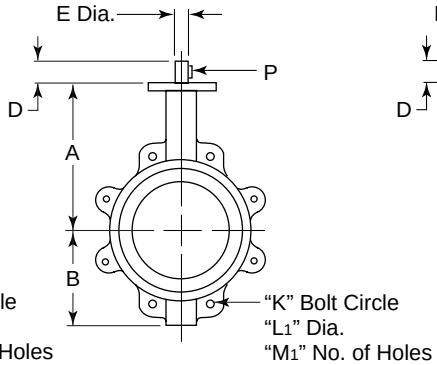


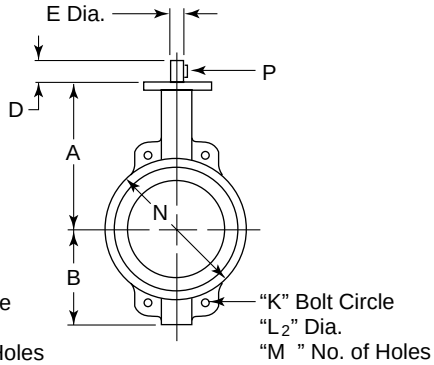


For 30" Valve







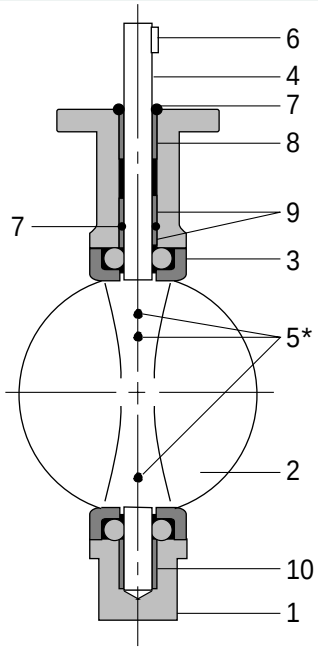


Dimensions 2" - 30"

Inches / mm	A	B	C	D	E	F	G	H	J	K	L_1*	L_2*	M_1*	M_2*	N	O	P
2"	6 3/8	3 1/4	1 3/4	1 1/4	1/2	3/8	2.76	0.39	2 3/4	4 3/4	5/8-11	1 1/16	4	4	4.	1.26	No. 3
50	161.93	82.55	44.45	31.75	12.70	9.53	70	10	69.85	120.65					101.60	32.0	Wooduff #3
2 1/2"	6 7/8	3 3/4	1 7/8	1 1/4	1/2	3/8	2.76	0.39	2 3/4	5 1/2	5/8-11	1 1/16	4	4	4 3/4	1.83	No. 3
65	174.63	95.25	47.63	31.75	12.70	9.53	70	10	69.85	139.70	17.46				120.65	46.5	Wooduff #3
3"	7 1/8	4	1 7/8	1 1/4	1/2	3/8	2.76	0.39	2 3/4	6	5/8-11	1 1/16	4	4	5 1/8	2.54	No. 3
75	180.98	101.60	47.63	31.75	12.70	9.53	70	10	69.85	152.40	17.46				130.18	64.5	Wooduff #3
4"	7 7/8	4 7/8	2 1/8	1 1/4	5/8	3/8	2.76	0.47	2 3/4	7 1/2	5/8-11	1 1/16	8	4	6 3/4	3.54	No. 9
100	200.03	123.83	53.98	31.75	15.88	9.53	70	12	69.85	190.50	17.46				171.45	89.9	Wooduff #9
5"	8 3/8	5 3/8	2 1/4	13/16	3/4	3/8	2.76	0.55	2 3/4	8 1/2	3/4-10	13/16	8	4	7 3/4	4.36	No. 9
125	212.73	136.53	57.15	20.64	19.05	9.53	70	14	69.85	215.90	20.64				196.85	110.7	Wooduff #9
6"	8 7/8	5 7/8	2 1/4	1 1/4	3/4	3/8	2.76	0.55	2 3/4	9 1/2	3/4-10	13/16	8	4	8 5/8	5.72	No. 9
150	225.43	149.23	57.15	31.75	19.05	9.53	70	14	69.85	241.30	20.64				219.08	145.3	Wooduff #9
8"	10 1/4	7 1/8	2 1/2	1 3/4	7/8	7/16	4.02	0.67	3 3/4	11 3/4	3/4-10	13/16	8	4	10 9/16	7.6	No. 9
200	260.35	180.98	63.50	44.45	22.23	11.11	102	17	95.33	298.45	20.64				268.29	193.0	Wooduff #9
10"	11 1/2	8 1/4	2 3/4	1 3/4	1 1/8	7/16	4.02	0.87	3 3/4	14 1/4	7/8-9	15/16	12	4	13 1/16	9.5	No. 15
250	292.10	209.55	69.85	44.45	28.58	11.11	102	22	95.33	361.95	23.81				331.79	241.3	Wooduff #15
12"	13 1/4	9 3/4	3 1/8	1 3/4	1 1/4	7/16	4.02	0.95	3 3/4	17	7/8-9	15/16	12	4	16 1/8	11.45	No. 15
300	336.55	247.65	79.38	44.45	31.75	11.11	102	24	95.33	431.80	23.81				409.58	290.8	Wooduff #15
14"	14 1/2	11	3 1/8	1 3/4	1 1/4	7/16	4.02	0.95	3 3/4	18 3/4	1-8	1 1/16	12	4	17 1/8	12.78	No. 15
350	368.30	279.40	79.38	44.45	31.75	11.11	102	24	95.33	476.25	26.99				434.98	324.6	Wooduff #15
16"	15 3/4	12	3 1/2	2	1 5/16	7/8	6.50	1.06	6 1/2	21 1/4	1-8	1 1/16	16	4	20	14.97	5/16" Sq. x 1 3/4"
400	400.05	304.80	88.90	50.80	33.34	22.23	165	27	165.10	539.75	26.99				508.00	380.2	
18"	16 5/8	14 3/8	4 1/4	2	1 1/2	7/8	6.50	1.06	6 1/2	22 3/4	1 1/8 - 7	1 1/4	16	4	21 3/8	16.83	3/8" Sq. x 1 1/2"
450	422.28	365.13	107.95	50.80	38.10	22.23	165	27	165.10	577.85	31.75				542.93	427.5	.
20"	18 7/8	14 5/8	5 1/4	2 1/2	1 5/8	7/8	6.50	1.26	6 1/2	25	1 1/8 - 7	1 1/4	20	4	23 5/16	18.67	3/8" Sq. x 1 3/4"
500	479.43	371.48	133.35	63.50	41.28	22.23	165	32	165.10	635.00	31.75				592.14	474.2	
24"	22 1/8	18	6 1/8	2 3/4	2	7/8	6.50	1.42	6 1/2	29 1/2	1 1/4 - 7	1 1/4	20	4	27 1/8	22.62	1/2" Sq. x 2 1/4"
600	561.98	457.20	155.58	69.85	50.80	22.23	165	36	165.10	749.30	34.93				708.03	574.5	
30"	25 1/2	24 1/4	6 3/4	3 1/4	2 1/2	7/8	8 1/2	N/A	11 1/4	36	1 1/4 - 7	1 1/4 - 7	28	4	34 3/8	28.6	5/8" Sq. x 2 5/8"
750	647.70	615.95	171.45	82.55	63.50	22.23	215.90		285.75	914.40					873.13	726.4	

*L_1 and *M_1 refer to Lug style valves, L_2 and M_2 refer to Wafer Style. "C" dimension is listed with elastomer in the relaxed condition. Approximately 1/8" total compression is required for proper sealing with pipe flanges. Valves are designed for installation between ANSI B16.1 Class 125 (Iron) and B16.5 Class 150 (Steel) flanges. Gaskets are not needed, and should not be used since the seat face seals against the mating flange. If the valve is to be installed in plastic or fiberglass flanges, flange rings, or Van Stone style flanges, consult your Center Line agent or the factory for additional information. Center Line recommends that a blind flange be used on end of line applications.

[1] Consult factory for dimension to 2 1/2" and 5" PTFE seated valves. "O" dimension is the valve clearance dimension.



Sizes 2"–30"

*Qty 0f 3 pins required for sizes 30" and above

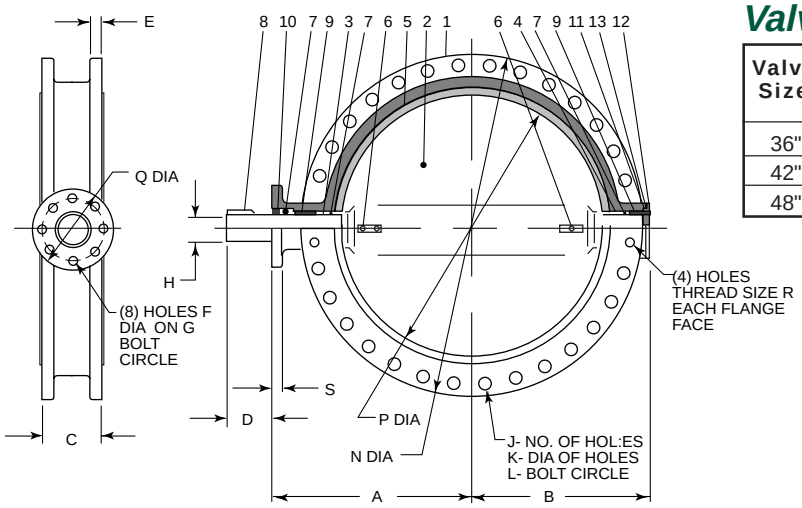
Bill of Materials 2" - 30"

Item	Description	Materials	Optional Materials
1	Body	Cast Iron	Ductile Iron
2	Disc	Ductile Iron[1]	Aluminum Bronze, 316 SS, Monel
3	Seat	Buna-N or EPDM	Neoprene, Hypalon, Viton, PTFE, FDA, Abrasion Resistant
4	Shaft	416 Stainless Steel	316 Stainless Steel, Monel
5	Taper Pin	316 Stainless Steel	Monel
6	Key	Carbon Steel	No Option Available
7	O-Ring	Buna-N	No Option Available
8	Bushing	PTFE	Luberized Bronze
9	Bushing	PTFE	Luberized Bronze
10	Bushing	PTFE	Luberized Bronze

[1]ENP plated for 2" - 12" valves

Bill of Materials 36" - 48"

Item	Description	Materials	Optional Materials
1	Body	Ductile Iron	No Option Available
2	Disc	Ductile Iron	Aluminum Bronze, 316 Stainless Steel, Monel
3	Upper Shaft	416 Stainless Steel	316 Stainless Steel, Monel
4	Lower Shaft	416 Stainless Steel	316 Stainless Steel, Monel
5	Seat	Buna-N or EPDM	Hypalon, Viton
6	Taper Pin	316 Stainless Steel	316 Stainless Steel, Monel
7	O-Ring	Buna-N	No Option Available
8	Key	Carbon Steel	No Option Available
9	Bushing	PTFE	No Option Available
10	Bushing	Luberized Bronze	No Option Available
11	Thrust Washer	Luberized Bronze	No Option Available
12	End Plate	Ductile	No Option Available
13	O-Ring	Buna-N	No Option Available



Valve Seating Torques (In-Lbs.)

Valve Size	Standard Disc Differential Pressure			Undercut Diff. Press.
	50 PSI	100 PSI	150 PSI	75 PSI
36"	54,667	57,035	59,400	39,600
42"	82,460	86,034	89,600	60,000
48"	108,022	112,704	117,376	78,600

C_V Values – Valve Sizing Coefficients (US-GPM @ 1ΔP)

Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
36"	260	3050	6730	12740	20220	32500	52500	79600	87500
42"	350	4095	9040	17108	27150	43640	70500	106890	117500
48"	455	5365	11840	22400	30600	51200	92300	140000	154000

*Dimensions

	36"		42"		48"	
	inches	mm	inches	mm	inches	mm
A	28.35	720.09	33.78	858.01	37	940.70
B	25.83	656.08	30.60	777.24	34	864.00
C	8 1/8	206.38	10	254.00	10.88	276.40
D	4.65	118.11	5.90	149.86	5.90	150.00
E	2.36	59.94	2.60	66.04	2.76	70.00
F	0.71	18.03	0.71	18.03	0.87	22.00
G	10	254	10	254	11.73	298
H	2.95	74.93	3.35	85.09	4.13	105.00
J	28	28	32	32	44	44
K	1 5/8	41.28	1 5/8	41.28	1.62	41.30
L	42 3/4	1058.85	49 1/2	1257.75	56	1422.40
M	.79 Sq.	20 Sq.	.87 Sq.	22 Sq.	1.1 Sq.	28 Sq.
N	46	1168.40	53	1346.58	59.49	1511
P	34.04	864.61	40.55	1029.97	45.67	1160
Q	11.81	299.97	11.81	299.97	13.78	350
R	1 1/2 - 6	-	1/2 - 6	-	1/2 - 6	-
S	1 1/4	31.75	1 1/4	31.75	-	-

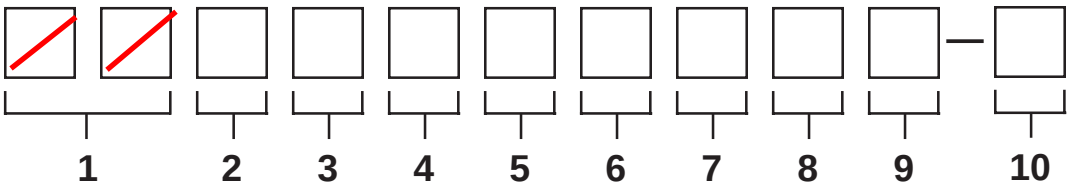
* Please note that dimensions apply to standard product only.
For custom/domestic product dimensions, please consult factory.

NOTE: TECHNICAL DATA SUBJECT TO CHANGE WITHOUT NOTICE.

Weights

Size		Wafer	Lug
2"	Lbs.	6	7
	kg.	2.72	3.18
2 1/2"	Lbs.	7	8
	kg.	3.18	3.63
3"	Lbs.	10	14
	kg.	4.54	6.35
4"	Lbs.	13	26
	kg.	5.90	11.79
5"	Lbs.	18	28
	kg.	8.16	12.70
6"	Lbs.	20	31
	kg.	9.07	14.06
8"	Lbs.	32	49
	kg.	14.51	22.23
10"	Lbs.	42	72
	kg.	19.05	32.66
12"	Lbs.	70	105
	kg.	31.75	47.63
14"	Lbs.	95	155
	kg.	43.09	70.31
16"	Lbs.	117	195
	kg.	53.07	88.45
18"	Lbs.	165	230
	kg.	74.84	104.33
20"	Lbs.	275	396
	kg.	124.74	179.62
24"	Lbs.	440	610
	kg.	199.58	276.70
30"	Lbs.	740	1050
	kg.	335.66	476.27
36"	Lbs.	1660	N/A
	kg.	754	
42"	Lbs.	2145	N/A
	kg.	975	
48"	Lbs.	3023	N/A
	kg.	1374	

CENTER LINE
FIGURE NUMBER SYSTEM



1. Size	Code
2"	02
2.5"	25
3"	03
to	
48"	48

2. Series/Style	Code
200 Wafer (2"-30")	A
200-Lug (2"-30")	B
200-Lug/Deadend (2"-48")	C
36"-48" Series 200 Flanged	D

3. Body	Code
Cast Iron (2"-30", Series 200)	1
Ductile Iron (A536)	2
Ductile Iron (A395)	C*

4. Pressure	Code
200 PSI (2" - 12", Series 200)	0
75 PSI Undercut Disc (8" & lgr)	3
150 PSI (14" - 48", Series 200)	6
125 PSI (TFE/BUNA seat)	8

5. Disc	Code
Ductile Iron-ENP (2"-12")	2
316 SS (2"-48")	4
Ductile Iron (14"-48")	5
Aluminum Bronze (2"-48")	6
Monel	7*

6. Shaft	Code
416 SS (2"-48")	1
316 SS (2"-48") (Std. w/316 SS Disc only)	4
Monel	7*

7. Bushing	Code
Bronze (36"-48")	0
PTFE (2"-30")	3

8. Seat/Liner	Code
Buna (2"-48")	1
Abrasion Resistant Buna	2*
Black Neoprene	3*
White Neoprene	4*
EPDM (2"-48")	5
Low Temp Viton (275 F)	6*
Hypalon	7*
Perox. Cured Buna	8*
White Buna	B*
Potable Water EPDM	D*
PTFE/Buna	L*
High Temp Viton (400 F)	P*
EPDM Food Grade	V*
White Buna Food Grade	W*

9. Actuator	Code
Handle (DIT)	2
Handle/Infinite Adjustment Lockable (DIT/IOL)	3
Handle/Infinite Adjustment (DIT/IO)	4
Gear/Handwheel	5
Pneumatic, Double Acting	6*
Pneumatic, Spring Return, Fail Closed	7*
Pneumatic, Spring Return, Fail Open	8*
Electric Actuator	9*
Buried Service Gear	C*
Direct Nut Actuator	D*
Gear w/Balance Stop Handwheel	G*
Gear/Chainwheel	U*
No Operator	X

10. Other	Code
Domestic Product	D

* Defines product options considered Custom

CENTER LINE

A Crane Co. Company

3201 Walnut Avenue • Long Beach, CA 90807 • Phone: 562.426.2531 • Fax: 562.426.6797

www.cranevalve.com

CS & CL Electric Actuators

Conbraco's CS and CL electric actuators are split phase reversing AC motors for standard duty or brushless DC Motors for continuous duty. Eight sizes are available which produce breakaway torques between 150 and 3000 lb-in. They are excellent industrial quality units capable of on/off, fail safe, and modulating applications.The efficient spur gear drive train is supported by permanently-lubricated bearings making it very secure while eliminating the potential for side loading of the output shaft.

Conbraco offers as standard a 75% duty cycle AC motor. Continuous-duty brushless DC motors are also available for a range of input voltages. All units are rated for use in ambient environments from -40°F (with optional heater & thermostat) to 150°F (note that units equipped with an internal battery are rated to 130°F). Choose from standard NEMA 4/4X enclosure or NEMA 4/4X/7&9 for use in hazardous locations. CSA certification is standard on standard 75% duty models.

Other standard features include:

- Thermal overload protection (AC motors)
- Dual conduit openings; 3/4" (1/2" with supplied bushings)
- Visual position indication
- All aluminum enclosure
- Captive cover bolts on CS Series
- Manual override shaft (optional handwheel override with declutchable shaft)

- Features-

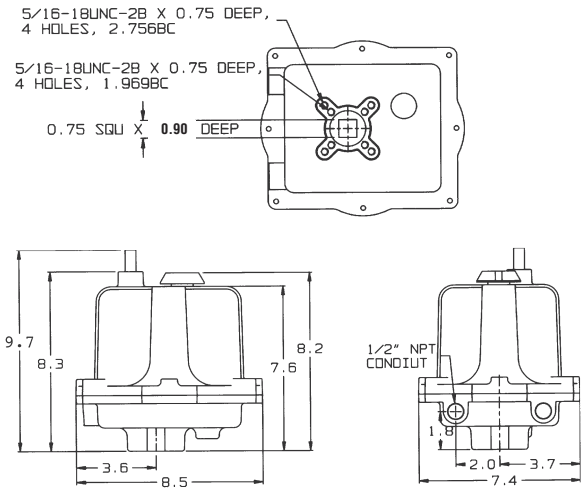
- Plug-in connectors for the motor, the brake option and the heater/thermostat option
- All connectors are coded to prevent mis-wiring.
- Limit switch wires are soldered to the board - no more loose connections.
- A six position terminal strip clearly labeled so it can be wired up in the field without an instruction manual.

Introducing Simplicity for Calibrating Modulating Actuators

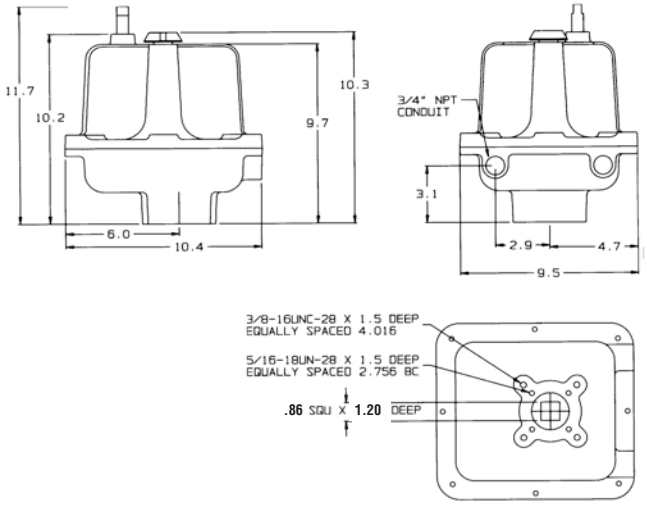
The Control Board brings a whole new level of simplicity to the field. It will work with either of the Motor Boards (115VAC or 230VAC). Features include:

- Switch selector for 4-20mA or 0-10VDC input
- Switch selector for 4-20mA or 0-10VDC position readback
- Switch selector for either "fail in-place" or "fail to zero" upon loss of control signal (provided input power remains)
- On-board push buttons to manually position the actuator
- An adjustable pot for Speed Control (motor pulsing)
- An adjustable pot for deadband adjustment
- A "Mode Selector" switch with LEDs, which are used for:
  - "No tools" pot calibration
  - Setting Zero and Span
  - Manually positioning the actuator
- Locked Rotor Protection if the actuator cannot achieve the position commanded by the control signal, it will cut power to the motor. Repeated stalls will not damage the actuator.
- Reverse acting operation with no rewiring.
- Split range operation with no rewiring.

CS Dimensions



CL Dimensions



CS & CL Specifications and Options

CS & CL Extended Duty Data

TECHNICAL DATA—115VAC AND 230VAC Models*

Torque Output (breakaway)	Speed (seconds per 90°) rotation)	Duty Cycle	VA Rating		Max Running Current at Full Load (True RMS)		Max Effective Peak Inrush Current (=.66 x peak inrush)	
			115VAC	230VAC	115VAC	230VAC	115VAC	230VAC
150 in lb	8	75%	70vA	115vA	.6 amps	.5 amps	1.25 amps	.924 amps
300 in lb	15	75%	70vA	115vA	.6 amps	.5 amps	1.25 amps	.924 amps
600 in lb	30	75%	70vA	115vA	.6 amps	.5 amps	1.25 amps	.924 amps
1000 in lb	25	75%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps
1500 in lb	40	75%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps
2000 in lb	55	75%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps
2500 in lb	70	75%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps
3000 in lb	75	55%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps

CS & CL Continuous Duty Data

Torque (in-lbs)	Duty Cycle	12VDC		24VDC		24VAC		115VAC		230VAC	
		Cycle Time (sec/90°)	Current Draw Amps	Cycle Time (sec/90°)	Current Draw Amps	Cycle Time (sec/90°)	Current Draw Amps	Cycle Time (sec/90°)	Current Draw Amps	Cycle Time (sec/90°)	Current Draw Amps
150	100%	11	2.2	13	1.2	8	1.8	9	0.4	9	0.4
300	100%	17	2.5	13	1.4	12	2.1	13	0.5	13	0.4
600	100%	17	2.8	13	1.7	13	2.5	14	0.6	14	0.5
1000	100%	21	4	14	2.4	15	3.5	15	0.9	15	0.6
1500	100%	40	4	24	2.4	27	3.5	29	0.9	29	0.6
2000	100%	40	4.3	33	2.4	28	3.5	29	0.9	29	0.6
2500	100%	55	3.3	40	2	38	3.1	39	0.8	39	0.6
3000	100%	60	3.7	42	2.2	40	3.5	42	0.8	43	0.6

*Notes:
1. The Current Draws stated above include all options. If the brake and/or heater & thermostat are not installed, the actual current draws will be less.
2. For Extended Duty Cycle Models, Current Draws are provided at full running torque. If the actuator encounters an overtorque condition, such as a stall condition, the Current Draw will be vastly increased.
3. "Continuous Duty actuators contain brushless DC motors and are therefore not limited by duty cycle restraints in environments at or below 104°F; in ambient environments above this temperature the duty cycle is de-rated to 80%."

ACTUATOR MODEL#'s/DESCRIPTION

230 VAC . . . . . 230 VAC MOTOR
24 VAC . . . . . 24 VAC MOTOR (1) (Continuous Duty only)
12/24 VDC . . . . . 12 OR 24 VDC MOTOR (Continuous Duty only)
X. . . . . NEMA 4,4X,7, & 9
W . . . . . NEMA 4 & 4X
H. . . . . TROPICAL HEATER
S2. . . . . TWO AUXILIARY SWITCHES SPDT
T. . . . . HEATER AND THERMOSTAT
K. . . . . MOTOR BRAKE(2)
Z. . . . . DECLUTCHABLE HANDWHEEL OVERRIDE

(1) NOT AVAILABLE WITH CSA LISTING. CONTACT FACTORY FOR CSA LISTING ON OPTION COMBINATIONS

(2) NOT REQUIRED ON CONTINUOUS DUTY CYCLE UNITS

CONTROL OPTIONS FOR CONTINUOUS DUTY CYCLE*

R2. . . . . SINGLE RELAY 2 WIRE CONTROL
C. . . . . POSITIONER (SPECIFY SIGNAL)**
CL2. . . . . POSITIONER WITH FAIL SAFE BACKUP FOR CS SERIES(1)
CL3. . . . . POSITIONER WITH FAIL SAFE BACKUP FOR CL SERIES(1)
L2. . . . . FAIL SAFE BATTERY BACKUP FOR CS SERIES***(1)
L3. . . . . FAIL SAFE BATTERY BACKUP FOR CL SERIES***(1)
J. . . . . SPEED CONTROL/TIMER BOARD/3 WIRE RELAY (Extended Duty only)

NOTE: NO MANUAL OVERRIDE ON FAILSAFE UNITS
*CONTACT ACTUATOR ENGINEERING FOR APPLICATIONS NOT COVERED BY INDICATED OPTIONS
*OPTION AVAILABILITY AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE
**OPTION "C" INCLUDES POSITION TRANSMITTER & CYCLE RATE REGULATOR
***OPTION "CL2","CL3","L2", &"L3" INCLUDE POSITION TRANSMITTER

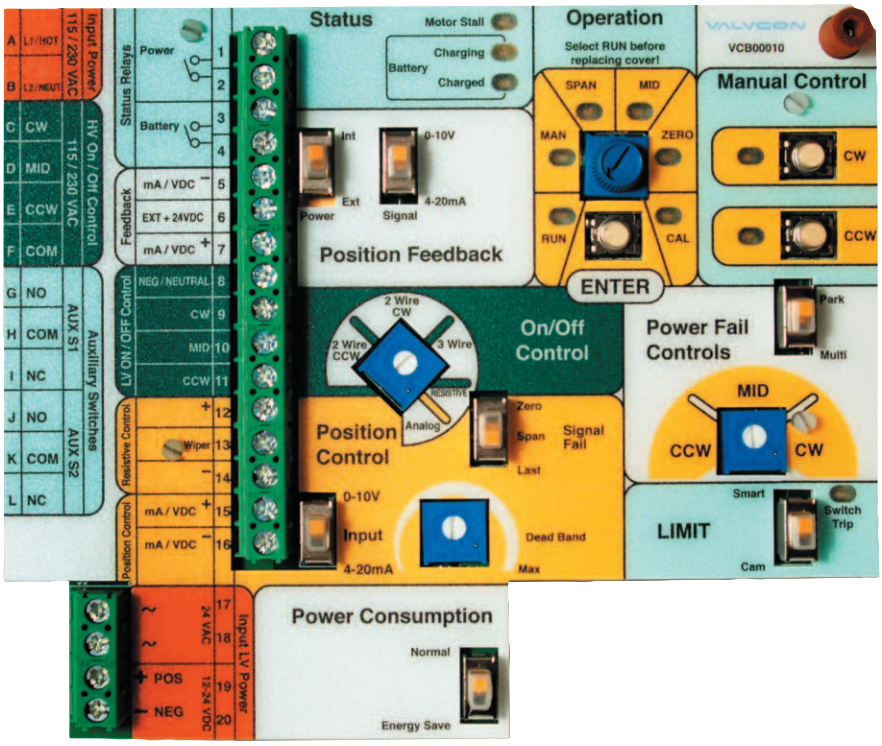
A BOARD OPTION MUST BE SELECTED WITH CONTINUOUS DUTY CYCLE. ONLY ONE BOARD OPTION CAN BE INSTALLED IN THE ACTUATOR.

How To Order Examples

ACTUATOR MODEL	TORQUE	ENCLOSURE	OPTIONS	VOLTAGE
CS XXX	600	W-NEMA IV	C (POSITIONER)	115VAC
CL XXX	2500	W-NEMA IV	S2 (TWO SWITCHES)	230 VAC

VALVCON
ADC-Series
CONTINUOUS DUTY, UNIVERSAL ON/OFF & MODULATING ELECTRIC ACTUATORS With U2, UL2, UL3, U4, UL4, UL5, U6, UL6 & UL7 Options With "-UP" In The Model Number

Installation, Maintenance and
Operating Instructions



IMO-I4800EN • 4/2014

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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the actuator.
If you require additional assistance, please contact the manufacturer or manufacturer's representative.
Addresses and phone numbers are printed on the back cover.
See also www.metso.com/valvcon for the latest documentation.

SAVE THESE INSTRUCTIONS!

Subject to change without notice.
All trademarks are property of their respective owners.

1 INTRODUCTION

1.1 ADC-Series Universal Control Actuators (with Optional Battery Back-up)

The ADC-Series consists of two different sized enclosures that cover different torque ranges. Model codes that start with "ADC" indicate the standard enclosure and a torque rating in the range from 150 to 600 in•lbs. "LADC" designates the larger enclosure and a torque rating in the range from 1000 to 3000 in•lbs.

The ADC-Series Actuators provide an optional internal battery pack to power the actuator in the event of a loss of external power. Actuators with battery back-up are identified in the model code by either a "UL2", "UL3", "UL4", "UL5", "UL6" or "UL7". The "UL2", "UL4" and "UL6" options are applicable in a standard ADC enclosure and the "UL3", "UL5" and "UL7" options are applicable in a LADC enclosure. The "UL4" and "UL5" options are factory-set for 180° operation with MID position factory set at 90°; and the "UL6" and "UL7" options are factory-set for 270° operation.

The ADC-Series Actuators' base electronic package consists of two separate boards; P/N VCB00010 Universal Control Board and the Switching Power Supply allowing for the choice of 115VAC, 230VAC, 12VDC, 24VDC or 24VAC actuator power.

1.2 Universal Control Board P/N VCB00010

The Universal Control Board can be configured for either "Two-Wire" or "Three-Wire" On/Off control, or "4-20mA Analog", "0-10VDC Analog", or a "Resistive" Positioner Control.

The Universal Control Board used in Positioner Control mode can be configured for Loss of Signal and has an adjustable input signal Dead Band.

The Universal Control Board allows independent 115VAC, 230VAC, 12VDC, 24VDC or 24VAC control signals from actuator power.

The Universal Control Board can provide analog position feedback, Power and Battery status and includes on-board battery status indicators.

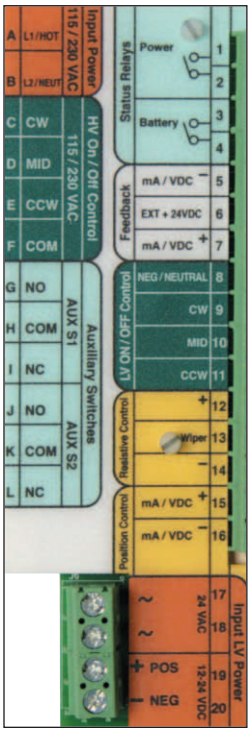
The Universal Control Board with the optional Battery Back-up installed will allow you to select power "Fail" position as well as to choose "Park" or "Multi" cycling upon loss of actuator power.

The Universal Control Board has locked rotor stall protection.

The Universal Control Board has manual push button control and simple digital smart set functionality for entering and saving precise end of travel positions for calibration to the application.

The Universal Control Board has an easy to navigate color scheme for its input and output wiring terminal blocks, detailed below:

Orange = Actuator Power
Green = On/Off Control
Yellow = Modulating Control
White = Analog Feedback
Light Blue = Status Feedback



2 SAFETY AND PRECAUTIONS

Caution: Dangerous Voltages Inside Actuator. Use extreme caution when working on the actuator with the cover removed.

Do not mis-apply high voltage to low voltage circuits or power the feedback if not in the externally powered mode. Damage may occur.

Adequately ground the actuator.

Use a dedicated power supply or an isolation transformer when using 24VAC actuator Input Power.

3 GENERAL

3.1 Interface

1 - CAL – A continuous yellow LED indicates that the CAL (calibration) mode has been selected. A flashing yellow LED displays to the user how close they are to hitting the CAL point depending on the speed of the flashes. The CAL mode allows the user to calibrate the position tracking potentiometer without the use of an ohmmeter or other electronic instruments. In CAL mode the actuator will travel beyond the saved settings for the Zero and Span stop positions.

2 - ZERO – A continuous yellow LED indicates that the ZERO mode has been selected. ZERO mode permits the user to set the desired Zero end-of- travel stop position with a corresponding control signal value. The Zero position is typically the fully clockwise position and minimum control signal value, but Zero may be set at any position.

3 - MID - A continuous yellow LED indicates that the MID mode has been selected. MID mode permits the user to save the desired "MID" position. The MID position may be set at any position inside (between) the saved Zero and Span end-of-travel positions. (MID is not typically used with the Position Control configuration but can be used as a mid-travel "fail" position upon loss of external power, provided the actuator is equipped with a back-up battery.)

4 - SPAN – A continuous yellow LED indicates that the SPAN mode has been selected. SPAN mode permits the user to set the desired Span end-of-travel stop with a corresponding control signal value. Typically, the Span position is the fully counterclockwise position and maximum control signal value, but Span may be set at any position.

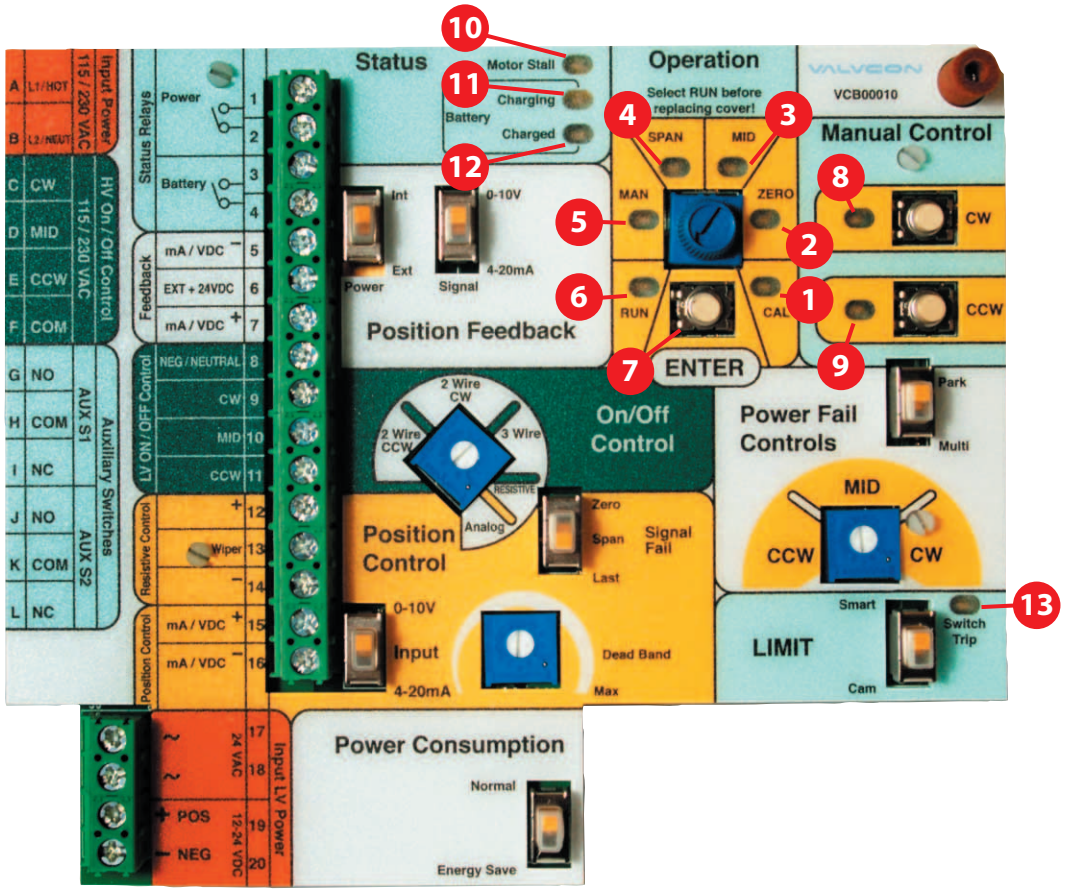
5 - MAN (MANUAL) – A continuous yellow LED indicates that Manual Control mode has been selected. The actuator will not respond to external control signals and the [CW] and [CCW] push buttons are enabled for manually driving the actuator in either direction. In Manual mode the actuator will not travel beyond the saved settings for the Zero and Span stop positions.

