

**JIMMY'S DRY CLEANERS SITE
NASSAU COUNTY
ROOSEVELT, NEW YORK**

SITE MANAGEMENT PLAN

NYSDEC Site Number: 130080

Prepared for:

New York State Department of Environmental Conservation

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

JUNE 2020

CERTIFICATION STATEMENT

I, ANDREW VITOLINS, certify that I am currently a Qualified Environmental Professional as in defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).


_____ QEP

_____ JUNE 8, 2020 _____ DATE

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ROOSEVELT, NEW YORK

SITE MANAGEMENT PLAN

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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines

SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

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

Site Identification: Site No. 130080 Jimmy's Drycleaners Site

Institutional Controls:	1. The property may be used for commercial or industrial use;
	2. Environmental Easement
	3. All ECs must be inspected at a frequency and in a manner defined in the SMP.
Engineering Controls:	1. SVE System
	2. Perimeter Fencing
Inspections:	Frequency
1. SVE System Inspection	Monthly
Monitoring:	
1. Groundwater Monitoring Well Network	Annually
Maintenance:	
1. Perimeter Fencing	As needed
2. SVE Blower maintenance	Quarterly
Reporting:	
1. Groundwater and Treatment System Data	Annually
2. Periodic Review Report	Every 16 months*

*Frequency of PRR is 16 months for the first two reports; thereafter frequency shall be reviewed and adjusted, if deemed necessary.

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

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Jimmy's Dry Cleaners Site located in Roosevelt, New York (hereinafter referred to as the "site"). See Figure 1. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program, Site No. 130080, which is administered by New York State Department of Environmental Conservation (NYSDEC). Two operable units comprise the Jimmy's Dry Cleaners Site, the site property itself (OU-1) and the groundwater plume (OU-2). For the purpose of this SMP, both operable units are considered the "site".

The executrix of the estate of the former site owner, James Lawrence, declined to enter into an agreement with the NYSDEC to remediate the site. A figure showing the site location and boundaries of this site is provided in Figure 1. The boundaries of the site are more fully described in the metes and bounds site description (Appendix A).

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. The Environmental Easement is currently under review by the NYSDEC and will be filed once review is complete. This Easement will require compliance with this SMP and all ECs and ICs placed on the site.

This SMP was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required

by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

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

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

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

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Environmental Easement for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

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

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

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

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

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

Table 1-1: Notifications*

Name	Contact Information
Heidi Dudek	(518) 402-0193 - heidi.dudek@dec.ny.gov

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

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located in Roosevelt, Suffolk County, New York and is identified as Section 55 Block 402 and Lot 11602 on the Nassau County Tax Map (see Figure 2). OU-1 is an approximately 0.25-acre area bounded by Nassau Road to the east, a Town of Hempstead-owned lot to the north, and a private lot to the west and south. The boundaries of the site are more fully described in Appendix A – Metes and Bounds. OU-2 is the groundwater contamination plume between Davis Street and West Wilton Street. (see Figure 2 – Site Layout Map). The owner of the site parcel at the time of issuance of this SMP is:

The executrix of the estate of James Lawrence, deceased former owner.

2.2 Physical Setting

2.2.1 Land Use

The Site consists of the following: The Soil Vapor Extraction (SVE) system, its enclosure, and fencing that was constructed as part of the remedy for OU-1, and a site perimeter fence. There are no other structures at the site. The balance of the site is covered with gravel or remnants of concrete slabs on grade. The dry cleaner has been shut down since November 1998. OU-2 includes the groundwater plume beneath a portion of the adjoining neighborhood, which consists of numerous residences and commercial buildings as well as roadways and rights-of-way. The Site is zoned commercial.

The properties adjoining the Site and in the vicinity of the Site primarily include commercial and residential properties. The properties immediately south of the Site include commercial properties; the properties immediately north of the Site include

residential properties; the properties immediately east of the Site include commercial properties; and the properties to the west of the Site include residential properties.

2.2.2 Geology

Soils encountered at the site from the ground surface to depths of up to 120 feet below ground surface (bgs) consist of brown and light brown, medium to fine grain sands, with varying amounts of sub-rounded gravel, and some areas of silt consistent with Pleistocene deposits found in the Western Long Island area. Review of the regional hydrogeology and site-specific groundwater elevations indicates that groundwater generally flows in a southerly direction. A geologic cross section is shown in Figure 3 (and location in Figure 4). Site specific boring logs are provided in Appendix D.

2.2.3 Hydrogeology

The soil-groundwater interface is typically encountered at approximately 20 feet bgs within the glacial deposits. There are three primary water bearing aquifers underlying Long Island. These aquifers (Glacial Deposits, Magothy, and Raritan) are considered to be hydraulically connected, with the Glacial and Magothy contributing recharge to the underlying Raritan aquifer. Groundwater samples were collected at depths ranging from the water table (20 feet bgs) down to 120 feet bgs during the various stages of investigation. Groundwater monitoring well construction logs are provided in Appendix D.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

Dry cleaning activities occurred at the site from an unknown date until 1998. In 1988, the NCDOH identified that the dry-cleaning operations and hazardous material storage at Jimmy's Dry Cleaners presented a risk to public health and the environment.

This conclusion was based on the observation of poor housekeeping practices; specifically, leaking dry cleaning equipment and inappropriate hazardous waste storage practices. The NCDOH also noted the presence of an unregistered below-grade fuel oil tank and potential for discharge of hazardous materials to a dry well located near the dry-cleaning facility. Investigations identified elevated levels of chlorinated VOCs in the soil, groundwater, soil gas, and indoor air near the dry cleaner and down-gradient of the site.

A Remedial Investigation (RI) was prepared to define the nature and extent of any contamination resulting from previous activities at the site (Shaw, 2003). The RI was conducted between August 2001 and December 2002.

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site required remediation.

The primary contaminant of concern is tetrachloroethene or PCE. The improper waste disposal and housekeeping practices of the former dry cleaner caused the release of PCE into soil and groundwater at the site. The contamination contributed to impacts to soil gas and indoor air.

Chemical concentrations are reported in parts per billion (ppb) for water, parts per million (ppm) for soil, milligrams per cubic meter (mg/m³) for soil gas and micrograms per cubic meter (ug/m³) for indoor air samples. For comparison purposes, where applicable, SCGs are provided for each medium.

Soil

Soil sampling performed on site identified elevated concentrations of PCE in shallow (0-4 feet) and deep (18 - 20 feet) soils (33 ppm and 330 ppm respectively) near the dry-cleaning equipment. The SCG for PCE in soil is 1.4 ppm. The distribution of the chemical constituents of concern in soil confirm that a loss of dry cleaning chemicals occurred within or near the building and migrated through the unsaturated soils to the water table.

Groundwater

Groundwater sampling identified extensive impacts to the groundwater down-gradient from the site. The groundwater impacts within OU-1 are primarily a result of PCE (up to 15,000 ppb) that was identified at depths of down to approximately 120 feet below grade, approximately 300 feet downgradient of the site. The groundwater standard for PCE is 5 ppb. Groundwater impacts extending beyond the limits of OU-1, approximately 3,400 feet to the south (down-gradient) of the site, are part of OU-2. Concentrations of PCE are highest in the shallower depths close to the site. A monitoring location to the north and up-gradient of the site did not identify the presence of PCE in groundwater, confirming the site as the source of the PCE.

Soil Gas

A soil gas survey identified elevated concentrations of VOCs (over 26,000 mg/m³) in the vadose zone (above the water table) on-site. The most elevated concentrations were identified in the northwest corner of the building near the dry-cleaning equipment. Additional elevated areas of VOCs in the soil gas were identified near the entrance/egress to the building and near the dry well located to the northeast of the building. The soil gas data confirmed that a loss of dry cleaning chemicals to soils occurred in each of these areas, resulting in soil and groundwater impacts.

Indoor Air

Indoor air monitoring identified PCE in air above SCGs in a former Deli and residence near the site. A soil vapor extraction (SVE) Interim Remedial Measure designed to inhibit the migration of chemical constituents in unsaturated soils was implemented and was successful in reducing concentrations of PCE in air at both locations.

Interim Remedial Measure

An Interim Remedial Measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. During the Remedial Investigation of OU-1, high levels of PCE vapor were found

within the site building and a nearby basement which prompted the NYSDEC to require the implementation of an IRM. In July 2002, an IRM was implemented at the site to reduce concentrations of VOCs in the vadose zone of the area including the former Deli (located at the site in the southern portion of the former dry cleaning building) and neighbouring residences. The IRM included an interim SVE system designed to reduce VOC soil vapor concentrations in the area including the former Deli and neighbouring residences. The interim SVE system was comprised of a 1.5 HP vacuum extraction blower, two vapor-phase carbon canisters and seven shallow vapor extraction wells connected by a 2-inch diameter schedule 80 PVC trunk line. The vapor extraction wells varied in total depth from five to ten feet below grade, each well includes three to five feet of well screen. The SVE system was operated from August 7, 2002 until it was replaced by the a new SVE system as part of the final remedy. This SVE system had been successful in reducing indoor air concentrations of PCE to acceptable concentrations.

A Final Feasibility Study Report was prepared for OU-1 in January 2004 and the NYSDEC Record of Decision (ROD) for the site was issued in March 2004.

A Feasibility Study Report was prepared for OU-2 in November 2007 and the NYSDEC Record of Decision (ROD) for OU-2 was issued in March 2008. The remediation goals for this operable unit are to eliminate or reduce to the extent practicable:

1. Exposures of persons at or around the site to PCE and its degradation products in the groundwater;
2. The release of contaminants from groundwater into the indoor air through soil vapor.
3. Further, the remediation goals for the site include attaining to the extent practicable:
 - a. Ambient groundwater quality standards.

Remedial Actions

The following is a summary of the Remedial Actions (RA) performed at the OU-1 site in accordance with the ROD.

1. A pilot scale study was conducted to confirm that conditions at the site are suitable for in-situ chemical oxidation (ISCO) of groundwater contamination. The results of the pilot study confirmed that ISCO was a viable treatment for the site groundwater.
2. A remedial design program was implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of a soil excavation, chemical oxidation, and SVE remedy in accordance with the ROD.
3. Soil in the source area beneath the former dry cleaner was excavated and disposed off-site in accordance with local, state, and federal regulations.
4. A more extensive SVE system (replacing the SVE system constructed as an Interim Remedial Measure) was installed. This system consists of three vapor extraction wells to address the source area soils, and six vapor extraction wells to address soil/soil gas/indoor air near adjacent residences. The SVE system includes off-gas treatment to meet applicable discharge requirements.
5. A full-scale ISCO remedy utilizing sodium permanganate was designed and implemented. The remedy included the installation of an injection array and manifold at the bottom of the OU-1 source removal soil excavation prior to backfill. This was followed by the injection of sodium permanganate through the source area treatment array.
6. Imposition of an institutional control in the form of an environmental easement that will: (a) require compliance with the approved site management plan, (b) limit the use and development of the property to commercial or industrial uses only; (c) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Nassau County Department of Health; and, (d) require the property owner to complete and submit to the NYSDEC an annual certification.
7. An annual certification will be prepared and submitted by a professional engineer or environmental professional acceptable to the Department, which will certify that the institutional controls and engineering controls put in place, are unchanged from the previous certification and nothing has occurred that would impair the ability of the

control to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or site management plan.

8. The operation of the SVE remedy will continue until the remedial objectives have been achieved or the NYSDEC decides that it is no required to protect public health and the environment . Continued monitoring of groundwater, soil gas, and air will be performed until remedial goals are met.