6 - RUN – A continuous green LED indicates that the normal operating mode has been selected. In RUN mode the actuator will respond external signals supplied to the Universal Control Board. This LED will turn off in Energy Save mode.

7 - ENTER – located directly below the mode selector and permits the user to activate modes and confirm settings by pressing the [ENTER] button.

8 - CW (CLOCKWISE) – A continuous yellow LED indicates that the actuator is driving in the CW direction. Located next to the Manual Control push button to drive the actuator in the CW direction.

VCB00010 Universal Control Board (Front)



9 - CCW (COUNTER-CLOCKWISE) – A continuous yellow LED indicates the actuator is driving in the CCW direction. Located next to the Manual Control push button to drive the actuator in the CCW direction.

10 - Motor Stall – A flashing red LED indicates a stall condition exists and that the actuator has been prevented from reaching the position commanded by the control signal. A STALL of more than several seconds will cause power to be automatically removed from the motor circuit, placing the actuator in a safe mode. A reverse signal or a manual mode [CW] or [CCW] movement is required to clear the stall condition. A STALL condition can be initiated by a blockage in the valve or damper, cam limit settings that are inside of the electronically saved travel stop positions, or some other increase in the torque load on the actuator.

11 - Battery Charging* – A continuous yellow LED indicates that the battery charging circuit is active to either charge or maintain the voltage on the Battery.

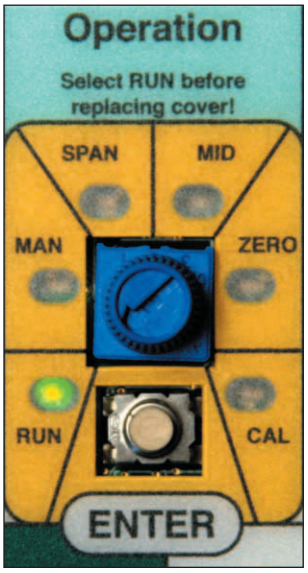
12 - Battery Charged* – A continuous green LED indicates that the battery is fully charged. A flashing green LED indicates the actuator is running on battery power. This LED will turn off in Energy Save mode.

* Note: Battery Charging and Battery Charged LEDs may be lit at the same time depending on the battery charge state.

13 - Switch Trip – A continuous red LED indicates that one of the end-of-travel limit switches has been "tripped" by the respective cam; this LED is intended to aid initial actuator set-up.

3.2 Operation Mode Selector Pot

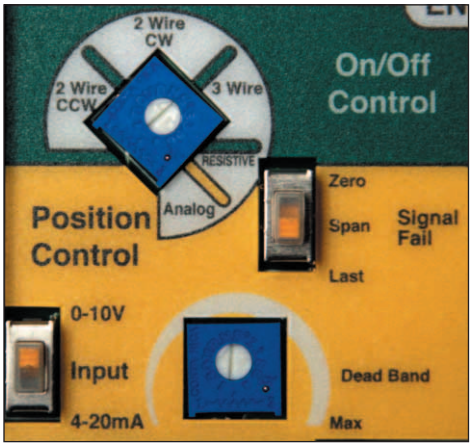
The Universal Control Board is equipped with an Operation Mode Selector Pot which allows the user to select the 6 modes of operation during calibration and set-up. LED indicators around the knob correspond to each of the modes; RUN, Manual (MAN), SPAN, MID, ZERO and Calibrate (CAL). When the Universal Control Board mode dial is set to any mode, the corresponding LED turns on, indicating the mode is selected.



In MAN (Manual) and CAL mode the unit will ignore any external control signals and respond only to the on-board push buttons (it should be noted that if the unit is equipped with an optional back-up battery and loss of power should occur while in MAN and CAL mode, the unit will drive to the selected "Power Fail" position).

3.3 Control Mode Selector Pot

The Universal Control Board is equipped with a Control Mode Selector Pot which enables the user to select between various "On/Off Control" and "Position Control" modes.



3.4 Travel Limit Cam and Switch Operation

With the Universal Control Board installed, the travel limit stops are set electronically as the Zero and Span position. Two limit switches operated by the cams on the output shaft are safety stops. Their intended function is to prevent damage in the event of a failure of the electronic limits. Therefore: Each cam must be set to operate the switch slightly outside of the electronic Zero and Span position range. Failure to set the cams properly may cause the actuator to stall when it cannot reach the commanded and electronically set end of travel position. The bottom limit switch determines clockwise safety stop position. The next limit switch up from the bottom determines the counter-clockwise safety stop position. Auxiliary switches and the corresponding cams will be the third and fourth up from the bottom.

Travel limits, also referred to as "end of travel stops", are the precise positions to which the actuator will drive. For "2 Wire" or "3 Wire" On/Off operation, travel limits are set at the full clockwise (CW) and full counter-clockwise (CCW) ends of travel.

To simplify the process of setting the precise travel limit positions, the ADC-Series provides two On/Off travel limit types. CW, CCW and MID may be set electronically via the "Smart" limit utility or CW and CCW may be set mechanically by selecting the "Cam" limit type.

3.4.1 Smart Limit

When "Smart" is selected as the limit type, the microprocessor stores the exact positions where the actuator will stop at each end of travel or mid position. Setting the "Smart" limit positions for the ZERO, MID and SPAN positions is done with the selector knob and [ENTER] button in the Operation field of the Universal Control board. To use the Smart limit features, the Feedback Potentiometer must be installed, connected and calibrated and the travel stop cams must be set to trip the switches slightly beyond the desired "electronic" stop positions for ZERO and SPAN. The end-of-travel limits on ADC actuators can be entered and saved between 0° and 270° of travel. For 180° and 270° rotation alternate potentiometer gearing is required (refer to option code). For "Three-Position" operation, limits must be entered and saved using the "Smart" Limit!

3.4.2 Cam Limit

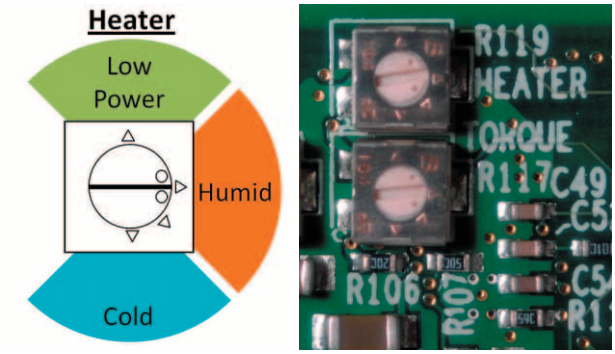
When "Cam" is selected as the limit type, two limit switches operated by the stainless steel cams on the output shaft extension are used to determine the exact positions where the actuator will stop at each end of CW and CCW travel. The bottom limit switch determines the clockwise stop position. The next limit switch up from the bottom determines the counter-clockwise stop position. The "end of travel limit" switches can be adjusted to provide from 5 to 320 degrees of actuator rotation. For "Three-Position" operation, limits must be entered and saved using the "Smart" Limit!

3.5 Built-In Heater/Thermostat Feature

The Universal Control Board is equipped with a built-in Heater/Thermostat Option that can be enabled for low-temperature use (environments where the temperature will drop below 32° Fahrenheit), high-humidity use ("tropical" environments), or disabled completely to conserve power, in environments where the climate is stable and/or controlled.

Note: All heater modes are disabled in "Energy Save" mode.

The Heater/Thermostat is enabled/disabled by turning a potentiometer on the Universal Control Board. See graphic below for proper positioning:



4 MAIN ACTUATOR POWER

The identification label on each actuator specifies the model number, serial number, actuator power voltage and current requirements for the actuator. It is important to verify the correct actuator voltage and control voltage prior to wiring the actuator.

4.1 115VAC or 230VAC Power Wiring

If using 115VAC or 230VAC as the MAIN Input Power: 115/230 VAC must be supplied constantly to the Universal Control Board as follows:

- Terminal A (AC L1/HOT)
- Terminal B (AC L2/NEUT)

4.2 24VAC Power Wiring

If using 24VAC as the MAIN Input Power: 24VAC must be supplied constantly to the Universal Control Board as follows:

- Terminal 17 (24AC HOT)
- Terminal 18 (24AC NEUT)

If using 24 VAC, each actuator must have a dedicated power supply and/or isolation transformer.

4.3 12VDC or 24VDC Power Wiring

If using 12VDC or 24VDC as the MAIN Input Power: 12/24 VDC must be supplied constantly to the Universal Control Board as follows:

- Terminal 19 (DC POS)
- Terminal 20 (DC NEG)

5 ON/OFF CONTROL

5.1 The three methods of On/Off Control:

The On/Off Control mode allows the actuator to drive in a desired direction in response to an application of voltage to the desired inputs. The different modes are as follows:

5.1.1 "2 Wire CW"

The actuator will default to the CCW position when main actuator power is present; the actuator will drive CW when the "CW" control power is energized.

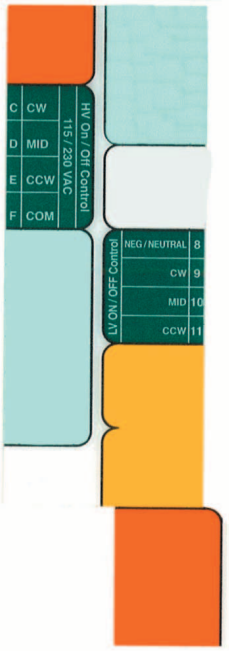
5.1.2 "2 Wire CCW"

The actuator will default to the CW position when main actuator power is present; the actuator will drive CCW when the "CCW" control power is energized.

5.1.3 "3 Wire" Open/Stop/Close Operation

The actuator will drive CCW when the "CCW" control power is energized and drive CW when the "CW" control power is energized; if control power is removed mid-travel, the actuator will stop in position. The actuator will drive to the programmed "MID" position when the "MID" control power is energized. The "MID" position is optional and can be set anywhere inside of the CW and CCW end-of-travel positions settings to provide a Three-Position "Center-Off" position, or a "Dribble Feed" position.

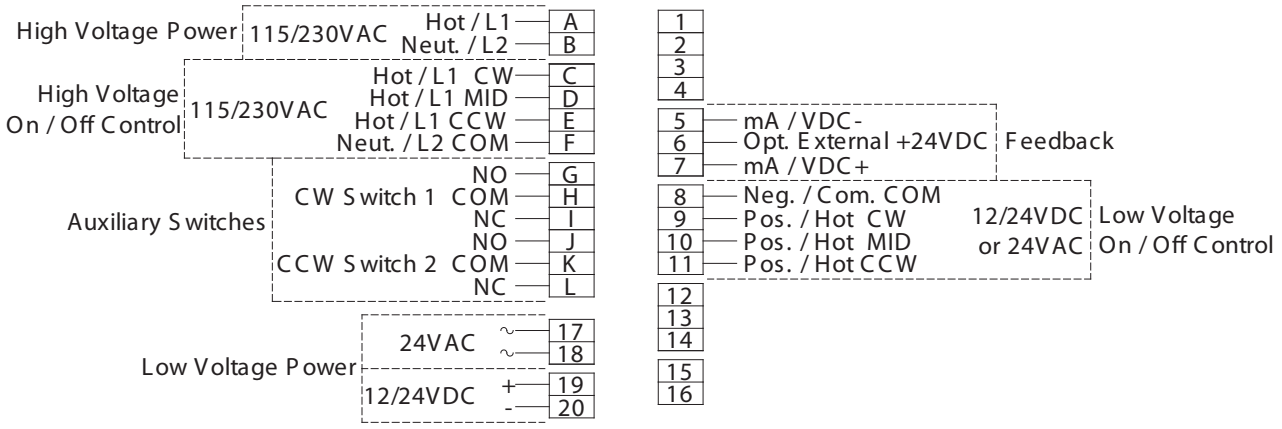
5.2 On/Off Control Signal Wiring



5.2.1 High Voltage:

To control the actuator with a high voltage signal (115VAC or 230VAC): Connect AC L2/NEUT to terminal F on the Universal Control Board. Energize AC L1/HOT at terminal C on the Universal Control Board to drive the actuator clockwise (CW). Energize AC L1/HOT at terminal D on the Universal Control Board to drive the actuator to the "MID" position. Energize AC L1/HOT at terminal E on the Universal Control Board to drive the actuator counter-clockwise (CCW).

On/Off Control Wiring



5.2.2 Low Voltage:

To control the actuator with a low voltage signal (12VDC, 24VDC or 24VAC): Connect 12/24DC NEG or 24AC NEUT to terminal 8 on the Universal Control Board. Energize DC POS or 24AC HOT at terminal 9 on the Universal Control Board to drive the actuator clockwise (CW). Energize DC POS or 24AC HOT at terminal 10 on the Universal Control Board to drive the actuator to the "MID" position. Energize DC POS or 24AC HOT at terminal 11 on the Universal Control Board to drive the actuator clockwise (CCW).

5.3 Set Up and Calibration

5.3.1 Initial Set Up

1. Remove actuator cover.
2. Select LIMIT type "Smart" or "Cam" by sliding the [Smart/Cam] switch down to select Cam or up to select Smart. Selecting Smart will enable other features on the board such as Position Feedback and "Three-Position" operation. Selecting Cam will allow the actuator to drive between the end-of-travel limit switch settings.
3. Select Control Method "2 Wire CCW", "2 Wire CW", or "3 Wire" by turning the selection potentiometer with a small flat blade screwdriver.

5.3.2 Potentiometer Calibration

Field installation of the Universal Control Board or replacement of the position tracking potentiometer requires calibration of the position tracking potentiometer prior to setting positions and values for ZERO, MID and SPAN. Universal Control Boards installed at the factory are fully calibrated at the factory and should not require further calibration.

To confirm proper potentiometer calibration:

1. Turn the Mode Selector Dial to [CAL] and press [ENTER] for 2 seconds.
2. Using the CW pushbutton, drive the actuator to the full clockwise position. - If the [CAL] LED is flashing, potentiometer calibration is required; proceed to step 3 below. - If the [CAL] LED remains on, calibration is not required; proceed to Setting ZERO, MID and SPAN Positions section below.
3. Loosen the set screw in the gear with a 1/16" hex wrench.
4. Rotate the gear until the LED remains on constantly; hold the gear in place and tighten the set screw. Ensure that the LED remains on after the set screw is tightened. Note: The LED assists the user in locating the proper calibration window; it will flash faster as you approach the calibration window and slower as you move away from it.
5. Press the [ENTER] button to save the potentiometer setting.

5.3.3 Setting ZERO, MID and SPAN Positions

Once (feedback potentiometer) calibration has been confirmed, set the desired "end of travel" positions. Make certain that the limit switch cams are set to operate the switches beyond the desired range for the ZERO and SPAN positions. ZERO and SPAN may be set at any position between 0° and 94° of travel (0° and 184° with "U4", "UL4" or "UL5" option; or 0° and 274° with "U6", "UL6" or "UL7" option).

Set ZERO:

1. Turn the Mode Selector Dial to [ZERO] and press [ENTER] for 2 seconds. The [ZERO] LED will begin to flash.
2. Drive the actuator to desired clockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired ZERO end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Press the [ENTER] button to save the ZERO setting.

Set MID: (if applicable)

1. Turn the Mode Selector Dial to [MID] and press [ENTER] for 2 seconds. The [MID] LED will begin to flash.
2. Drive the actuator to the desired MID or "THIRD" position using the CW or CCW push button.
3. Press the [ENTER] button to save the MID setting.

Set SPAN:

1. Turn the Mode Selector Dial to [SPAN] and press [ENTER] for 2 seconds. The [SPAN] LED will begin to flash.
2. Drive the actuator to desired counterclockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired SPAN end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Press the [ENTER] button to save the SPAN setting.

5.3.4 Verify End-Of-Travel Settings:

1. Turn the Mode Selector Dial to [RUN].
2. Apply various control signals to verify operation.
3. Verify that the "Switch Trip" LED is not illuminated at either the ZERO or SPAN positions (if it is, "back" the respective end-of-travel cam "off" of the respective limit switch).
4. Replace actuator cover.

5.3.5 Proper Actuator Cover Replacement

1. Remove the override shaft from the actuator cover bushing; if the actuator is equipped with a handwheel, remove the handwheel before removing the top piece of the "two-piece" shaft from the cover bushing.
2. Install the override shaft on the square motor shaft; if the actuator is equipped with a handwheel, install the bottom piece of the "two-piece" shaft on the motor shaft and then install the top piece of the shaft onto the bottom piece of the shaft.
3. Align cover so that the override shaft will pass through the override bushing and carefully push it down so that the cover flange contacts the base flange.
4. Once the cover is properly seated, tighten the screws to secure the cover; a cross pattern is recommended for uniform distribution of load.
5. If the position indicator is not seated to the output/cam shaft, turn until it drops into place in order to ensure accurate visual position indication.

6 POSITION CONTROL

6.1 The three methods of Position Control

The Position Control mode allows the actuator to modulate (change position) in response to a change in an analog or resistance control signal. The different modes are as follows:

6.1.1 "4-20mA Current Analog" Control

The actuator will modulate between positions in direct response to the change in the input current signal. Set 4 mA as the Zero position and 20mA as Span for normal operation or set 4mA as Span and 20mA as Zero for reverse acting.

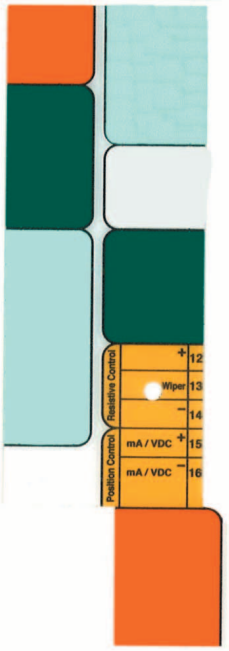
6.1.2 "0-10VDC Voltage Analog" Control

The actuator will modulate between positions in direct response to the change in the input voltage signal. Set 0VDC as the Zero position and 10VDC as Span for normal operation or set 0VDC as Span and 10VDC as Zero for reverse acting.

6.1.3 "Resistive" Control (up to 10K Ohm)

The actuator will modulate between positions in direct response to the change in the input resistive signal.

6.2 Position Control Signal Wiring



6.2.1 Analog Control Wiring

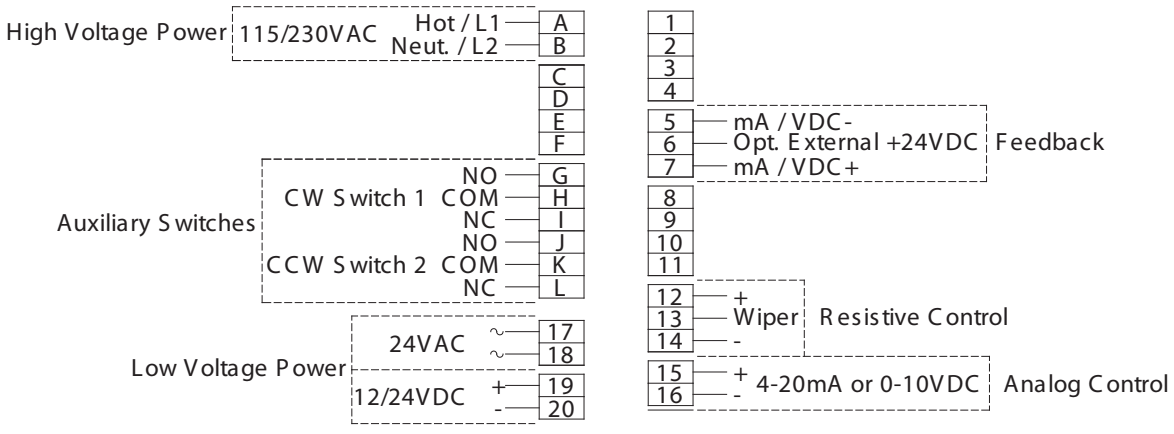
To control the actuator with a 4-20mA or 0-10V analog signal: Connect mA / VDC - (NEG) to terminal 16 and mA / VDC + (POS) to terminal 15 on the Universal Control Board.

Slide the [Input] switch up to select 0-10V or down to select 4-20mA.

6.2.2 Resistive Control Wiring

To control the actuator with a resistance signal such as 0-135 Ohms: Connect Resistance Signal - (NEG) to terminal 14, Resistance Signal Wiper to terminal 13, and Resistance + (POS) to terminal 12 on the Universal Control Board. The board will respond to resistance signals up to 10K Ohms (minimum SPAN signal is 100 Ohms; i.e. signal = 0-100 Ohms).

Positioning Control Wiring



6.3 Set Up and Calibration

6.3.1 Initial Set Up

1. Remove actuator cover.
2. Select LIMIT type "Smart" by sliding the [Smart/Cam] switch up to select Smart. Selecting Smart will enable other features on the board such as Position Feedback
3. Select Control Method "Analog" or "Resistive" by turning the selection potentiometer with a small flat blade screwdriver.

6.3.2 Potentiometer Calibration

Field installation of the Universal Control Board option or replacement of the position tracking potentiometer requires calibration of the position tracking potentiometer prior to setting positions and values for ZERO, MID and SPAN. Universal Control Board options installed at the factory are fully calibrated at the factory and should not require further calibration. To confirm proper potentiometer calibration:

1. Turn the Mode Selector Dial to [CAL] and press [ENTER] for 2 seconds.
2. Using the CW pushbutton, drive the actuator to the full clockwise position. - If the [CAL] LED is flashing, potentiometer calibration is required; proceed to step 3 below. - If the [CAL] LED remains on, calibration is not required; proceed to Setting ZERO, MID and SPAN Positions section below.
3. Loosen the set screw in the gear with a 1/16" hex wrench.
4. Rotate the gear until the LED remains on constantly; hold the gear in place and tighten the set screw. Ensure that the LED remains on after the set screw is tightened. Note: The LED assists the user in locating the proper calibration window; it will flash faster as you approach the calibration window and slower as you move away from it.
5. Press the [ENTER] button to save the potentiometer setting.

6.3.3 Setting ZERO, MID, and SPAN Positions

Once (feedback potentiometer) calibration has been confirmed, set the desired "end of travel" positions. Make certain that the limit switch cams are set to operate the switches beyond the desired range for the ZERO and SPAN positions. ZERO and SPAN may be set at any position between 0° and 94° of travel (0° and 184° with "U4", "UL4" or "UL5" option; or 0° and 274° with "U6", "UL6" or "UL7" option).

Set ZERO:

1. Turn the Mode Selector Dial to [ZERO] and press [ENTER] for 2 seconds. The [ZERO] LED will begin to flash.
2. Drive the actuator to desired clockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired ZERO end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Apply the desired Analog Signal that will correspond with the Zero position (ie 4mA).
4. Press the [ENTER] button to save the ZERO setting.

Set MID: (if applicable)

1. Turn the Mode Selector Dial to [MID] and press [ENTER] for 2 seconds. The [MID] LED will begin to flash.
2. Drive the actuator to the desired MID or "THIRD" position using the CW or CCW push button.
3. Press the [ENTER] button to save the MID setting.

Set SPAN:

1. Turn the Mode Selector Dial to [SPAN] and press [ENTER] for 2 seconds. The [SPAN] LED will begin to flash.
2. Drive the actuator to desired counterclockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired SPAN end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Apply the desired Analog Signal that will correspond with the Span position (ie 20mA).
4. Press the [ENTER] button to save the SPAN setting.

6.3.4 Verify End-Of-Travel Settings:

1. Turn the Mode Selector Dial to [RUN].
2. Apply various control signals to verify operation.
3. Verify that the “Switch Trip” LED is not illuminated at either the ZERO or SPAN positions (if it is, “back” the respective end-of-travel cam “off” of the respective limit switch).
4. Replace actuator cover.

6.3.5 Proper Actuator Cover Replacement

1. Remove the override shaft from the actuator cover bushing; if the actuator is equipped with a handwheel, remove the handwheel before removing the top piece of the "two-piece" shaft from the cover bushing.
2. Install the override shaft on the square motor shaft; if the actuator is equipped with a handwheel, install the bottom piece of the "two-piece" shaft on the motor shaft and then install the top piece of the shaft onto the bottom piece of the shaft.
3. Align cover so that the override shaft will pass through the override bushing and carefully push it down so that the cover flange contacts the base flange.
4. Once the cover is properly seated, tighten the screws to secure the cover; a cross pattern is recommended for uniform distribution of load.
5. If the position indicator is not seated to the output/cam shaft, turn until it drops into place in order to ensure accurate visual position indication.

6.4 Deadband Adjustment

Dead Band is the window of control signal change which the actuator will ignore. The sensitivity of the actuator to respond to changes in the control signal is adjustable. Minimum Dead Band (1%) allows the actuator to respond to small control signal changes. Maximum Dead Band (3%) allows the actuator to ignore small control signal changes (such as noise on the control signal).

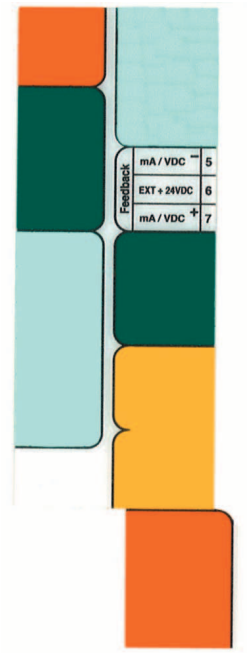
6.5 Signal Fail Options

In the event that the control signal to the actuator is lost and external power is still applied, the Signal Fail position selector switch on the Universal Control Board provides options for the actuator to drive to the Zero (minimum signal) position, the Span (maximum signal) position, or to remain at its “Last” (current) position. Note: If you use a 0-10VDC control signal, the actuator cannot differentiate between a 0VDC signal and an actual loss of signal; therefore it will drive to the “Zero” position regardless of the switch setting.

7 POSITION FEEDBACK AND STATUS INDICATORS

7.1 Position Feedback

The Position Feedback provides an analog indication of the actuator output position scaled between the configured Zero and Span positions.



7.1.1 4-20mA

The 4-20mA Feedback can be powered either internally (by the actuator) or externally (by the loop).

If the Position Feedback will be powered externally, it is extremely important to terminate the customer supplied +24VDC to the correct terminal on the Universal Control Board. The Position Feedback switches are also important. The Power Switch should be down into the "Ext" position and the Signal Switch should be down into the "4-20mA" position.

The 4-20mA Feedback circuit will power down if no impedance is measured on the output terminals in both Normal and Energy Save Mode operation. This is to stop any unnecessary power drain while the 4-20mA feedback circuit is not connected. Keep the metering circuit connected to ensure that the feedback will be present as needed. If the actuator position changes and there is a metering circuit present then the feedback circuit will resume operation and track the position.

7.1.2 0-10VDC

The 0-10V Feedback can only be used with internally (by the actuator) supplied power.

The Position Feedback switches are also important. The Power Switch should be up into the "Int" position and the Signal Switch should be up into the "0-10V" position.

7.2 Status Indicators

7.2.1 Auxiliary Switches

Two auxiliary limit switches will provide position indication for customer use. The switches are dry contacts that can be used to operate other devices. Switches are single pole, double throw; rated for 12/ HP, 11 amps @ 250VAC, CSA certified.

7.2.2 Power Status Relay

The Power Status Relay is "high" if external voltage (12-24VDC, 24VAC power inputs to the board and the output from the Switching Power Supply to the board) is greater than 12.5V. The relay is "low" if external voltage drops below 10.5V and will alternate between "high" and "low" if the motor is stalled.

7.2.3 Battery Status Relay

The Battery Status Relay is "high" if battery is present (Vbat >= 6V) and fully charged (Charger current is <10mA); if the relay switches to "low" the back-up battery should be checked/replaced. Note: After a loss of external power, the Battery Status Relay may show "low" for a period of time while the battery is charging.

8 POWER MANAGEMENT

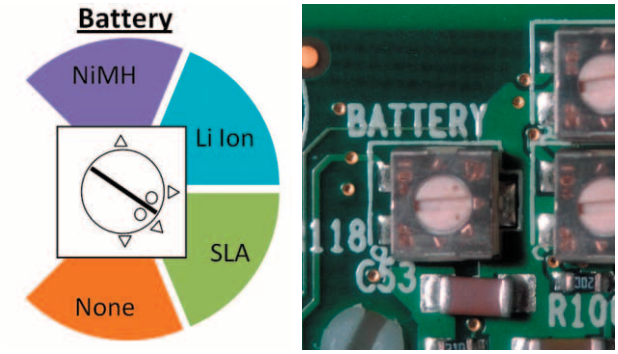
8.1 Battery

With the optional battery backup (included with options UL2, UL3, UL4, UL5, UL6 & UL7), the actuator will sense the loss of main input power to the Universal Control Board and immediately switch to internal battery power. When line power returns, the actuator will automatically resume normal operation.

The battery charging voltage has been designed for optimum battery performance. When the charging circuit is active (even when topping off charge or in sleep mode), the yellow Charging LED will light. After reaching full charge, the green Charged LED will light.* Fully charged, the battery voltage will reach approximately 13.6 volts. This voltage is designed to vary with temperature, and could be as high as 14.4 volts if in a very cold environment, or as low as 12.8 volts if in a very warm environment. This is normal operation. A battery case that is swollen or cracked must be replaced. Please consult the factory for replacement. If the battery does not reach full charge (the green Charged LED remaining on and the yellow Charging LED turning off) within 48hrs, consult the factory or your local representative.

* Note: Battery Charging and Battery Charged LEDs may be lit at the same time depending on the battery charge state.

Replacement battery packs should be stored only after a full charge and at less than 80°F. Temperature can affect battery shelf life. Generally lower temperatures will increase shelf life while higher temperatures will decrease shelf life. When recharging battery packs, they should only be recharged from the Universal Control Board charging circuit, which is calibrated to provide the proper voltage and current for maximum battery pack life, or from a Metso recommended battery charger.



The only suggested maintenance is to examine, and if necessary, replace the batteries every two years. Battery life can vary with temperature. Cooler environments will generally prolong battery life and under ideal conditions ADC batteries will last in excess of five years. To change the batteries, perform the following:

1. Disconnect power to the actuator.
2. Remove actuator cover and set aside carefully so as not to damage the machined flange.
3. Disconnect battery connection at the Universal Control board.
4. Unhook one side of the battery hold-down o-ring.
5. Remove the battery.
6. Install new battery and replace hold-down o-ring.
7. Plug battery connector into the connector into the Universal Control Board.
8. Replace actuator cover.
9. Apply power.

8.2 Power Fail Controls

The ADC-Series Universal Control Board is designed to be easily configured to drive to either the CW, CCW or MID position upon loss of actuator power. This is the power loss or "Fail" position.

When designating MID as the power loss or "Fail" position, the limit type must be set at "Smart" and the MID position must have been entered and saved in the "Operation" field otherwise the Actuator will calculate a default MID position between the calibrated Zero and Span positions.

The ADC-Series Universal Control Board is designed to provide continuing service in the event of a loss of external power. Upon power loss the ADC-Series actuator, equipped with an optional Back-Up Battery can be configured to drive the actuator and "Park" immediately at the designated power loss Fail position and "go to sleep".

In "Multi" mode it will continue to cycle on battery power while a control signal and adequate battery power remain available. When "Multi" is selected, the actuator will cycle until a low battery power condition is detected then automatically drive to and remain at the designated power loss or Fail Position.

In "Multi" mode a fully charged battery will provide up to ten complete 90 degree cycles under optimum conditions. Upon reaching the power loss position, the system will "go to sleep" until input power is restored.

8.3 Wake and Manually Drive Actuator

Manually Drive the Actuator (Using the Battery) During Power Outage (If using "Park" Power Fail Control selection) After the battery drives the actuator to the Power Loss Position, the Universal Control Board powers down and remains in "sleep" mode until external power returns. To "wake" the actuator, to control it with the external control signal or to enable the CW or CCW push buttons for manual control, move the Power Fail Controls switch to "Multi" mode and press [Enter]. This will "wake" the electronics and the actuator can be manually operated via the CW or CCW push buttons until low battery power level is detected. To "park" the actuator and revert it back to sleep mode flip the Power Fail switch back to "Park" mode and the actuator will drive to the fail position and go back to sleep.

8.4 Energy Save Mode

The ADC-Series Universal Control Board is equipped with an "Energy Save" mode in which the unit will "doze" when a control signal change is not detected after a one-minute time-out; this is especially beneficial in solar applications where the continuous power draw can be minimized considerably by using "Energy Save" mode. Once a signal change is detected, the unit will "wake" and respond; if no additional changes are made within one minute, the unit will again enter the "doze" cycle.

Selecting "Energy Save" Mode To select "Energy Save" mode, simply slide the Power Consumption switch down; to return to "Normal", simply slide the switch up.

Note: All heater modes are disabled in "Energy Save" mode.

9 DEFAULT SETTINGS AND MODES

Board Section	Function	Condition	State
Back of Board	Torque	Small Actuator	Pot Mid
		Large Actuator	Pot Full CW
	Heater	Low Power	Full CCW
	Battery (with battery installed)	Sealed Lead Acid	Pot 3/4 CW
	Battery (no battery installed)	None	Full CW
Position Feedback	Power	External	Switch Down
	Signal	4-20mA	Switch Down
On/Off Control	Control Mode	2 Wire CCW	Pot Full CCW
Position Control	Input	4-20mA	Switch Down
	Signal Fail	Zero	Switch Up
	Dead Band	Min	Pot Full CCW
Power Fail Control	Park/Multi	Park	Switch Up
	CCW/Mid/CW	CW	Pot Full CW
Limit	Smart/Cam	Smart	Switch Up
Power Consumption	Normal/Energy Save	Normal	Switch Up
Operation	Mode Selector	Run	Pot Full CCW

10 TROUBLESHOOTING

Symptom: Actuator Stall LED is blinking in a mid-travel position.
Fix: This could be due to hunting; increase actuator Deadband or adjust controller's setpoint tolerance

Symptom: Actuator does not respond to 4-20mA or 0-10V control signal.
Fix: Verify that Analog Position Control Mode has been selected. If the problem persists calibration is required.

Symptom: No Feedback in Energy Save mode.
Fix: If the Feedback wires are removed from the terminal block, even briefly, the Feedback signal is turned off; ensure the wires are connected and cycle power to reinstate Feedback signal.

Symptom: LED's shut off after a minute.
Fix: Check to see if Energy Save mode has been selected; LEDs are turned off after one minute in Energy Save mode in order to reduce power consumption.