Remedial activities for OU-1 were completed at the site between June 2015 and May 2016. Remedial activities for OU-2 were completed in December 2017.

A Feasibility Study Report was prepared for OU-2 in November 2007 and the NYSDEC Record of Decision (ROD) for OU-2 was issued in March 2008. The goals for the remedial program in the ROD were established through the remedy election process stated in 6NYCRR Part 375. The remediation goals for this site are to eliminate or reduce to the extent practicable:

1. Exposures of persons at or around the site to PCE and its degradation products in the groundwater;
2. The release of contaminants from groundwater into the indoor air through soil vapor.
3. Further, the remediation goals for the site include attaining to the extent practicable:
 - a. Ambient groundwater quality standards.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Records of Decision dated March 2004 (OU1) and March 2008 (OU2) are as follows:

Groundwater

RAOs for Public Health Protection

- Prevent contact with, or inhalation of, chlorinated VOCs in groundwater.

RAOs for Environmental Protection

- Attain, to the extent practical, ambient groundwater quality standards.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Attain, to the extent practicable, the Department's Soil Cleanup Objectives (SCO) for Unrestricted Use and Residential ("NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives").

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.
- Eliminate or reduce to the extent practicable exposures of construction and/or utility workers at or around the site to chlorinated VOCs in soil vapor.

2.5 Remaining Contamination

2.51 – Soil

Site soils were excavated to the specified limits that coincided with historic elevated levels of PCE in unsaturated subsurface soil; however there may be remaining PCE contamination in soil located below the water table within the excavation area (Figure 2). Any excavation in this area will be subject to the Excavation Work Plan provided in Appendix L of this SMP.

2.5.2 Groundwater

Chlorinated VOCs (CVOCs) remain in the groundwater at and downgradient (south) of the site. The primary contaminant of concern is PCE. Tables 1 and 2 and Figure 5 summarize the results of all samples of groundwater that exceed the SCGs after completion of the remedial action. A majority of exceedances are to the south of the site, with the greatest distance from the site at monitoring well cluster MW-3S and MW-3D, approximately 3,200 feet south of the site.

2.5.3 Soil Vapor

There are currently no on-site structures that would be affected by soil vapor intrusion. Sampling data indicates that there are currently no off-site structures that are affected by soil vapor intrusion. A Soil Vapor Extraction (SVE) System was installed (replacing the previous SVE system installed as part of the Interim Remedial Measure) at the site as part of the remedy and is operational. The SVE System must continue to operate to mitigate any future soil vapors into new on-site construction. The only exception to this would be if a new building is constructed on-site with built-in vapor intrusion mitigation. Operation and maintenance of the SVE System shall continue in accordance with Section 4.0.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

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

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the ROD to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to commercial and industrial uses only. Adherence to these ICs on the site is required by the Environmental Easement, which is currently under review by the NYSDEC, and will be implemented under this SMP. The Environmental Easement will be filed by the NYSDEC and amended to this SMP. ICs

identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 2. These ICs are:

- The property may be used for: commercial or industrial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property (which includes OU-1 and OU-2) is prohibited without necessary water quality treatment as determined by the NYSDOH or the Nassau 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.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- 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 the Environmental Easement.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 2, and any potential impacts that are identified must be monitored or mitigated.

3.3 Engineering Controls

3.3.1 Soil Vapor Extraction System

An SVE System was installed in April 2016 at the site as part of the remedy. The System was started on April 27, 2016. The SVE system is comprised of the following:

- Nine soil vapor extraction wells;
- Buried SVE soil vapor extraction piping system to convey the recovered vapor to the SVE treatment system;
- Five soil vapor monitoring probes utilized to monitor the performance of the soil vapor extraction wells and allow for tuning of the system to optimize performance;
- A pre-manufactured shed building that houses the SVE system;
- At the inlet to the SVE system, there is a temperature gauge, vacuum gauge, and flow meter to monitor inlet conditions;
- Flow enters a moisture separator for removal of entrained water vapor;
- From the moisture separator, a vacuum gauge is installed to monitor the downstream vacuum;
- The header branches to two inlet filter/silencer and vacuum blower. Each blower assembly also has air dilution inlet with a silencer and vacuum relief valve. At the discharge of each vacuum blower is a pressure relief valve;
- The vacuum blower discharge tees to a common header that contains a temperature gauge, pressure gauge, and flow meter;
- Flow enters two Granular Activated Carbon (GAC) vapor phase vessels that are configured in series. Sampling ports are installed on the inlet and outlet side of each vessel to allow for monitoring of breakthrough at each vessel;

- A temperature gauge and pressure gauge are located between the two GAC vessels as well as downstream of the second GAC vessel;
- Flow discharges through the SVE building to a discharge stack located 20 feet above grade to ensure dispersion of the SVE system exhaust; and
- An autodialer system that can report system status and annunciate any system alarms via a telephone connection.

In addition to the contract SVE system, the following modifications were made to the system to the SVE system to optimize operations:

- The addition of a cellular phone connection for the autodialer; and
- The addition of an automatic drain and controls for the moisture separator to allow the automatic draining of the tank and restart of the system on a high moisture separator level.

This system must be operated and maintained until the remedial objectives are obtained or until the NYSDEC determines that continued operation is not required to protect public health and the environment. Procedures for operating and maintaining the SVE system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-built drawings, signed and sealed by a professional engineer, are included in Appendix E – Operations and Maintenance Manual. Figure 2 shows the location of the ECs for the site.

3.3.2 Criteria for Completion of Remediation/Termination of Remedial Systems

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

3.3.2.1 - Soil Vapor Extraction System

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

3.3.2.2 - Monitoring Wells associated with Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC with consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the site SCGs, or have become asymptotic at an acceptable level over an extended period. In the event that monitoring data indicates that monitoring for natural attenuation may no longer be required, a proposal to discontinue the system will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix F.

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

- Sampling and analysis of groundwater;
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

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

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site – wide Inspection

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix G – Site Management Forms. 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; and
- Confirm that site records are up to date.

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

- Whether ECs 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; and

- If site records are complete and up to date; and

Reporting requirements are outlined in Section 7.0 of this plan.

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

4.3 Treatment System Monitoring and Sampling

4.3.1 Remedial System Monitoring

Monitoring of the SVE System will be performed on a routine basis, as identified in Table 4-1 Remedial System Monitoring Requirements and Schedule (see below). Modification to the frequency or sampling requirements will require approval from the NYSDEC. A visual inspection of the complete system will be conducted during each monitoring event. Unscheduled inspections and/or sampling may take place when a suspected failure of the SVE System has been reported or an emergency occurs that is deemed likely to affect the operation of the system.

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

4.3.2 Remedial System Sampling

Samples shall be collected from the SVE System on a routine basis. Sampling locations, required analytical parameters and schedule are provided in Table 4-1 below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 4-1 – Remedial System Sampling Requirements and Schedule

Sampling Location	Analytical Parameters	Schedule
	VOC (EPA Method TO-15)	
SVE Effluent Pre-and Post-Carbon	X	Annual

Detailed sample collection and analytical procedures and protocols are provided in Appendix E – Operation and Maintenance Manual.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the monitoring well network on a routine basis. Sampling locations, required analytical parameters, and schedule are provided in Table 4-2 – Post-Remediation Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC. In addition to the groundwater samples, soil vapor samples will be collected from the SVE system vapor points to evaluate whether a potential for vapor intrusion impacts to any future on-site, or current off-site, buildings remains.

Table 4-2 – Post Remediation Sampling Requirements and Schedule

Sampling Location	Media	Analytical Parameters	Schedule
2010-MW-1I	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-2I	Groundwater	VOCs (EPA Method 8260)	Annual
ITMW-4D	Groundwater	VOCs (EPA Method 8260)	Annual
ITMW-4S	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-3D	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-3S	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-3I	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-8D	Groundwater	VOCs (EPA Method 8260)	Annual
ITMW-1S	Groundwater	VOCs (EPA Method 8260)	Annual
ITMW-1D	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-1(1)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-1(2)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-1(3)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-2(1)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-2(2)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-2(3)	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-9D	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-4S	Groundwater	VOCs (EPA Method 8260)	Annual
2010-MW-4I	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-3(1)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-3(2)	Groundwater	VOCs (EPA Method 8260)	Annual
CMT-3(3)	Groundwater	VOCs (EPA Method 8260)	Annual
SVM-1	Soil Vapor	VOCs (EPA TO-15)	Annual
SVM-2	Soil Vapor	VOCs (EPA TO-15)	Annual
SVM-3	Soil Vapor	VOCs (EPA TO-15)	Annual
SVM-4	Soil Vapor	VOCs (EPA TO-15)	Annual
SVM-5	Soil Vapor	VOCs (EPA TO-15)	Annual

Detailed sample collection and analytical procedures and protocols are provided in Appendix H – Field Activities Plan and Appendix F – Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed annually to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Monitored Natural Attenuation is the remaining remedial component for groundwater. It is expected that groundwater contaminants will attenuate over time.

The network of monitoring wells has been installed to monitor downgradient groundwater conditions at the site.

Table 4-3 summarizes the wells identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the groundwater monitoring, 27 downgradient wells are sampled to evaluate the effectiveness of the remedial system.

Table 4-3 – Monitoring Well Construction Details

WELL ID	Depth to Bottom (ft bgs)	Elevation Feet Above Mean Sea Level (AMSL)				Latitude	Longitude	Well Diameter	Type of Pump
		Top of Outer Casing	Top of PVC*	Top of Screen	Bottom of Screen				
2010-MW-1I	75	29.97	29.48	-34.52	-44.52	40.672763	-73.588755	2	bladder
2010-MW-2I	75	35.19	34.75	-29.25	-39.25	40.672656	-73.589766	2	bladder
2010-MW-3S	35	31.37	31.19	6.69	-3.31	40.671459	-73.589295	2	bladder
2010-MW-3I	75	31.61	31.28	-31.72	-41.72	40.671457	-73.589317	2	bladder
2010-MW-3D	150	32.67	32.36	-105.64	-115.64	40.671431	-73.589548	2	bladder
2010-MW-4S	35	24.01	23.64	-1.36	-11.36	40.669207	-73.588135	2	bladder
2010-MW-4I	77	23.88	23.59	-41.91	-51.91	40.66921	-73.588103	2	bladder
2010-MW-5I	75	23.97	23.66	-40.84	-50.84	40.667336	-73.587649	2	bladder
2010-MW-6I	75	26.31	25.96	-38.79	-48.54	40.667227	-73.589121	2	bladder
2010-MW-7D	148	25.61	25.2	-108.8	-118.8	40.667274	-73.588504	2	bladder
2010-MW-8D	150	27.72	27.21	-112.79	-122.79	40.671518	-73.588743	2	bladder
2010-MW-9D	150	27.25	26.93	-113.07	-123.07	40.670749	-73.58882	2	bladder
2010-MW-10D	150	27.19	26.64	-113.36	-123.36	40.668268	-73.588906	2	bladder
CMT-1S	35	26.14	25.74	-7.76	-8.26	40.671558	-73.588353	1	peristaltic
CMT-1I	60	26.14	25.74	-32.76	-33.26	40.671558	-73.588353	1	peristaltic
CMT-1D	100	26.14	25.74	-72.76	-73.26	40.671558	-73.588353	1	peristaltic
CMT-2S	35	26.33	25.89	-8.61	-9.11	40.670109	-73.587405	1	peristaltic
CMT-2I	60	26.33	25.89	-33.61	-34.11	40.670109	-73.587405	1	peristaltic
CMT-2D	100	26.33	25.89	-73.61	-74.11	40.670109	-73.587405	1	peristaltic
CMT-3S	40	26.93	26.71	-12.79	-13.29	40.669122	-73.588699	1	peristaltic
CMT-3I	65	26.93	26.71	-37.79	-38.29	40.669122	-73.588699	1	peristaltic
CMT-3D	105	26.93	26.71	-77.79	-78.29	40.669122	-73.588699	1	peristaltic
CMT-4S	30	26.39	26.01	-3.49	-3.99	40.668857	-73.58994	1	peristaltic
CMT-4I	55	26.93	26.01	-28.49	-28.99	40.668857	-73.58994	1	peristaltic
CMT-4D	95	26.93	26.01	-68.49	-68.99	40.668857	-73.58994	1	peristaltic
CMT-5S	30	26.6	26.24	-1.01	-2.01	40.665134	-73.588082	1	peristaltic
CMT-5I	53	26.6	26.24	-26.51	-27.01	40.665134	-73.588082	1	peristaltic
CMT-5D	83	26.6	26.24	-56.51	-57.01	40.665134	-73.588082	1	peristaltic
ITDGW-26	19.4	26.36	26	-	-	40.670763	-73.588636	2	peristaltic
ITMW-1S	66	26.56	26.33	-29.17	-39.17	40.671537	-73.588566	2	bladder
ITMW-1D	106	26.79	26.61	-68.89	-78.89	40.671534	-73.588594	2	bladder
ITMW-2S	51	25.45	25.26	-15.24	-25.24	40.667281	-73.588419	2	bladder
ITMW-2D	102	25.47	25.2	-66.3	-76.3	40.667278	-73.588458	2	bladder
ITMW-3S	65	25.35	25.09	-29.91	-39.91	40.663591	-73.587622	2	bladder
ITMW-3D	90	25.4	25.15	-54.85	-64.85	40.663589	-73.587639	2	bladder
ITMW-4S	65	33.85	33.61	-21.39	-31.39	40.671265	-73.591088	2	bladder
ITMW-4D	105	33.92	33.49	-61.51	-71.51	40.671267	-73.591068	2	bladder