11 SPECIFICATIONS & TECHNICAL INFORMATION

Table 1

Torque (in-lbs)	Duty Cycle	12VDC		24VDC		24VAC		115VAC		230VAC	
		Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)
150	100%	11	2.2	13	1.2	8	1.8	9	0.4	9	0.4
300	100%	17	2.5	13	1.4	12	2.1	13	0.5	13	0.4
600	100%	17	2.8	13	1.7	13	2.5	14	0.6	14	0.5
1000	100%	21	4	14	2.4	15	3.5	15	0.9	15	0.6
1500	100%	40	4	24	2.4	27	3.5	29	0.9	29	0.6
2000	100%	40	4.3	33	2.4	28	3.5	29	0.9	29	0.6
2500	100%	55	3.3	40	2	38	3.1	39	0.8	39	0.6
3000	100%	60	3.7	42	2.2	40	3.5	42	0.8	43	0.6

Table 2 - Specifications

Temperature Range	32°F to 130°F (0°C to 55°C) (without heater and thermostat enabled) -40°F to 130°F (-40°C to 55°C) (with heater and thermostat enabled)
Conduit Connections	(2) 3/4" NPT all sizes (3/4" to 1/2" reducing bushings included)
Output	150 to 600 in-lbs: ISO 5211 F05 and F07 bolt circles, 3/4" female square (14mm female square w/ "I" Option; 15mm female keyed output w/ "Y" Option). 1000 to 3000 in-lbs: ISO 5211 F07 and F10 bolt circles, 1" female square (1000 in-lbs: 19mm female square w/ "I" Option; 1500 - 3000 in-lbs: 22mm female square w/ "I" Option; 1000 to 3000 in-lbs: 20mm female keyed output w/ "Y" Option)
Voltage	12 VDC: 10.8 to 13.2 VAC 24 VDC: 21.6 to 26.4 VDC 24 VAC: 21.6 to 26.4 VAC, 60 Hz or 50 Hz 115 VAC: 103.5 to 126.5 VAC, 60 Hz or 50 Hz 230 VAC: 207 to 253 VAC, 60 Hz or 50 Hz **Note: Operation at 50 Hz may result in a longer cycle time and an increased current draw.**
Limit Switches	**(2) Single pole, double throw switches rated for 1/2 HP, 11 amps @ 250 VAC, CSA certified.**
Motor	Brushless DC motor with Class B or better insulation; sub-fractional horsepower
Lubrication	Permanently lubricated gear train and bearings
Gear Train	Hardened steel, machine cut spur gears
Approximate Weight	17 lbs for sizes up to 600 in•lb (ADC models) 31 lbs for sizes 1000 in•lb and above (LADC models)
Enclosure	Die cast aluminum

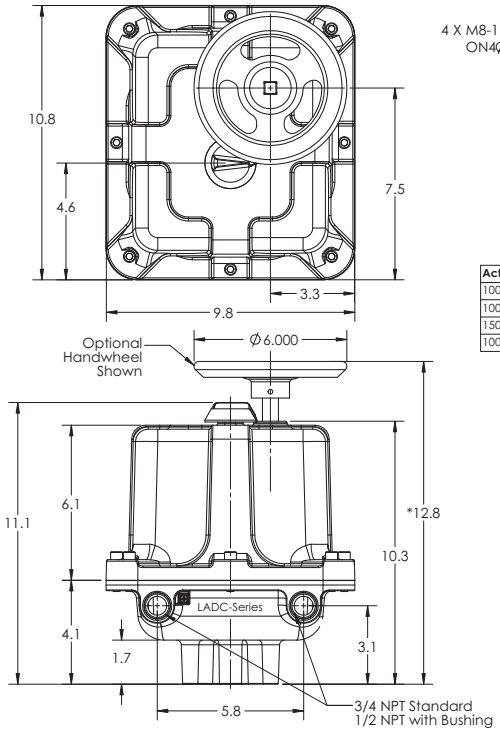
11.1 ADC-SERIES UNIVERSAL CONTROL BOARD

Table 3 - Control Board Specifications

Input Impedance (Analog Control)	Voltage Input: 35K ohms Current Input: 200 ohms
Analog Control Signal	May be either 4-20mA or 0-10VDC (selectable via on-board slide swithch) Fully compatible with ISA-S50. 1 as a type 4, class L, power isolated device. Input minus (-) and transmit minus (-) are tied together and isolated from power and earth ground.
Resistive Control Signal	Board will accept a resistance control signal as low as 0-100 ohms and as high as 0-10K ohms.
Position Out Signal	May be either 4-20mA or 0-10VDC (selectable via on-board slide switch) Minimum resistive load for voltage output: 1K ohm Maximum resistive load for current output: 500 ohm
Stall Protection	If the actuator cannot achieve the position commanded by the control signal, this feature will remove all power to the motor after 5 seconds. The actuator will not restore power to the motor until the control signal commands the actuator to drive in the opposite direction.
Power Loss Position	In the event of a loss of main power, user can choose either the Zero position or the Span, or Mid position, via selector pot, as the power loss "Park" position.
Power Fail Park or Battery Cycle	In the event of a loss of main power, user can choose either to drive the actuator immediately to the "Park" Power Loss Position or continue to cycle (if control signal is available) until low battery level is detected before driving to the "Park" position.
Control Fail Position	In the event of a loss of control signal (with power still supplied), user can choose either the Zero, Span or the Last position via slide switch NOTE: If the the minimum control signal = 0, the fail position must be Last
Position Potentiometer	360° Rotation, 0 ohms to 1k ohms.
Local Supervisory Control	User can select manual (MAN) to override control signal and drive actuator by pushing the CW or CCW buttons. Actuator may be manually positioned to any location between the existing Zero and Span settings. For additional range, reset the ZERO and Span locations.
Split Range Control	Actuator will accept split range control signal (i.e. 4-12mA or 12-20mA; 0-5V or 5-10V) with no wiring changes.
Reverse Acting	With no wiring changes required, the actuator may be calibrated to drive clockwise upon an increasing control signal, and counter-clockwise upon a decreasing signal.
Dead Band	The amount of change in control signal that the actuator will ignore before the output shaft begins to move. Adjustable from 1% to 3%.

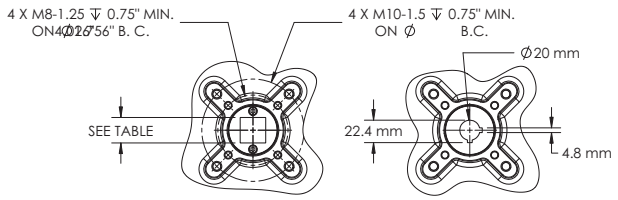
11.2 DIMENSIONS

LADC-SERIES



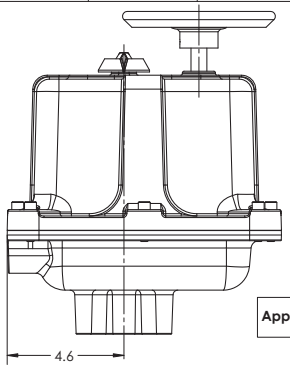
*11.7 WITHOUT HANDWHEEL
TO REMOVE COVER REQUIRES AN ADDITIONAL 5.75"

Mounting Flange, ISO 5211
F07/F10



Female Square Drive — Female Keyed Drive

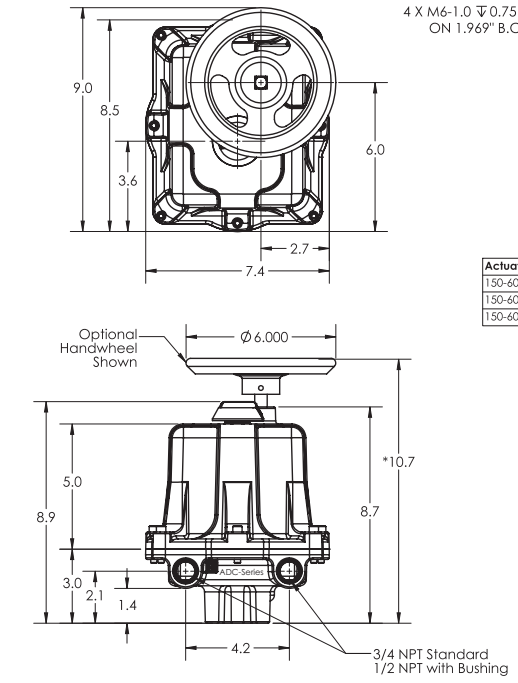
Actuator Size	Drive Option	Drive Type	Drive Size	Depth
1000-3000 lb-in	Standard	Square	1.000 (25mm)	1.20 (30.5mm)
1000 lb-in	Option "I"	Square	0.748 (19mm)	1.20 (30.5mm)
1500-3000 lb-in	Option "I"	Square	0.866 (22mm)	1.20 (30.5mm)
1000-3000 lb-in	Option "Y"	Keyed	0.787 (20mm)	1.50 (38.1mm)



Approximate Weight	31 lb

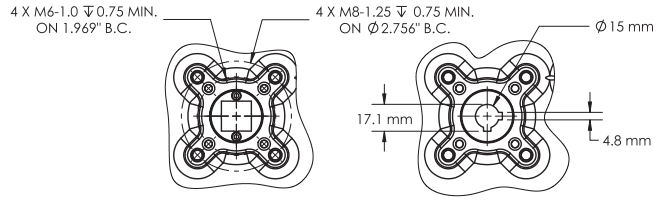
All Dimensions in inches unless otherwise stated

ADC-SERIES



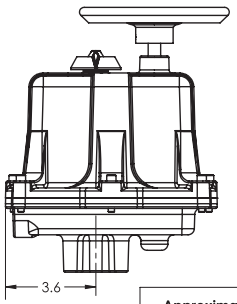
*9.7 WITHOUT HANDWHEEL
TO REMOVE COVER REQUIRES AN ADDITIONAL 4.75"

Mounting Flange, ISO 5211
F05/ F07



Female Square Drive — Female Keyed Drive

Actuator Size	Drive Option	Drive Type	Drive Size	Depth
150-600 lb-in	Standard	Square	0.750 (19mm)	0.90 (22.9mm)
150-600 lb-in	Option "I"	Square	0.551 (14mm)	0.90 (22.9mm)
150-600 lb-in	Option "Y"	Keyed	0.591 (15mm)	1.40 (35.6mm)



Approximate Weight	17 lb

All Dimensions in inches unless otherwise stated

Figure 1

12 ENCLOSURE

Table 4

How To Order - ADC-Series Electric Actuators [1]

Series	Enclosure Type		Torque		Board Options [2]		Other Options		Operating Voltage	
	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
ADC	W	Weathertight	150	150 in•lb	U2	On/Off / Positioner Board	I[3]	ISO 5211 Output	-UP	Universal Power:
		NEMA 4/4X	300	300 in•lb	UL2	On/Off / Positioner Board with Battery Back-Up	MB[4]	Modbus Communication		12/24 DC, 24 AC or
			600	600 in•lb	U4	On/Off / Positioner Board 180-Degree	Y[5]	Keyed Output		115/230 AC
	WX	Weathertight			UL4	On/Off / Positioner Board 180-Degree with Battery Back-Up	Z	Handwheel		
		& Explosionproof			U6	On/Off / Positioner Board 270-Degree				
		NEMA 4/4X/7&9			UL6	On/Off / Positioner Board 270-Degree with Battery Back-Up				
LADC	W	Weathertight	1000	1000 in•lb	U2	On/Off / Positioner Board	I[3]	ISO 5211 Output	-UP	Universal Power:
		NEMA 4/4X	1500	1500 in•lb	UL3	On/Off / Positioner Board with Battery Back-Up	MB[4]	Modbus Communication		12/24 DC, 24 AC or
			2000	2000 in•lb	U4	On/Off / Positioner Board 180-Degree	Y[5]	Keyed Output		115/230 AC
	WX	Weathertight	2500	2500 in•lb	UL5	On/Off / Positioner Board 180-Degree with Battery Back-Up	Z	Handwheel		
		& Explosionproof	3000	3000 in•lb	U6	On/Off / Positioner Board 270-Degree				
		NEMA 4/4X/7&9			UL7	On/Off / Positioner Board 270-Degree with Battery Back-Up				

Notes: 1. All ADC-Series actuators accept any of the following input voltages (12VDC, 24VDC, 24VAC, 115VAC and 230VAC), are rated for continuous duty cycle, include a holding brake, two auxiliary limit switches, 4-20mA or 0-10VDC position feedback, wrench-operated manual override, CSA "C US" certification, CE compliance, and a heater/thermostat that can be user-enabled on the option board.

2. Must select only one board option; all board options can be configured for On/Off or Modulating operation and a built-in Heater/Thermostat that can be activated for either Low-Temperature, or High-Humidity environments.

3. 150 - 600 lb-in models with I option are supplied with a 14mm female square (note that without option I the female square is 3/4"). 1000 lb-in models with I option are supplied with a 19mm female square and 1500 - 3000 lb-in models are supplied with a 22mm female square (note that without option I the female square is 1").

4. The Modbus Communication option allows for controlling, and polling the unit for diagnostic information using a Modbus communication signal (RS-485; Two-Wire).

5. 150 - 600 lb-in models with Y option are supplied with a 15mm female keyed output. 1000 - 3000 lb-in models with Y option are supplied with a 20mm female keyed output.

- **Enclosure "W"** (weathertight) is certified by CSA to meet specifications for NEMA 4/4X for weathertight and dustight, environments and is CE compliant. It is intended for non-hazardous locations in indoor or outdoor use and provides a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation. It is not designed to be submersible.
- **Enclosure "WX"** (weathertight & explosionproof) is certified by CSA to meet specifications for NEMA 7&9, Hazardous location environments as well as to meet NEMA 4/4X specifications. The enclosure is CE compliant and ATEX certified by Sira. Explosionproof means that an internal explosion will be contained, with no sparking that could ignite external atmospheric gases. The enclosure is rated for the following environments:

  NEMA Class I, Division 1, Group C

  NEMA Class I, Division 1, Group D

  NEMA Class II, Division 1, Group E

  NEMA Class II, Division 1, Group F

  NEMA Class II, Division 1, Group G

  NEMA Class III

  Ex d IIB T6 Gb

Sample Model Code: ADCWX150UL2-UP

Actuator Series	ADC
Enclosure Type	WX
Torque	150
Board Option	UL2
Other Options (if applicable)	
Operating Voltage	-UP

(For enclosure specifications and dimensions see Table 2 and Figure 1).

- **Torque = Breakaway Torque** Valvcon Electric Actuators are rated at breakaway torque. This is the torque required to move a full load immediately upon power-up.

13 ADDITIONAL ACTUATOR PRODUCTS AND ACCESSORIES FROM METSO

V-Series

- Up to 3000 inch pounds for On/Off, Modulating or Automatic Cycling applications
- 115VAC and 230VAC voltages
- 75% Duty Cycle (55% on 3000 lb-in models)
- NEMA 4/4X and NEMA 4/4X/7&9 enclosures
- CSA (C US) Certified
- CE Compliant
- ATEX Certified: Ex d IIB ("WX" models only)
- Standard Features: manual override and visual position indicator
- Available Options: Modulating Control Board, Speed Control/Timer Board, Iso/Readback Board, extra limit switches, heater/thermostats, motor brake, feedback potentiometer, metric and "keyed" female outputs and handwheel override

ESR-Series

- Up to 600 inch pounds for true "Two-Wire" On/Off applications
- 80% Duty Cycle
- 115VAC and 230VAC voltages
- NEMA 4/4X and NEMA 4/4X/7&9 enclosures
- Available Options: dynamic brake, extra limit switches, heater/thermostats and metric and "keyed" female outputs

I-Series Network Capable

- Modbus®
- AS-Interface
- DeviceNet™
- Foundation Fieldbus
- Other fieldbus protocols (consult factory)

QX-Series

- Up to 3000 inch pounds for On/Off applications
- Economical NEMA 4/4X/7&9 solution
- 12VDC & 24VDC voltages
- 80% Duty Cycle
- CSA (C US) Certified
- Standard Features: auxiliary limit switches, dynamic brake, manual override and visual position indicator
- Available Options: metric and "keyed" female outputs, heater/thermostats and handwheel override

LCR Series

- Up to 600 inch pounds
- Economical actuators for Reversing applications
- 25% duty cycle (80% on 12VDC or 24VDC models)
- NEMA 4/4X enclosure
- 115VAC, 230VAC, 24VAC, 12 VDC and 24VDC voltages
- Options include extra limit switches and heater/thermostats
- Male output (standard) or female output (optional)

LCU Series

- Up to 600 inch pounds
- Economical actuators for Unidirectional applications
- 25% duty cycle (80% on 12VDC or 24VDC models)
- NEMA 4/4X enclosure
- 115VAC, 230VAC, 24VAC, 12 VDC and 24VDC voltages
- Options include extra limit switches and heater/thermostats
- Male output (standard) or female output (optional)

Q6-Series for Remote Solar Applications

- 600 inch pounds
- 12VDC
- Low current draw
- 80% Duty Cycle
- NEMA 4/4X/7&9
- CSA (C US) Certified

Subject to change without prior notice.

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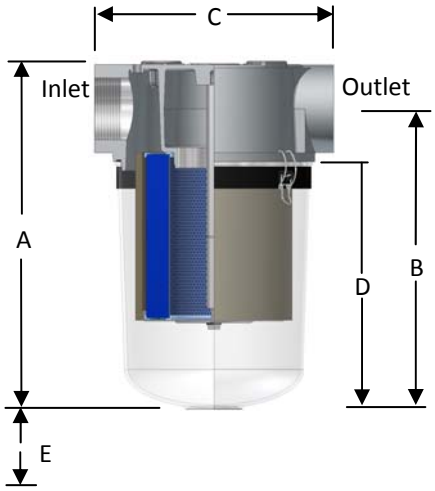
www.metso.com/valvcon

metso

”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

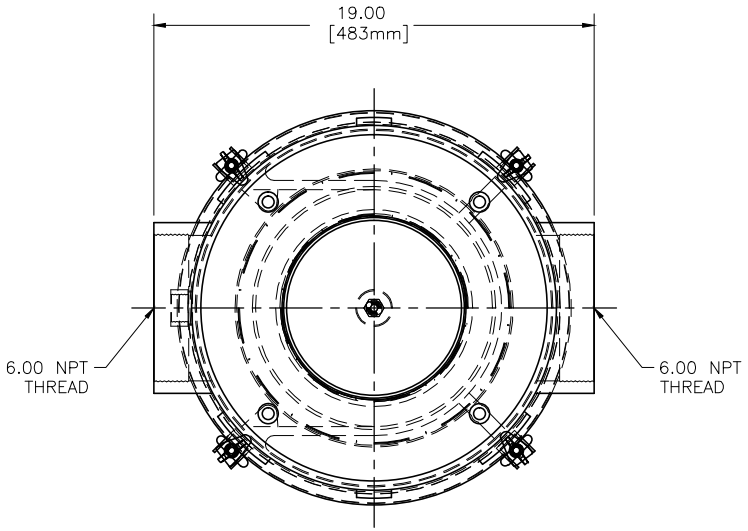
FPT Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Weight	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D	E	lbs.	Polyester	Paper	
1"	40	CT-897-100C	CT-896-100C	13 3/8	11 13/16	7	10 3/8	9	12	897	896	115
1-1/4"	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

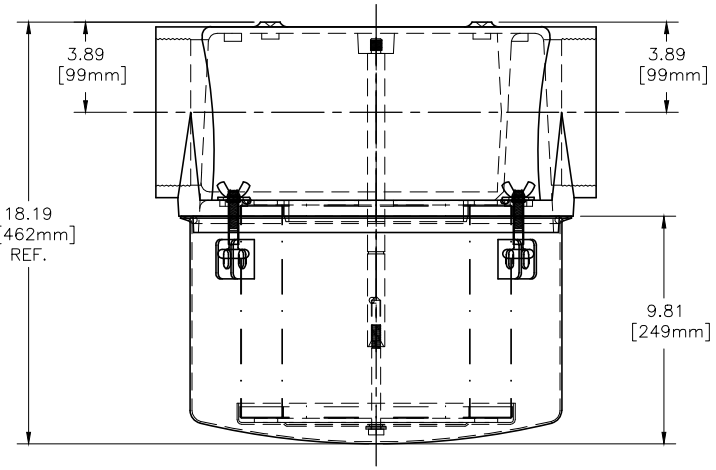
Note CT 2” & 2-1/2” models: Element seals on the base of the housing.

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.

REVISIONS					
REV	DESCRIPTION	ECN #	CHG BY	DATE	APP'D





ELEMENT	275P	ELEMENT	275P
MATERIAL	POLYESTER	MATERIAL	POLYESTER
FLOW RATE	1868 m3/hr	FLOW RATE	1100 CFM
SURFACE AREA	1.7 m2	SURFACE AREA	19 SQ. FT.
I.D.	203mm	I.D.	8.00
O.D.	298mm	O.D.	11.75
HEIGHT	244mm	HEIGHT	9.63

MODEL #	MATERIAL	FINISH
CT-275P-600C	CAST ALUMINUM/CARBON STEEL	NONE/BLACK PAINT

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UNLESS OTHERWISE SPECIFIED:
-DIMENSIONS ARE IN INCHES
-FINISH: BREAK EDGES .005-.020 RADIUS/CHAMFER
-REF: APPROXIMATE DIMENSIONS, NO TOLERANCES APPLY

SOLBERG MANUFACTURING INC.
1151 W. ARDMORE AVE.
ITASCA, IL 60143
630/616-4400

DESCRIPTION:
CT-275P-600C

APPROVALS	DATE	SHEET: #	SHEET SIZE: C	SCALE: NTS
DRAWN: CRW	02/12/09	DRAWING NUMBER:		REV: —
APPROVED: -	-	SD14217		

SOLBERG

Filter Silencers and Inlet Filters Maintenance Manual

www.solbergmfg.com

Note: Please read the maintenance instructions given by the OEM for the machinery first. The OEM's manual should be adhered to in order to protect the equipment. Solberg Manufacturing, Inc has made every effort to make sure that these instructions are accurate but is not responsible for any typos, slight variations or for human errors that may occur.

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Maintenance Manual

Solberg Air Inlet Filters and Filter Silencers

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**For Further Information Please Call: 630-773-1363*

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SOLBERG

Section A

INTRODUCTION

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet air filters.

WARNING

This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the inlet air filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will meet your application requirements.

Section B

GENERAL INFORMATION

1. Identification of Solberg Inlet Air Filters.

All Solberg inlet air filters should have an identification label/nameplate that gives the following information:

Assembly Model #
Replacement Element #

(The exception is OEM supplied units. In this case, please enter the OEM part numbers below.)
Fill in the actual nameplate data from your new Solberg inlet filter(s):

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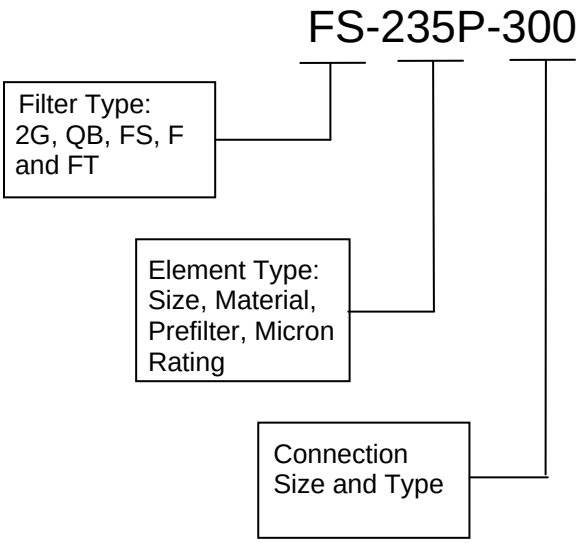
No.	Filter Model Number	Replacement Element	Initial Delta P Readings
1			
2			
3			
4			
5			

Table 1

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'FS' design filter with a 235 element with prefilter and 3" MPT connection size:



2. Filtration Rules of Thumb

General: For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary

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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 (Pre-filtered Applications)	10 CFM/ft^2	(17m^3/h)/cm^2
	Severe Duty (workshop, factory-like)	7 CFM/ft^2	(12m^3/h)/cm^2
	Extreme Duty (Foundry, Construction-like)	5 CFM/ft^2	(8.5m^3/h)/cm^2

Table 2

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

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important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10” to 15” / 250-280mm H_2O over the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200m^3/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Airflow	
1/4"	6 CFM	10m^3/h	1 ¼"	60 CFM	102m^3/h	6"	1,100 CFM	1870m^3/h
3/8"	8 CFM	14m^3/h	1 ½"	80 CFM	136m^3/h	8"	1,800 CFM	3060m^3/h
1/2"	10 CFM	17m^3/h	2"	135 CFM	230m^3/h	10"	3,300 CFM	5610m^3/h
3/4"	20 CFM	34m^3/h	2 ½"	195 CFM	332m^3/h	12"	4,700 CFM	7990m^3/h
1"	35 CFM	60m^3/h	3"	300 CFM	510m^3/h	14"	6,000 CFM	10200m^3/h
			4"	520 CFM	884m^3/h			
			5"	800 CFM	1360m^3/h			

Table 3 **Note: This information is for general use only. A qualified engineer must properly design each system.*

3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C
Filter Change-Out Differential: 10” to 15” / 250-380mm H_2O Over Initial Delta P

Media	Micron Rating
Standard Paper	99+% @ 2 micron
Standard Polyester	99+% @ 5 micron
“S” Series Wire Mesh	Epoxy Coated Wire Mesh
“Z” Series Polyester	99+% @ 1 micron
“HE” Series HEPA	99.97% @ 0.3 microns
“U” Series Polyester	99+% @ 25 micron
“W” Series Polyester	99+% @ 100 micron
“S2” Series	Stainless Steel Wire Mesh
“AC” & “ACP” Series	N/A
“Y” Series Polypropylene	99+% @ 5 micron

Table 4

Temperature Range: -15° to 385°F / -26° to 196°C
Filter Change-Out Differential**:** 10” to 15”/ 250-380mm H_2O Over Initial Delta P

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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

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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 operating temperature for most Solberg inlet air filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers. High temperature products are available.

B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on the inlet and outlet ports.

C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

2. Disconnecting canister top from canister base.

A. FS-04-06-10 *(or 05-07-11):* Twist top housing to open. Use care to support bottom housing while removing top housing. Fitting damage can occur if fitting is torqued in the wrong direction.

B. Small QB/FS/F/FT*:* Remove weather hood or top plate by loosening hex nut or wing nut and lifting off.

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C. Large 2Q/QB/FS/F/FT: Remove cover by loosening hex nut or wing nut and lifting off.

3. Removing element for service/maintenance.

A. Carefully remove retaining hex head/wing-nut and washer over top plate, and then remove element. Note: Model “04-06-10” elements should be free when housing tops are removed.

B. Clean sealing surfaces of housing, top 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 equipment 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. With multiple element stacks place elements in line with base element and ensure elements seat properly.

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.

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5. **Securing canister top to canister base.**

   A. Make sure all surfaces are free from dust and other particulate.

   B. Small QB/FS/F/FT: Replace top plate and/or weather hood if necessary. Feed threaded rod into corresponding bolthole and tighten. Note: Do NOT over tighten!

   C. Large 2G/QB/FS/F/FT: Replace cover. Feed threaded rod into corresponding bolt hole(s) and tighten. Note: Do NOT over tighten!

   D. FS-04-06-10 (or 05-07-11): Reassemble top housing to bottom housing by aligning tabs and turning into place.

6. **Equipment Startup.**

   A. Be sure to read the instructions on installation or element replacement as listed above before starting equipment.

WARNING

If at any time the operator is unable to verify the integrity of the element or any housing feature, the factory or a regional representative should be contacted prior to start-up.

   B. Please check the listed steps prior to startup.

      1. Check element to make sure it is seated properly on element base or sealing surface.

WARNING

Failure to seat the element properly may result in contaminant by-pass resulting in damage to equipment.

      2. Check element top plate or cover to make sure it is seated properly on element.

      3. Check housing cover (if applicable) that it is installed correctly onto housing.

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4. Be sure all fasteners and hardware (if applicable) have been tightened.

WARNING

If the air flow is reversed through a Solberg filter unit, be sure to check the element and housing internals for damage. Failure to do so may result in damage to equipment.

Section D

MAINTENANCE RECOMMENDATIONS

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10" to 15" / 250-380mm H^2O above drop above the initial reading. Refer to page 4 for initial values.

2. Always check 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!

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.

SPARE PARTS LIST:

Contact your Solberg Representative for spare part model numbers.

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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

SN 1810-11 1/2

TECHNICAL CHARACTERISTICS

- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - **cURus** motor

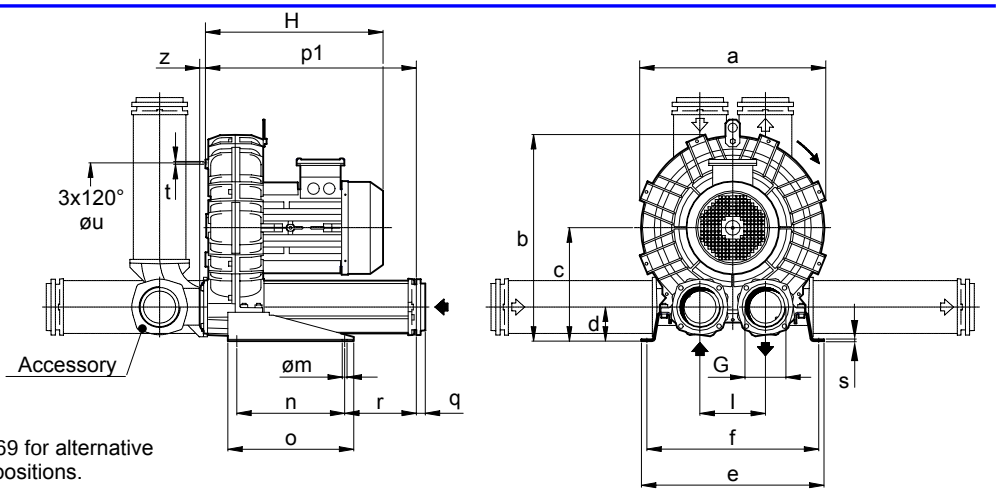
OPTIONS

- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES

- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors

Dimensions in inches.
Dimension for reference only.



See page 69 for alternative mounting positions.

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 Δp (In Hg)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	Inches	Lbs
K07-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***	**5.9**	***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***	**9.2**	***10.4***	**83.0**	***81.0***	**23.94**	**288.80**
			25	**-**	**11.1**	**-**	**83.8**	**-**	**24.81**	**313.10**
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	**-**	**8.8**	**-**	**87.2**	**-**	**24.92**	**320.80**

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

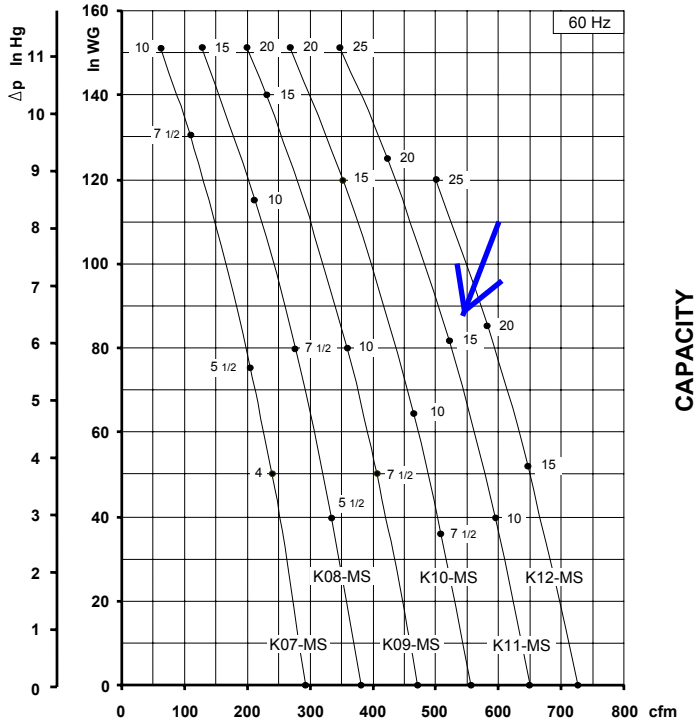
- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

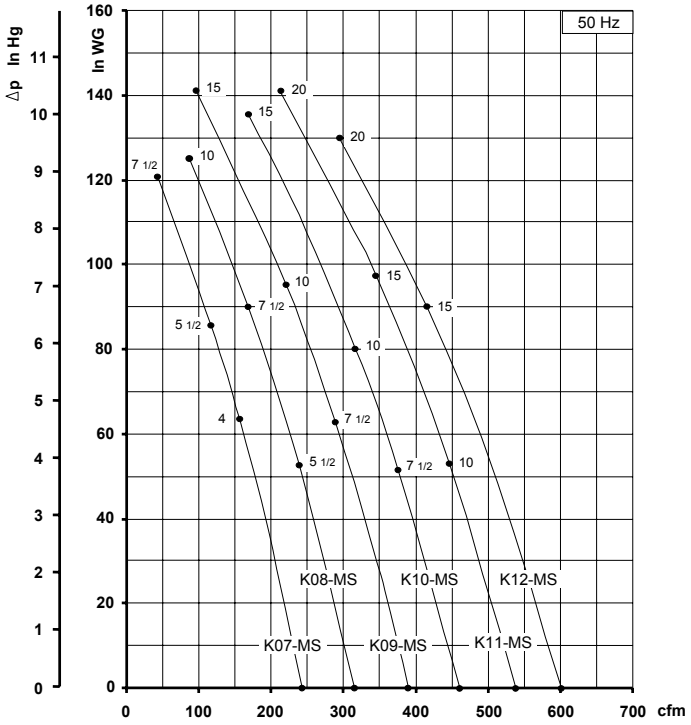
SCL K07 / K08 / K09 / K10 / K11 / K12

MS SERIES

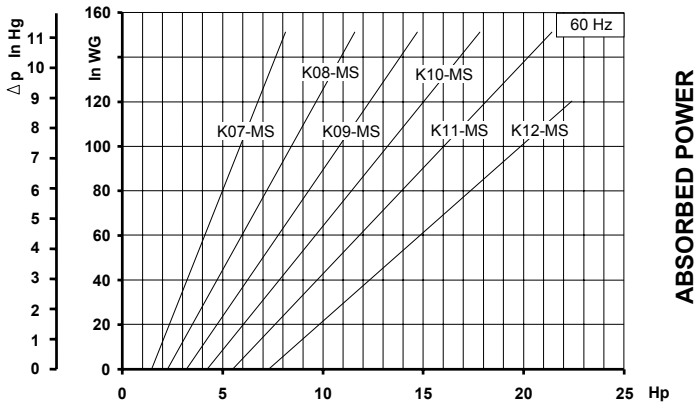
SN 1810-11 2/2

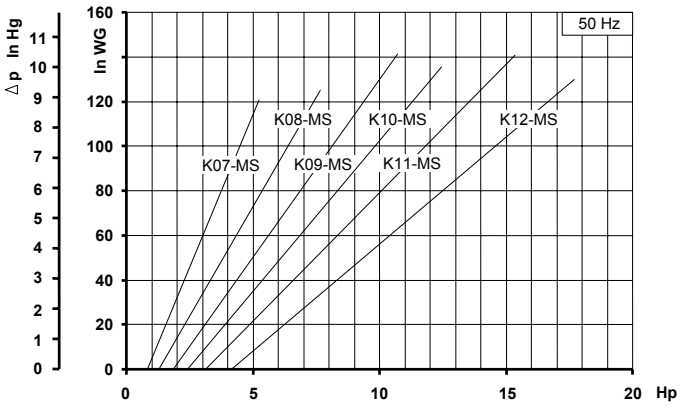
CAPACITY



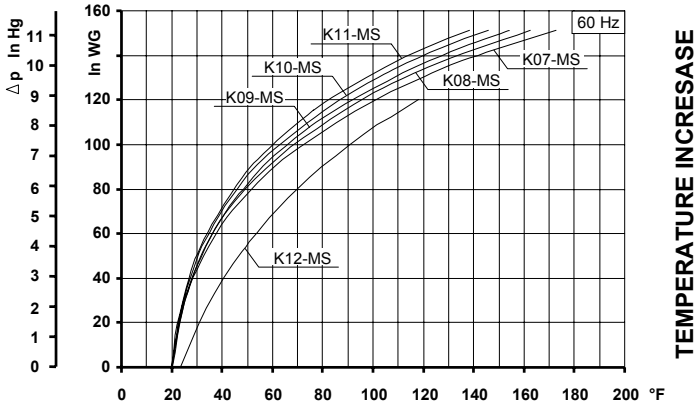


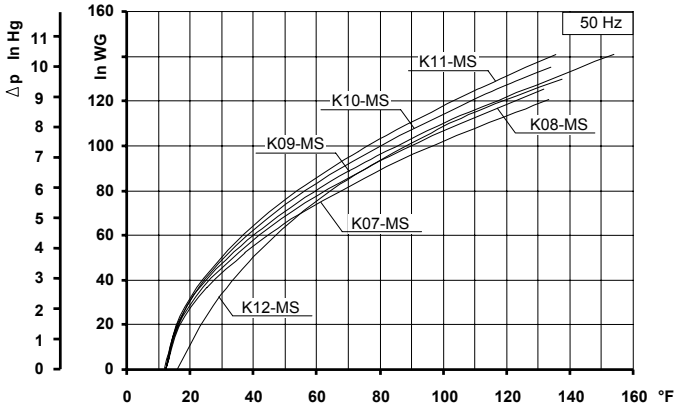
ABSORBED POWER





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.