Monitoring well construction logs are included in Appendix D of this document. The monitoring well network is shown on Figure 6.

If biofouling or silt accumulation occurs in the off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, 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 any monitoring well 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 the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.4.2 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix G - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Field Activities Plan provided as Appendix H of this document.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the site to operate and maintain the SVE System;
- Will be updated periodically to reflect changes in site conditions or the manner in which the SVE system is operated and maintained.

Further detail regarding the Operation and Maintenance of the SVE System is provided in Appendix E - Operation and Maintenance Manual. A copy of this Operation and Maintenance Manual, along with the complete SMP, is to be maintained at the site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of this SMP.

5.2 Operation and Maintenance of Soil Vapor Extraction System

Operation and maintenance of the SVE System are covered in compiled documents in Appendix E and provide instruction for the activities listed below. Cut-sheets and as-built drawings for SVE System are also provided in Appendix E.

5.2.1 System Start-Up and Testing

The system testing described in Appendix E will be conducted if, in the course of the SVE system lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.2.2 Routine System Operation and Maintenance

Routine maintenance activities will consist of the following and will be conducted on a monthly basis except where otherwise noted:

Procedure Frequency

- | | |
|--|------------|
| • Record all gauge readings in system log and field book. | Each Visit |
| • Empty Moisture Separator. | Monthly |
| • Bleed SVE lines. | Monthly |
| • Change SVE blower bearings. | 15,000 hrs |
| • Clean SVE inline filter elements. | Monthly |
| • Replace SVE inline filter elements when differential pressure across unit reaches 15 in. H ₂ O above the initial differential pressure. | |

The inspection form to be filled out during each routine activity is included in Appendix G.

5.2.3 System Monitoring Devices and Alarms

The SVE system has a remote monitoring system to indicate that the system is not operating properly. In the event that warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SVE system will be restarted. Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

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

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

According to FEMA, the site is located in an area of minimal flood hazard. There are no trees at or near the site. There is one utility pole at the site that connects electricity and telephone to the site. This pole is approximately 20 feet east of the SVE System enclosure. The conduit and lines from the pole to the equipment at the site are routed underground. In the event of system power loss due to severe weather, the system will shut down.

6.2 Green Remediation Evaluation

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

completed for the site during site management, and as reported in the Periodic Review Report (PRR).

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

6.2.2. Remedial Systems

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

6.2.3 Building Operations

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

6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and use of consumables in relation to visiting the Site in order to conduct system checks and or collect samples and shipping samples to

a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

The system will be monitored remotely for alarms in conjunction with monthly site visits.

6.2.5 Metrics and Reporting

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

6.3 Remedial System Optimization

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

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

- A new and applicable remedial technology becomes available.

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

The RSO study will focus on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

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

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 7-1 and summarized in the Periodic Review Report.

Table 7-1: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Inspection Report	Monthly
Groundwater Sampling	Annually
Periodic Review Report	Every 16 months

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC. As such, the frequency of the PRR is 16 months for the first two reports; thereafter, frequency shall be reviewed and adjusted, if deemed necessary.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;

- 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);
- 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 contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

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

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;

- Description of non-routine activities performed;
- 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).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuISTM database in accordance with the requirements found at this link <http://www.dec.ny.gov/chemical/62440.html>.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Site Management Plan is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted every 16 months to the Department or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix C - Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.

- 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, etc.), 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 in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: <http://www.dec.ny.gov/chemical/62440.html>.
- A site evaluation, which includes the following:
 - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;
 - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
 - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
 - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
 - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
 - 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 operated 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;
- Alarm conditions;
- Trends in equipment failure;
- A summary of the performance, effluent and/or effectiveness monitoring; and
- Comments, conclusions, and recommendations based on data evaluation.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

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

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*

- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and 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/Remedial Party or Owner’s/Remedial Party’s Designated Site Representative] (and if the site consists of multiple properties): [I have been authorized and designated by all site owners/remedial parties to sign this certification] for the site.”

At the end of each certifying period, as determined by the NYSDEC, the following certification will be provided to the Department:

“For each institutional identified for the site, I certify that all of the following statements are true:

- *The institutional control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*

- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement.*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner’s Designated Site Representative] for the site.”

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

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work 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 Work Plan until it has been approved by the NYSDEC.

7.4 Remedial Site Optimization Report

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

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

8.0 REFERENCES

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

NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation”.

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

NYSDEC, 2004. Record of Decision, Jimmy’s Dry Cleaners Site, Operable Unit 1. Division of Environmental Remediation. March 2004.

NYSDEC, 2008. Record of Decision, Jimmy’s Dry Cleaners Site, Operable Unit 2. Division of Environmental Remediation. March 2008.

TABLES



Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-1 (1)					CMT-1 (2)					CMT-1 (3)				
		8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/31/2018	8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/31/2018	8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/31/2018
VOCs (µg/L)																
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	0.16 J	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U,V-05	5 U	5 U
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U	10 UJ	5 UJ	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,4-Dioxane		50 R	100 U,V-05	50 U,V-16	100 U	50 U	50 R	100 U,V-05	50 U	100 U	50 U	100 R	100 U,V-05	50 U,V-16	100 U	50 U
2,2-Dichloropropane	5	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U,V-05	1 U	1 U
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	40 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	50 U	11 J	50 U	50 U	50 U	6.2 J	16 J,V-06	50 U	50 U	100 U	50 U	14 J	50 U	50 U
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U	2 U,R-05	2 U	5 U	5 U,V-05	2 U	2 U,R-05	2 U	5 U	5 U,V-05	4 U	2 U,R-05	2 U	5 U	5 U,V-05
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U,V-05	4 U	4 U	4 U	4 U	4 U,V-	8 U	4 U	4 U	4 U	4 U,V-05
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Analyzed
NS - Not Sampled

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-1 (1)					CMT-1 (2)					CMT-1 (3)				
		8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/31/2018	8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/31/2018	8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/31/2018
VOCs (µg/L)																
Chloroform	7	2 U	2 U	0.22 J	2 U	0.33 J	2 U	2 U	1.4 J	0.51 J	0.42 J	4 U	0.29 J	0.27 J	2 U	0.29 J
Chloromethane		2 UJ	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U	2 U	2 U	4 UJ	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2	2	2.3	1.4	1.3
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U,L-04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U,L-04	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	1 U	0.5 U	0.5 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	1 U,L-04	1.5 J,V-06	1 U	1 U	NA	1 U,L-04	1 U	1 U	1 U	NA	1 U,L-04	0.79 J,V-06	1 U	1 U
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U V-05	2 U	2 U	2 U	2 U	2 U V-05	4 U	2 U	2 U	2 U	2 U V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		20 UJ	20 U	20 U,V-16	20 U	20 U	20 UJ	20 U	20 U,V-20	20 U	20 U	40 UJ	20 U	20 U,V-16	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	5.8	3	1.1	0.83 J	1.9	9.2	5.2	1 U	2.1	2.9	94	33	29	33	25
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	10 U	10 U	10 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	0.63 J	0.56 J	0.66 J	0.59 J
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U
Additional Compounds																
1,4 Dioxane (by 8270D µg/L)		NA	0.14 B,J	0.057 J	NA	NA	NA	0.15 B,J	0.064 J	NA	NA	NA	0.16 B,J	0.2 U	NA	NA
Manganese (mg/L)	35	NA	0.01 U	0.01 U	0.01 U	0.002 U	NA	0.0019 J	0.025	0.01 U	0.0029	NA	0.15	0.15	0.16	0.13
Sodium (mg/L)	20	NA	120	160	260	170	NA	140	86	150	150	NA	76	92	93	87
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	3.64 ^B	NA	NA	NA	NA	5.22 ^B	NA	NA	NA	NA	4.25 ^B	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	3.13 ^B	NA	NA	NA	NA	4.75 ^B	NA	NA	NA	NA	6.29 ^B	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	8.12 ^B	NA	NA	NA	NA	10.3 ^B	NA	NA	NA	NA	8.37 ^B	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	21 ^B	NA	NA	NA	NA	26.7 ^B	NA	NA	NA	NA	31.2 ^B	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	15.8 ^B	NA	NA	NA	NA	19.5 ^B	NA	NA	NA	NA	20.6 ^B	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	2.14 ^B	NA	NA	NA	NA	2.44 ^B	NA	NA	NA	NA	1.8 ^B J	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	53.83 ^B	NA	NA	NA	NA	68.91 ^B	NA	NA	NA	NA	72.51 ^B	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.
Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-2 (1)										CMT-2 (2)					CMT-2 (3)				
		8/22/2013	4/21/2016	MW-X2-04212016 Dup of CMT-2(1)	1/19/2017	MW-X2-01192017 Dup of CMT-2(1)	8/16/2017	MW-X2-08162017 Dup of CMT-2(1)	1/30/2018	MW-X2-01302018 Dup of CMT-2(1)	8/22/2013	4/21/2016	1/18/2017	8/16/2017	1/31/2018	8/22/2013	4/21/2016	1/19/2017	8/16/2017	1/31/2018	
VOCs (µg/L)																					
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U	
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,4-Dioxane		50 R	100 U,V-16	100 U,V-16	50 U	50 U	100 U	100 U	100 U	50 U	50 R	100 U,V-16	50 U	100 U	50 U	50 R	100 U,V-16	50 U,V-16	100 U	50 U	
2,2-Dichloropropane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Acetone	50*	50 U	50 U	50 U	21 J,V-06	17 J,V-06	50 U	50 U	50 U	50 U	50 U	50 U	11 J,V-06	50 U	50 U	50 U	50 U	19 J	50 U	50 U	
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromomethane	5	2 U	2 U	2 U	2 U	2 U	5 U	5 U	5 U,V-05	5 U V-05	2 U	2 U	2 U	5 U	2 U V-05	2 U	2 U	2 U	5 U	5 U V-05	
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U,V-05	4 U V-05	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U V-05	
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	

Legend:
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Site # 1-30-080
00266415.0000



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VOCs (µg/L)																					
Chloroform	7	2 U	2 U	2 U	2 U	1.3 J	1.3 J	1.2 J	3.8	4	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Chloromethane		2 UJ	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	0.65 J	2 U	2 U	
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Cyclohexane		NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U,L-04	2 U	2 U	
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Methyl Acetate		NA	1 U,L-04	1 U,L-04	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U,L-04	1 U	1 U	1 U	1 U	NA	1 U,L-04	1.2 J,V-06	1 U	
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U,V-05	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U,V-05	
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
tert-Butyl Alcohol (TBA)		20 UJ	20 U,V-16	20 U,V-16	20 U,V-20	20 U,V-20	20 U	20 U	20 U	20 U	20 UJ	20 U,V-16	20 U,V-20	20 U	20 U	20 UJ	20 U,V-16	20 U,V-16	20 U	20 U	
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrachloroethylene	5	1 U	1 U	1 U	0.81 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Additional Compounds																					
1,4 Dioxane (by 8270D µg/L)		NA	0.16 B,J	0.16 B,J	0.045 J	0.2 U	NA	NA	NA	NA	NA	0.22 B	0.094 J	NA	NA	NA	0.2 B	0.15 J	NA	NA	
Manganese (mg/L)	35	NA	0.0016 J	0.0012 J	0.002 J	0.0023 J	0.01 U	0.01 U	0.0024 J,R-04	0.0028 J	NA	0.88	1.0	0.99	0.99	NA	3.2	3.3	3.8	3.3	
Sodium (mg/L)	20	NA	47	47	80	76	66	64	69	71	NA	66	64	67	64	NA	55	54	55	52	
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70^	NA	NA	NA	NA	NA	40.8^B	42.8^B	NA	NA	NA	NA	NA	3.49^B	NA	NA	NA	NA	2.2^B	NA	
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70^	NA	NA	NA	NA	NA	14.9^B	15.1^B	NA	NA	NA	NA	NA	4.83^B	NA	NA	NA	NA	2.64^B	NA	
Perfluoroheptanoic acid (PFHpA) (ng/L)	70^	NA	NA	NA	NA	NA	5.84^B	6.21^B	NA	NA	NA	NA	NA	5.44^B	NA	NA	NA	NA	4.17^B	NA	
Perfluorooctanoic acid (PFOA) (ng/L)	70^	NA	NA	NA	NA	NA	25.8^B	26.2^B	NA	NA	NA	NA	NA	18.1^B	NA	NA	NA	NA	16.1^B	NA	
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70^	NA	NA	NA	NA	NA	124^B	127^B	NA	NA	NA	NA	NA	12.6^B	NA	NA	NA	NA	10.6^B	NA	
Perfluorononanoic acid (PFNA) (ng/L)	70^	NA	NA	NA	NA	NA	2.78^B	2.96^B	NA	NA	NA	NA	NA	1.18^B J	NA	NA	NA	NA	1.32^B J	NA	
Total PFAS (ng/L)	70^	NA	NA	NA	NA	NA	214.12^B	220.27^B	NA	NA	NA	NA	NA	45.64^B	NA	NA	NA	NA	37.03^B	NA	

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µg/L - micrograms per liter
mg/L - milligrams per liter
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Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-3 (1)					CMT-3 (2)					CMT-3 (3)						
		8/20/2013	4/20/2016	1/18/2017	8/15/2017	1/30/2018	8/20/2013	4/20/2016	1/18/2017	8/15/2017	1/30/2018	8/20/2013	DUP-MW-X-82013 Dup of CMT-3(3)	4/20/2016	1/18/2017	8/16/2017	1/30/2018	
VOCs (µg/L)																		
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	10 U	20 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U	5 U,V-05	
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	2 U	4 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U,V-05	
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U	10 U	20 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U	
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	1 U	4 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,4-Dioxane		50 R	100 U,V-05	50 U	100 U	50 U	50 R	100 U,V-05	100 U	400 U	50 U	50 R	50 R	100 U,V-05	50 U	100 U	50 U	
2,2-Dichloropropane	5	1 U	1 U	1 U,V-05	1 U	1 U,V-05	1 U	1 U	2 U	4 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U,V-05	
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	40 U	80 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	40 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	40 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Acetone	50*	50 U	50 U	17 J	50 U	50 U	50 U	50 U	41 J,V-06	200 U	50 U	50 U	50 U	50 U	15 J,V-06	50 U	50 U	
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	20 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromomethane	5	2 U	2 U,R-05	2 U,R-05	5 U	5 U	2 U	2 U,R-05	4 U	20 U	2 U	2 U	2 U	2 U,R-05	2 U	5 U	5 U	
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	8 U	16 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	20 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
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VOCs (µg/L)																	
Chloroform	7	2 U	0.36 J	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane		2 UJ	2 U	2 UJ	2 U	2 U	2 UJ	2 U	4 U	8 U	2 U	2 UJ	2 UJ	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	1 U	1 U	0.29 J	1 U	0.16 J	1 U	1	31	9.4	14	1 U	1 U	0.42 J	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	NA	5 U	10 U	20 U	5 U	NA	NA	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	1 U	2.4 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	1 U,L-04	1 U	1 U	1 U	1 U	NA	1 U,L-04	2 U	4 U	1 U	NA	NA	1 U,L-04	1 U	1 U
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	1 U	NA	1 U	2 U	4 U	1 U	NA	NA	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	20 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	4 U	8 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U,V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U	0.5 U	1 U	2 U	0.5 U,L-04	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04
tert-Butyl Alcohol (TBA)		20 UJ	20 U	20 U	20 U	20 U	20 UJ	20 U	40 U,V-20	80 U	20 U	20 UJ	20 UJ	20 U	20 U,V-20	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	1.2	1.6	8.5	3.6	3.7	27	19	3	20 U	0.98 J	10	9.3	24	7.4	26	25
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	40 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichloroethylene	5	1 U	1 U	0.34 J	1 U	1 U	1.4	1.8	2.6	4 U	0.81 J	1 U	1 U	0.57 J	0.27 J	0.38 J	0.45 J
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds																	
1,4 Dioxane (by 8270D µg/L)		NA	0.11 B,J	0.2	NA	NA	NA	0.18 B,J	0.2 U	NA	NA	NA	NA	0.15 B,J	0.2 U	NA	NA
Manganese (mg/L)	35	NA	0.34	0.27	0.31	0.26	NA	1.5	2.6	1.1	1.0	NA	NA	0.11	0.075	0.092	0.11
Sodium (mg/L)	20	NA	75	57	68	68	NA	48	350	380	240	NA	NA	48	51	60	54
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70^A	NA	NA	NA	7.81	NA	NA	NA	NA	3.42	NA	NA	NA	NA	NA	5.07	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70^A	NA	NA	NA	4.91	NA	NA	NA	NA	10.7	NA	NA	NA	NA	NA	7.97	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70^A	NA	NA	NA	7.46	NA	NA	NA	NA	11.7	NA	NA	NA	NA	NA	7.98	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70^A	NA	NA	NA	29.8	NA	NA	NA	NA	23.8	NA	NA	NA	NA	NA	29.9	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70^A	NA	NA	NA	16.7	NA	NA	NA	NA	17	NA	NA	NA	NA	NA	24.7	NA
Perfluorononanoic acid (PFNA) (ng/L)	70^A	NA	NA	NA	1.43 J	NA	NA	NA	NA	2.01	NA	NA	NA	NA	NA	1.49 J	NA
Total PFAS (ng/L)	70^A	NA	NA	NA	68.11	NA	NA	NA	NA	68.63	NA	NA	NA	NA	NA	77.11	NA

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VOCs (µg/L)													
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U,V-05	5 U	5 U,V-05	5 U	5 U	5 U	5 U,V-05	5 U	5 U
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	0.5 U	1 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		100 U,V-05	50 U	100 U	50 U	100 U,V-16	50 U,V-06	100 U	50 U	100 U,V-05	50 U,V-16	100 U	50 U
2,2-Dichloropropane	5	1 U	1 U,V-05	1 U	1 U,V-05	1 U	1 U,V-05	1 U	1 U	1 U	1 U,V-05	1 U	1 U
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	7.5 J	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	15 J	50 U	50 U	9.7 J	25 J	50 U	50 U	50 U	15 J	50 U	50 U
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U,R-05	2 U,R-05	5 U	2 U	2 U	2 U	5 U	5 U,V-05	2 U,R-05	2 U	5 U	2 U
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U,V-05	4 U	4 U	4 U	4 U,V-05
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Analyzed
NS - Not Sampled

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-4 (1)				CMT-4 (2)				CMT-4 (3)					
		4/20/2016	1/17/2017	8/15/2017	1/30/2018	4/21/2016	1/24/2017	8/16/2017	1/31/2018	4/20/2016	1/20/2017	8/16/2017	1/31/2018		
VOCs (µg/L)															
Chloroform	7	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Chloromethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	
Cyclohexane		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U	2 U	2 U	2 U,L-04	2 U	2 U	2 U	2 U,L-04	2 U	2 U	2 U	
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,V-16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Methyl Acetate		1 U,L-04	1 U	1 U	1 U	1 U	1 U,L-04	1.2 J,V-06	1 U	1 U	1 U,L-04	1.2 J,V-06	1 U	1 U	
Methyl Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U,V-05	
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
tert-Butyl Alcohol (TBA)		20 U	20 U	20 U	20 U	20 U,V-16	5.1 J,V-06	20 U	5.1 J	20 U	20 U,V-16	20 U	2.6 J	J	
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrachloroethylene	5	1 U	1 U	0.83 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J	1 U	0.18 J	1 U	1 U	
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
Additional Compounds															
1,4 Dioxane (by 8270D µg/L)		0.13 B,J	0.2 U	NA	NA	0.16 B,J	NA	NA	NA	0.17 B,J	NA	NA	NA	NA	
Manganese (mg/L)	35	0.47	0.31	0.29	0.15	0.83	1.2	2.6	0.91	0.29	0.36	0.39	0.33		
Sodium (mg/L)	20	76	84	80	68	10	14	19	14	35	39	40	36		
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	4.59	NA	NA	NA	2 ^B U	NA	NA	NA	2.75 ^B	NA		
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	4.39	NA	NA	NA	2 ^B U	NA	NA	NA	4.31 ^B	NA		
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	6.89	NA	NA	NA	2 ^B U	NA	NA	NA	4.32 ^B	NA		
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	25.5	NA	NA	NA	1.93 J	NA	NA	NA	8.67 ^B	NA		
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	20.8	NA	NA	NA	1.46 J	NA	NA	NA	2.31 ^B	NA		
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	2.03	NA	NA	NA	2 ^B U	NA	NA	NA	2 ^B U	NA		
Total PFAS (ng/L)	70 ^A	NA	NA	64.20	NA	NA	NA	3.39	NA	NA	NA	22.36 ^B	NA		

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.

Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-5 (1)					CMT-5 (2)				CMT-5 (3)					
		8/20/2013	4/21/2016	1/17/2017	8/14/2017	1/29/2018	4/21/2016	1/17/2017	8/14/2017	1/29/2018	8/20/2013	4/21/2016	1/16/2017	8/15/2017	1/29/2018	
VOCs (µg/L)																
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U	5 U,V-05
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U,V-05
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	2 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		50 R	100 U,V-16	50 U	100 U	50 U	100 U,V-16	50 U	100 U	50 U	50 R	100 U,V-16	50 U	100 U	50 U	50 U
2,2-Dichloropropane	5	1 U	1 U	1 U,V-05	1 U,R-05	1 U,V-05	1 U	1 U,V-05	1 U,V-05	1 U,V-05	1 U	1 U	1 U,V-05	1 U	1 U	1 U,V-05
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	50 U	20 J	50 U	50 U	7.2 J	21 J	50 U	50 U	50 U	4.9 J	26 J	50 U	50 U	50 U
Acrylonitrile		5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U	2 U	2 U,R-05	5 U,R-05	2 U	2 U	2 U,R-05	5 U,R-05	2 U	2 U	2 U	2 U,R-05	5 U	2 U	2 U
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	5 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
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UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
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Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	CMT-5 (1)					CMT-5 (2)				CMT-5 (3)					
		8/20/2013	4/21/2016	1/17/2017	8/14/2017	1/29/2018	4/21/2016	1/17/2017	8/14/2017	1/29/2018	8/20/2013	4/21/2016	1/16/2017	8/15/2017	1/29/2018	
VOCs (µg/L)																
Chloroform	7	2 U	2 U	0.86 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane		2 U	2 U	2 U	2 U, V-05	2 U	2 U	2 U	2 U, V-05	2 U	2 UJ	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	0.21 J	1 U	0.27 J	0.3 J	1 U	1 U	1 U	1 U	1.5	
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 L-04, V-05	0.5 U	0.5 U	0.5 U	0.5 L-04, V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	2 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	1 U, L-04	1 U	1 U, L-04	1 U	1 U, L-04	1 U	1 U, L-04	1 U	1 U, L-04	1 U	1 U, L-04	1 U	1 U	1 U
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U	2 U, V-05	2 U	2 U	2 U	2 U, V-05	2 U	2 U	2 U	2 U	2 U, V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	2 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U, L-04	0.5 U	0.5 U	0.5 U	0.5 U, L-04	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U, L-04
tert-Butyl Alcohol (TBA)		20 UJ	20 U, V-16	20 U	20 U, V-05	20 U	20 U, V-16	20 U	20 U, V-05	20 U	20 UJ	20 U, V-16	20 U	20 U	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U, V-05	0.5 U	0.5 U	0.5 U	0.5 U, V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	1 U	1 U	1 U	1 U	1 U	63	26	36	45	4.6	12	4.9	85	91	
Tetrahydrofuran		10 U	10 U	10 U	10 U, V-05	10 U	10 U	10 U	10 U, V-05	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U, V-05	0.5 U	0.5 U	0.5 U	0.5 U, V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U, V-05	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U, V-05	2 U	2 U	2 U	2 U, V-05	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	0.35 J	1 U	0.46 J	0.52 J	1 U	1 U	1 U	1.6	1.5	
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds																
1,4 Dioxane (by 8270D µg/L)		NA	0.11 B, J	0.2 U	NA	NA	0.17 B, J	0.2 U	NA	NA	NA	0.13 B, J	0.2 U	NA	NA	NA
Manganese (mg/L)	35	NA	0.0045 J	0.01 U	0.01 U	0.002 U	0.0032 J	0.0059 J	0.0035 J	0.017	NA	0.0046 J	0.0025 J	0.0044 J	0.0057 J	
Sodium (mg/L)	20	NA	35	55	49	48	34	45	51	45	NA	46	59	46	46	
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	5.1	NA	NA	NA	5.14	NA	NA	NA	NA	5.7	NA	
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	5.14	NA	NA	NA	4.31	NA	NA	NA	NA	4.68	NA	
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	6.58	NA	NA	NA	7.66	NA	NA	NA	NA	8.02	NA	
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	30.5	NA	NA	NA	26.7	NA	NA	NA	NA	24.4	NA	
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	7.42	NA	NA	NA	15.8	NA	NA	NA	NA	7.65	NA	
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	0.94 J	NA	NA	NA	1.93 J	NA	NA	NA	NA	1.06 J	NA	
Total PFAS (ng/L)	70 ^A	NA	NA	NA	55.68	NA	NA	NA	61.54	NA	NA	NA	NA	51.51	NA	

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.
Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
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µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	ITMW-1S					ITMW-1D						ITMW-2S					
		8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/30/2018	8/21/2013	82113 Dup of IT-MW-1D	4/20/2016	1/19/2017	8/17/2017	2/2/2018	8/20/2013	4/21/2016	1/20/2017	8/17/2017	1/31/2018	
VOCs (µg/L)																		
1,1,1,2-Tetrachloroethane	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,1,1-Trichloroethane	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,1,2,2-Tetrachloroethane	5	5	U	0.5	U	NS	0.5	U	0.5	U	1	U	1	U	0.5	U	0.5	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,1,2-Trichloroethane	1	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,1-Dichloroethane	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,1-Dichloroethylene	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,1-Dichloropropene	5	20	U	2	U	NS	2	U	2	U	4	U	4	U	2	U	2	U
1,2,3-Trichlorobenzene	5	50	U	5	U	NS	5	U	5	U,V-05	10	U	10	U	5	U	5	U
1,2,3-Trichloropropane	0.04	20	U	2	U	NS	2	U	2	U	4	U	4	U	2	U	2	U
1,2,4-Trichlorobenzene	5	10	U	1	U	NS	1	U	1	U,V-05	2	U	2	U	1	U	1	U
1,2,4-Trimethylbenzene	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	50	UJ	5	U	NS	5	U	5	U	10	UJ	10	UJ	5	U	5	U
1,2-Dibromoethane (EDB)	5	5	U	0.5	U	NS	0.5	U	0.5	U	1	U	1	U	0.5	U	0.5	U
1,2-Dichlorobenzene	3	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,2-Dichloroethane	0.6	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,2-Dichloropropane	1	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,3,5-Trichlorobenzene		10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,3,5-Trimethylbenzene	5	10	U	1	U	NS	1	U	2	U	2	U	2	U	1	U	1	U
1,3-Dichlorobenzene	3	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,3-Dichloropropane	5	5	U	0.5	U	NS	1	U	0.5	U	1	U	1	U	0.5	U	1	U
1,4-Dichlorobenzene	3	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	1	U
1,4-Dioxane		500	R	100	U,V-05	NS	100	U	50	U	100	R	100	U,V-05	NS	NS	50	U
2,2-Dichloropropane	5	10	U	1	U	NS	1	U	1	U,V-05	2	U	2	U	1	U	NS	NS
2-Butanone (MEK)	50	200	U	20	U	NS	20	U	20	U	40	U	40	U	20	U	NS	NS
2-Chlorotoluene	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
2-Hexanone (MBK)	50*	100	U	10	U	NS	10	U	10	U	20	U	20	U	10	U	NS	NS
4-Chlorotoluene	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
4-Methyl-2-pentanone (MIBK)		100	U	10	U	NS	10	U	10	U	20	U	20	U	10	U	NS	NS
Acetone	50*	500	U	50	U	NS	50	U	50	U	100	U	100	U	50	U	NS	NS
Acrylonitrile		50	U	5	U	NS	5	U	5	U	10	U	10	U	5	U	NS	NS
Benzene	1	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
Bromobenzene	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
Bromochloromethane	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
Bromodichloromethane	50*	5	U	0.5	U	NS	0.5	U	0.5	U	1	U	1	U	0.5	U	NS	NS
Bromoform	50*	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
Bromomethane	5	20	U	2	U,R-05	NS	5	U	2	U	4	U	4	U	2	U,R-05	5	U,V-05
Carbon Disulfide		40	U	4	U	NS	4	U	4	U	8	U	8	U	4	U	4	U,V-05
Carbon Tetrachloride	5	50	U	5	U	NS	5	U	5	U	10	U	10	U	5	U	5	U
Chlorobenzene	5	10	U	1	U	NS	1	U	1	U	2	U	2	U	1	U	NS	NS
Chlorodibromomethane		5	U	0.5	U	NS	0.5	U	0.5	U	1	U	1	U	0.5	U	NS	NS
Chloroethane	5	20	U	2	U	NS	2	U	2	U	4	U	4	U	2	U	2	U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
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** - Applies to sum of cis- and trans-1,3-Dichloropropene.
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B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
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Site # 1-30-080
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SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	ITMW-1S					ITMW-1D						ITMW-2S				
		8/21/2013	4/20/2016	1/19/2017	8/16/2017	1/30/2018	8/21/2013	82113 Dup of IT-MW-1D	4/20/2016	1/19/2017	8/17/2017	2/2/2018	8/20/2013	4/21/2016	1/20/2017	8/17/2017	1/31/2018
VOCs (µg/L)																	
Chloroform	7	20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U	2 U	2 U	4 U	2 U	2 U
Chloromethane		20 UJ	2 U	NS	2 U	2 U	4 UJ	4 UJ	2 U	NS	NS	2 U	2 UJ	2 U	4 U	2 U	2 U
cis-1,2-Dichloroethylene	5	10 U	0.39 J	NS	2 U	1 U	2 U	2 U	0.39 J	NS	NS	1 U	1 U	0.41 J	2.2	1.4	1.5
cis-1,3-Dichloropropene	0.4**	5 U	0.5 U	NS	0.5 U	5 U	1 U	1 U	0.5 U	NS	NS	5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
Cyclohexane		NA	5 U	NS	5 U	5 U	NA	NA	5 U	NS	NS	5 U	NA	5 U	10 U	5 U	5 U
Dibromomethane	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U	2 U	2 U	4 U, L-04	2 U	2 U
Diethyl Ether		20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U	2 U	2 U	4 U	2 U	2 U
Diisopropyl Ether (DIPE)		5 U	0.5 U	NS	0.5 U	0.5 U	1 U	1 U	0.5 U	NS	NS	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
Ethylbenzene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
Hexachlorobutadiene	0.5	5 U	0.5 U	NS	0.6 U	0.6 U	1 U	1 U	0.5 U	NS	NS	0.6 U	0.5 U	0.5 U	1 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	10 U	1 U	NS	1 U	2 U	2 U	2 U	1 U	NS	NS	2 U	1 U	1 U	2 U	1 U	1 U
m+p Xylene	5	20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U	2 U	2 U	4 U	2 U	2 U
Methyl Acetate		NA	1 U, L-04	NS	1 U	1 U	NA	NA	1 U, L-04	NS	NS	1 U, L-04	NA	1 U, L-04	1.5 J, V-06	1 U, L-04	1 U
Methyl Cyclohexane		NA	1 U	NS	1 U	1 U	NA	NA	1 U	NS	NS	1 U	NA	1 U	2 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
Methylene Chloride	5	50 U	5 U	NS	5 U	5 U	10 U	10 U	5 U	NS	NS	5 U	5 U	5 U	10 U	5 U	5 U
Naphthalene	10*	20 U	2 U	NS	2 U	2 U, V-05	4 U	4 U	2 U	NS	NS	2 U, V-05	2 U	2 U	4 U	2 U	2 U, V-05
n-Butylbenzene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
n-Propylbenzene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
o-Xylene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		10 U	1 U	NS	1 U	2 U	2 U	2 U	1 U	NS	NS	2 U	1 U	1 U	2 U	1 U	1 U
sec-Butylbenzene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
Styrene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		5 U	0.5 U	NS	0.5 U	0.5 U, L-04	1 U	1 U	0.59	NS	NS	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		200 UJ	20 U	NS	20 U	20 U	40 UJ	40 UJ	20 U	NS	NS	20 U	20 UJ	20 U, V-16	40 U, V-16	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		5 U	0.5 U	NS	0.5 U	0.5 U	1 U	1 U	0.5 U	NS	NS	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
tert-Butylbenzene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
Tetrachloroethylene	5	260	76	NS	6.4	11	58	58	26	NS	NS	18	9.8	7.2	96	130	100
Tetrahydrofuran		100 U	10 U	NS	10 U	10 U	20 U	20 U	10 U	NS	NS	10 U	10 U	10 U	20 U	10 U	10 U
Toluene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
trans-1,2-Dichloroethylene	5	10 U	1 U	NS	1 U	1 U	2 U	2 U	1 U	NS	NS	1 U	1 U	1 U	2 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	5 U	0.5 U	NS	0.5 U	0.5 U	1 U	1 U	0.5 U	NS	NS	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U, V-05	2 U	2 U	4 U	2 U	2 U
Trichloroethylene	5	10 U	0.7 J	NS	1 U	1 U	2 U	2 U	0.23 J	NS	NS	1 U	1 U	0.24 J	1.9 J	1.7	1.5
Trichlorofluoromethane (Freon 11)	5	20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U	2 U	2 U	4 U	2 U	2 U
Vinyl Chloride	2	20 U	2 U	NS	2 U	2 U	4 U	4 U	2 U	NS	NS	2 U	2 U	2 U	4 U	2 U	2 U
Additional Compounds																	
1,4 Dioxane (by 8270D µg/L)		NA	0.17 B, J	NS	NA	NA	NA	NA	0.16 B, J	NS	NS	NA	NA	0.15 B, J	0.07 J	NA	NA
Manganese (mg/L)	35	NA	0.02 J	NS	2.4	0.37	NA	NA	0.95 J	NS	NS	1.7	NA	0.0046 J	0.046	0.0071 J	0.002 U
Sodium (mg/L)	20	NA	50	NS	87	65	NA	NA	53	NS	NS	130	NA	46	45	45	42
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70^A	NA	NA	NA	3.42^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	5.56	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70^A	NA	NA	NA	3.46^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	5.44	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70^A	NA	NA	NA	6.53^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	10.7	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70^A	NA	NA	NA	23.2^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	33.3	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70^A	NA	NA	NA	24.8^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	24.3	NA
Perfluorononanoic acid (PFNA) (ng/L)	70^A	NA	NA	NA	2.33^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	1.91 J	NA
Total PFAS (ng/L)	70^A	NA	NA	NA	63.74^B	NA	NA	NA	NA	NS	NS	NA	NA	NA	NA	81.21	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.
Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	ITMW-2D					ITMW-3S					ITMW-3D				
		8/20/2013	4/21/2016	1/20/2017	8/17/2017	1/31/2018	8/22/2013	4/22/2016	1/17/2017	8/15/2017	1/29/2018	8/22/2013	4/22/2016	1/17/2017	8/14/2017	1/30/2018
VOCs (µg/L)																
1,1,1,2-Tetrachloroethane	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	120 U	100 U	120 U,V-05	40 U	5 U	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U,V-05
1,2,3-Trichloropropane	0.04	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	25 U	20 U	25 U	40 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	5	25 U	20 U	25 U	40 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05
1,2-Dibromo-3-chloropropane (DBCP)	0.04	120 UJ	100 U	120 U	100 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U
1,2-Dibromoethane (EDB)	5	12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U
1,4-Dichlorobenzene	3	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		1200 R	2000 U,V-16	1200 U,V-16	2000 U	50 U	50 R	100 U,V-16	50 U	100 U	50 U	50 R	100 U,V-16	50 U	100 U	100 U
2,2-Dichloropropane	5	25 U	20 U	25 U,V-05	20 U	1 U	1 U	1 U	1 U,V-05	1 U,V-05	1 U,V-05	1 U	1 U	1 U,V-05	1 U,V-05	1 U,V-05
2-Butanone (MEK)	50	500 U	400 U	500 U	400 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	250 U	200 U	250 U	200 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		250 U	200 U	250 U	200 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	1200 U	1000 U	1200 U	1000 U	50 U	50 U	5.1 J	21 J	50 U	50 U	50 U	6.8 J	17 J	50 U	50 U
Acrylonitrile		120 U	100 U	120 U	100 U	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U,V-05	5 U
Benzene	1	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	50 U	40 U	50 U	100 U,R-05	2 U,V-05	2 U	2 U	2 U,R-05	5 U,R-05	2 U	2 U	2 U	2 U,R-05	5 U,R-05	5 U
Carbon Disulfide		100 U	80 U	100 U	80 U	4 U,V-05	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Carbon Tetrachloride	5	120 U	100 U	120 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
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UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
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E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Analyzed
NS - Not Sampled