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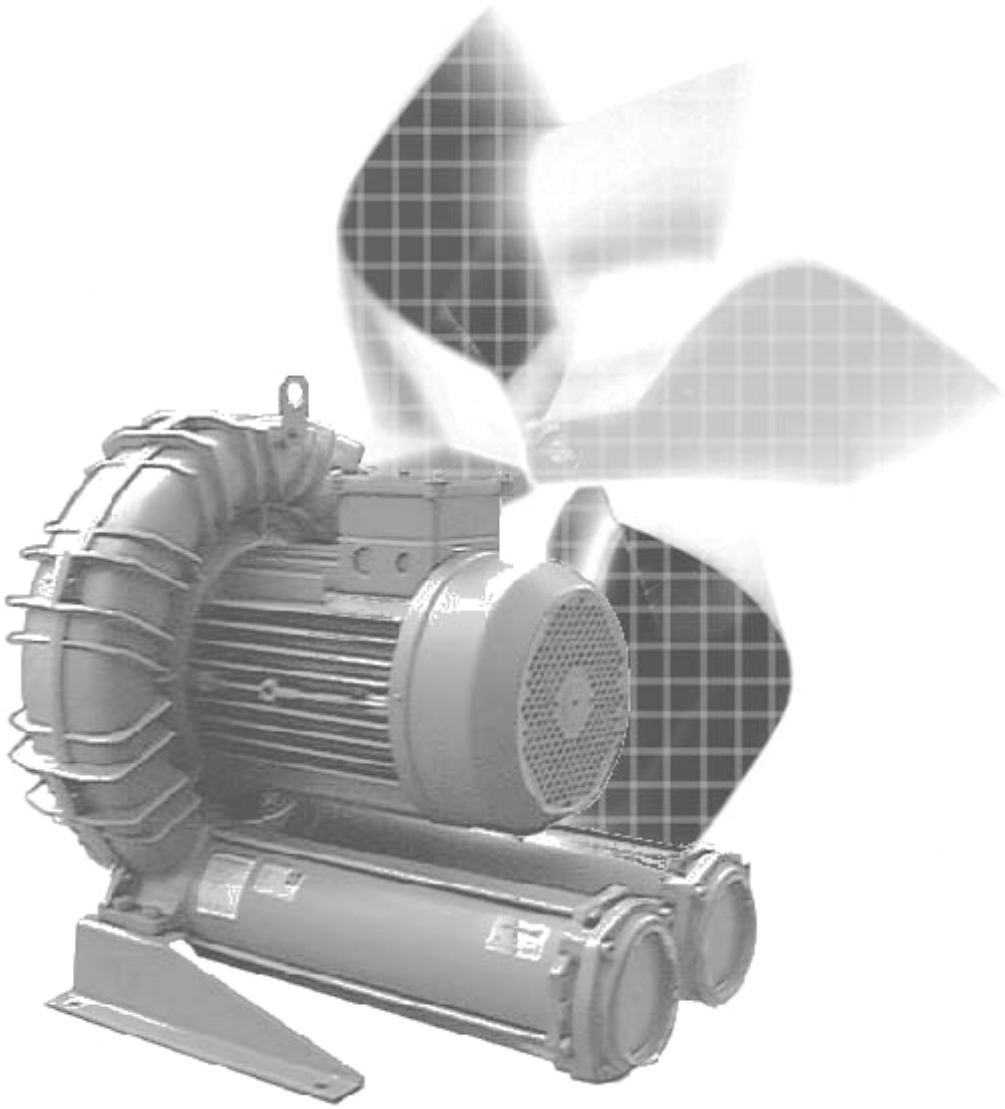
CE

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 Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	kW		**hPa** (mbar)		**Lp / Lw** (1) **dB (A)**		**Ps** max A	**M**
	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	**MPa** (bar)	**kg**
SCL K07-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.

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US - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	Hp		**In Hg / In WG**		**Lp / Lw** (1) **dB (A)**		**Ps** max	**M**
	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	**In Hg**	**lbs**
SCL K07-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.
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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.

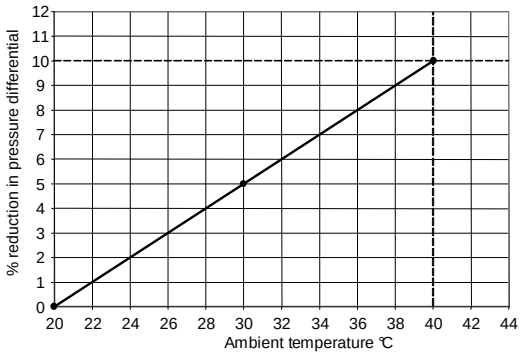
As a vacuum pump:
Gas intake temperature 20°C (+68°F) measured at the suction opening and atmospheric back pressure 1013 mbar (abs) (29,92 in Hg).

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.

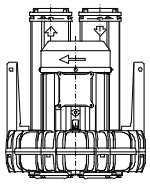


fig.1

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

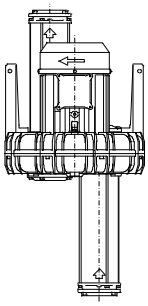


fig 2 with 90° manifold

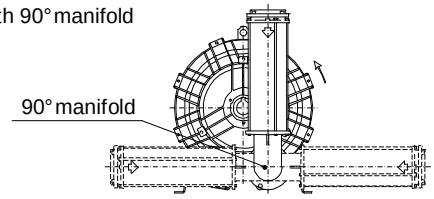


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fig 3

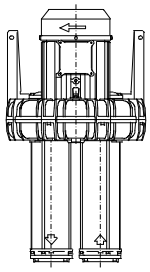


fig 3 with 90° manifolds

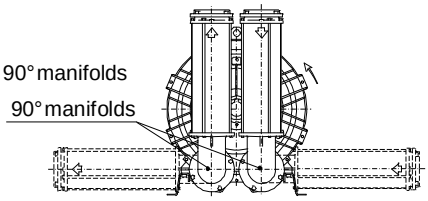


fig 4

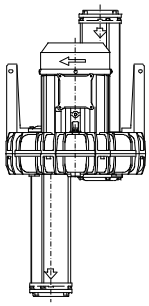
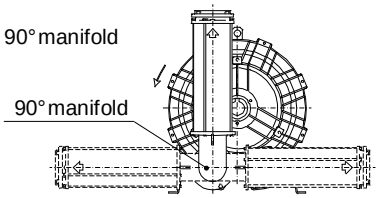


fig 4 with 90° manifold



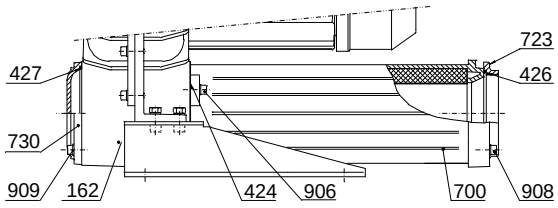
Position the unit in a horizontal position with the brackets on a flat, stable surface.

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.

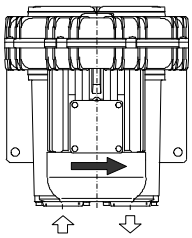
When using the unit with a motor powered via an inverter, follow the wiring instructions supplied by the inverter manufacturer carefully.

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.

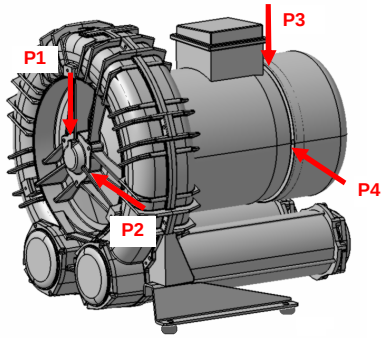
Also compare the values measured with those indicated in the "CHARACTERISTIC DATA" table on page 3/4.

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℃ (+320℉).

- 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℃ (+320℉).

- 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.

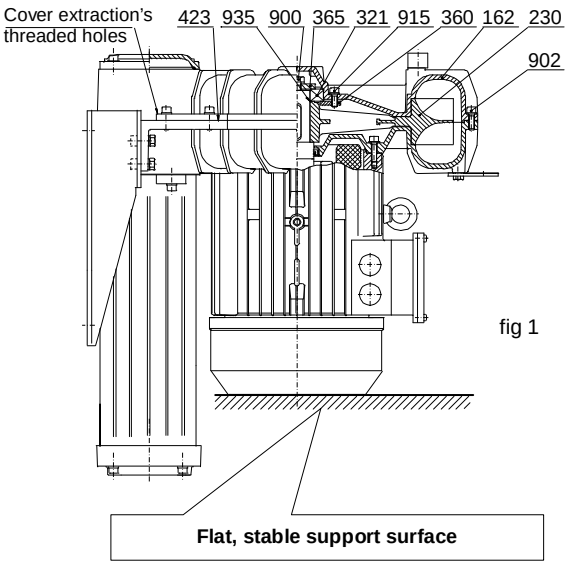


fig 1

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).

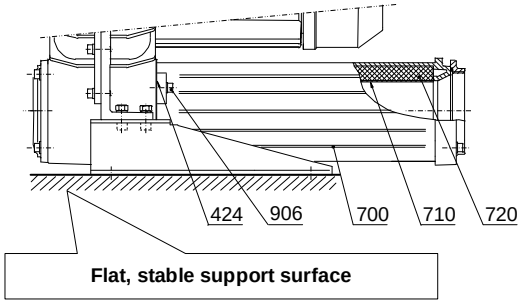


fig 2

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

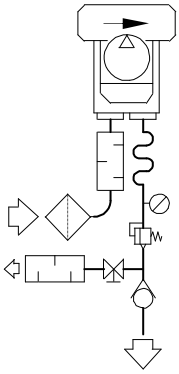
All undertakings, agreements, or legal relations are governed by the relevant sales contract. These are in no way limited by the contents of this manual.

The quality of the materials and workmanship is guaranteed, as indicated in the general sales conditions.

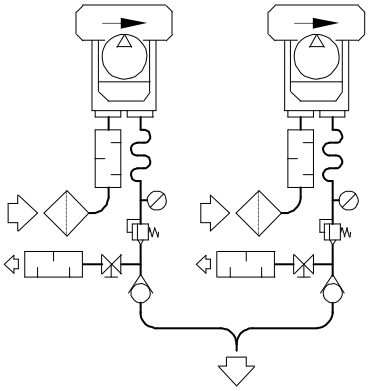
Guarantees are regulated by the general conditions of sale.

8. INSTALLATION DIAGRAMS

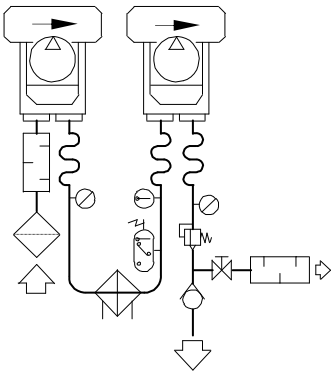
8.1 PRESSURE SERVICE



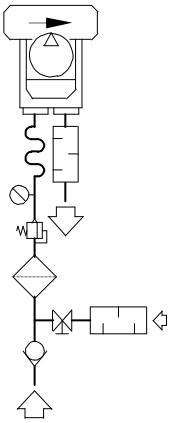
8.2 PARALLEL PRESSURE SERVICE



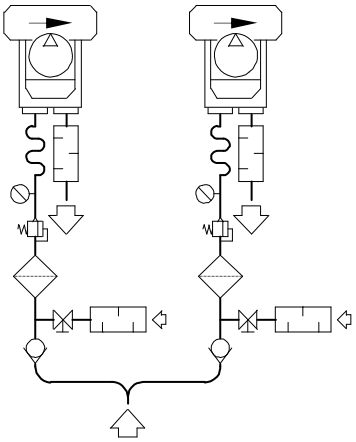
8.3 SERIES PRESSURE SERVICE



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. - 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.

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REGENERATIVE BLOWERS - **VACUUM**

SCL K07 / K08 / K09 / K10 / K11 / K12

MS SERIES

SN 1810-11 1/2

TECHNICAL CHARACTERISTICS

- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - **cURus** motor

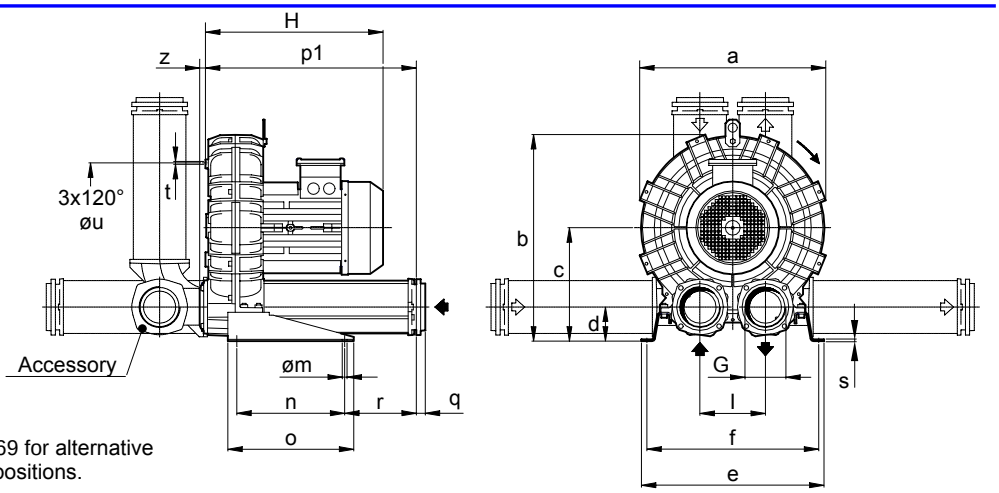
OPTIONS

- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES

- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors

Dimensions in inches.
Dimension for reference only.



See page 69 for alternative mounting positions.

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 Δp (In Hg)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	Inches	Lbs
K07-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***	**5.9**	***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***	**9.2**	***10.4***	**83.0**	***81.0***	**23.94**	**288.80**
			25	**-**	**11.1**	**-**	**83.8**	**-**	**24.81**	**313.10**
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	**-**	**8.8**	**-**	**87.2**	**-**	**24.92**	**320.80**

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

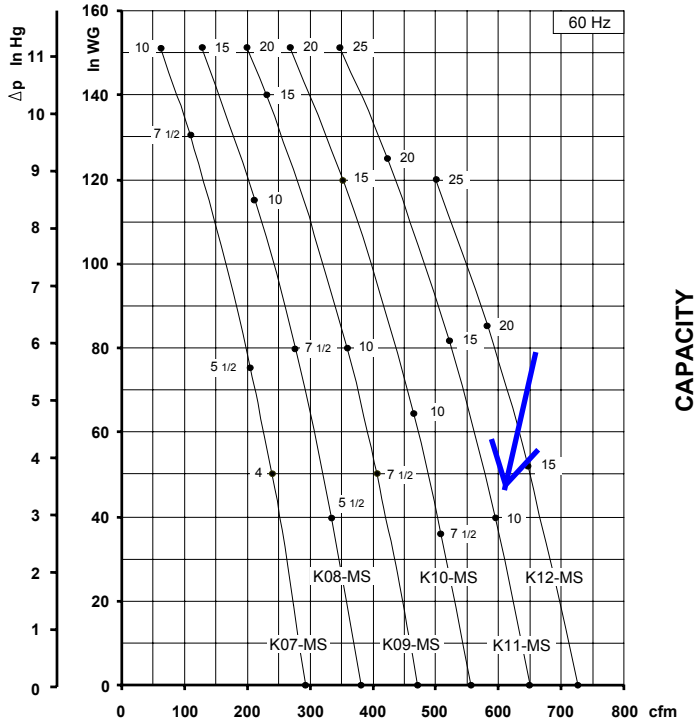
- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

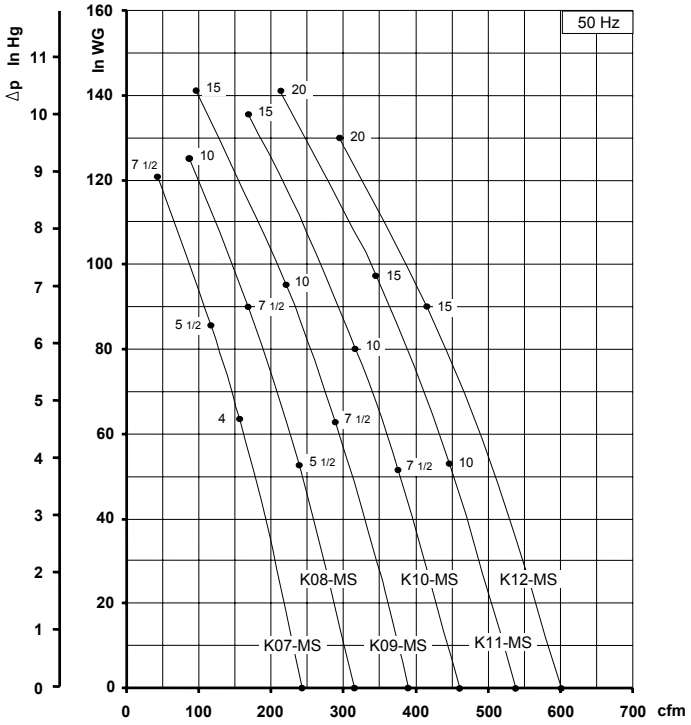
SCL K07 / K08 / K09 / K10 / K11 / K12

MS SERIES

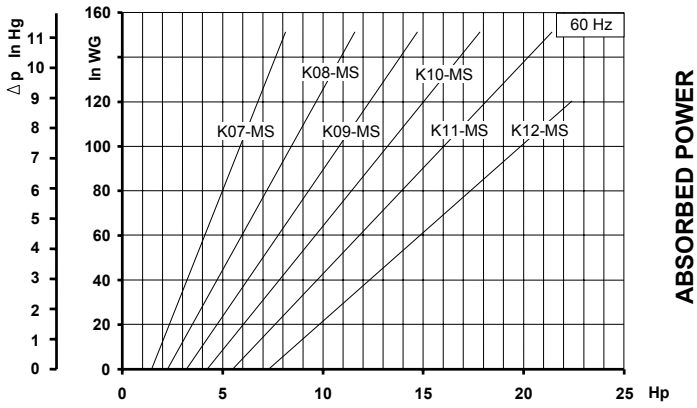
SN 1810-11 2/2

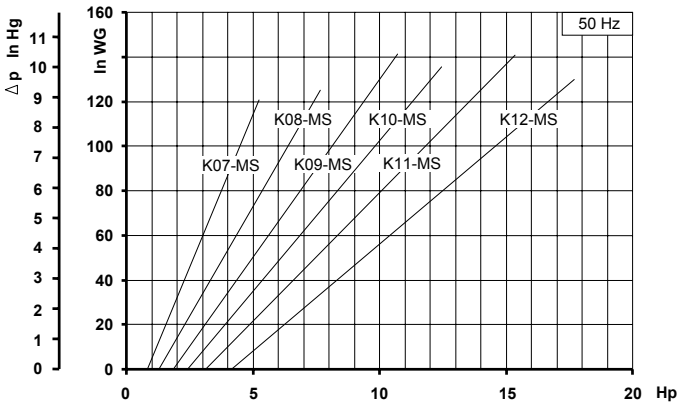
CAPACITY



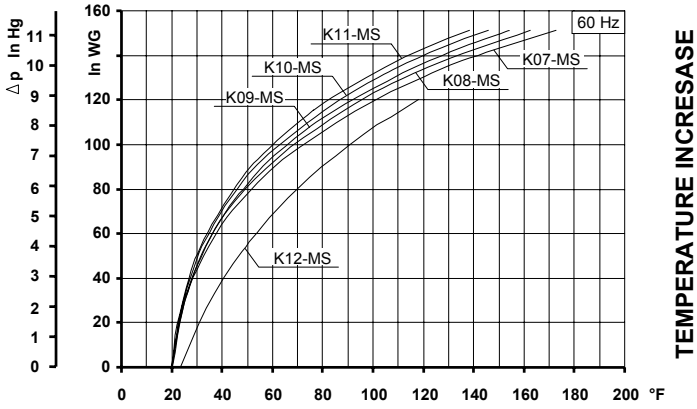


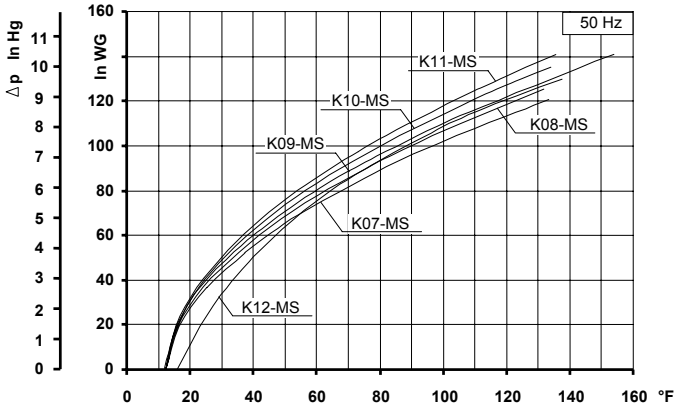
ABSORBED POWER





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.

Safety Valves

SS1401

The following table is a guide to select the appropriate safety valve. The selections in the table are based on blowers operating at 60 Hz - for 50 hz applications refer to the safety valve data sheets. To select the appropriate safety valve, determine the blower model, horsepower, and whether it is to be used for vacuum or pressure service. If it is desirable to have the valve activate at lower pressures than the maximum rated pressure or vacuum of the blower, a different safety valve might be required (refer to safety valve data sheets). In some cases, two valves are required. FPZ valves are supplied uncalibrated. All safety valves include detailed instructions on how to calibrate and install the valve.

Single Stage Blowers			
Model	HP	Safety Valve Vacuum	Safety Valve Pressure
K03-MS	3/4	VRL6	VRL6
K04-MS	ALL	VRL6	VRL6
K05-MS	ALL	VRL6	VRL6
K06-MS	3	VRL6	VRL8
K06-MS	4	VRL6	VRL6
K06-MS	5 1/2	VRL6	VRL6
K06-MS	6 1/5	VRL6	VRL6
K07-MS	4	VRL8	VRL8
K07-MS	5 1/2	VRL6	VRL8
K07-MS	7 1/2	VRL6	VRL6
K07-MS	10	VRL6	VRL6
K08-MS	5.5	VRL8	VRL9
K08-MS	7 1/2	VRL8	VRL8
K08-MS	10	VRL6	VRL8
K08-MS	15	VRL6	VRL6
K09-MS	7 1/2	VRL9	VRL9
K09-MS	10	VRL8	VRL8
K09-MS	15	VRL6	VRL8
K09-MS	20	VRL6	VRL6
K10-MS	7 1/2	VRL9	VRL9
K10-MS	10	VRL9	VRL9
K10-MS	15	VRL8	VRL8
K10-MS	20	VRL6	VRL8
K10-MS	25	-	VRL6
K11-MS	10	VRL9	VRL9
K11-MS	15	VRL9	VRL9
K11-MS	20	VRL8	VRL8
K11-MS	25	VRL8	VRL8
K12-MS	15	VRL9	VRL9
K12-MS	20	VRL9	VRL9
K12-MS	25	VRL8	VRL8
K05-TS	ALL	VRL8	VRL8
K06-TS	5 1/2	VRL9	VRL9
K06-TS	7 1/2	VRL8	VRL8
K06-TS	10	VRL6	VRL8
K07-TS	7 1/2	VRL9	VRL9
K07-TS	10	VRL9	VRL9
K07-TS	15	VRL8	VRL8
K08-TS	7 1/2	N.A	N.A.
K08-TS	10	VRL9	(2) VRL9
K08-TS	15	VRL9	VRL9
K09-TS	15	(2) VRL9	(2) VRL9
K09-TS	20	VRL9	VRL9
K09-TS	25	VRL8	VRL9
K10-TS	15	(2) VRL9	(2) VRL9
K10-TS	20	(2) VRL9	(2) VRL9
K10-TS	25	VRL9	VRL9
K11-TS	25	(2) VRL9	(2) VRL9
K11-TS	30	(2) VRL9	(2) VRL9
K12-TS	30	(3) VRL9	(3) VRL9

Two Stage Blowers			
Model	HP	Safety Valve Vacuum	Safety Valve Pressure
15DH	ALL	VRL6	VRL6
R20-MD	ALL	VRL6	VRL6
30DH	ALL	VRL6	VRL6
40DH	ALL	VRL6	VRL6
K07-MD	3	VRL6	VRL6
K07-MD	4	VRL6	VRL6
K07-MD	5 1/2	VRL6	VRL6
K07-MD	7 1/2	VRL6	VRL6-HP
K08-MD	5 1/2	VRL6	VRL6
K08-MD	7 1/2	VRL6	VRL6
K08-MD	10	VRL6	VRL6
K08-MD	15	-	VRL6-HP
K09-MD	5 1/2	VRL8	VRL8
K09-MD	7 1/2	VRL6	VRL6
K09-MD	10	VRL6	VRL6
K09-MD	15	-	VRL6-HP
K10 -MD	7 1/2	VRL8	VRL8
K10-MD	10	VRL6	VRL6
K10-MD	15	VRL6	VRL6
K10-MD	20	-	VRL6-HP
K11-MD	10	VRL8	VRL8
K11-MD	15	VRL6	VRL8
K11-MD	20	VRL6	VRL6-HP
K11-MD	25	-	VRL6-HP
K12-MD	15	VRL8	VRL8
K12-MD	20	VRL6	VRL6
K12-MD	25	-	VRL6-HP
K04-TD	2	VRL6	VRL6
K04-TD	3	VRL6	VRL6
K05-TD	3	VRL6	VRL6
K05-TD	4	VRL6	VRL6
K05-TD	5 1/2	VRL6	VRL6
K06-TD	5 1/2	VRL6	VRL8
K06-TD	7 1/2	VRL6	VRL6
K06-TD	10	VRL6	VRL6
K07-TD	7 1/2	VRL8	VRL8
K07-TD	10	VRL6	VRL6
K07-TD	15	VRL6	VRL6
K08-TD	7 1/2	VRL8	VRL8
K08-TD	10	VRL8	VRL8
K08-TD	15	VRL6	VRL6
K09-TD	20	VRL6	VRL8
K09-TD	25	VRL6	VRL6
K10-TD	15	VRL9	VRL9
K10-TD	20	VRL8	VRL8
K10-TD	25	VRL6	VRL8
K11-TD	20	VRL9	VRL9
K11-TD	25	VRL8	VRL8
K12-TD	25	VRL9	VRL9
K12-TD	30	VRL8	VRL8

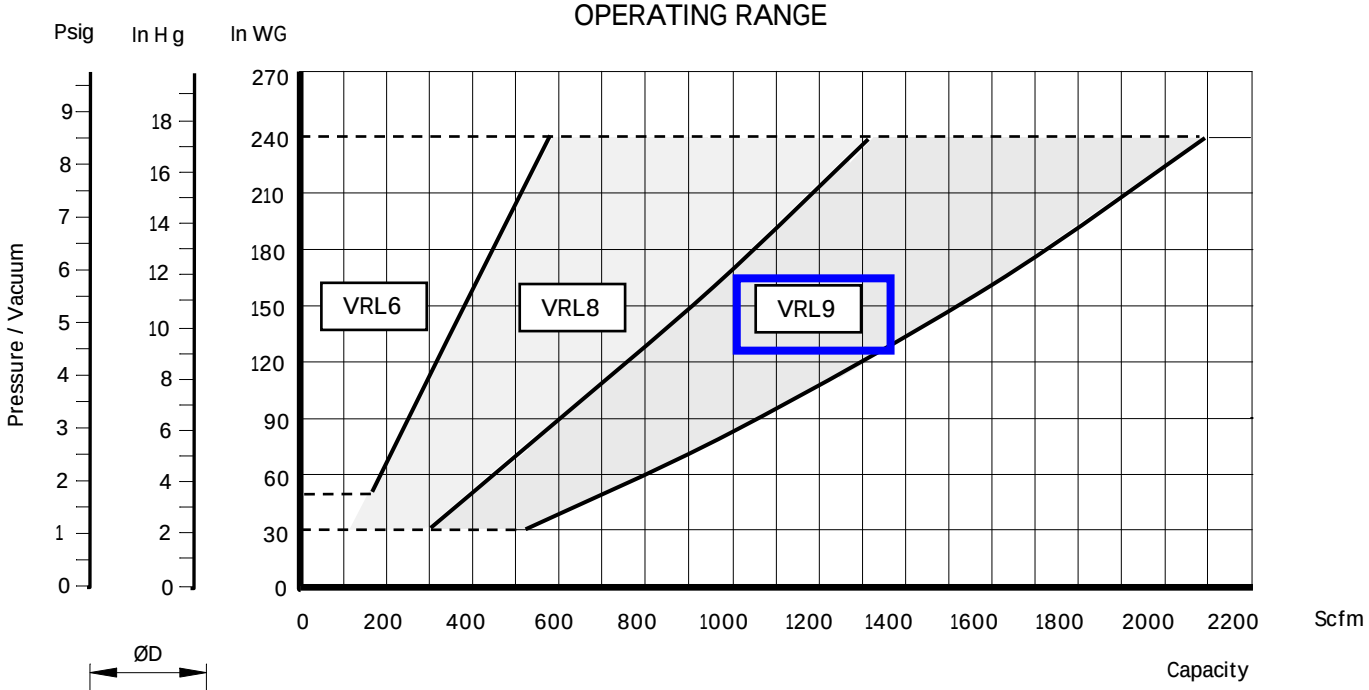
Valve selections are based on 60 Hz operation and refer to air having a density equal to 0.075 lbs / cu. Ft and inlet temperarture of 68 deg F. Data is subject to change without notice.

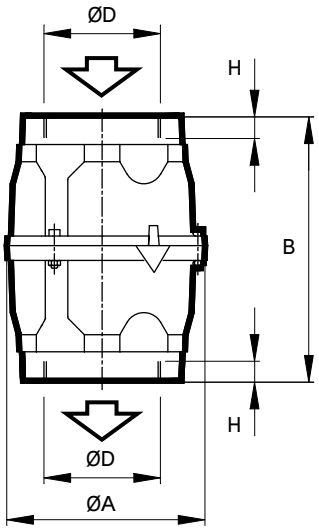
Safety Valves

The VRL valves are designed to protect blowers and / or motors from over pressurization or excess vacuum. When there is over pressurization, the valve opens and discharges to the outside. When there is excess in vacuum, the valve opens and takes flow from outside.
The valves have been designed for low pressure / low vacuum, with minimal difference between the initial value at which the valve begins to open and its fully opened position. The valves are supplied with 2 different springs to maximize their efficiency.
These compact valves, made of aluminum alloy, are both easy to install and calibrate. The valves are designed to operate in a wide range of capacities. The VRL can be plumbed to divert excess primary flow through a secondary external outlet when working in pressure conditions or to pipe in a secondary flow when working in vacuum.
Maximum efficiency is achieved by keeping operating values (flow versus pressure or vacuum) within the operating range (shaded area on graph). Capacity refers to air having a density equal to 0.075 lbs./cu.ft .

VRL6 VRL8 VRL9

OPERATING RANGE





OVERALL DIMENSIONS

TYPE	ND	D	A	B	H	WEIGHT (Lbs)
VRL6	2”	2” NPT	4.02	6.90	0.47	1.9
VRL8	3”	3” NPT	5.31	7.48	0.59	4.2
VRL9	4”	4” NPT	6.30	8.11	0.71	5.7

- Dimensions in inches.
- Specifications subject to change without prior notice.

® **FPZ S.p.A.**
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www.fpz.com

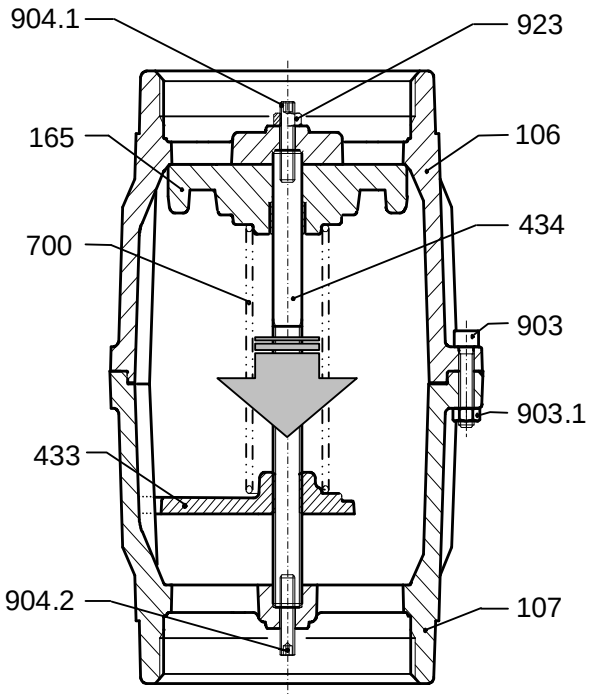
I – GB – F – D – E **SN 1701-7**

VALVOLA DI SICUREZZA VRL
SAFETY VALVE VRL
SOUPAPE DE SECURITE VRL
SICHERHEITSVENTIL VRL
VALVULA DE SEGURIDAD VRL

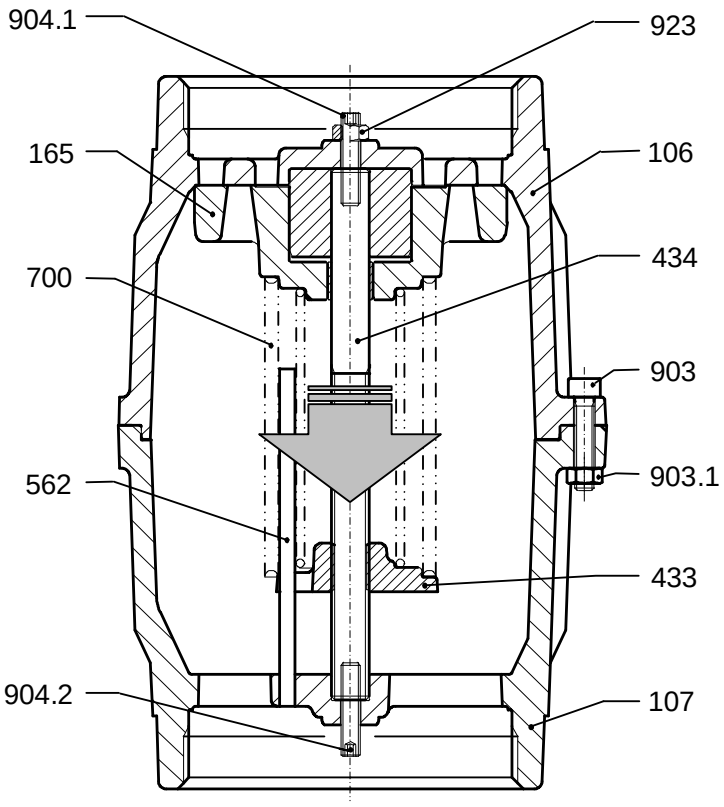
ISTRUZIONI D'USO
USE INSTRUCTIONS
INSTRUCTIONS D'UTILISATION
ANWENDUNGSHINWEISE
INSTRUCCIONES PARA EL USO

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

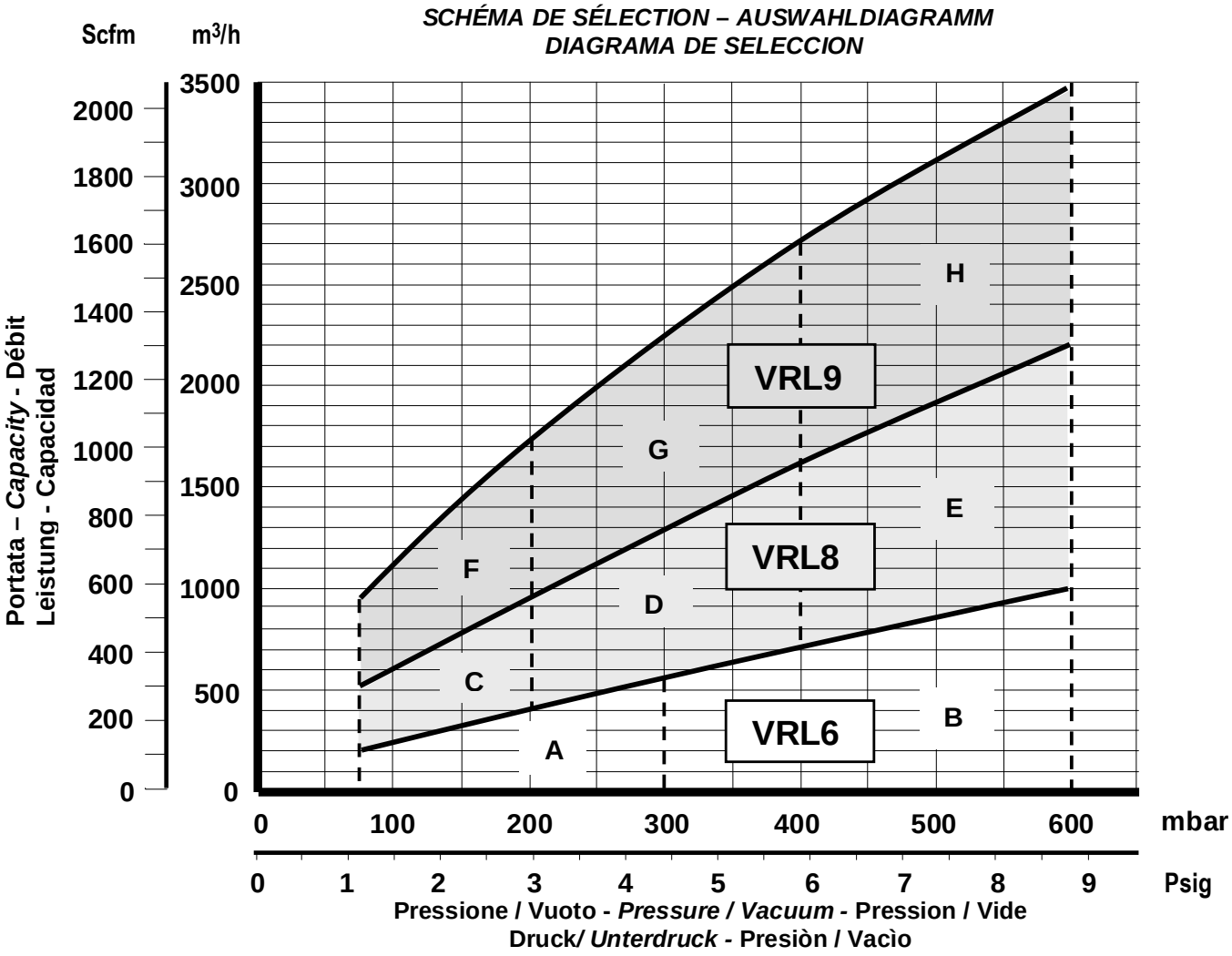


TABELLA DI SELEZIONE MOLLA - *SPRING SELECTION CHART* - TABLEAU DE SÉLECTION RESSORT
***UEBERSICHTSTABELLE FEDERN* - TABLA DE SELECCION MUELLE**

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	-

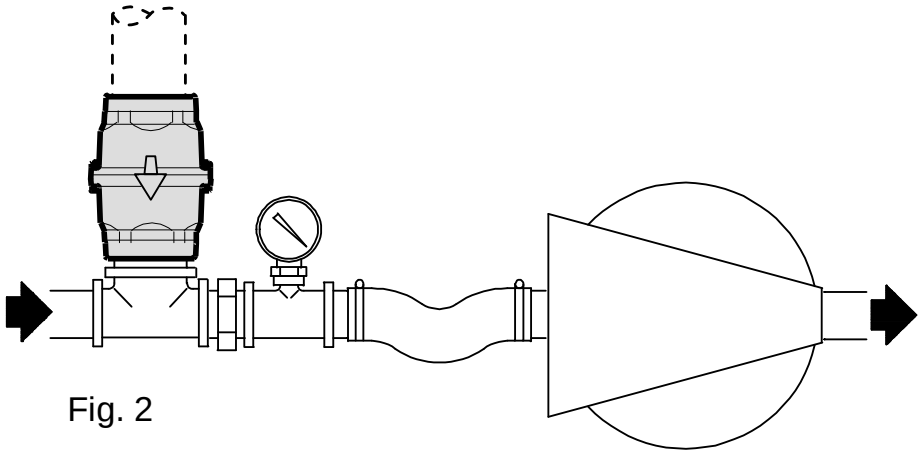


Fig. 2

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

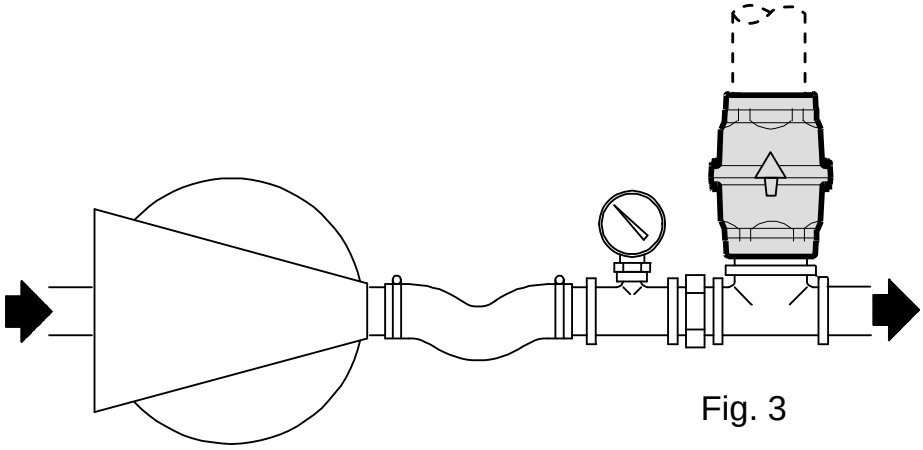


Fig. 3

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.

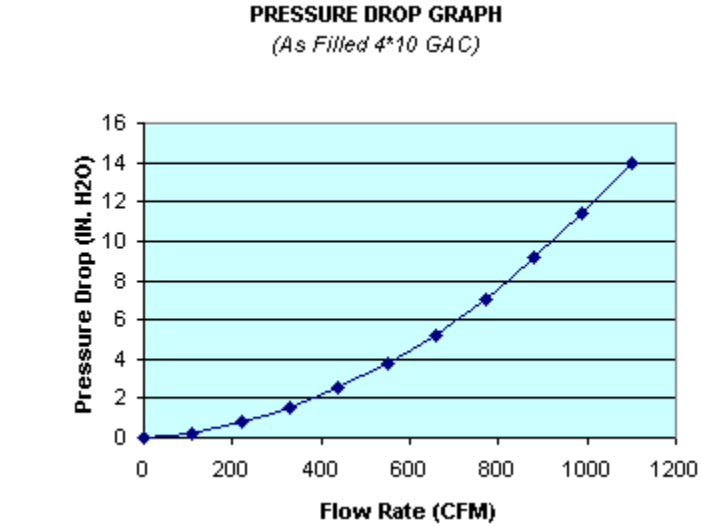
B) Setting-up at allowed pressure level

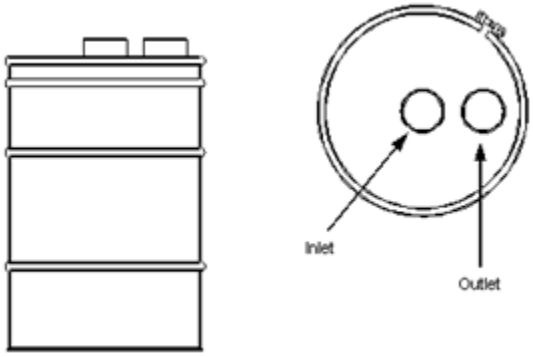
- Remove the two plastic caps on valve, if any.
- Remove nut 923 from upper grub screw 904.1 and place it on to the lower grub screw 904.2. Do not tighten.
- Position valve on the discharge by-pass and connect a pressure gage as close as possible to the blower outlet (Fig. 3).
- Relieve spring tension 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

VR-400

High Flow Radial Design Vapor Phase Filter





VR-400 SPECIFICATIONS			
Overall Height	3'11"	Vessel/Internal Piping Materials	CS/ SCH 40 PVC
Diameter	30"	Internal Coating	Polyamide Epoxy Resin
Inlet / Outlet (FNPT)	6"	External Coating	Urethane Enamel
Drain / Vent (FNPT)	OPT	Maximum Pressure / Temp	2 PSIG / 150° F
GAC Fill (lbs)	400	Cross Sectional Bed Area	8.8 FT^2
Shipping / Operational Weight (lbs)	500/575	Bed Depth/Volume	11.7 IN / 14.25 FT^3

TETRASOLV

VAPOR PHASE FILTRATION MEDIA : 4x10 RE-ACTIVATED CARBON

GENERAL DESCRIPTION

Select Re-Activated carbon from domestic sources is quality screened during our purchasing process for activity, density and fines. The use of re-activated carbon is recommended as a lower cost alternative for most sites where drinking water quality is not necessary. In many cases our re-activated carbon meets and exceeds imported virgin carbon. In addition all carbon either sold by itself or installed in our filtration units is traced by lot number to the installation or sale.

4*10 (Vapor Phase) Standard Specifications:	**Standard**	**Value**
Carbon Tetrachloride Activity Level	ASTM D-3467	40 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	4x10 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

Packaging:		
50 Pound Bags	50 Pound Drums	Bulk Tanker
1,000 Pound Bulk Sacks	200 Pound Drums	

Operation & Maintenance Manual

VFD ● VFV ● VF ● VR SERIES

Tetrasolv Filtration Vapor Filters

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

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1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat vapor. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

The most common application utilizes activated carbon as the adsorption media. Typically vapor which contains low levels of organic contaminants flows upward through the column of activated carbon where the larger organic molecules adhere to the porous structure of the activated carbon granules. This adsorption begins at the bottom of the “bed” and continues upward as the original adsorptive area becomes saturated.

Complete saturation of the carbon is dependent upon many factors such as contaminant levels, temperature, compounds being adsorbed, humidity, etc. Typically a carbon isotherm has been run on the influent stream to determine the expected rate of consumption of the activated carbon media. When monitoring has determined discharge air no longer meets discharge requirements the carbon will have to be removed and replaced ***(refer to section 5.0)***.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system. If you have any questions please contact Tetrasolv Filtration at the number listed below or support@tetrasolv.com.

- ***WARNING: Where system pressure may exceed design pressure we strongly recommend the use of a relief device. Exceeding the maximum pressure of the filter could result in catastrophic failure***

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of the vessel.

- Always adhere to “lockout/tagout” procedures when servicing the system.

- Wear appropriate safety equipment when operating system.

♦ ***WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.***

♦ ***WARNING: High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehydes, organic acids and sulphur may cause severe temperature rises.***

- Understand the potential hazards of the stream being treated by the system. The activated carbon may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the carbon may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

♦ ***WARNING: Failure to follow the procedures outlined below can result in catastrophic damage to the system.***

Crane Lift - If a crane lift is to be used we recommend the following method. A “spreader” equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

3.3 Inspection

Perform the following inspections after un-loading the system. Note any discrepancies and contact TetraSolv immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.

- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.

- If the filters are shipped without carbon visually inspect the interior of the vessel for damaged internals.

- Inspect the carbon discharge, drain and vent valves for damage

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it’s maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped

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loose with the system.

The outlet piping if connected to a stack or vent should be designed to prevent the introduction of water or debris into the adsorber piping. Discharge piping should be sized equal to or greater than the diameter of the system piping or back pressure could occur creating excess pressure drop on the system.

Flowrates greater than 60 cfm / sq ft can produce bed fluidization in vapor phase filters. When this occurs carbon granules can be lifted and propelled out of the carbon bed in up-flow applications. In extreme cases large amounts of carbon can be expelled. If the system will be operating near or greater than the amount stated above please contact Tetrasolv for recommendations.

Carbon filters can be manifold in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

Vapor conditions such as high humidity and high temperature (> 125º F) can cause inefficient adsorbtion to occur. If these conditions exist contact Tetrasolv for support. Also, any free water or product and debris should be eliminated with a knockout filter prior to the vapor stream entering the system. Many other vapor issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

4.0 OPERATION

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.

4.3 Monitoring

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate media breakdown or presence of high moisture. Rapid increase in pressure drop could indicate adsorber failure.

Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

5.0 ADSORBER SERVICING

The Adsorber may be serviced on-site using a vacuum removal method. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber be checked thoroughly and any minor maintenance conducted.

5.1 Carbon Loading - Bulk Bag

- ***WARNING - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.***

Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasping it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

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5.2 Carbon Loading - Vacuum Method

In this method dry-activated carbon will be loaded into to the adsorbers using a vacuum rig. To add the carbon to the filters use the following method:

WARNING: Due to the low vacuum rating of the VF series adsorbers (< 60" H_20) only experienced change-out personnel should attempt this method of re-filling. Exceeding the recommend vacuum rating could lead to failure of the superstructure of the vessel.

1. Connect a 3" vacuum source to the auxiliary connection of the adsorber to be filled.

2. Install a 16" bolted transfer lid onto the manway opening of the adsorber to be filled.

3. Turn on the vacuum and check for good flow of air through the adsorber. Connect the fill line to the transfer lid and lead enough hose to reach the fresh carbon source (Note: This should be as short of a distance as possible).

4. Begin vacuuming carbon into the adsorber. It is important to note that the loading method is actually conveying and not true vacuum. The hose should contain 1/3 air with the carbon. Closely view the adsorber being filled. If the adsorber is collasping in excessively take less carbon and more air. This is something from experience and cannot be adequately explained here.

5. When transfer is complete the transfer lid should be removed and the carbon in the adsorber should be leveled out to insure even pressure drop across the bed.

6. Close the manway and turn the adsorber back on.

> ***Note: When the system if first started up small amounts of fines may be present in the discharge stream. This is normal and should discontinue within a short period of time.***

6.0 MAINTENANCE

6.1 Extended Shutdown

If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

Monitor the system closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

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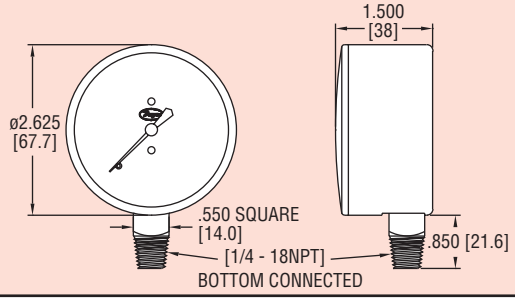
Series LPG4

2.5″ Low Pressure Gage

1.5% Full-Scale Accuracy in a 2-1/2″ Gage



Our **Series LPG4** gages offer top of the line performance and accuracy for pressure and vacuum applications up to and including 160 in w.c. The LPG4 is constructed from a single beryllium-copper diaphragm affixed to a precision-machined brass plate. This innovative design, together with a high-precision, milled-teeth brass movement and nickel-silver pinion and bearing surface, provide the user with a top of the line low pressure instrument.

SPECIFICATIONS
Service: Compatible gases & liquids.
Wetted Materials: Brass and beryllium copper.
Housing: Drawn steel, black finish.
Lens: Polycarbonate (removable).
Accuracy: ±1.5% full-scale.

Pressure Limit: 100% of range scale.
Temperature Limits:
Process: -40 to 160°F (-40 to 70°C);
Ambient: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP54).
Weight: 7.3 oz (0.21 kg).

Model	Range	Model	Range
LPG4-D7122N	-10 to 0 in w.c. (-2.5 to 0 kPa)	LPG4-D8322N	0 to 40 in w.c. (0 to 10 kPa)
LPG4-D7222N	-15 to 0 in w.c. (-4 to 0 kPa)	LPG4-D8422N	0 to 60 in w.c. (0 to 15 kPa)
LPG4-D7322N	-25 to 0 in w.c. (-6 to 0 kPa)	LPG4-D8522N	0 to 80 in w.c. (0 to 20 kPa)
LPG4-D7422N	-40 to 0 in w.c. (-10 to 0 kPa)	LPG4-D8622N	0 to 100 in w.c. (0 to 25 kPa)
LPG4-D7522N	-60 to 0 in w.c. (-15 to 0 kPa)	LPG4-D8722N	0 to 160 in w.c. (0 to 40 kPa)
LPG4-D7622N	-80 to 0 in w.c. (-20 to 0 kPa)	LPG4-D8922N	-4 to 0 to 6 in w.c. (-1 to 0 to 1.5 kPa)
LPG4-D7722N	-100 to 0 in w.c. (-25 to 0 kPa)	LPG4-D9022N	-6 to 0 to 10 in w.c. (-1.5 to 0 to 2.5 kPa)
LPG4-D7822N	-120 to 0 in w.c. (-30 to 0 kPa)	LPG4-D9122N	-8 to 0 to 16 in w.c. (-2 to 0 to 4 kPa)
LPG4-D7922N	-235 to 0 in w.c. (-60 to 0 kPa)	LPG4-D9222N	-16 to 0 to 24 in w.c. (-4 to 0 to 6 kPa)
LPG4-D8022N	0 to 10 in w.c. (0 to 2.5 kPa)	LPG4-D9322N	-24 to 0 to 40 in w.c. (-6 to 0 to 10 kPa)
LPG4-D8122N	0 to 15 in w.c. (0 to 3.75 kPa)	LPG4-D9422N	-30 to 0 to 50 in w.c. (-7.5 to 0 to 14.5 kPa)
LPG4-D8222N	0 to 25 in w.c. (0 to 6 kPa)	LPG4-D9522N	-40 to 0 to 60 in w.c. (-10 to 0 to 0.15 kPa)

OPTION
For NIST traceable calibration certificate, use order code NISTCAL-PG1.

Series 1950 Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions

Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION
For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

Note: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

Series 1950 Switches
Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02-2S	0.03 to 0.10	0.025	0.05
1950-00-2F	0.07 to 0.15	0.04	0.05
1950-0-2F	0.15 to 0.5	0.10	0.15
1950-1-2F	0.4 to 1.6	0.15	0.20
1950-5-2F	1.4 to 5.5	0.3	0.4
1950-10-2F	3.0 to 11.0	0.4	0.5
1950-20-2F	4.0 to 20.0	0.4	0.6
Model Number	Operating Range: PSI	Approximate Dead Band Min. Set Point	Max. Set Point
1950P-2-2F	0.5 to 2.0	0.3 psi	0.3 psi
1950P-8-2F	1.5 to 8.0	1.0 psi	1.0 psi
1950P-15-2F	3.0 to 15.0	0.9 psi	0.9 psi
1950P-25-2F	4.0 to 25.0	0.7 psi	0.7 psi
1950P-50-2F	15.0 to 50	1.0 psi	1.5 psi

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits:
Continuous: 1950's - 45″ w.c. (0.11 bar);
1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar).
Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: IP54, NEMA 3, 7 and 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8″ female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, UL, CSA, FM.

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

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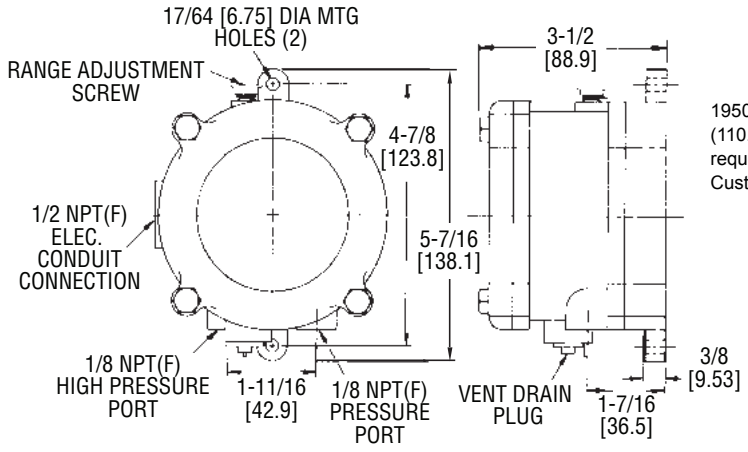
Phone: 219/879-8000 **www.dwyer-inst.com**
Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**



1950-02: 7-3/4″ (196.9) dia. x 4-11/32″ (110.3) depth. For complete dimensions request drawing 28-700175-00 from our Customer Service Department

1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Specifications on reverse. Switch may be installed outdoors or in areas where the hazard of explosion exists. See reverse for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4″ O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8″ female NPT pressure ports as noted below:

A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.

B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.

C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked “COM” (common), “NO” (norm open), “NC” (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the set point pressure and counterclockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a “T” assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch. The Series 1950 Explosion-Proof Differential Pressure Switch is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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Series VTVA & VTR
Direct Mount & Remote Reading

35BL - Back Flange, Lower Mount

35BB - Back Flange, Back Mount

35RB - Semi-flush, Panel Mount

35ZL - Adjustable Bracket Mount

35VA - Vari-angle® Direct Mount

CODE	CATALOG NO.	DESCRIPTION
I		**CASE SIZE**
	35	31/2" Case
	45	41/2" Case
II		**CASE TYPE**
	V	Vari-angle® Direct Mount
	B	Back Flange, Surface Mount
	R	Semi-flush, Panel Mount
	Z	Adjustable Bracket, Remote Mount
III		**CASE CONNECTION**
	A	Adjustable
	B	Back Connection
	L	Lower Connection
IV		**CASE WINDOW**
	3	Snap in Lexan with "O" Ring
V		**THERMAL SYSTEM**

	Bulb Type	Bulb Material	Capillary Material	Capillary Protection
0	Union	Copper (Vari-angle only)		
2	Plain	Copper	Copper	Cu. Braid
3	Plain	316 S.S.	316 S.S.	None
5	Union	Copper	Copper	Cu. Braid
7	Union	316 S.S.	Copper	Cu. Braid
8	Union	316 S.S.	316 S.S.	Intlock Armor*
9	Union	316 S.S.	316 S.S.	None

*At bulb end 31/2" long. All systems have S.S. Spring capillary protection at indicating head. No. 5–7 system include S.S. spring at bulb end – S.S. jam nut standard on No. 8–9 system.

BULB SELECTION

	Thermal System No. 5 Thru 9 (Union) Dia.	Thermal System No. 5 Thru 9 (Union) Length	Thermal System No. 2 & 3 (Plain) Dia.	Thermal System No. 2 & 3 (Plain) Length	Max. System Len.
1	7/16	2.5"	N.A.	N.A.	10Ft.
2	7/16	3.4"	3/8	3.4	25Ft.
3	7/16	5.4"	3/8	4.9	50Ft.
4	7/16	7.4"	3/8	7.9	99Ft.
5	7/16	9.4"	3/8	9.4	99Ft.
X	1/8" x 180" Averaging Bulb				10Ft.
6	N.A.	N.A.	3/8	2.5	05Ft.

® Vari-angle is a registered trademark of Weiss Instruments, Inc.

SPECIFICATIONS

CASE & RING - drawn stainless steel case with snap-in "O" ring gasketed clear lexan window.
CASE STYLES - five case styles are available (as shown) to accommodate direct mount, surface or panel mounting.
DIAL - white coated aluminum with black markings.
POINTER - slotted adjustable type.
BOURDON TUBE - phosphor bronze.
THERMAL BULB & LINE ASSEMBLY - copper or 316 stainless steel.
PROCESS CONN. FITTING - separable socket, union or air duct flange connections.
ACCURACY - one scale division throughout range.

VII		**PROCESS CONNECTION FITTING**
	1	Union Connection 1/2" NPT
	2	Union Connection 3/4" NPT
	3	Separable Socket 1/2" NPT
	4	Separable Socket 3/4" NPT
	5	Separable Socket 1/2" NPT with 2" Lag Extention (No.3 Bulb only)
	6	Separable Socket 3/4" NPT with 2" Lag Extention (No.3 Bulb only)
	7	Air Duct Flange, Union Conn., Aluminum only
	9	Plain bulb, no fitting
VIII		**PROCESS CONNECTION MATERIAL**
	1	Brass
	2	304 Stainless Steel
	3	316 Stainless Steel
	5	Aluminum (Air Duct Flange only)
	0	None – Plain Bulb
IX A-B	See Example Below	**SYSTEM LENGTH SPECIFYING** 9A - Use 2 digits: EX. 05, 10, 99 for length required. 9B - Use FT for feet, use IN for inches

EXAMPLE FOR OBTAINING COMPLETE CATALOG NUMBER FROM CODES - SERIES VTVA & VTR

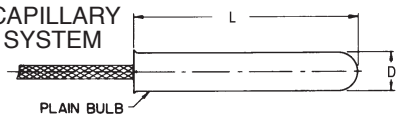
CODE I–IV (HEAD ASSY)		CODE V–VIII (THERMAL SYSTEM)		CODE IX A – B (CAPILLARY LENGTH)
4 5 B L 3	—	5 2 3 1	—	0 5 F T

RANGE: 40-240 F

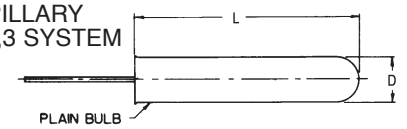
Thermal Systems

Code V

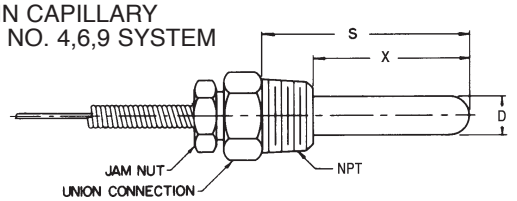
BRAIDED CAPILLARY
CAT. NO. 2 SYSTEM



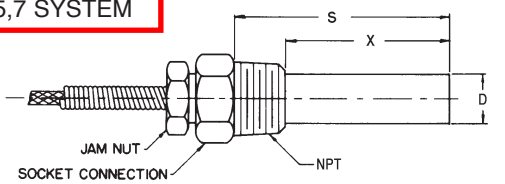
PLAIN CAPILLARY
CAT. NO. 1,3 SYSTEM



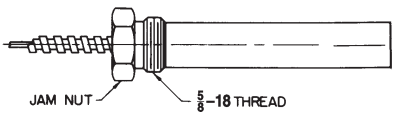
PLAIN CAPILLARY
CAT. NO. 4,6,9 SYSTEM



BRAIDED CAPILLARY
CAT. NO. 5,7 SYSTEM

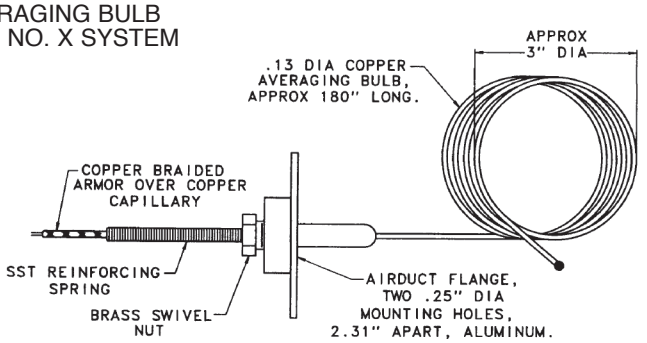


ARMORED CAPILLARY
CAT. NO. 8 SYSTEM



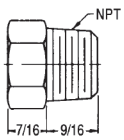
Code VI

AVERAGING BULB
CAT. NO. X SYSTEM

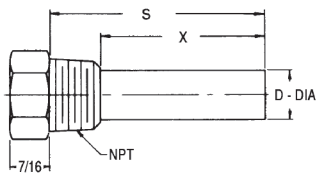


Process Connection Fittings - Code VII

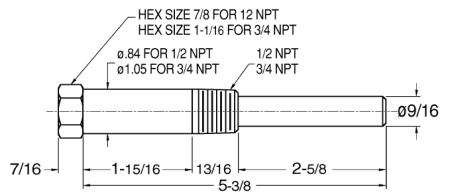
UNION CONNECTION
CAT. NO. 1,2



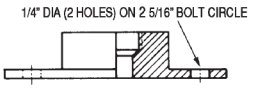
SOCKET CONNECTION
CAT. NO. 3,4



SOCKET W/ LAG EXTENSION
CAT. NO. 5,6 (No. 3 Bulb only)



FLANGE CONNECTION
CAT. NO. 7



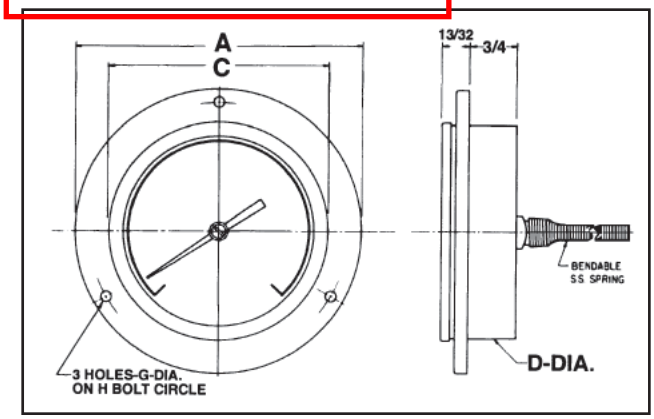
Bulb Dimensions

BULB NO. (CODE VI)	PLAIN CONNECTION		UNION CONNECTION			SOCKET CONNECTION			FLANGE CONNECTION	
	L	D	X	S	D	X	S	D	X	D
0	N/A	N/A	1	1 7/8	7/16	N/A	N/A	N/A	N/A	N/A
1	N/A	N/A	1 13/16	2 3/8	7/16	1 15/16	2 1/2	9/16	2 3/16	7/16
2	3 7/16	3/8	2 5/8	3 3/8	7/16	2 5/8	3 3/8	9/16	3	7/16
3	4 7/8	3/8	4 5/8	5 3/8	7/16	4 5/8	5 3/8	9/16	5	7/16
4	7 7/8	3/8	6 5/8	7 3/8	7/16	6 5/8	7 3/8	9/16	7	7/16
5	9 7/16	3/8	8 5/8	9 3/8	7/16	8 5/8	9 3/8	9/16	9	7/16
6	2 1/2	3/8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	3	5/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

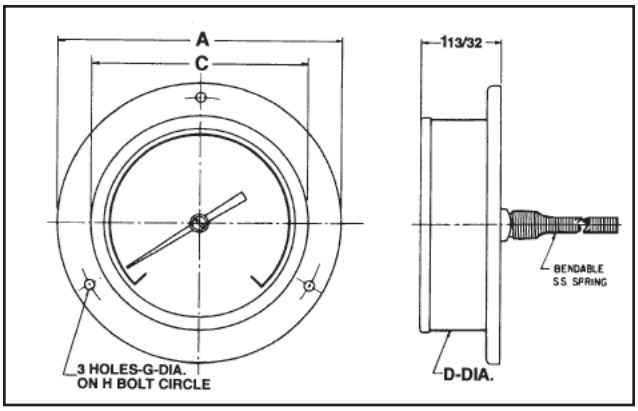
NOTE: "X" for Flange Conn. is the Insertion Length from Tip of Bulb to Face of Flange.

Series VTVA & VTR Dimensions

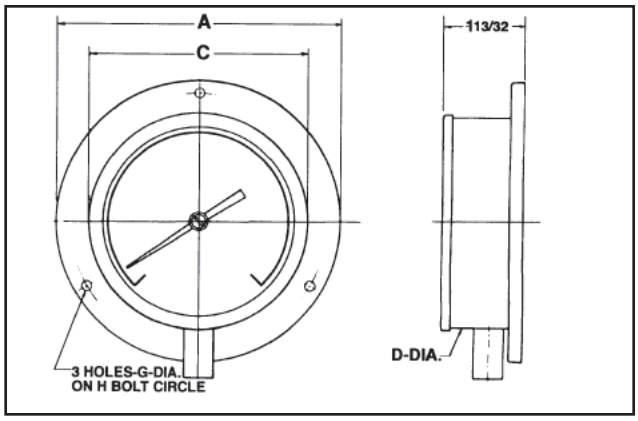
RB Case - Semi Flush Panel Mount



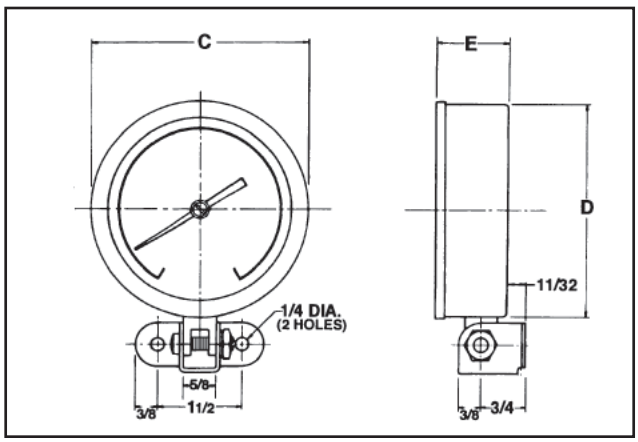
BB Case - Surface Mounted Back Connected



BL Case - Surface Mounted Bottom Connected



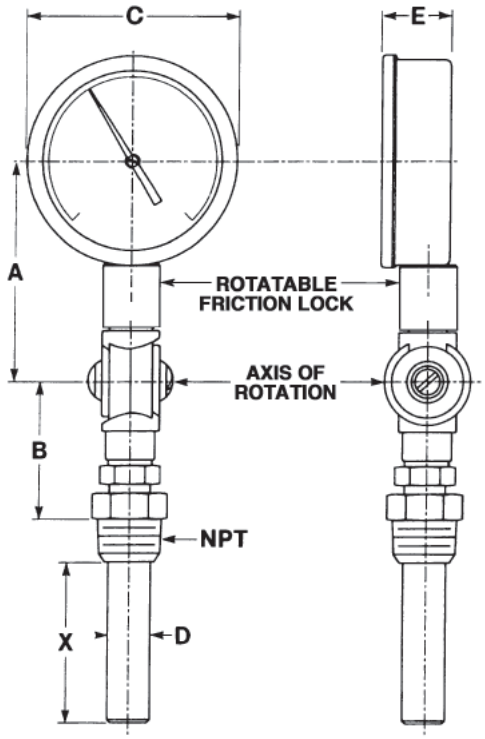
ZL Case - Adjustable Bracket Mount



Series VTR Dimensions

DIAL SIZE	A	C	D	E	G	H	*PANEL HOLE
3 1/2"	4 3/4	3 11/16	3 19/32	1 1/4	5/32	4 5/16	3 5/8
4 1/2"	5 7/8	4 11/16	4 19/32	1 1/4	7/32	5 3/8	4 5/8

Series VTVA - Direct Mount



DIAL SIZE	A	B	C	E	*D	**X LENGTH FOR BULB NO. (CODE VI)			
						2	3	4	5
3 1/2"	3 7/8	2 9/16	3 11/16	1 1/4	9/16	2 5/8	4 5/8	6 5/8	8 5/8
4 1/2"	4 3/8	2 9/16	4 11/16	1 1/4	9/16				

*D Dimension for Union Connection and Air Duct Union Flange Conn. is 7/16"
** Same for Union Conn. and Air Duct Union Flange Connection.