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	ITMW-2D						ITMW-3S					ITMW-3D				
		8/20/2013	4/21/2016	1/20/2017	8/17/2017	1/31/2018	8/22/2013	4/22/2016	1/17/2017	8/15/2017	1/29/2018	8/22/2013	4/22/2016	1/17/2017	8/14/2017	1/30/2018	
VOCs (µg/L)																	
Chloroform	7	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane		50 UJ	40 U	50 U	40 U	2 U	2 UJ	2 U	2 U	2 U	2 U,V-05	2 U	2 UJ	2 U	2 U	2 U,V-05	2 U
cis-1,2-Dichloroethylene	5	25 U	20 U	7.2 J	5.8 J	6.8 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J
cis-1,3-Dichloropropene	0.4**	12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		NA	100 U	120 U	100 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U
Dibromomethane	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	50 U	40 U	50 U,L-04	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diethyl Ether		50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04, V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04, V-05	0.5 U	0.5 U
Ethylbenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	12 U	10 U	12 U	12 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	25 U	20 U	25 U	20 U	2 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
m+p Xylene	5	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	20 U,L-04	24 J,V-06	20 U,L-04	1 U	NA	1 U,L-04	1 U	1 U,L-04	1 U	NA	1 U,L-04	1 U	1 U,L-04	1 U	1 U
Methyl Cyclohexane		NA	20 U	25 U	20 U	1 U	NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	120 U	100 U	120 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	50 U	40 U	50 U	40 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05	2 U
n-Butylbenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		25 U	20 U	25 U	20 U	2 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		500 UJ	400 U,V-16	500 U,V-16	400 U	20 U	20 UJ	20 U,V-16	20 U	20 U,V-05	20 U	20 UJ	20 U,V-16	20 U	20 U,V-05	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U
tert-Butylbenzene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	1500	1100	1200	930	720	1.5	4.3	5.6	26	11	1 U	2.7	3.2	9.8	9.5	
Tetrahydrofuran		250 U	200 U	250 U	200 U	10 U	10 U	10 U	10 U	10 U,V-05	10 U	10 U	10 U	10 U	10 U,V-05	10 U	10 U
Toluene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	25 U	20 U	25 U	20 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	12 U	10 U	12 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U
Trichloroethylene	5	25 U	5.2 J	7.0 J	20 U	5 J	1 U	1 U	1 U	0.27 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)	5	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	50 U	40 U	50 U	40 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds																	
1,4 Dioxane (by 8270D µg/L)		NA	0.46 B	0.28	NA	NA	NA	0.12 B,J	0.2 U	NA	NA	NA	0.13 B,J	0.2 U	NA	NA	NA
Manganese (mg/L)	35	NA	0.77	0.82	0.98	0.97	NA	0.01 U	0.0058 J	0.01 U	0.002	NA	0.002 U	0.0037 J	0.0034 J	0.0077 J	0.0077 J
Sodium (mg/L)	20	NA	30	36	38	38	NA	41	56	66	62	NA	33	36	52 MS-19	62	
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70^A	NA	NA	NA	2.59	NA	NA	NA	NA	3.56	NA	NA	NA	NA	4.85	NA	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70^A	NA	NA	NA	7.42	NA	NA	NA	NA	4.95	NA	NA	NA	NA	6.96	NA	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70^A	NA	NA	NA	9.4	NA	NA	NA	NA	7.63	NA	NA	NA	NA	9.14	NA	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70^A	NA	NA	NA	21.0	NA	NA	NA	NA	28.3	NA	NA	NA	NA	30	NA	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70^A	NA	NA	NA	8.85	NA	NA	NA	NA	20.1	NA	NA	NA	NA	13.4	NA	NA
Perfluorononanoic acid (PFNA) (ng/L)	70^A	NA	NA	NA	0.98 J	NA	NA	NA	NA	3.19	NA	NA	NA	NA	2.2	NA	NA
Total PFAS (ng/L)	70^A	NA	NA	NA	50.24	NA	NA	NA	NA	67.73	NA	NA	NA	NA	66.55	NA	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
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Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
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Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	ITMW-4S				ITMW-4D				2010-MW-1I					
		4/19/2016	1/18/2017	8/16/2017	1/29/2018	4/19/2016	1/18/2017	8/15/2017	2/1/2018	8/22/2013	4/20/2016	1/25/2017	8/18/2017	2/1/2018	
VOCs (µg/L)															
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	10 U	5 U	NS	20 U	5 U,V-05	
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U,V-05	
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	10 UJ	5 UJ	NS	20 U	5 U,V-05	
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	2 U	1 U	NS	4 U	1 U	
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,3-Dichloropropane	5	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
1,4-Dioxane		50 U	50 U	100 U	50 U	50 U	50 U	100 U	50 U	100 R	100 U,V-05	NS	400 U	50 U	
2,2-Dichloropropane	5	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	NS	80 U	20 U	
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	40 U	10 U	NS	40 U	10 U	
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	10 U	NS	40 U	10 U	
Acetone	50*	50 U	17 J,V-06	50 U	50 U	50 U	15 J,V-06	50 U	50 U	100 U	50 U	NS	200 U	50 U	
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	NS	20 U	5 U	
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Bromomethane	5	2 U	2 U	5 U	2 U	2 U	2 U	5 U	2 U,V-05	4 U	2 U,R-05	NS	20 U,R-05	2 U,V-05	
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U,V-05	8 U	4 U	NS	16 U	4 U	
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	NS	20 U	5 U	
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
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Site # 1-30-080
00266415.0000