GRAINGER APPROVED VENDOR 18C784

Press Gauge, Low Press Diaphragm, 2-1/2 In

Item # 18C784 Mfr. Model # 18C784 UNSPSC # 41112403

Technical Specs

Item:	Pressure Gauge
Gauge Type:	Low Pressure Diaphragm
Dial Size:	2-1/2"
Range:	0 to 30" H2O
Connection Size: 1/4" NPT	1/4" NPT
Connection Location:	Lower
Smallest Graduation:	0.5" H2O
Accuracy:	+/-1.5%
Case Material:	Steel
Case Color:	Black
Socket Material:	Copper Alloy HPb59-1
Tube Material:	Copper Alloy
Lens Material:	Polycarbonate
Operating Temp. Range:	-40 Degrees to 160 Degrees F
For Use With:	Non-Explosive Gas That Do Not Crystalize And Corrode Copper All
Series:	YE65

Compliance and Restrictions

This product contains a chemical that is regulated under California Proposition 65.
Warning: This product contains a chemical known to the State of California to cause cancer.
Warning: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Series VTVA & VTR
Direct Mount & Remote Reading

35BL - Back Flange, Lower Mount

35BB - Back Flange, Back Mount

35RB - Semi-flush, Panel Mount

35ZL - Adjustable Bracket Mount

35VA - Vari-angle® Direct Mount

CODE	CATALOG NO.	DESCRIPTION
I		**CASE SIZE**
	35	31/2" Case
	45	41/2" Case
II		**CASE TYPE**
	V	Vari-angle® Direct Mount
	B	Back Flange, Surface Mount
	R	Semi-flush, Panel Mount
	Z	Adjustable Bracket, Remote Mount
III		**CASE CONNECTION**
	A	Adjustable
	B	Back Connection
	L	Lower Connection
IV		**CASE WINDOW**
	3	Snap in Lexan with "O" Ring
V		**THERMAL SYSTEM**

	Bulb Type	Bulb Material	Capillary Material	Capillary Protection
0	Union	Copper (Vari-angle only)		
2	Plain	Copper	Copper	Cu. Braid
3	Plain	316 S.S.	316 S.S.	None
5	Union	Copper	Copper	Cu. Braid
7	Union	316 S.S.	Copper	Cu. Braid
8	Union	316 S.S.	316 S.S.	Intlock Armor*
9	Union	316 S.S.	316 S.S.	None

*At bulb end 31/2" long. All systems have S.S. Spring capillary protection at indicating head. No. 5–7 system include S.S. spring at bulb end – S.S. jam nut standard on No. 8–9 system.

VI — BULB SELECTION

	Thermal System No. 5 Thru 9 (Union) Dia.	Thermal System No. 5 Thru 9 (Union) Length	Thermal System No. 2 & 3 (Plain) Dia.	Thermal System No. 2 & 3 (Plain) Length	Max. System Len.
1	7/16	2.5"	N.A.	N.A.	10Ft.
2	7/16	3.4"	3/8	3.4	25Ft.
3	7/16	5.4"	3/8	4.9	50Ft.
4	7/16	7.4"	3/8	7.9	99Ft.
5	7/16	9.4"	3/8	9.4	99Ft.
X	1/8" x 180" Averaging Bulb				10Ft.
6	N.A.	N.A.	3/8	2.5	05Ft.

® Vari-angle is a registered trademark of Weiss Instruments, Inc.

SPECIFICATIONS

CASE & RING - drawn stainless steel case with snap-in "O" ring gasketed clear lexan window.
CASE STYLES - five case styles are available (as shown) to accommodate direct mount, surface or panel mounting.
DIAL - white coated aluminum with black markings.
POINTER - slotted adjustable type.
BOURDON TUBE - phosphor bronze.
THERMAL BULB & LINE ASSEMBLY - copper or 316 stainless steel.
PROCESS CONN. FITTING - separable socket, union or air duct flange connections.
ACCURACY - one scale division throughout range.

VII		**PROCESS CONNECTION FITTING**
	1	Union Connection 1/2" NPT
	2	Union Connection 3/4" NPT
	3	Separable Socket 1/2" NPT
	4	Separable Socket 3/4" NPT
	5	Separable Socket 1/2" NPT with 2" Lag Extention (No.3 Bulb only)
	6	Separable Socket 3/4" NPT with 2" Lag Extention (No.3 Bulb only)
	7	Air Duct Flange, Union Conn., Aluminum only
	9	Plain bulb, no fitting
VIII		**PROCESS CONNECTION MATERIAL**
	1	Brass
	2	304 Stainless Steel
	3	316 Stainless Steel
	5	Aluminum (Air Duct Flange only)
	0	None – Plain Bulb
IX A-B	See Example Below	**SYSTEM LENGTH SPECIFYING** 9A - Use 2 digits: EX. 05, 10, 99 for length required. 9B - Use FT for feet, use IN for inches

EXAMPLE FOR OBTAINING COMPLETE CATALOG NUMBER FROM CODES - SERIES VTVA & VTR

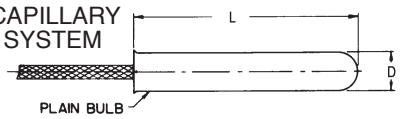
CODE I–IV (HEAD ASSY)		CODE V–VIII (THERMAL SYSTEM)		CODE IX A – B (CAPILLARY LENGTH)
4 5 B L 3	—	5 2 3 1	—	0 5 F T

RANGE: 40-240 F

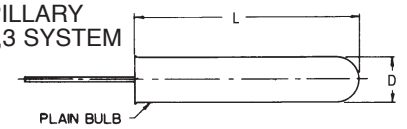
Thermal Systems

Code V

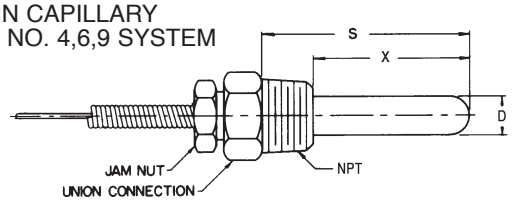
BRAIDED CAPILLARY
CAT. NO. 2 SYSTEM



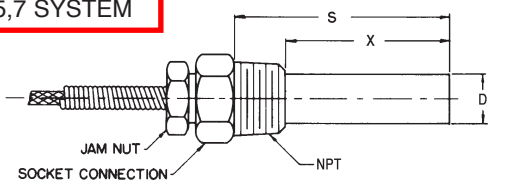
PLAIN CAPILLARY
CAT. NO. 1,3 SYSTEM



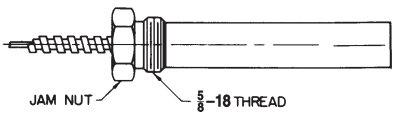
PLAIN CAPILLARY
CAT. NO. 4,6,9 SYSTEM



BRAIDED CAPILLARY
CAT. NO. 5,7 SYSTEM

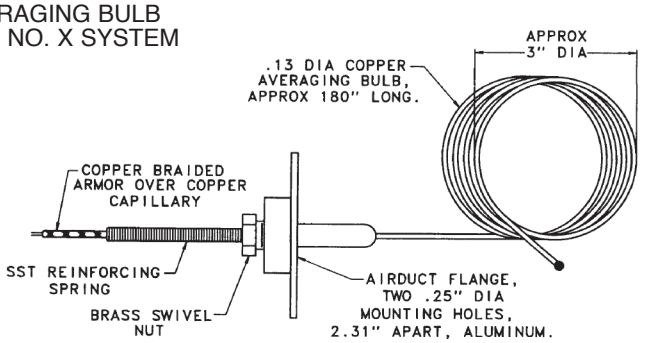


ARMORED CAPILLARY
CAT. NO. 8 SYSTEM



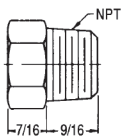
Code VI

AVERAGING BULB
CAT. NO. X SYSTEM

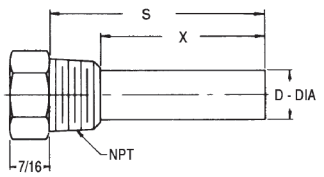


Process Connection Fittings - Code VII

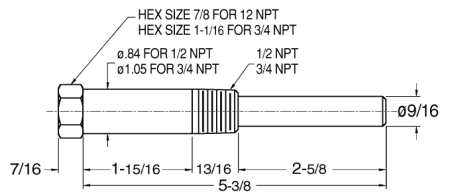
UNION CONNECTION
CAT. NO. 1,2



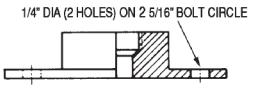
SOCKET CONNECTION
CAT. NO. 3,4



SOCKET W/ LAG EXTENSION
CAT. NO. 5,6 (No. 3 Bulb only)



FLANGE CONNECTION
CAT. NO. 7



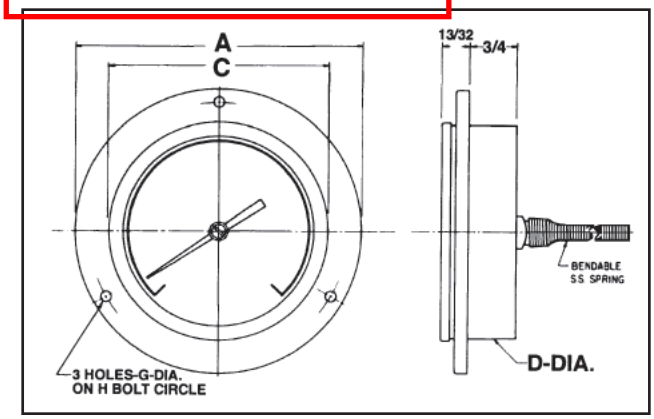
Bulb Dimensions

BULB NO. (CODE VI)	PLAIN CONNECTION		UNION CONNECTION			SOCKET CONNECTION			FLANGE CONNECTION	
	L	D	X	S	D	X	S	D	X	D
0	N/A	N/A	1	1 7/8	7/16	N/A	N/A	N/A	N/A	N/A
1	N/A	N/A	1 13/16	2 3/8	7/16	1 15/16	2 1/2	9/16	2 3/16	7/16
2	3 7/16	3/8	2 5/8	3 3/8	7/16	2 5/8	3 3/8	9/16	3	7/16
3	4 7/8	3/8	4 5/8	5 3/8	7/16	4 5/8	5 3/8	9/16	5	7/16
4	7 7/8	3/8	6 5/8	7 3/8	7/16	6 5/8	7 3/8	9/16	7	7/16
5	9 7/16	3/8	8 5/8	9 3/8	7/16	8 5/8	9 3/8	9/16	9	7/16
6	2 1/2	3/8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	3	5/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

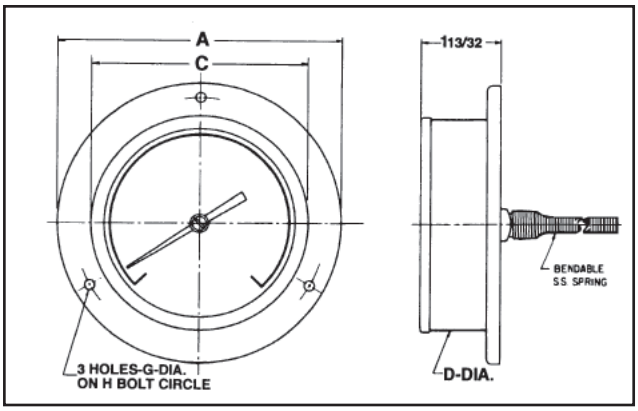
NOTE: "X" for Flange Conn. is the Insertion Length from Tip of Bulb to Face of Flange.

Series VTVA & VTR Dimensions

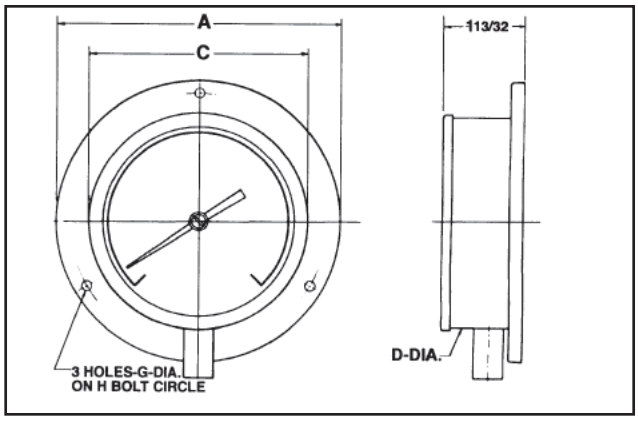
RB Case - Semi Flush Panel Mount



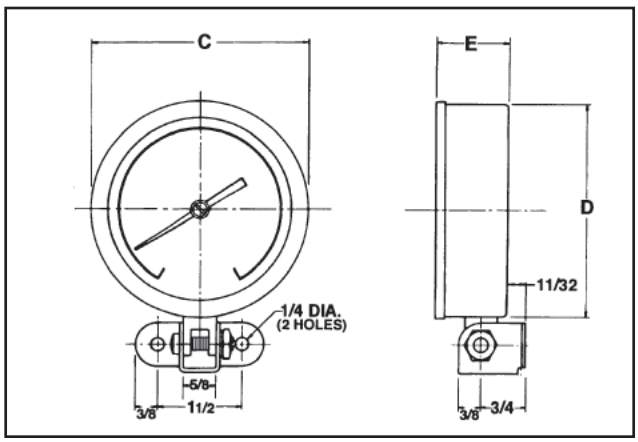
BB Case - Surface Mounted Back Connected



BL Case - Surface Mounted Bottom Connected



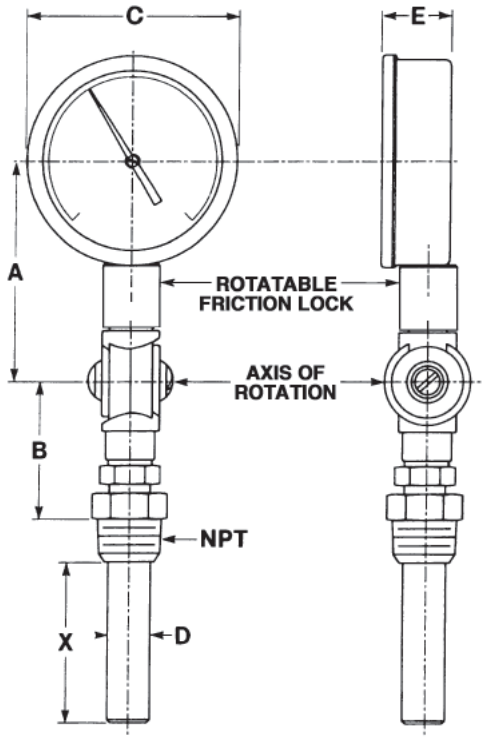
ZL Case - Adjustable Bracket Mount



Series VTR Dimensions

DIAL SIZE	A	C	D	E	G	H	*PANEL HOLE
3 1/2"	4 3/4	3 11/16	3 19/32	1 1/4	5/32	4 5/16	3 5/8
4 1/2"	5 7/8	4 11/16	4 19/32	1 1/4	7/32	5 3/8	4 5/8

Series VTVA - Direct Mount



DIAL SIZE	A	B	C	E	*D	**X LENGTH FOR BULB NO. (CODE VI)			
						2	3	4	5
3 1/2"	3 7/8	2 9/16	3 11/16	1 1/4	9/16	2 5/8	4 5/8	6 5/8	8 5/8
4 1/2"	4 3/8	2 9/16	4 11/16	1 1/4	9/16				

*D Dimension for Union Connection and Air Duct Union Flange Conn. is 7/16"
** Same for Union Conn. and Air Duct Union Flange Connection.

100 Series

PRESSURE, VACUUM, DIFFERENTIAL PRESSURE AND TEMPERATURE SWITCHES

FEATURES

- Single Switch Output
- Epoxy Coated and Gasketed Cast Aluminum Enclosure Type 4X
- Tamper-Resistant Set Point "Lock"
- Heat Trace and Freeze Protection Thermostats
- Proof Pressures to 10,000 psi (689,5 bar)
- Adjustable Ranges:

  Pressure:
  30 "Hg Vac to 5000 psi
  (-1 to 344,7 bar)

  "wc Ranges:
  300 "wc Vacuum to 250 "wc Pressure
  (-746,7 to 622,3 mbar)

  Differential Pressure:
  0.2 "wcd to 500 psid
  (0,5 mbar to 34,5 bar)

  Temperature:
  -180 to 650°F
  (-117.8 to 343.3°C)

ISO 9001 CERTIFIED COMPANY

OVERVIEW

The 100 Series is a cost-effective pressure and temperature switch for process plants and OEM equipment. The rugged, one piece enclosure features a slanted cover for wiring accessibility.

A wide variety of microswitch and process-connection options make this versatile series ideal for applications requiring a rugged weather-proof mechanical switch.

Typical applications that utilize the 100 Series are heat tracing, freeze protection, processing equipment (pumps, compressors), inputs for annunciator panels, and fire suppression systems.

FEATURES

- UL listed and cUL certified.
- CE compliant to low voltage directive and pressure equipment directive.
- Optional ATEX or GOST intrinsic safety compliance
- Single switch (SPDT or DPDT) output
- Welded stainless steel diaphragm models
- Ultra low pressure, "wc models
- Optional sensor material for corrosive media
- Polished stainless steel flush-mount connection
- Pump switch models with wide adjustable deadband

"Clam shell" design allows for ease in wiring (pressure model shown)

Bulb and capillary temperature model with manual reset option

Differential pressure model

SPECIFICATIONS

STORAGE TEMPERATURE	-65 to 160°F (-54 to 71°C)
AMBIENT TEMPERATURE LIMITS	-40 to 160°F (-40 to 71°C); models 520-525, 540-548, 700-706, 15731-15736: 0 to 160°F (-18 to 71°C); Set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	Temperature models: ± 1% of adjustable range Pressure models 15623, 15731-15737, 171-174, 218, 270-376, 520-535, 540-543, 700-706, 560-564: ± 1% of adjustable range; models 190-194, 183-189, 483-494, 544-548, 565-567, 610-680, 15884: ±1.5% of adjustable range Internal set point lock on all pressure models
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE	Die cast aluminum, epoxy powder coated, gasketed, captive cover screws
ENCLOSURE CLASSIFICATION	Enclosure type 4X
SWITCH OUTPUT	One SPDT snap action switch; switch may be wired "normally open" or "normally closed"
ELECTRICAL RATING	15A 125/250/480 VAC resistive except for H100-15623, 15731-15737, 15884, 20A 125/250/480 VAC resistive, B100-13546 and E100-13545, 22A/480 VAC. Electrical switches have limited DC capabilities at 24-30 VDC, 2A resistive and 1A inductive. 125 VDC, 0.5A resistive, 0.03A inductive. Consult factory for additional information.
WEIGHT	2-7 lbs; Varies with model
ELECTRICAL CONNECTION	1/2" NPT (female); Two 7/8" diameter knockouts
PRESSURE CONNECTION	Models 15623, 218, 270-376, 610-680, 701-706, 15731-15884: 1/4" NPT (female); Models 171-194, 483-494, 520-535, 15737: 1/2" NPT (female); Models 540-548: 1/8" NPT (female); Models 560-564: 2" Sanitary Fitting; Models 565-567: 1.5" Sanitary Fitting (Sanitary fittings mate with Tri-Clamp® fitting systems)
TEMPERATURE ASSEMBLY	Bulb and capillary: 6 feet 304 stainless steel except for E100-13545, 10 feet 304 stainless steel Immersion stem: nickel-plated brass (standard) except for B100-13546 stainless steel; optional 316L stainless steel
FILL	Models 1BS/BC are solvent filled, models 2-8 non-toxic oil filled
TEMPERATURE DEADBAND	Type **F** typically 1% and type **B**, **C**, and **E** typically 2% of range under laboratory conditions (70°F ambient circulating bath at rate of 1/2°F per minute change)
HEAT TRACING OR FREEZE PROTECTION	Thermostats designed specifically for heat tracing and freeze protection ambient sensing applications are available with types B100 and E100

100 Series

APPROVALS

UE declarations and third-party issued Agency certifications are available for download at www.ueonline.com/prod_approval.

UNITED STATES AND CANADA

UL Listed, **cUL** Certified
Temperature: UL 873; CSA C22.2 no. 24, File # E10667
Pressure: UL 508; CSA C22.2 no. 14, File # E42272;
Enclosure Type 4X

EUROPE

ATEX Directive (94/9/EC)

II 1 G EEx ia IIC T6, **(OPTIONAL - code M405**)
Tamb.= -50°C to +60°C
UL International DEMKO A/S (N.B.#0539)
Certificate #DEMKO 03 ATEX 0335063
EN 50014, 50020, 50284

Low Voltage Directive (LVD) (73/23/EC & 93/68/EEC)

UEC compliant to LVD
Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD

Pressure Equipment Directive (PED) (97/23/EC)

Compliant to PED
Products rated lower than 7.5 psi are outside the scope of the PED

RUSSIA

Gosgortechnadzor Permit **(OPTIONAL – code M406)**
0ExiaIICT6
Tamb = -50°C to +60°C
NANIO CCVE Certification Center
Certificate # ROSS US.GB05.Bo2933
GOST R 51330.0, 51330.1, 51330.10 & 51330.14

TEMPERATURE MODEL CHART

Model	Adjustable Set Point Range		Max. Temp		Scale Division		Stem or Bulb Size‡/Finish‡‡
	°F	°C	°F	°C	°F	°C	OD x Length
Type B100 Internal adjustment via reference dial **Type C100** No reference dial; model 13546 not available							
120	0 to 225	-17.8 to 107.2	275	135	10†	5†	9/16" x 1-7/8" below 1/2 "NPT thread (nickel-plated brass)
121	200 to 425	93.3 to 218.3	475	246.1	10†	5†	9/16" x 1-7/8" below 1/2 "NPT thread (nickel-plated brass)
13546† (Freeze Protection)	15 to 140	-9.4 to 60	160	71.1	5†	2†	9/16" x 2-11/16" long stainless steel
Type E100 Stainless steel bulb and capillary; internal adjustment via reference dial							
2BSA	-120 to 100	-84.4 to 37.8	150	65.6	10	5	3/8 x 2-5/8"
2BSB	30 to 250	-1.1 to 121.1	300	148.9	10	5	3/8 x 2-5/8"
3BS	100 to 400	37.8 to 204.4	450	232.2	10	5	3/8 x 2-1/8"
4BS	25 to 100	-3.9 to 37.8	150	65.6	2	1	3/8 x 6-3/4"
5BS	-20 to 80	-28.9 to 26.7	130	54.4	5	2	3/8 x 5"
8BS	350 to 640	176.7 to 337.8	690	365.6	10	5	3/8 x 3-1/4"
13545 (Heat Tracing)	25 to 325	-3.9 to 162.8	360	182.2	10	5	1/8 x 11-5/8"
Copper bulb and capillary							
2BCA	-120 to 100	-84.4 to 37.8	150	65.6	10	5	3/8 x 2-5/8"
2BCB	30 to 250	-1.1 to 121.1	300	148.9	10	5	3/8 x 2-5/8"
3BC	100 to 400	37.8 to 204.4	450	232.2	10	5	3/8 x 2-1/8"
4BC	25 to 100	-3.9 to 37.8	150	65.6	2	1	3/8 x 6-3/4"
5BC	-20 to 80	-28.9 to 26.7	130	54.4	5	2	3/8 x 5"
8BC	350 to 640	176.7 to 337.8	690	365.6	10	5	3/8 x 3-1/4"
Type F100 Stainless steel bulb and capillary; no reference dial							
1BS	-180 to 120	-117.8 to 48.9	170	76.7	N/A		3/8 x 3-3/4"
2BS	-125 to 350	-87.2 to 176.7	400	204.4	N/A		3/8 x 2-5/8"
3BS	-125 to 500	-87.2 to 260	550	287.8	N/A		3/8 x 2-1/8"
4BS	-40 to 120	-40 to 48.9	170	76.7	N/A		3/8 x 6-3/4"
5BS	-40 to 180	-40 to 82.2	230	110	N/A		3/8 x 5"
6BS	0 to 250	-17.8 to 121.1	300	148.9	N/A		3/8 x 4-1/2"
7BS	0 to 400	-17.8 to 204.4	450	232.2	N/A		3/8 x 3"
8BS	50 to 650	10 to 343.3	700	371.1	N/A		3/8 x 3-1/4"
Copper bulb and capillary							
1BC	-180 to 120	-117.8 to 48.9	170	76.7	N/A		3/8 x 3-3/4"
2BC	-125 to 350	-87.2 to 176.7	400	204.4	N/A		3/8 x 2-5/8"
3BC	-125 to 500	-87.2 to 260	550	287.8	N/A		3/8 x 2-1/8"
4BC	-40 to 120	-40 to 48.9	170	76.7	N/A		3/8 x 6-3/4"
5BC	-40 to 180	-40 to 82.2	230	110	N/A		3/8 x 5"
6BC	0 to 250	-17.8 to 121.1	300	148.9	N/A		3/8 x 4-1/2"
7BC	0 to 400	-17.8 to 204.4	450	232.2	N/A		3/8 x 3"
8BC	50 to 650	10 to 343.3	700	371.1	N/A		3/8 x 3-1/4"

†Type B100 only
‡Optional immersion stem lengths and capillary lengths are available. Standard capillary length is 6 ft except models 13545 which is 10 ft.
‡‡Optional stainless steel immersion stem, and armored capillary covering available.

HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Fill in the type portion of your part number with the corresponding number.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, deadband and proof pressure.

Fill in the model portion of your part number with the corresponding number.

Select an **Option**

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

Fill in the option portion of your part number with the corresponding number.

Leave "option" portion blank if no options are needed.

FOR MULTIPLE OPTIONS: Call United Electric Controls.

TYPE	DESCRIPTION
PRESSURE	Type H100 - One SPDT output; epoxy coated enclosure; internal adjustment with "High-Low" reference scale
DIFFERENTIAL PRESSURE	Type H100K- One SPDT output; epoxy coated enclosure; internal adjustment with "High-Low" reference scale
TEMPERATURE	Type B100 - Immersion stem; one SPDT output; internal adjustment with reference dial
	Type C100 - Immersion stem; one SPDT output; internal adjustment with no reference
	Type E100 - Bulb and capillary; one SPDT output; internal adjustment with reference dial
	Type F100 - Bulb and capillary; one SPDT output; internal adjustment with no reference

SWITCH OPTIONS*

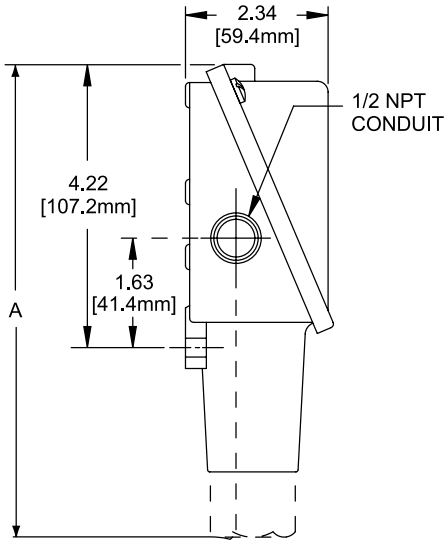
0140	Gold contacts, 1A 125 VAC resistive. NOT AVAILABLE MODELS 13545, 13546, 15623, 15731-15884
0500	Close deadband, 5A 125/250 VAC resistive. NOT AVAILABLE MODELS 520-535, 13545, 13546, 15623, 15731-15884
1010	DPDT switch, 10A 125/250 VAC resistive; deadband and minimum set point will increase. NOT AVAILABLE TEMPERATURE VERSIONS, TYPE H100K OR MODELS 171-194, 483-567, 680, 15623, AND 15731-15884
1070	10 A 125 VDC resistive; deadband and minimum set point will increase. NOT AVAILABLE MODELS 171-194, 483-535, 560-567, 13545, 13546, 15623, 15731-15884
1519	Adjustable deadband, 15 A 125/250/480 VAC resistive; adjustment wheel changes rise setting only. If adjustment on fall setting is required, use primary adjustment. NOT AVAILABLE TYPES B100, E100 OR MODELS 171-194, 483-494, 560-567, 610-616, 51623, 15731-15884
1530	External manual reset, 15 A 125/250/480 VAC resistive; latches on rise, only. NOT AVAILABLE MODELS 13545, 13546, 15623, 15731-15884
1535	High ambient, 15 A 125/250 VAC resistive; temperatures up to 250°F (121.1°C). NOT AVAILABLE MODELS 520-535, 13545, 13546, 15623, 15731-15884
1537	Vapor sealed switch, 15 A 125/250 VAC resistive. NOT AVAILABLE MODELS 523, 533, 13545, 13546, 15623, 15731-15884
2000	20 A 125/250/480 VAC resistive. NOT AVAILABLE TYPE H100K OR MODELS 520-535, 13545, 13546, 15623, 15731-15884
3000	30 A 125/250/277 VAC resistive. NOT AVAILABLE TYPE H100K OR MODELS 171-194, 483-567, 680, 13545, 13546, 15623, 15731-15884

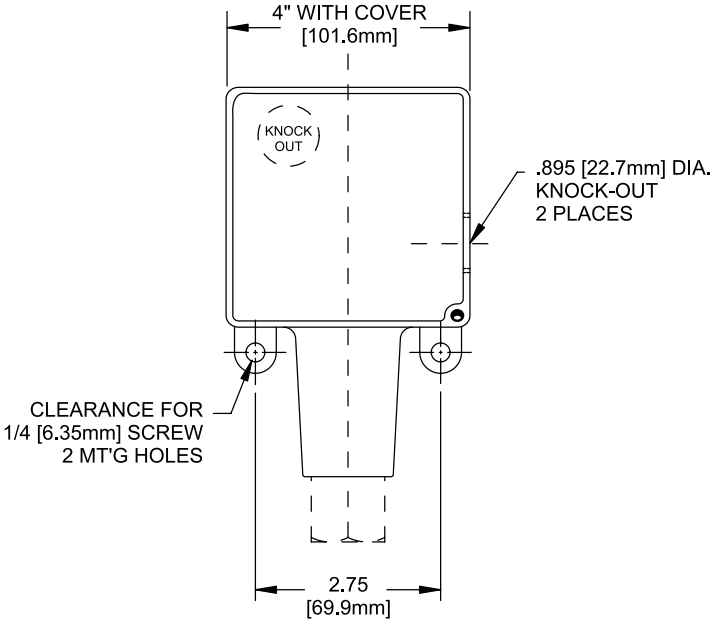
* *All switches have limited DC capabilities. Consult factory for details.*

DIMENSIONAL DRAWINGS

Dimensional drawings for all models may be found at www.ueonline.com

Types B100 C100, E100, F100, H100, H100K





Dimension A			
Models	**Inches**	**mm**	**NPT**
Pressure			
171-174	7.63	193.8	1/2"
183-186, 484-486	7.56	192.0	1/2"
188-189, 488-489	6.63	168.4	1/2"
190-194, 490-494	6.63	168.4	1/2"
218	6.56	166.6	1/4"
270-274	7.00	177.8	1/4"
358-376	7.00	177.8	1/4"
520-525, 15737	8.44	214.4	1/2"
530-535	8.00	203.2	1/2"
560-564	6.63	168.4	2" Sanitary Fitting
565-567	6.63	168.4	1-1/2" Sanitary Fitting
610-616, 680, 15884	7.00	177.8	1/4"
701-706, 15623, 15731-15736	6.63	168.4	1/4"
Differential Pressure			
540-543	8.47	215.1	1/8"
544-548	8.53	216.7	1/8"
Temperature			
120, 121, 13546	9.38	238.3	Immersion stem
1BC-8BC, 1BS-8BS,13545	8.69	220.7	Bulb & capillary

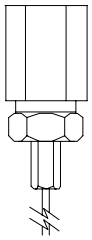
All dimensions stated in inches (millimeters)

DIMENSIONAL DRAWINGS

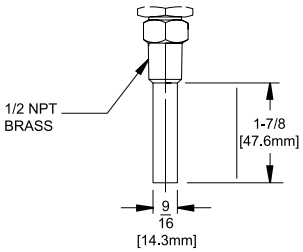
Dimensional drawings for all models may be found at www.ueonline.com

Temperature Sensors

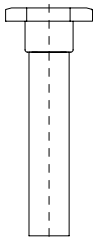
Models 1BC-8BC, 1BS-8BS, 13545



Models 120-121

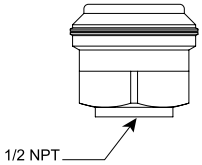


Model 13546

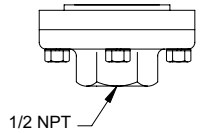


Pressure Sensors

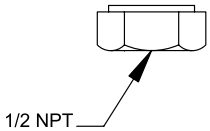
Models 171-174



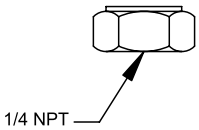
Models 183-186, 483-486



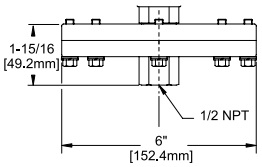
Models 188-194, 488-494



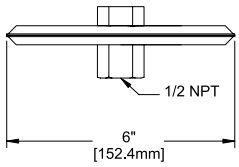
Models 218-376, 610-706, 15623,15731-15736



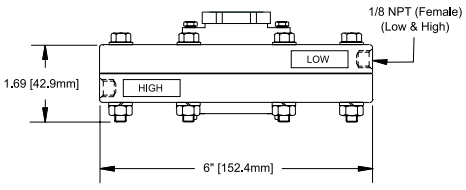
Models 520-525, 15737



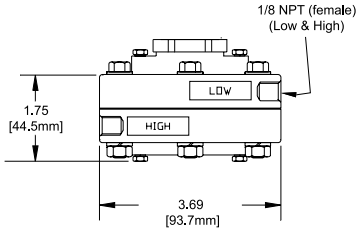
Models 530-535



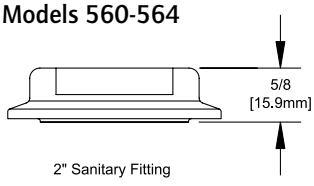
Models 540-543



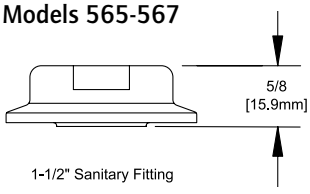
Models 544-548



Models 560-564



Models 565-567



All dimensions stated in inches (millimeters)

CROP-TROL CONTROLLERS
T675F

Used to control an oil-burning, portable crop dryer.

- Suitable for line-voltage, low-voltage or millivolt (Powerpile) switching.
- Mounts directly on dryer with sensing bulb in discharge air duct.
- Knob extends through case for manual control point adjustment.
- Differential setting wheel, located under cover, adjusts difference between cut-in and cut-out temperatures.

GENERIC REMOTE BULB CONTROLLERS
T675, T678

Regulate temperature of air or liquids in ducts, pipes, tanks and boilers.

- Suitable for applications requiring temperature control of air or liquids where controller must be placed outside the sensing area.
- Typical uses include control of dampers and valves in heating, cooling and heating-cooling systems.
- Fast response models (available for use in return air duct) operate approximately four times faster than standard models.
- Controller can be mounted in any position.
- Ambient temperature compensation provides good temperature control.

Remote Temperature Controllers

Part Number	Setpoint Temperature	Relay Outputs	Element Type	Capillary Length (Feet)	Differential (˚F)	Comments
T675A1045	0˚ F to 100˚ F	1 SPDT	Stainless steel bulb	20 ft	3˚ F to 10˚ F	Stainless Steel Bulb
T675A1102	160˚ F to 260˚ F	1 SPDT	Copper bulb	20 ft	3˚ F to 10˚ F	
T675A1136	0˚ F to 100˚ F	1 SPDT	Copper bulb	20 ft	1˚ F fixed	
T675A1425	55˚ F to 175˚ F	1 SPDT	Copper bulb	20 ft	3.6˚ F to 12˚ F	
T675A1458	55˚ F to 175˚ F	1 SPDT	Copper bulb	5 ft	1˚ F fixed	
T675A1508	0˚ F to 100˚ F	1 SPDT	Copper bulb	5 ft	3˚ F to 10˚ F	Includes 107324A Duct Bulb Holder
T675A1516	0˚ F to 100˚ F	1 SPDT	Copper bulb	5 ft	1˚ F fixed	Includes 107324A Duct Bulb Holder
T675A1524	55˚ F to 175˚ F	1 SPDT	Copper bulb	20 ft	1˚ F fixed	
T675A1532	160˚ F to 260˚ F	1 SPDT	Copper bulb	5 ft	3˚ F to 10˚ F	Includes 107324A Duct Bulb Holder
T675A1540	55˚ F to 175˚ F	1 SPDT	Copper bulb	5 ft	3.6˚ F to 12˚ F	Includes 107324A Duct Bulb Holder
T675A1565	0˚ F to 100˚ F	1 SPDT	Copper bulb	20 ft	3˚ F to 10˚ F	Includes 107324A Duct Bulb Holder
T675A1706	0˚ F to 100˚ F	1 SPDT	Fast response capillary	5 ft	3˚ F to 10˚ F	Fast response model, includes 107324A Duct Bulb Holder
T675A1722	55˚ F to 175˚ F	1 SPDT	Fast response capillary	5 ft	3.6˚ F to 12˚ F	Fast response model, includes 107324A Duct Bulb Holder
T675A1771	55˚ F to 175˚ F	1 SPDT	Fast response capillary	5 ft	1˚ F fixed	Fast response model, includes 107324A Duct Bulb Holder
T675A1920	-15˚ C to +35˚ C	1 SPDT	Copper bulb	20 ft	1.7˚ C to 5.6˚ C	Bi-lingual French, Celsius Model
T675A2068	-15˚ C to +35˚ C	1 SPDT	Copper bulb	1.5 m	1.7˚ C to 5.6˚ C	Celsius model
T675A2076	-15˚ C to +35˚ C	1 SPDT	Copper bulb	1.5 m	0.6˚ C fixed	Celsius model
T675A2084	-15˚ C to +35˚ C	1 SPDT	Copper bulb	6.1 m	1.7˚ C to 5.6˚ C	Celsius model
T675A2100	15˚ C to 75˚ C	1 SPDT	Copper bulb	1.5 m	2˚ C to 6.6˚ C	Celsius model
T675A2118	75˚ C to 125˚ C	1 SPDT	Copper bulb	1.5 m	1.7˚ C to 5.6˚ C	Celsius model
T675B1002	30˚ F to 50˚ F	1 SPDT	Copper bulb	10 ft	Manual Reset	
T675B1010	30˚ F to 50˚ F	1 SPDT	Copper bulb	20 ft	Manual Reset	
T675B1028	-20˚ F to +50˚ F	1 SPDT	Copper bulb	10 ft	Manual Reset	
T675F1032	80˚ F to 220˚ F	1 SPDT	Copper bulb	10 ft	5˚ F to 30˚ F	
T678A1015	0˚ F to 100˚ F	2 SPDT	Copper bulb	20 ft	Switch: 3˚ F fixedl/Interstage: 3˚ F to 10˚ F adjustable	
T678A1155	-15˚ C to +35˚ C	2 SPDT	Copper bulb	5 ft	3˚ F	Bi-lingual French, Celsius Model
T678A1163	5˚ F to 95˚ F	2 SPDT	Copper bulb	6.1 m	Switch: 1.7˚ C fixedl/Interstage: 1.7˚ C to 5.6˚ C adjustable	Celsius model
T678A1353	55˚ F to 175˚ F	2 SPDT	Copper bulb	5 ft	3.6˚ F	
T678A1361	55˚ F to 175˚ F	2 SPDT	Copper bulb	20 ft	Switch: 3.6˚ F fixedl/Interstage: 3.6˚ F to 12˚ F adjustable	
T678A1395	15˚ C to 75˚ C	2 SPDT	Copper bulb	1.5 m	2˚ C	Celsius model
T678A1437	0˚ F to 100˚ F	2 SPDT	Copper bulb	5 ft	Switch: 3˚ F fixedl/Interstage: 3˚ F to 10˚ F adjustable	
T678A1445	55˚ F to 175˚ F	2 SPDT	Copper bulb	5 ft	Switch: 3.6˚ F fixedl/Interstage: 3.6˚ F to 12˚ F adjustable	
T678A1478	0˚ F to 100˚ F	2 SPDT	Fast response capillary	5 ft	Switch: 3˚ F fixedl/Interstage: 3˚ F to 10˚ F adjustable	Fast response model
T678A1494	55˚ F to 175˚ F	2 SPDT	Fast response capillary	5 ft	Switch: 3.6˚ F fixedl/Interstage: 3.6˚ F to 12˚ F adjustable	Fast response model
T678A1627	0˚ F to 100˚ F	2 SPDT	Averaging capillary	10 ft	Switch: 3.6˚ F fixedl/Interstage: 3.6˚ F to 12˚ F adjustable	
T678A1692	15˚ C to 7˚5 C	2 SPDT	Copper bulb	1.5 m	2˚ C	Celsius model
T678C1005	55˚ F to 85˚ F	2 SPDT	Copper bulb	5.5 ft	5˚ F	Changeover Stat
T678F1002	55˚ F to 85˚ F	2 SPDT	Copper bulb	5.5 ft	2.0˚ F	

Honeywell

T675A,B AND T678A TEMPERATURE CONTROLLERS

APPLICATION

The T675 and T678 Temperature Controllers are designed to control the temperature of air or liquids in ducts, pipes, tanks, and boilers. Typical uses include control of dampers and valves in heating, cooling, or heating-cooling systems.

The T675A has 1 spdt switch. It makes or breaks a circuit on a change in temperature at the sensing bulb. Fast-response models with adjustable differential are available for duct installation. They respond approximately 4 times faster than standard models.

The T675B is a low limit temperature controller with 1 spst switch. It breaks a circuit on a temperature fall and must be manually reset.

The T678A has 2 spdt switches which operate 2 independent circuits in sequence. Fast-response models operate 4 times faster than standard models.

INSTALLATION

WHEN INSTALLING THIS PRODUCT . . .

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

Disconnect power supply before beginning installation to prevent electrical shock and equipment damage.

The installation should be made within the limits specified below.

ELECTRICAL RATINGS:

T675A models with adjustable differential and T678A:

	120 Vac	240 Vac	277 Vac
Full Load	8.0 A	5.1 A	4.2 A
Locked Rotor	48.0 A	30.6 A	25.2 A
Pilot Duty	125 VA	125 VA	125 VA

T675A models with fixed differential—125 VA at 120/208/240/277 Vac.

T675B—125 VA pilot duty up to 277 Vac.

T678A—maximum connected load = 2000 VA.

MAXIMUM BULB PRESSURE: 50 psi [344.7 kPa] for direct immersion.

LOCATION AND MOUNTING

The controller may be installed in any convenient position. Mount it with 3 screws through the slotted holes in the back of the case (Fig. 1). Be sure to consider the length of the capillary before mounting the controller.

Install the sensing element where it is exposed to the average temperature of the controlled medium. The sensing bulb may be directly immersed or mounted in a well. T675A or T678A fast-response models must use the capillary holder furnished with the device (Fig. 2). The remote sensing bulb of standard models should be held in place with a capillary holder, immersion well, or compression fitting (Figs. 3-5). Sharp bends or kinks in the capillary tubing affect the efficiency of the controller and must be avoided. Excess capillary should be carefully coiled and left directly beneath the controller.

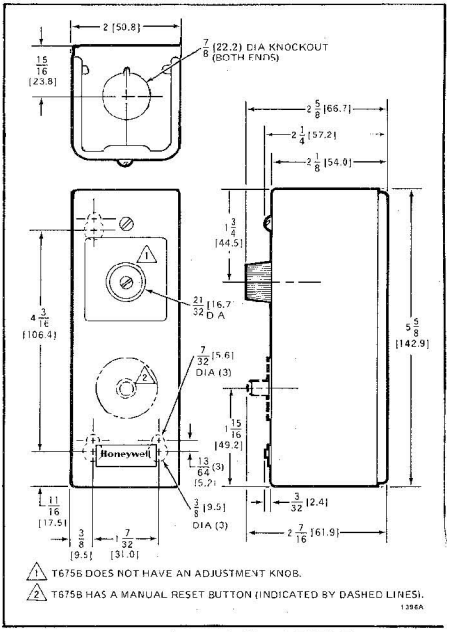


Fig. 1—Dimensions of the T675 and T678 Temperature Controllers, in in. [mm in brackets].

NOTE: When pressure fittings are used in areas of vibration, such as pipe lines, the bulb must be adequately supported.

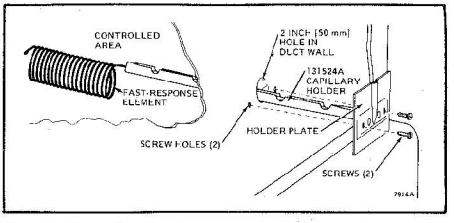


Fig. 2—Mounting a fast-response element in an air duct.

(continued on page 2)

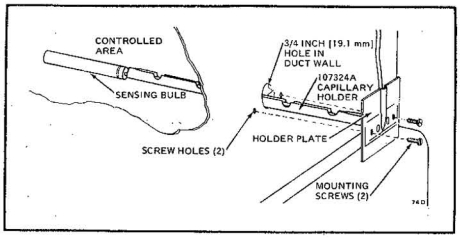


Fig. 3—Mounting the sensing bulb and capillary holder in an air duct.

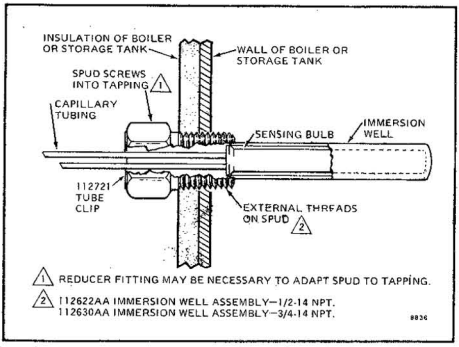


Fig. 4—Mounting the sensing bulb in an immersion well.

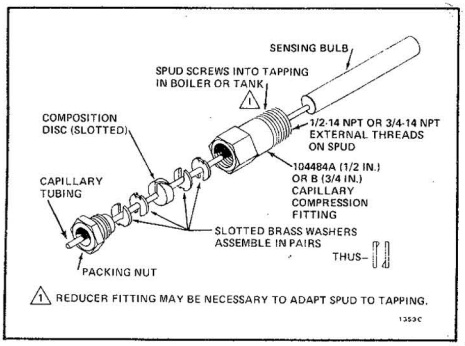


Fig. 5—Mounting the sensing bulb using a capillary compression fitting.

WIRING

Disconnect the power supply before making wiring connections to prevent electrical shock and equipment damage. All wiring must comply with applicable electrical codes and ordinances. If using the controller with a flame safeguard control, use moisture-resistant No. 14 wire suitable for at least 167 F [75 C] for a primary control (such as an RA890), or for at least 194 F [90 C] for a programming control (such as an R4140). *For high temperature installations*, use moisture-resistant No. 14 wire selected for a temperature rating above the maximum operating temperature.

Two knockouts for 1/2 inch conduit are provided—one in the top and one in the bottom of the case. Follow the wiring instructions furnished with the heating or cooling system. Fig. 6 shows the switching action.

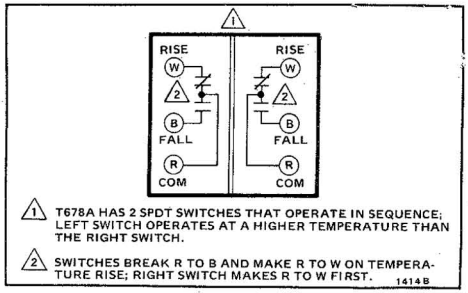


Fig. 6—T678A switching action. T675A is similar, but it has only one spdt switch. T675B has one spst switch that opens on temperature fall.

OPERATION

T675A

As the temperature of the controlled medium falls below the set point less differential, the T675A switch makes terminals R to B and energizes a normally closed solenoid valve to provide heat. In cooling applications, the T675A makes terminals R to W as the temperature rises above the set point, energizing cooling equipment. Fig. 7 shows the operation of the T675A. Fig. 8 shows the location of the adjustment dial on models with an adjustable differential.

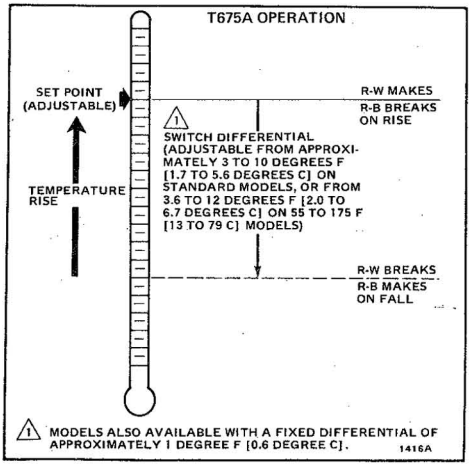


Fig. 7—Operation of the T675A.

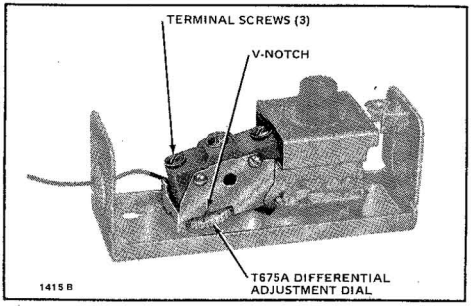


Fig. 8—Location of the adjustment dial on T675A models with an adjustable differential.

FREEZE-UP PROTECTION

When using the T675A (auto-recycling) for freeze-up protection, the recommended set point is 38 F [3.3 C] plus the switch differential.

Example: Set point of 38 F [3.3 C] plus 1 degree F [0.6 degree C] (fixed differential model) equals an actual set point of 39 F [3.9 C].

Example: Set point of 38 F [3.3 C] plus 3 degrees F [1.7 degrees C] (adjustable differential model) equals an actual set point of 41 F [5 C].

This provides an adequate safety factor for freeze-up protection.

NOTE: The T675B is a manual reset device specifically designed for freeze-up protection.

T675B

Used as a low limit controller, the T675B interrupts the operation of equipment if the temperature of the controlled medium falls below the set point. The device is reset manually after a rise in temperature of approximately 10 degrees F [5.6 degrees C]; push in the manual reset button on the front of the case. The operation of the T675B is shown graphically in Fig. 9.

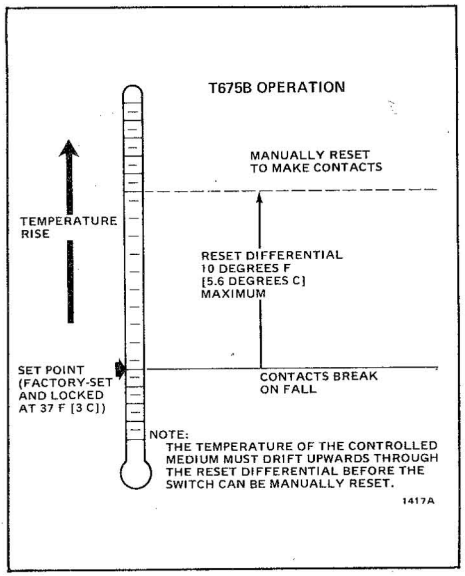


FIG. 9—OPERATION OF THE T675B.

T678A

When the temperature at the sensing element rises above the set point of the controller, the switch on the right makes R-W. Should the temperature continue to rise through the preselected interstage differential of the controller, the switch on the left will make R-W.

Conversely, on a temperature fall, the switch on the left makes R-B, providing first step switching. If the temperature continues to fall, the switch on the right makes R-B to provide sequencing of equipment.

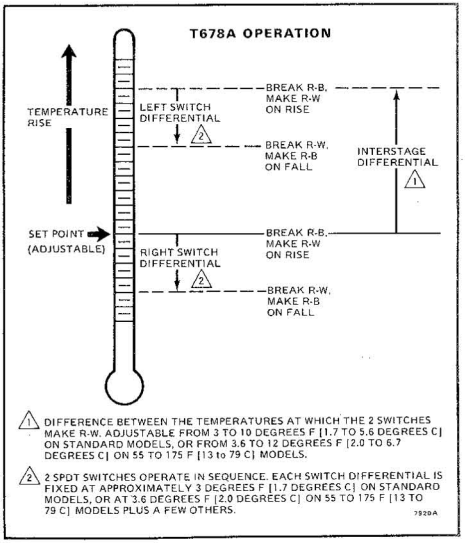


Fig. 10—Operation of the T678A.

The T678A Temperature Controller has an adjustable interstage differential. The set point adjustment knob determines the temperature at which the right switch operates. The left switch can be adjusted to operate from 3 to 10 degrees F [1.7 to 5.6 degrees C] (or 3.6 to 12 degrees F [2.0 to 6.7 degrees C] on some models) above the point of operation of the right switch. An illustration depicting the operation of the T678A is shown in Fig. 10. The interstage differential is adjusted by turning the star wheel with a narrow screwdriver inserted into the rectangular hole in the chassis (Fig. 11).

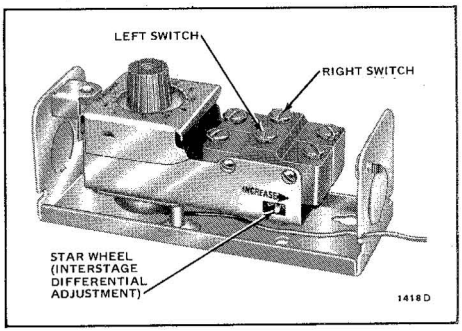


Fig. 11—Interstage differential adjustment on a T678A.

CALIBRATION

All controllers are carefully tested and calibrated at the factory under controlled conditions. If the controller is not operating at a temperature corresponding to the scale setting and differential setting, check to see that the sensing bulb senses the average temperature of the medium controlled. If the temperature of the controlled medium is changing rapidly, the differential will appear wider than its setting.

(continued on page 4)

For calibration, an accurate temperature reading of the controlled medium must be taken. Place an accurate thermometer near the sensing bulb, or refer to a thermometer that has been installed as part of the system. If the sensing bulb is installed in an inaccessible area, or if the controlled medium is unstable, the bulb should be removed and placed in a controlled bath for accurate calibration.

T675A

These controllers are calibrated so that the dial setting, indicated by the pointer on the adjustment knob, is the point at which the R-W switch contacts make on a temperature rise. Measure the temperature at the bulb. Rotate the adjustment knob counterclockwise from the top of the scale, simulating a temperature rise, until the R-W switch contacts make. Note the dial reading. If it differs from the bulb temperature, calibrate the dial as follows:

1. Determine the number of degrees difference between the bulb temperature and the dial reading at which the R-W switch contacts make.

2. Remove the adjustment knob and slip the fingers of the calibration wrench (accessory, Part No. 801534) into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note the dial indication at this point. Turn the dial and the calibration nut up or down scale the number of degrees that the bulb temperature differs from the point at which the contacts make (determined in step 1). For example, move the dial from 45 to 65 if the dial reading in step 1 was 45 degrees and the bulb temperature was 65 degrees.

3. Check the calibration adjustment by moving the adjustment knob up and down the scale while listening for the contacts to make and break. If the dial is still out of calibration, repeat the calibration procedure.

T675B

NOTE: The cover must be removed to see the dial. All T675B models have been factory-set and locked at 37 F [3 C].

These controllers are calibrated so that the dial setting, indicated by the fixed pointer at the top of the dial, is the point at which the switch contacts break on temperature fall.

Measure the temperature at the bulb. Remove the cover of the controller. Loosen the locking screw. Insert a screwdriver in the slot in the center of the dial. Start with the dial at the bottom of the scale, and rotate the dial counterclockwise to simulate a temperature fall until the switch contacts break. Note the dial reading. If it differs from the bulb temperature, follow the calibration procedure outlined for the T675A. Tighten the locking screw and replace the cover.

T678A

These controllers are calibrated so that the dial setting, indicated by the pointer on the adjustment knob, is the point at which the R-W contacts of the right switch make on a temperature rise. If the temperature continues to rise, the R-W contacts of the left switch make at the dial setting *plus* the interstage differential. (The interstage differential is adjustable as shown in Figs. 10 and 11.)

Measure the temperature at the bulb. Rotate the adjustment knob counterclockwise from the top of the scale, simulating a temperature rise, until the R-W contacts of the right switch make. Note the dial reading. If it differs from the bulb temperature, follow the calibration procedure outlined for the T675A.

After calibrating the dial, check the setting of the interstage differential. Set the adjustment knob at the bulb temperature. Then rotate the adjustment knob counterclockwise , simulating a temperature rise, until the R-W contacts of the left switch make. Note the dial reading. The difference between this reading and the bulb temperature is the interstage differential. The interstage differential may be adjusted if necessary (Fig. 11).

CHECKOUT

Check the operation of the controller by raising and lowering the set point through the temperature range of the air or liquid being controlled. Make sure that the controlled equipment operates as intended.

Printed in U.S.A. on recycled paper containing at least 10% post-consumer paper fibers.

SECTION 7 - VENTILATION FAN COMPONENTS -

ROOM VENTILATION FAN, RADIAL - S&P PV100

ROOM VENTILATION FAN, SPEED CONTROLLER, 5A, 120VAC - S&P SC 15 / WC-15

BLOWER ENCLOSURE VENTILATION FAN, RADIAL - EBM-PAPST W1G200-EC95-47

BLOWER ENCLOSURE VENT FAN THERMOSTAT - HONEYWELL T6031A

MODEL FEATURES

- Exhaust air up to 942 CFM with static pressure capabilities to 1.5” w.g.
- Galvanized steel casing with black baked enamel coating
- Pre-wired junction box
- Ideal for applications where space is limited
- Non-overloading backward inclined wheel for efficiency at higher static pressures
- AMCA Seal for Air Performance
- cULus Listed

MODEL OVERVIEW

The POWERVENT (PV) series of direct drive centrifugal in-line duct ventilation fans consists of twelve model sizes 4”, 5”, 6”, 8”, 10” and 12.4” respectively. All models are designed for direct connection in-line with standard diameter round ducting. Airflow performance values range from 108 CFM (PV-100) up to 942 CFM (PV-315x).

All PV fan models incorporate a powerful external rotor motor that has been factory matched to a non-overloading backward curved centrifugal fan wheel.

This powerful combination enables the PV fans to deliver exceptional airflow performances against high static pressure typically found in ducted ventilation systems. All motors within PV fans are fully speed controllable using voltage or frequency control regulators.

The PV series of duct exhaust or supply fans have been specifically designed for simple installation and many years of maintenance free operation. The PV fans can be mounted at any angle and at any point along the duct. The totally enclosed motor design allows the PV fans to operate in high moisture, lint and dust laden air. All models are manufactured with high quality materials and workmanship that is supported by a comprehensive **five (5) year warranty**.

All PV Fans feature a corrosion resistant galvanized steel casing with black baked enamel coating and are supplied with a strong mounting bracket and prewired junction box.

The PV100x fans feature Class F motor insulation.

Model PV is available in our Quickship program. All sizes are available for next day shipping from stock.

5 year fan housing and motor warranty

All specifications are subject to change without notice unless approved in submittal by Soler & Palau.

CONSTRUCTION/SPECIFICATION CHECKLIST

Casing
- Manufactured from high grade pressed galvanized steel, with black baked enamel coating.
- Extra long inlet and discharge collars make installation quick and trouble free.
- Supplied with a strong galvanized steel mounting bracket.
- Supplied with a prewired junction box.

Wheel / Impeller
- Backward curved centrifugal type.
- Factory matched to an external rotor motor and dynamically balanced to eliminate vibration.

Motor
- Totally enclosed permanent split capacitor start and run external rotor motors.
- 115V 60Hz (single phase) electrical connection.
- Permanently sealed, self lubricating precision ball bearings.
- Safety Thermal Overload Protection Cut-Out (Automatic Reset Type).
- All Models are suitable for working airstreams up to 140° F

Code Approval
- All models have been independently safety tested by Underwriters Laboratories, Inc. and are UL and cUL Listed.
- Independently safety tested by Intertek Laboratories, and are ETL Listed.
- Independently tested for Airflow Performance. The PV range is licensed to bear the AMCA seal for Air Performance.

ACCESSORIES

BOC
Interior
Air Valve

CAR
Backdraft
Damper

ACOP-VENT
Antivibrating
coupling

SIL
Sound
Attenuator

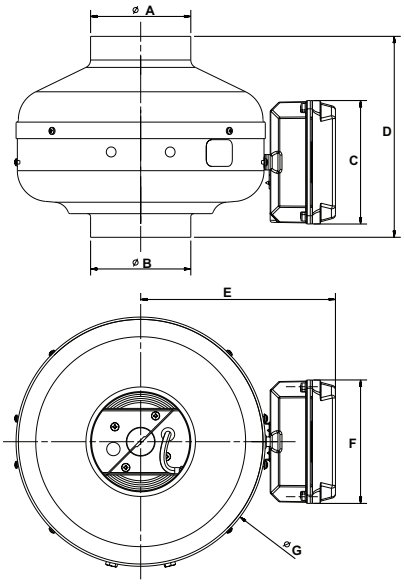
PER
Plastic louver
shutter

SC 15
Variable speed
control

Please refer to the S&P Group A (Residential/Light Commercial) catalog for a complete line of accessories.

PERFORMANCE/DIMENSIONS

Dimensions in inches/mm



Model	A	B	C	D	E	F	G	Weight lbs(kgs)
PV-100	3 13/16 / 97.5	3 13/16 / 97.5	4 3/4 / 120	7 11/16 / 196	7 1/2 / 190	4 3/4 / 120	9 9/16 / 243	7 / 3.0
PV-100x	3 13/16 / 97.5	3 13/16 / 97.5	4 3/4 / 120	7 11/16 / 196	7 1/2 / 190	4 3/4 / 120	9 9/16 / 243	7 / 3.0
PV-125	4 13/16 / 122.5	4 13/16 / 122.5	4 3/4 / 120	7 13/16 / 198	7 1/2 / 190	4 3/4 / 120	9 9/16 / 243	7 / 3.0
PV-125x	4 13/16 / 122.5	4 13/16 / 122.5	4 3/4 / 120	7 13/16 / 198	7 1/2 / 190	4 3/4 / 120	9 9/16 / 243	7 / 3.0
PV-150	5 13/16 / 147	5 13/16 / 147	4 3/4 / 120	8 7/16 / 214	9 5/16 / 236	4 3/4 / 120	13 1/8 / 334	11 / 5.0
PV-150x	5 13/16 / 147	5 13/16 / 147	4 3/4 / 120	8 7/16 / 214	9 5/16 / 236	4 3/4 / 120	13 1/8 / 334	11 / 5.0
PV-200	7 13/16 / 198	7 13/16 / 198	4 3/4 / 120	8 3/4 / 223	9 5/16 / 236	4 3/4 / 120	13 1/8 / 334	11 / 5.0
PV-200x	7 13/16 / 198	7 13/16 / 198	4 3/4 / 120	8 3/4 / 223	9 5/16 / 236	4 3/4 / 120	13 1/8 / 334	11 / 5.0
PV-250	9 3/4 / 248	9 3/4 / 248	4 3/4 / 120	8 1/16 / 205	9 5/16 / 236	4 3/4 / 120	13 1/8 / 334	13 / 6.0
PV-250x	9 3/4 / 248	9 3/4 / 248	4 3/4 / 120	8 1/16 / 205	9 5/16 / 236	4 3/4 / 120	13 1/8 / 334	13 / 6.0
PV-315	12 5/16 / 312	12 5/16 / 312	4 3/4 / 120	9 3/16 / 233	10 9/16 / 269	4 3/4 / 120	15 13/16 / 401	21 / 10.0
PV-315x	12 5/16 / 312	12 5/16 / 312	4 3/4 / 120	9 3/16 / 233	10 9/16 / 269	4 3/4 / 120	15 13/16 / 401	21 / 10.0

Air Performance

Model No.	Nom. RPM	Volts	Max. Watts	CFM v Static Pressure (SP) Ins. WG									Max. SP	Duct Dia. Ins.
				0”	0.125”	0.25”	0.375”	0.5”	0.75”	1.0”	1.25”	1.5”		
PV-100	1400	115	57	108	100	92	85	78	66	52	33	18	1.70	4”
PV-100x	2880	115	84	153	142	130	120	111	96	80	63	34	1.85	4”
PV-125	2350	115	58	128	104	85	74	63	47	32	15	-	1.43	5”
PV-125x	2745	115	85	206	190	170	153	135	110	88	62	33	1.77	5”
PV-150	2750	115	78	245	205	177	157	129	93	59	-	-	1.20	6”
PV-150x	2700	115	130	390	367	340	312	285	233	193	153	110	2.05	6”
PV-200	3100	115	130	402	375	350	327	296	239	179	135	85	1.94	8”
PV-200x	2930	115	180	544	515	485	446	415	360	312	273	230	2.64	8”
PV-250	3000	115	170	568	533	502	471	440	370	312	263	221	2.61	10”
PV-250x	3045	115	214	618	595	570	540	510	450	390	340	297	2.80	10”
PV-315	2600	115	170	654	605	570	525	487	408	333	265	203	2.21	12.4”
PV-315x	2650	115	370	942	905	859	811	762	622	508	440	390	3.90	12.4”

Performance certified is for installation type D-Ducted inlet, Ducted outlet. Performance ratings do not include the effects of appurtenances (accessories). Speed (RPM or RPS) shown is nominal. Performance is based on actual speed of test.

S&P USA Ventilation Systems, LLC., Div. of Soler & Palau Ventilation Group, certifies that the PV range shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

*PV 150x and larger ENERGY STAR® qualified.

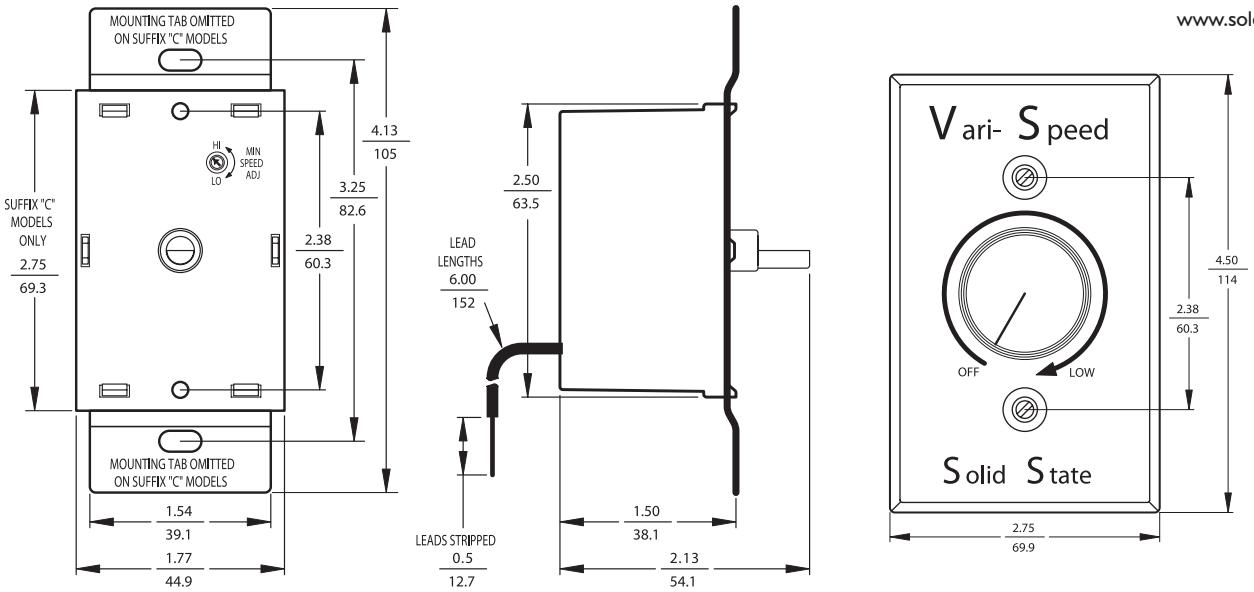
The PV-POWERVENT Series fans are California Title 24 compliant and meet ASHRAE 62.2 when installed with 3 way switch and remotely mounted speed control.

Sound

Fan sound levels are measured in sones. At this time there are no sone level test standards available through HVI due to the fact that remote mounted fan noise levels are in proportion to the following: type of duct, length of duct, fan distance from the intake source and other random factors. It is generally accepted that remote mounted venting is usually quieter than standard (in room) venting.

SC-15 & 25 - Rotary Speed Controls

The World's Leading Producer of Air Movement Products
6393 Powers Avenue
Jacksonville, Florida 32217-2298
P: 800.961.7370 F: 800.961.7379
www.solerpalau-usa.com



Electrical Ratings

Model No.	AC Line Input Voltage (Volts AC - 50/60 Hz)	Maximum Current Rating (Amps RMS)	Ambient Temperature (°F / °C)
SC-15	115	5	104 / 40
SC-25	115	10	104 / 40

Mounting Kit: Includes individual packaging with dial plate, knob, mounting screws, wire connectors, and instructions.

ACCESSORY MODEL	1	2	3	4	5	REMARKS

PROJECT: _____ CONTRACTOR: _____
LOCATION: _____ REVISION DATE: _____
FORM NO.: _____ SUBMITTED BY: _____ DATE: _____
ENGINEER: _____ APPROVED BY: _____ DATE: _____

For more information contact us at www.solerpalau-usa.com or 1.800.961.7370 for additional submittal drawings.

Soler & Palau will not be responsible for fabrication changes or errors resulting from customer use of a non-current submittal drawing.

Soler&Palau Ventilation Group

Operating instructions

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www.ebmpapst.com

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Translation of the original operating instructions

1. SAFETY REGULATIONS AND NOTES

Please read these operating instructions carefully before starting to work with the device. Observe the following warnings to prevent malfunctions or physical damage to both property and people.
These operating instructions are to be regarded as part of this device. If the device is sold or transferred, the operating instructions must accompany it.
These operating instructions may be duplicated and forwarded for information about potential dangers and their prevention.

1.1 Levels of hazard warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Compliance with the measures is mandatory.

WARNING
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damage of property.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualification

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by qualified, trained and authorised technical staff.
Only authorised specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

Any safety hazards stemming from the device must be re-evaluated once it is installed in the end device.
Observe the following when working on the unit:

⇒ Do not make any modifications, additions or conversions to the device without the approval of ebm-papst.

1.4 Electrical voltage

⇒ Check the electrical equipment of the device at regular intervals, refer to chapter 6.2 Safety test.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrical load on the device
Risk of electric shock

→ Stand on a rubber mat if you are working on an electrically charged device.

WARNING
Terminals and connections have voltage even with a unit that is shut off
Electric shock

→ Wait five minutes after disconnecting the voltage at all poles before opening the device.

CAUTION
If control voltage is applied or a speed setpoint is stored, the motor automatically restarts, e.g. after a power failure.
Danger of injury

→ Keep out of the danger zone of the device.

→ When working on the device, switch off the mains supply voltage and secure the latter from being switched on again.

→ Wait until the device stops.

→ After working on the device, remove any used tools or other objects from the device.

1.5 Safety and protective functions

DANGER
Missing safety device and non-functioning safety device
If there is no safety device, you could be seriously injured, for example if you reach into the running device or your hands are sucked into it.

→ Operate the device only with a fixed and isolating safety protection and a fixed guard grille.
The guard must withstand the kinetic energy of a fan blade detaching at maximum speed.

→ The device is a built-in component. You, the owner/ operator, are responsible for providing adequate protection for the device.

→ Shut down the device immediately if you detect a missing or ineffective protective feature.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open and closed-loop control devices.
If unacceptable emission intensities occur when the fan is installed, appropriate shielding measures have to be taken by the user.

NOTE
Electrical or electromagnetic interferences after integrating the device in installations on the customer's side.

→ Verify that the entire setup is EMC compliant.

1.7 Mechanical movement

DANGER
Rotating device
Body parts that come into contact with the rotor and impeller can be injured.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair, loose items of clothing and jewellery could become entangled and pulled into the device. You could be injured.

→ Do not wear any loose clothing or jewellery while working on rotating parts.

→ Protect long hair by wearing a cap.

1.8 Emission

WARNING
Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise.
Danger of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment, e.g. hearing protection.

→ Also observe the requirements of local agencies.

1.9 Storage

⇒ Store the device, partially or fully assembled, in a dry and weatherproof manner in the original packing in a clean environment.

⇒ Protect the device from environmental impacts and dirt until the final installation.

⇒ We recommend storing the device for a maximum up to one year to guarantee proper operation and longest possible service life.

⇒ Even devices explicitly suited for outdoor use are to be stored as described prior to being commissioned.

⇒ Maintain the storage temperature, see chapter 3.5 Transport and storage conditions.

1.10 Disposal

When disposing of the device, please comply with all relevant requirements and regulations applicable in your country.

Translation of the original operating instructions

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2. PROPER USE

The device is exclusively designed as a built-in device for moving air according to its technical data.
Any other or secondary use is deemed improper and constitutes a misuse of the device.
Installations on the customer's side must meet the mechanical, thermal and service life-related stresses that can occur.

Proper use also includes:

- Moving air with a density of 1.2 kg/m³.
- Using the device in accordance with the permitted ambient temperature, see chapter 3.5 Transport and storage conditions and chapter 3.2 Nominal data.
- Operating the device with all protective features in place.
- Minding the operating instructions.

Improper use

Using the device in the following ways is particularly prohibited and may cause hazards:

- Operating the device with an imbalance, e.g. caused by dirt deposits or icing.
- Moving air that contains abrasive particles.
- Moving highly corrosive air, e.g. salt spray mist. Exceptions are devices that are intended for salt spray mist and protected accordingly.
- Moving air that contains dust pollution, e.g. suctioning off saw dust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or for taking on safety-related functions.
- Operation with completely or partially disassembled or modified protective features.
- In addition, all application options that are not listed under proper use.

Translation of the original operating instructions

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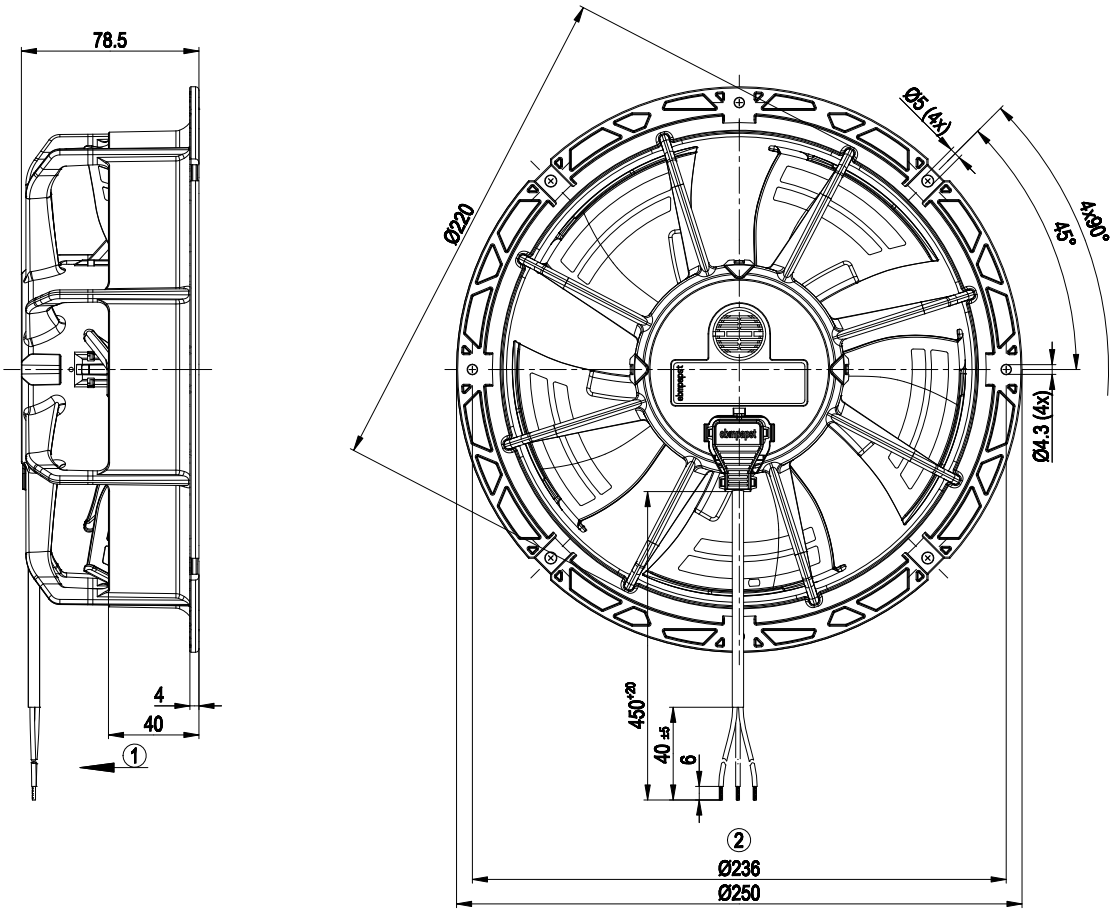
3. TECHNICAL DATA

3.1 Product drawing



All measures have the unit mm.

1	Direction of air flow "V"
2	Connection line PVC AWG20; 3 x brass lead tips crimped

Translation of the original operating instructions

3.2 Nominal data

Motor	M1G055-BD

Phase	1~	1~
Nominal voltage / VAC	115	115
Frequency / Hz	50/60	50/60

Type of data definition		ml
Speed / min^{-1}	900	1300
Power input / W	-	8.0
Current draw / A		0.11
Max. back pressure / Pa		23
Min. ambient temperature / °C	-30	-30
Max. ambient temperature / °C	50	50

ml = Max. load · me = Max. efficiency · fa = Running at free air
cs = Customer specs · cu = Customer unit

Subject to alterations

3.3 Technical features

Mass	1 kg
Size	200 mm
Material of impeller	PA plastic
Material of wall ring	PP plastic
Number of blades	5
Direction of air flow	"V"
Direction of rotation	Counter-clockwise, seen on rotor
Type of protection	IP 54
Insulation class	"B"
Humidity class	F3-1
Mounting position	Any
Condensate discharge holes	None
Operation mode	S1
Motor bearing	Ball bearing
Technical features	- Over-temperature protected motor - Soft start - Speed selection max/min
Speed steps	2
Motor protection	Thermal overload protector (TOP) wired internally
Cable exit	Lateral
Protection class	II
Product conforming to standard	EN 60335-1; CE
Approval	CSA C22.2 Nr.77; EAC; UL 2111; VDE

For cyclic speed loads, note that the rotating parts of the device are designed for maximum one million load cycles. If you have specific questions, contact ebm-papst for support.

3.4 Mounting data

For depth of screw, see chapter 3.1 Product drawing

⇒ Secure the mounting screws against accidentally coming loose (e.g. by using self-locking screws).

Strength class for mounting screws	8.8

You can obtain additional mounting data from the product drawing if necessary.

3.5 Transport and storage conditions

⇒ Use the device in accordance with its protection type.

Max. permissible ambient motor temp. (transp./ storage)	+ 80 °C
Min. permissible ambient motor temp. (transp./storage)	- 40 °C

3.6 Electromagnetic compatibility

EMC interference immunity	Acc. to EN 61000-6-2 (industrial environment)
EMC harmonics	Acc. to EN 61000-3-2/3
EMC interference emission	Acc. to EN 61000-6-3 (household environment)

Translation of the original operating instructions

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4. CONNECTION AND START-UP

4.1 Connecting the mechanical system

CAUTION
Cutting and crushing hazard when removing the device from the packaging

Blades can be bent

→ Carefully remove the device from its packaging, only touching the wall ring. Make sure to avoid any shock.

→ Wear safety shoes and cut-resistant safety gloves.

⇒ Check the device for transport damage. Damaged devices must no longer be installed.

⇒ Install the undamaged device according to your application.

4.2 Connecting the electrical system

DANGER
Incorrect insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation requirements for voltage, current, insulation material, load etc.

→ Route cables such that they cannot be touched by any rotating parts.

CAUTION
Electrical voltage
The fan is a built-in component and features no electrically isolating switch.

→ Only connect the fan to circuits that can be switched off with an all-pole separating switch.

→ When working on the fan, you must switch off the installation/machine in which the fan is installed and secure it from being switched on again.

NOTE
Water penetration into leads or wires
Water enters at the cable end on the customers side and can damage the device.

→ Make sure that the cable end is connected in a dry environment.

Connect the device only to circuits that can be switched off using an all-pole disconnecting switch.

4.2.1 Prerequisites

⇒ Check whether the data on the type plate agree with the connection data.

⇒ Before connecting the device, ensure that the supply voltage matches the operating voltage of the device.

⇒ Only use cables designed for current according to the type plate. For determining the cross-section, follow the basic principles in accordance with EN 61800-5-1. The protective earth must have a cross-section equal to or greater than the outer conductor cross-section.
We recommend the use of 105°C cables. Ensure that the minimum cable cross-section is at least AWG26/0.13 mm².

4.2.2 Idle current

Because of the EMC filter integrated for compliance with EMC limits (interference emission and interference immunity), idle currents in the mains cable can be measured even when the motor is at a standstill and the mains voltage is switched on.

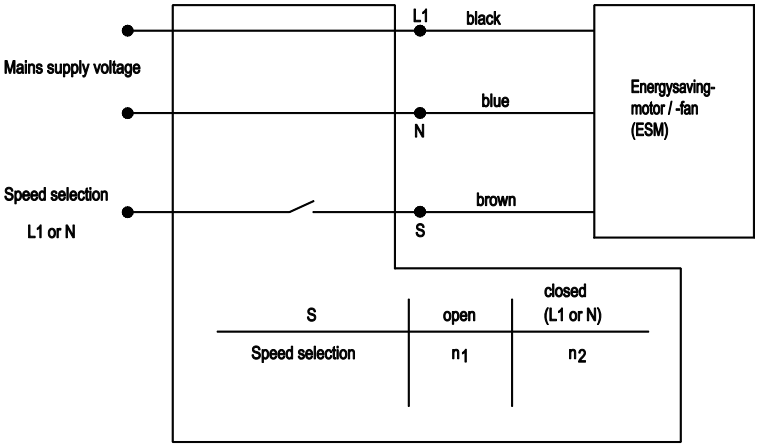
- The values lie in a range of typical < 50 mA.
- The effective power in this operating state (readiness for operation) is simultaneously at typical < 2 W.

4.2.3 Locked-rotor protection

Due to the locked-rotor protection, the start-up current (LRA) is equal to or less than the nominal current (FLA).

Translation of the original operating instructions

4.3 Connection screen



Translation of the original operating instructions

4.4 Checking the connections

⇒ Make sure that the power is off (all phases).

⇒ Secure it from being switched on again.

⇒ Check the correct fit of the connection lines.

4.5 Switch on device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical connection. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Fire hazard

→ Ensure that no combustible or flammable materials are located close to the fan.

⇒ Inspect the device for visible external damage and the proper function of the protective features before switching it on.

⇒ Check the air flow paths of the fan for foreign objects and remove any that are found.

⇒ Apply the nominal voltage to the voltage supply.

⇒ Start the device by changing the input signal.

4.6 Switching off the device

⇒ Disconnect the device from the supply voltage at the main switch for the supply line.

5. INTEGRATED PROTECTIVE FUNCTIONS

The integrated protective functions cause the motor to switch off automatically in case of faults described in the table.

Malfunctions	**Description / Function of safety feature**
Rotor position detection error	An automatic restart occurs.
Locked rotor	⇒ After the blockage is removed, the motor restarts automatically.
Motor overload	After cooling the device restarts automatically.

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6. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

Do not perform any repairs on your device. Return the device to ebm-papst for repair or replacement.

WARNING
Terminals and connections have voltage even with a unit that is shut off
Electric shock

→ Wait five minutes after disconnecting the voltage at all poles before opening the device.

CAUTION
If control voltage is applied or a speed setpoint is stored, the motor automatically restarts, e.g. after a power failure.
Danger of injury

→ Keep out of the danger zone of the device.

→ When working on the device, switch off the mains supply voltage and secure the latter from being switched on again.

→ Wait until the device stops.

→ After working on the device, remove any used tools or other objects from the device.

If the device remains out of use for some time, e.g. when in storage, we recommend switching the device on for at least two hours to allow any condensate to evaporate and to move the bearings.

Malfunction/error	Possible cause	Possible remedy
Impeller running roughly	Imbalance in rotating parts	Clean the device; if imbalance is still evident after cleaning, replace the device. If you have attached any weight clips during cleaning, make sure to remove them afterwards.
Motor does not turn	Mechanical blockage	Switch off, de-energise, and remove mechanical blockage.
	Mains supply voltage faulty	Check mains supply voltage, restore power supply, apply control signal.
	Faulty connection	De-energise, correct connection, see connection diagram.
	Thermal overload protector responded	Allow motor to cool off, locate and rectify cause of error, if necessary cancel restart lock-out
Overtemperature of electronics/motor	Insufficient cooling	Improve cooling. Let the device cool down. To reset the error message, switch off the mains supply voltage for a min. of 25 s and switch it on again.
	Ambient temperature too high	Reduce the ambient temperature. Let the device cool down.
	Unacceptable operating point	Correct the operating point. Let the device cool down.

If you have any other problems, contact ebm-papst.

6.1 Cleaning

NOTE
Damage to the device during cleaning.
Malfunction possible

→ Do not clean the device using a water jet or high-pressure washer.

→ Do not use any cleaners containing acids, bases or solvents.

→ Do not use any pointed or sharp-edged objects to clean.

6.2 Safety test

NOTE
High-voltage test
The integrated EMC filter contains Y capacitors. Therefore, the trigger current is exceeded when AC testing voltage is applied.

→ Test the device with DC voltage when you carry out the high-voltage test required by law. The voltage to be used corresponds to the peak value of the AC voltage required by the standard.

What has to be tested?	How to test?	Frequency	Which measure?
Check the protective casing against accidental contact for damage and to ensure that it is intact	Visual inspection	At least every 6 months	Repair or replacement of the device
Check the device for damage to blades and housing	Visual inspection	At least every 6 months	Replacement of the device
Mounting the connection lines	Visual inspection	At least every 6 months	Fasten
Check the insulation of the wires for damage	Visual inspection	At least every 6 months	Replace wires

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Honeywell

T4031A,B,P; T6031A,B
Refrigeration Temperature Controllers

PRODUCT DATA

GENERAL

The T4031A,B,P and T6031A,B are temperature controllers used in a variety of cooling applications where remote mounting of the sensing element in the controlled medium is required.

FEATURES

- **Wide control temperature range is suitable for controlling ducts, tanks, freezers, coolers, display cases. and defrost termination.**
- **Universal mounting bracket is available for easy replacement of other controllers.**
- **Models are available with various control ranges.**
- **Control setpoint is dial-knob adjustable.**
- **Models are available with fixed or adjustable temperature differentials.**
- **Capillary lengths are 5, 8, or 20 ft (1.5, 2.4, 6.1m) depending on model.**
- **Reliable snap-acting spst or spdt switch.**
- **Ambient temperature compensated.**
- **Insert supplied with TRADELINE® models replaces setpoint knob to discourage tampering.**

Contents

General 1
Features 1
Specifications 2
Ordering Information 2
Installation 3
Operation and Checkout 5

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SPECIFICATIONS

IMPORTANT

The specifications given in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the specifications listed. Also, this product is tested and calibrated under closely controlled conditions, and some minor differences in performance can be expected if those conditions are changed.

TRADELINE® Models

TRADELINE® models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. TRADELINE® model specifications are the same as those of standard models except as noted below.

TRADELINE® Model Available:

T6031A Refrigeration Temperature Controller-spdt switch, adjustable temperature differential, tamper-resistant insert.

Capillary Length:

8 ft (2.4m)

Additional Features:

TRADELINE® pack with cross reference label and special instructions

Standard Models

T4031A Refrigeration Temperature Controller-spst switch makes on temperature rise; fixed differential

T4031B Refrigeration Temperature Controller—same as T4031A but less case

T4031P Refrigeration Temperature Controller—same as T4031A but uses screw, not knob, to adjust setpoint

T6031A Refrigeration Temperature Controller-spdt switch, fixed or adjustable temperature differential

T6031B Refrigeration Temperature Controller—same as T6031A but less case

Switch Action:

T4031A,B,P spst switch makes R to W on temperature rise

T6031A,B spdt switch makes R to W on temperature rise, R to B on temperature fall

Capillary Lengths and Temperature Ranges:

Model	Copper Capillary Tube Length		Setting Range[a]		Differential	
	ft	m	°F	°C	°F	°C
T4031A,B	5	1.5	-30 to 50	-34 to 10	Fixed at 3.5	Fixed at 1.6
	20	6.1				
T4031P	8	2.4	-30 to +90	-34 to +32	3.5 to 16	1.6 to 9
T6031A,B	5	1.5	-15 to +90	-9 to +32	Fixed at 3.5 or Adjust. from 3.5 to 12	Fixed at 1.6 or Adjust. from 1.6 to 7
	20	6.1				
	5	1.5	-30 to +50	-34 to +10		
	20	6.1				
	8	2.4	-30 to +90	-34 to +32		

[a] Dial scale markings in degrees Fahrenheit

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or your distributor, refer to the TRADELINE® catalog or price sheets for complete ordering number, or specify:

1. Order number.
2. Setting range.
3. Fixed or adjustable differential (T6031).
4. Length of copper capillary tube.
5. Accessories, if desired.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Home and Building Control Sales office (check white pages of your phone directory).
2. Home and Building Control Customer Relations
   Honeywell, 1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9. International Sales and Service Offices in all principal cities of the world.

Electrical Ratings:

	120 Vac		240 Vac	
	Normally Closed	Normally Open[a]	Normally Closed	Normally Open[a]
Full Load Amp	8	16	5.1	8
Locked Rotor Amp	48	80	30.6	40

[a] Makes on temperature rise.

Pilot Duty:
125 VA

Dimensions:
See Fig. 1

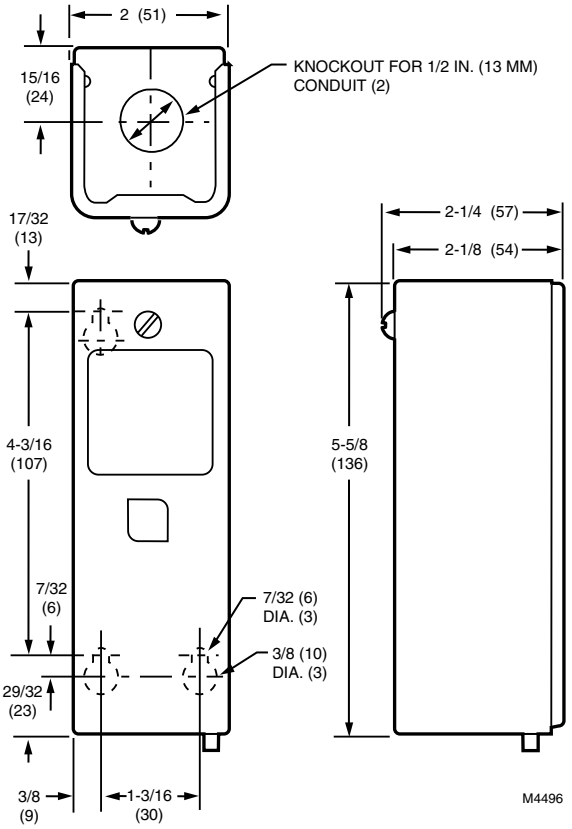

Fig. 1. Dimensions of T4031, T6031 in. (mm).

Underwriters Laboratories Inc.:
Listed

Maximum Ambient Operating Temperature:
125°F (52°C)

Accessories:
112622AA Immersion Well—short-necked, 1/2 in. NPT, copper
7617ABY Compression Fitting—50 psi water, 15 psi air
107324A Bulb Holder—for duct installation
105900 T-strap—for strapping bulb to pipe
7617ABZ Bag Assembly—for mounting controller to fan coil units
801534 Calibration Wrench
7640HY Standoff Bracket Bag Assembly—to mount controller to an insulated duct
130883 Universal Mounting Bracket
194899 Tamper-resisting Insert Button
Celsius Scaleplates:
194486 D: -15°C to +35°C replaces (0°F to 100°F) scaleplate
194486H: 15°C to 75°C replaces (55°F to 175°F)
194486F: 75°C to 125°C replaces (160°F to 260°F)

INSTALLATION

When Installing this Product…

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ CAUTION

- Disconnect power supply before installation to prevent electrical shock and equipment damage.
- Do not damage or change shape of capsule. Deformed capsule will cause calibration offset.

Mounting

Install controller in any convenient location. Make sure that the sensing bulb reaches the system to be controlled. The ambient temperature must not exceed 125°F (52°C) in the area where the controller is installed.

Install the sensing element where it can sense the average temperature. Avoid sharp bends or kinks in the capillary tubing that can affect the accuracy of the controller. Carefully coil the excess capillary tubing and leave it directly beneath the controller.

The 130883 Mounting Plate furnished with TRADELINE® models allows the control to be mounted in existing mounting holes.

Duct Installation

Position the sensing bulb in the duct to sense the average air temperature. Avoid mounting the bulb close to hot pipes, cooling coils, etc.

The 107324A Bulb Holder is available for suspending the bulb in a duct. See Fig. 2.

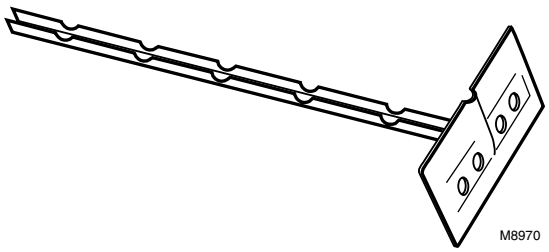

Fig. 2. 107324A bulb holder.

To install duct:

1. Make a hole in duct wall to admit sensing bulb into holder.
2. Using holder as template, mark and drill mounting holes.
3. Break off bulb holder to required length. (Be sure holder is long enough to hold sensing bulb away from duct wall and in freely circulating air.)
4. Place capillary tubing in bulb holder channel, with bulb at inner end of holder. Pinch together top edges of channel segments.
5. Insert assembled bulb and holder into duct, and fasten to duct wall with screws supplied.

Tank Installation

The sensing bulb can be inserted directly into a tank using a compression fitting; or the bulb can be inserted into an immersion well (order separately), which is screwed into a tank or boiler.

Select a location where liquid of average temperature can circulate freely around the sensing bulb.

Using Compression Fitting (Fig. 3)

1. Drain system. Screw boiler plug into properly sized and threaded boiler or pipe tapping.
2. Place packing nut on capillary tubing.
3. Slide sensing bulb completely through boiler plug.
4. Place composition disc and the four slotted brass washers on capillary tubing.
5. Slide assembly into boiler plug and tighten packing nut.
6. Refill system and check for leaks. Neatly coil excess capillary tubing.

Using Immersion Well (Fig. 4)

1. Drain system. Screw the well into threaded fitting.
2. Refill system and check for leaks.
3. Insert sensing bulb into well until it bottoms.
4. Fit bulb retaining clamp over immersion well flange and capillary tubing, and tighten screw.

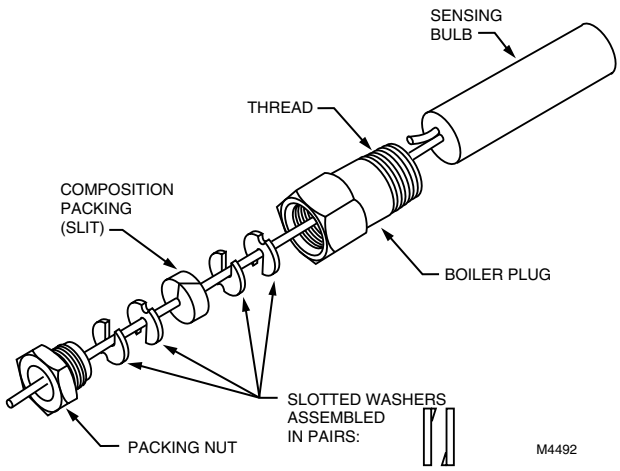

Fig. 3. Compression fitting installation.

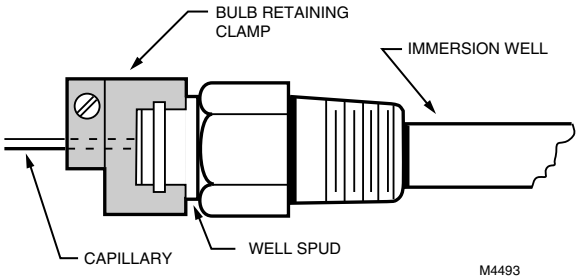

Fig. 4. Immersion well installation.

Cold Room Installation

Locate the bulb in freely circulating air in the controlled area or on the suction side of a refrigerant line, and secure the bulb in position.

Wiring (Fig. 5)

All wiring must comply with local electrical codes and ordinances.

Two knockouts are provided, one at the top and one at the bottom of the case for 1/2 in. conduit. Follow the wiring instructions furnished with the heating or cooling system. For replacement, make sure the new control is wired into the system to operate the same as the old control.

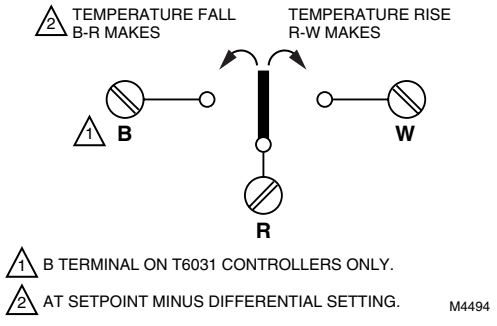

Fig. 5. Wiring terminals on T4031 and T6031 temperature controllers.

OPERATION AND CHECKOUT

When the temperature at the sensing bulb rises above the controller setpoint, a circuit is made between the R-W terminals. During a temperature fall, the R-W circuit breaks at the setpoint temperature *minus* the switch differential. Controllers with a B terminal break the B-R terminal circuit on a temperature rise to the setpoint. B-R makes again when R-W breaks on a temperature drop. See Fig. 6.

For example, if a controller with a 3°F (1.7°C) differential is set at 39°F (3.9°C), R-W makes when the bulb temperature rises to 39°F. Then during a temperature fall, R-W breaks when the temperature drops to 35°F (1.7°C) (39°F minus the 3°F differential [3.9°C minus the 1.7°C differential]).

On models with a B terminal, B-R makes when R-W breaks. Then the temperature has to climb past the control differential to the set point of 39°F (3.9°C) before the B-R circuit breaks and the R-W circuit makes.

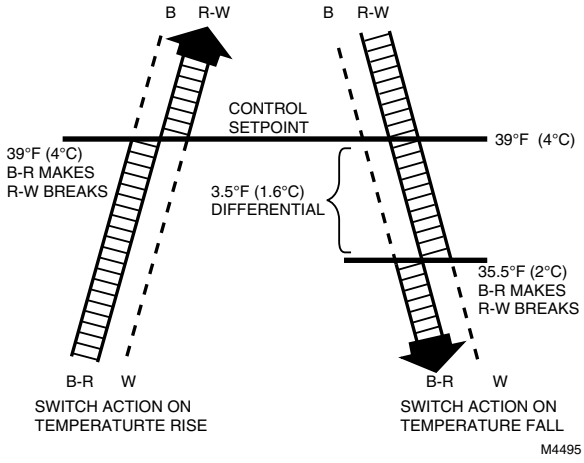

Fig. 6. Operation of switch on temperature rise and fall.

SETTING

Set the controller to the system manufacturer's recommended settings, if available.

Temperature Setpoint Knob—Turn the knob on the front of the case until the pointer indicates the temperature to be maintained in the controlled medium.

Screw—Insert a flatheaded screwdriver into the slot on the shaft, which is located in the center of the scaleplate. Turn the screwdriver clockwise ↷ to increase the temperature control point. Turn the screwdriver counterclockwise ↶ to decrease the temperature control point.

Adjustable Differential—With the cover off, turn the differential adjustment wheel (marked 3-6-9-12°F) until the desired differential is aligned with the notch in the frame. See Fig. 7.

Fixed differential models are 3.5°F at midscale.

Calibration

All controllers are carefully tested and calibrated at the factory under controlled conditions. If the controller is not operating at a temperature corresponding to the scale and differential setting, verify that the bulb senses the average temperature of the medium. If the temperature of the controlled medium is changing rapidly, the differential will appear wider than its setting.

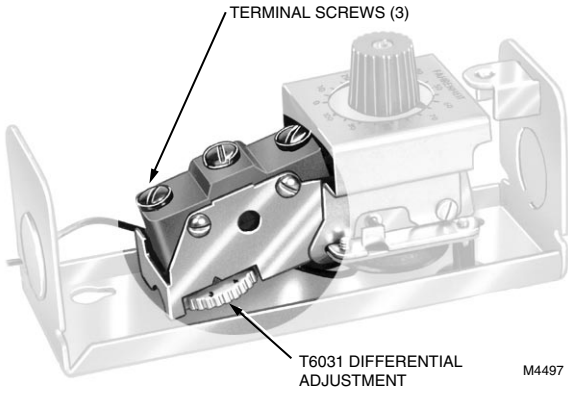

Fig. 7. Internal view showing differential adjustment wheel (applicable models).

For calibration, take an accurate temperature reading of the controlled medium. Place an accurate thermometer near the bulb of the controller, or refer to a thermometer installed as part of the system. If the bulb of the controller is installed in an inaccessible area, or if the controlled medium is unstable, remove the bulb and place in a controlled bath for accurate calibration.

These controllers are calibrated so the dial setting is the point at which the R-W switch contacts make (B-R contacts break) on a temperature rise. Measure the temperature at the bulb. Rotate the dial counterclockwise ↶ from the top of the scale, simulating a temperature rise, until the R-W switch contacts make. Note the dial reading. If it differs from the setpoint, calibrate the dial as follows:

1. Determine the number of degrees difference between the set point and the point at which the contacts make.
2. Remove the dial knob and slip the fingers of the calibration wrench into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note the dial indication at this point. Turn the dial and the calibration nut up or down scale the number of degrees that the set point differs from the point at which the contacts make (determined in step 1). For example, move the dial from 45 to 65 degrees for a 20 degree change in calibration.
3. Check the calibration adjustment by moving the dial up and down the scale while watching the contacts make and break. If dial is still out of calibration, repeat calibration procedure.
4. To install tamper-resisting insert on TRADELINE® model, remove screw from adjustment knob, remove knob, and install insert.

APPENDIX K

ENGINEERING CONTROL TROUBLE SHOOTING GUIDE

ENGINEERING CONTROL TROUBLESHOOTING GUIDE
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Environmental Control Type: SSDS and SVE System

Problem:

Blower Not Operating

Troubleshooting Guidance:

Confirm/Check:

By-Pass Valve Has Been Initiated to Passively Vent System to Exhaust Stack (if not, call Emer. Contact Immediately)

Electric service is operational at Site building and there is no sign of damage or vandalism to the System

Electric connections to the System are intact and have not been damaged

Status of All Alarms (see guidance sheets on alarm conditions)

If Problem Persists following Troubleshooting/Repair:

Call Emergency Site Contact Below

Emergency Contact Information

Name	***Title***	***Contact Numbers***
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)
Sotha Oum	RFLP Site Representative	218-685-6500 (office)

ENGINEERING CONTROL TROUBLESHOOTING GUIDE
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Environmental Control Type: SSDS and SVE System

Problem:

High Condensate Level/Alarm Condition

Troubleshooting Guidance:

Confirm/Check:

Electric service is operational at Site building and there is no sign of damage or vandalism to the System

Viewing pane on southern side of manifold collection header to verify condensate level

Transfer pump is operating and no blockages are present in the associated hose

If Condensate Water is Present:

Utilize transfer pump and hose to empty condensate collection header to 55-gallon drum

Ensure drain connection on manifold header (northern side) and 55-gallon drum are closed/sealed.

If Problem Persists following Troubleshooting/Repair:

Call Emergency Site Contact Below

Emergency Contact Information

Name	***Title***	***Contact Numbers***
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
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ENGINEERING CONTROL TROUBLESHOOTING GUIDE
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Environmental Control Type: SSDS and SVE System

Problem:

Low Vacuum Alarm Condition

Troubleshooting Guidance:

Confirm/Check:

Electric service is operational at Site building and there is no sign of damage or vandalism to the System

Condensate Level

Status of Particulate Filter

Status of Piping and System Connections

If Problem Persists following Troubleshooting/Repair:

Call Emergency Site Contact Below

Emergency Contact Information

Name	***Title***	***Contact Numbers***
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)
Sotha Oum	RFLP Site Representative	212-685-6500 (office)

ENGINEERING CONTROL TROUBLESHOOTING GUIDE
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Environmental Control Type: SSDS and SVE System

Problem:

High Effluent Temperature Alarm Condition

Troubleshooting Guidance:

Confirm/Check:

Electric service is operational at Site building and there is no sign of damage or vandalism to the System

Status of Temperature Gauge

Status of Particulate Filter

Status of Piping and System Connections

If Problem Persists following Troubleshooting/Repair:

Call Emergency Site Contact Below

Emergency Contact Information

Name	***Title***	***Contact Numbers***
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)
Sotha Oum	RFLP Site Representative	212-685-6500 (office)

ENGINEERING CONTROL TROUBLESHOOTING GUIDE
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Environmental Control Type: SSDS and SVE System

Problem:

High System Enclosure Temperature Alarm Condition

Troubleshooting Guidance:

Confirm/Check:

Electric service is operational at Site building and there is no sign of damage or vandalism to the System

Status of Temperature Gauge

Status of Particulate Filter

Status of Piping and System Connections

If Problem Persists following Troubleshooting/Repair:

Call Emergency Site Contact Below

Emergency Contact Information

Name	***Title***	***Contact Numbers***
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)
Sotha Oum	RFLP Site Representative	212-685-6500 (office)

ENGINEERING CONTROL TROUBLESHOOTING GUIDE
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Environmental Control Type: Site Cover System

Problem:

Breech in Cover System

Troubleshooting Guidance:

Consult Excavation Work Plan and Site Management Plan to verify location and cover system type

Confirm/Check:

No leaks or spills are draining into the breech of the cover system.

No odors or vapors are escaping from the breech of the cover system.

Following Troubleshooting/Repair:

Call Emergency Site Contact Below to Report Condition

Emergency Contact Information

Name	***Title***	***Contact Numbers***
Dustin Kapson	AKRF Project Manager	646-388-9767 (office), 646-823-5144 (cell)
Marc Godick	AKRF Project Director	914-922-2356 (office), 917-991-4030 (cell)
James Rinzler	Owner's Representative	212-685-6500 (office)
Sotha Oum	RFLP Site Representative	212-685-6500 (office)

APPENDIX L
ENGINEERING CONTROL MAINTENANCE LOG

SSDS/SVE System Maintenance Log
FORMER NESSEN LAMPS SITE
3200 Jerome Avenue, Bronx NY

Date	Time	Location	Reason for maintenance	Error message	Restart successful?	Description of persistant problem(s)	Modification to system?	Photograph or sketch of problem/modification
MM/DD/YY	HH:MM	Basement	Fan shut down.	High Temperature Alarm	Yes	Enclosure temperature switche tripped, caused by high ambient temperature. Discussed increasing temperature switch range with NES.	NA	NA
MM/DD/YY	HH:MM	Entire site	Quarterly inspection	NA	NA	NA; see Detailed System Monitoring Inspection Form	NA	NA