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		4/19/2016	1/18/2017	8/16/2017	1/29/2018	4/19/2016	1/18/2017	8/15/2017	2/1/2018	8/22/2013	4/20/2016	1/25/2017	8/18/2017	2/1/2018	
VOCs (µg/L)															
Chloroform	7	1.3 J	0.46 J	0.59 J	0.54 J	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	0.34 J	
Chloromethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 UJ	2 U	NS	8 U	2 U	
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3.5	2.2	NS	4 U	0.27 J	
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	1 U	0.5 U	NS	2 U	5 U	
Cyclohexane		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	NS	20 U	5 U	
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.6 U	0.6 U	1 U	0.5 U	NS	2.4 U	0.6 U	
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	2 U	1 U	NS	4 U	2 U	
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U,L-04	NS	4 U, L-04	1 U,L-04	
Methyl Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	NS	4 U	1 U	
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	NS	20 U	5 U	
Naphthalene	10*	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U,V-05	4 U	2 U	NS	8 U	2 U,V-05	
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	2 U	1 U	NS	4 U	2 U	
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
tert-Butyl Alcohol (TBA)		20 U,V-05	20 U,V-20	20 U	20 U	20 U,V-05	20 U,V-20	20 U	20 U	40 UJ	20 U	NS	80 U	20 U	
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
Tetrachloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	0.39 J	1 U	88	37	NS	180	90	
Tetrahydrofuran		10 U,V-05	10 U	10 U	10 U	10 U,V-05	10 U	10 U	10 U	20 U	10 U	NS	40 U	10 U	
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	NS	4 U	1 U	
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	NS	2 U	0.5 U	
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U,V-05	
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.1	0.93 J	NS	4 U	0.21 J	
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	4 U	2 U	NS	8 U	2 U	
Additional Compounds															
1,4 Dioxane (by 8270D µg/L)		0.08 J	0.1 J	NA	NA	0.085 J	0.06 J	NA	NA	NA	0.18 B,J	NS	NA	NA	
Manganese (mg/L)	35	0.016	0.018	0.018	0.015	0.16	0.18	0.21	0.16	NA	0.0018 J	NS	0.3	0.11	
Sodium (mg/L)	20	49	51	52	50	60	54	56	51	NA	64	NS	81	95	
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	4.86	NA	NA	NA	5.66	NA	NA	NA	NS	5.56	NA	
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	6.8	NA	NA	NA	7.57	NA	NA	NA	NS	7.51	NA	
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	26.1	NA	NA	NA	10.3	NA	NA	NA	NS	9.9	NA	
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	42.4	NA	NA	NA	29.6	NA	NA	NA	NS	32.8	NA	
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	13.9	NA	NA	NA	11.9	NA	NA	NA	NS	51.1	NA	
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	3.97	NA	NA	NA	1.26 J	NA	NA	NA	NS	4.59	NA	
Total PFAS (ng/L)	70 ^A	NA	NA	98.03	NA	NA	NA	66.29	NA	NA	NA	NS	111.46	NA	

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Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-2I					2010-MW-3S					2010-MW-3I				
		8/22/2013	4/22/2016	1/24/2017	8/18/2017	2/1/2018	8/21/2013	4/19/2016	1/19/2017	8/16/2017	1/29/2018	8/21/2013	4/19/2016	1/18/2017	8/16/2017	2/1/2018
VOCs (µg/L)																
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U,V-05	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U,V-05
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U,V-05
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 UJ	5 UJ	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U,V-05
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		50 R	100 U,V-16	50 U,V-16	100 U	50 U	50 R	50 U	50 U	100 U	50 U	50 R	50 U	50 U	100 U	50 U
2,2-Dichloropropane	5	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	50 U	17 J	50 U	50 U	50 U	50 U	18 J,V-06	50 U	50 U	50 U	50 U	23 J,V-06	50 U	50 U
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U	2 U	2 U	5 U,R-05	2 U,V-05	2 U	2 U	2 U	2 U	5 U	2 U	2 U	2 U	5 U	2 U,V-05
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Analyzed
NS - Not Sampled

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-2I					2010-MW-3S					2010-MW-3I				
		8/22/2013	4/22/2016	1/24/2017	8/18/2017	2/1/2018	8/21/2013	4/19/2016	1/19/2017	8/16/2017	1/29/2018	8/21/2013	4/19/2016	1/18/2017	8/16/2017	2/1/2018
VOCs (µg/L)																
Chloroform	7	2 U	2 U	2 U	2 U	0.37 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane		2 UJ	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U	2 U	2 U	2 UJ	2 UJ	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	1 U	0.66 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U,L-04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.5 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	1 U,L-04	1.1 J,V-06	1 U,L-04	1 U,L-04	NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U,L-04	
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		20 UJ	20 U,V-16	20 U,V-16	20 U	20 U	20 UJ	20 U,V-05	20 U,V-20	20 U	20 U	20 UJ	20 U,V-05	20 U,V-20	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	1 U	0.7 J	0.91 J	1.5	1.2	1 U	1 U	1 U	1 U	1 U	9.2	4.9	2	10	3.7
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U,V-05	10 U	10 U	10 U	10 U	10 U,V-05	10 U	10 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U,V-05
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds																
1,4 Dioxane (by 8270D µg/L)		NA	0.15 B,J	0.2 U	NA	NA	NA	0.2 U	0.2 U	NA	NA	NA	0.12 J	0.089 J	NA	NA
Manganese (mg/L)	35	NA	0.013	0.079	0.027	0.011	NA	0.0054 J	0.025	0.0098 J	0.002 U	NA	0.025	0.014	0.027	0.017
Sodium (mg/L)	20	NA	42	53	53	53	NA	77	72	79	55	NA	49	48	52	51
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	5.75	NA	NA	NA	NA	4.74	NA	NA	NA	NA	4.47	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	5.73	NA	NA	NA	NA	2.65	NA	NA	NA	NA	4.97	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	14.4	NA	NA	NA	NA	6.17	NA	NA	NA	NA	12	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	37	NA	NA	NA	NA	21.4	NA	NA	NA	NA	25.8	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	35.8	NA	NA	NA	NA	6.7	NA	NA	NA	NA	17.5	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	3.32	NA	NA	NA	NA	1.10 J	NA	NA	NA	NA	2.45	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	102	NA	NA	NA	NA	42.76	NA	NA	NA	NA	67.19	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.
Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-3D					2010-MW-4S									
		8/21/2013	4/21/2016	1/18/2017	8/16/2017	2/1/2018	8/22/2013	4/19/2016	MW-X-04192016 Dup of 2010-MW-4S	1/19/2017	MW-X-01192017 Dup of 2010-MW-4S	8/17/2017	MW-X-08172017 Dup of 2010-MW-4S	1/30/2018	MW-X-01302018 Dup of 2010-MW-4S	
VOCs (µg/L)																
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U,V-05	5 U,V-05	5 U	5 U	5 U,V-05	5 U,V-05	5 U,V-05
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	1 U,V-05	1 U,V-05
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 U,V-05	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	2 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		50 R	100 U,V-16	50 U	100 U	50 U	50 R	50 U	50 U	50 U,V-16	50 U,V-16	100 U	100 U	50 U	50 U	50 U
2,2-Dichloropropane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	1 U,V-05	1 U	1 U	1 U,V-05	1 U,V-05	1 U,V-05
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	50 U	16 J,V-06	50 U	50 U	50 U	5.1 J	50 U	16 J	11 J	50 U	50 U	50 U	50 U	50 U
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	2 U	2 U	2 U	1 U	1 U,V-05	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.32 J	0.33 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U	2 U	2 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	5 U	5 U	2 U	2 U	2 U
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
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µg/L - micrograms per liter
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Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-3D					2010-MW-4S								
		8/21/2013	4/21/2016	1/18/2017	8/16/2017	2/1/2018	8/22/2013	4/19/2016	MW-X-04192016 Dup of 2010-MW-4S	1/19/2017	MW-X-01192017 Dup of 2010-MW-4S	8/17/2017	MW-X-08172017 Dup of 2010-MW-4S	1/30/2018	MW-X-01302018 Dup of 2010-MW-4S
VOCs (µg/L)															
Chloroform	7	2 U	2 U	2 U	2 U	2 U	2 U	0.26 J	0.23 J	0.62 J	0.65 J	0.72 J	0.75 J	0.44 J	0.32 J
Chloromethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	5 U
Dichlorodifluoromethane (Freon 12)	5	2 U	0.37 J	2 U	0.48 J,L-04	0.5 J	2 U	2 U	2 U	2 U	2 U,L-04	2 U,L-04	2 U	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	1 U,L-04	1 U	1 U	1 U,L-04	NA	1 U	1 U	1.5 J,V-06	1 J,V-06	1 U	1 U	1 U	1 U
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U,V-05	2 U,V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U,L-04
tert-Butyl Alcohol (TBA)		20 UJ	20 U,V-16	20 U,V-20	20 U	20 U	20 UJ	20 U,V-05	20 U,V-05	20 U,V-16	20 U,V-16	20 U	20 U	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	1 U	1 U	1 U	1 U	2 U	8.2	2	2.1	0.55 J	0.6 J	0.41 J	0.39 J	0.99 J	1
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U,V-05	10 U,V-05	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds															
1,4 Dioxane (by 8270D µg/L)		NA	0.2 B,J	0.081 J	NA	NA	NA	0.064 J	0.072 J	0.23	0.3	NA	NA	NA	NA
Manganese (mg/L)	35	NA	0.16	0.17	0.18	0.15	NA	0.13	0.15	0.23	0.24	0.12	0.11	0.01	0.013
Sodium (mg/L)	20	NA	69	81	84	81 MS-19	NA	170	170	150	150	180	170	140	140
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	4.21 ^B	NA	NA	NA	NA	NA	NA	3.18 ^B	3.14 ^B	NA	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	8.14 ^B	NA	NA	NA	NA	NA	NA	2.45 ^B	2.35 ^B	NA	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	13.9 ^B	NA	NA	NA	NA	NA	NA	9.29 ^B	9.37 ^B	NA	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	29.2 ^B	NA	NA	NA	NA	NA	NA	26.1 ^B	27.2 ^B	NA	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	11.1 ^B	NA	NA	NA	NA	NA	NA	28.1 ^B	28.8 ^B	NA	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	1.45 ^B J	NA	NA	NA	NA	NA	NA	3.84 ^B	4 ^B	NA	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	68 ^B	NA	NA	NA	NA	NA	NA	72.96 ^B	74.86 ^B	NA	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.

Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-4I						2010-MW-5I					2010-MW-6I				
		8/22/2013	4/19/2016	1/19/2017	8/17/2017	1/30/2018	8/20/2013	4/21/2016	1/24/2017	8/17/2017	1/31/2018	8/22/2013	4/22/2016	1/20/2017	8/17/2017	1/31/2018	
VOCs (µg/L)																	
1,1,1,2-Tetrachloroethane	5	5 U	2 U,R-05	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,1-Trichloroethane	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,2,2-Tetrachloroethane	5	2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1,2-Trichloroethane	1	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethane	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethylene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloropropene	5	10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
1,2,3-Trichlorobenzene	5	25 U	10 U	2 U,V-05	10 U	5 U	5 U	5 U,V-05	5 U	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U	
1,2,3-Trichloropropane	0.04	10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
1,2,4-Trichlorobenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2,4-Trimethylbenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dibromo-3-chloropropane (DBCP)	0.04	25 UJ	10 U	10 U	10 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
1,2-Dibromoethane (EDB)	5	2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
1,2-Dichlorobenzene	3	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dichloroethane	0.6	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-Dichloropropane	1	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-Trichlorobenzene		5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-Trimethylbenzene	5	5 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	
1,3-Dichlorobenzene	3	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3-Dichloropropane	5	2.5 U	1 U	1 U	2 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	
1,4-Dichlorobenzene	3	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,4-Dioxane		250 R	100 U	100 U,V-16	200 U	50 U	50 R	100 U,V-16	50 U,V-16	100 U	50 U	50 R	100 U,V-16	50 U,V-16	100 U	50 U	
2,2-Dichloropropane	5	5 U	2 U,V-05	2 U,V-05	2 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U	
2-Butanone (MEK)	50	100 U	40 U	40 U	40 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	
2-Chlorotoluene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
2-Hexanone (MBK)	50*	50 U	20 U	20 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
4-Chlorotoluene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
4-Methyl-2-pentanone (MIBK)		50 U	20 U	20 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Acetone	50*	250 U	100 U	20 J	100 U	50 U	50 U	50 U	9.9 J	50 U	50 U	50 U	50 U	14 J	50 U	50 U	
Acrylonitrile		25 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Benzene	1	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromobenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromochloromethane	5	5 U	4 U	4 U	2 U	1 U,V-05	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	
Bromodichloromethane	50*	2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Bromoform	50*	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Bromomethane	5	10 U	4 U	4 U	10 U	2 U	2 U	2 U	5 U,R-05	2 U,V-05	2 U	2 U	2 U	2 U	5 U	5 U	
Carbon Disulfide		20 U	8 U	8 U	8 U	4 U,V-05	4 U	4 U	4 U	4 U	4 U	6.5 U	6.5 U	6.5 U	4 U	4 U,V-05	
Carbon Tetrachloride	5	25 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Chlorobenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Chlorodibromomethane		2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Chloroethane	5	10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
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µg/L - micrograms per liter
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		8/22/2013	4/19/2016	1/19/2017	8/17/2017	1/30/2018	8/20/2013	4/21/2016	1/24/2017	8/17/2017	1/31/2018	8/22/2013	4/22/2016	1/20/2017	8/17/2017	1/31/2018
VOCs (µg/L)																
Chloroform	7	10 U	4 U	4 U	8 U	0.32	2 U	2 U	2 U	4 U	4 U	2 U	2 U	2 U	4 U	2 U
Chloromethane		10 UJ	4 U	4 U	4 U	2 U	2 UJ	2 UJ	2 UJ	2 U	2 U	2 UJ	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	5 U	2 U	2 U	2 U	0.21 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	2.5 U	1 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		NA	10 U	10 U	10 U	5 U	NA	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U
Dibromomethane	5	5 U	2 U	2 U	2 U	5 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	10 U	4 U	4 U,L-04	4 U	2 U	2 U	2 U	2 U,L-04	2 U	2 U	2 U	2 U	2 U,L-04	2 U	2 U
Diethyl Ether		10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	2.5 U	1 U	1 U	1.2 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.6 U	0.5 U
Isopropylbenzene (Cumene)	5	5 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
m+p Xylene	5	10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		NA	2 U	1.5 J,V-06	2 U	1 U	NA	1 U,L-04	1.3 J,V-06	1 U,L-04	1 U	NA	1 U,L-04	1 J,V-06	1 U	1 U
Methyl Cyclohexane		NA	2 U	2 U	2 U	1 U	NA	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	5 U	0.64 J	0.4 J	0.22 J	0.3 J	1 U	0.43 J	0.34 J	0.31 J	0.42 J	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	25 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	10 U	4 U,V-05	4 U	4 U	2 U V-05	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U,V-05
n-Butylbenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		5 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		100 UJ	40 U	40 U,V-16	40 U	20 U	20 UJ	20 U,V-16	20 U,V-16	20 U	20 U	20 UJ	20 U	20 U,V-16	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,V-16	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	230	170	76	83	99	1.4	1.8	1.3	2.2	1.8	11	9.7	6.2	9.1	8.4
Tetrahydrofuran		50 U	20 U	20 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	5 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	2.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichloroethylene	5	5 U	1.3 J	0.62 J	2 U	0.88 J	4.5	2.5	1.1	2.5	1.9	1 U	0.24 J	1 U	1 U	0.21 J
Trichlorofluoromethane (Freon 11)	5	10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	10 U	4 U	4 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds																
1,4 Dioxane (by 8270D µg/L)		NA	0.34	0.2	NA	NA	NA	0.18 B,J	0.20 U	NA	NA	NA	0.17 B,J	0.08 J	NA	NA
Manganese (mg/L)	35	NA	0.32	0.15	0.21	0.12	NA	0.5	0.57	0.5	0.52	NA	0.12	0.047	0.06	0.04
Sodium (mg/L)	20	NA	57	69	57	61	NA	120	130	130	120	NA	36	42	47	44
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	2.32 ^B	NA	NA	NA	NA	2.65	NA	NA	NA	NA	4.22 ^B	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	3.29 ^B	NA	NA	NA	NA	6.89	NA	NA	NA	NA	9.38 ^B	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	6.36 ^B	NA	NA	NA	NA	9.62	NA	NA	NA	NA	10.6 ^B	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	20.3 ^B	NA	NA	NA	NA	28.3	NA	NA	NA	NA	27.3 ^B	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	11.8 ^B	NA	NA	NA	NA	23.5	NA	NA	NA	NA	15.7 ^B	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	1.59 ^B J	NA	NA	NA	NA	2.31	NA	NA	NA	NA	1.76 ^B J	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	45.66 ^B	NA	NA	NA	NA	73.27	NA	NA	NA	NA	68.96 ^B	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.
Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-7D					2010-MW-8D					2010-MW-9D				
		8/20/2013	4/22/2016	1/20/2017	8/17/2017	1/31/2018	8/21/2013	4/20/2016	1/19/2017	8/16/2017	2/1/2018	8/23/2013	4/20/2016	1/25/2017	8/18/2017	2/1/2018
VOCs (µg/L)																
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	0.18 J	2 U	0.38 J	25 U	5 U	5 U	2 U	0.48 J
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U,V-05	5 U	5 U	25 U	10 U	5 U	10 U	5 U,V-05	120 U	25 U	25 U	10 U	5 U,V-05
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U,V-05	25 U	5 U	5 U	2 U	1 U,V-05
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 U	25 UJ	10 U	5 U	10 U	5 U,V-05	120 UJ	25 U	25 U	10 U	5 U,V-05
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	2 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	1 U	1 U	2.5 U	1 U	0.5 U	2 U	2 U	12 U	2.5 U	2.5 U	2 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
1,4-Dioxane		50 R	100 U,V-16	50 U,V-16	100 U	50 U	250 R	200 U,V-05	50 U	200 U, V-16	50 U	1200 R	500 U,V-05	250 U	200 U	50 U
2,2-Dichloropropane	5	1 U	1 U	1 U,V-05	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	100 U	40 U	20 U	40 U	20 U	500 U	100 U	100 U	40 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	50 U	20 U	10 U	20 U	10 U	250 U	50 U	50 U	20 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	50 U	20 U	10 U	20 U	10 U	250 U	50 U	50 U	20 U	10 U
Acetone	50*	50 U	5.6 J	14 J	50 U	50 U	250 U	100 U	17 J,V-06	100 U	50 U	1200 U	250 U	250 U	100 U	50 U
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	25 U	10 U	5 U	10 U	5 U	120 U	25 U	25 U	10 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Bromomethane	5	2 U	2 U	2 U	5 U,R-05	5 U,V-05	10 U	4 U,R-05	2 U	10 U	5 U,V-05	50 U	10 U,R-05	10 U,R-05	10 U,R-05	2 U,V-05
Carbon Disulfide		6.5 U	4 U	4 U	4 U	4 U,V-05	20 U	8 U	4 U	8 U	4 U	100 U	28	20 U	8 U	4 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	25 U	10 U	5 U	10 U	5 U	120 U	25 U	25 U	10 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Analyzed
NS - Not Sampled

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000



SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-7D					2010-MW-8D					2010-MW-9D				
		8/20/2013	4/22/2016	1/20/2017	8/17/2017	1/31/2018	8/21/2013	4/20/2016	1/19/2017	8/16/2017	2/1/2018	8/23/2013	4/20/2016	1/25/2017	8/18/2017	2/1/2018
VOCs (µg/L)																
Chloroform	7	2 U	2 U	2 U	4 U	4 U	10 U	4 U	2 U	4 U	4 U	50 U	10 U	10 U	8 U	2 U
Chloromethane		2 UJ	2 UJ	2 UJ	2 U	2 U	10 UJ	4 U	2 U	4 U	2 U	50 UJ	10 U	10 U,V-05	4 U	2 U
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	5 U	1.9 J	0.88 J	1.4 J	1.6	25 U	2.6 J	1.8 J	3.1	3.8
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	5 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	NA	10 U	5 U	10 U	5 U	NA	25 U	25 U	10 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U,L-04	0.37 J	2 U	10 U	4 U	2 U	8 U	2 U	50 U	10 U	10 U	8 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	2.5 U	1 U	0.5 U	1.2 U	0.6 U	12 U	2.5 U	2.5 U	1.2 U	0.6 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	2 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U
Methyl Acetate		NA	1 U,L-04	1.2 J,V-06	1 U,L-04	1 U	NA	2 U,L-04	1 U	2 U,L-04	1 U,L-04	NA	5 U,L-04	5 U	2 U,L-04	1 U,L-04
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	NA	2 U	1 U	2 U	1 U	NA	5 U	5 U	2 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	16	12	9.1	8.8	10	5 U	2 U	1 U	2 U	2 U	25 U	5 U	5 U	4 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	25 U	10 U	5 U	10 U	5 U	120 U	25 U	25 U	10 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	10 U	4 U	2 U	4 U	2 U,V-05	50 U	10 U	10 U,V-05	4 U	2 U,V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	2 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
tert-Butyl Alcohol (TBA)		20 UJ	20 U,V-16	20 U,V-16	20 U	20 U	100 UJ	40 U	20 U,V-20	40 U	20 U	500 UJ	100 U	100 U	40 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U	1 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
Tetrachloroethylene	5	1 U	1 U	1 U	1 U	1 U	130	150	7.7	90	74	540	260	140	310	680 E
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	50 U	20 U	10 U	40 U,V-05	10 U	250 U	50 U	50 U	20 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	5 U	5 U	2 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	1 U	0.5 U	1 U	0.5 U	12 U	2.5 U	2.5 U,V-05	1 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U,V-05	50 U	10 U	10 U	4 U	2 U,V-05
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	5 U	2 U	1 U	2 U	1 U	25 U	1.9 J	1 J	3.6	3.9
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	10 U	4 U	2 U	4 U	2 U	50 U	10 U	10 U	4 U	2 U
Additional Compounds																
1,4 Dioxane (by 8270D µg/L)		NA	0.34 B	0.19 J	NA	NA	NA	0.19 B,J	0.082 J	NA	NA	NA	0.17 B,J	0.2 U	NA	NA
Manganese (mg/L)	35	NA	0.26	0.28	0.24	0.26	NA	0.2	8.3	3.0	3.2	NA	0.22	0.31	0.32	0.31
Sodium (mg/L)	20	NA	70	81	76	76	NA	81	84	93	89	NA	54	64	65	62
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	2.02	NA	NA	NA	NA	4.01 ^B	NA	NA	NA	NA	3.19	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	5.59	NA	NA	NA	NA	10.5 ^B	NA	NA	NA	NA	6.73	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	6.81	NA	NA	NA	NA	11.1 ^B	NA	NA	NA	NA	7.44	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	12.9	NA	NA	NA	NA	24.1 ^B	NA	NA	NA	NA	26	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	2.32	NA	NA	NA	NA	12.6 ^B	NA	NA	NA	NA	44.8	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	2 U	NA	NA	NA	NA	1.23 ^B J	NA	NA	NA	NA	2.27	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	31.64	NA	NA	NA	NA	63.54 ^B	NA	NA	NA	NA	90.43	NA

Notes:
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V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
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R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	2010-MW-10D					ITDGW-26	FB-X-82113	FB-X-82313	FB-1-04222016	Trip Blank				
		8/22/2013	4/20/2016	1/25/2017	8/18/2017	2/1/2018	8/23/2013	8/21/2013	8/23/2013	4/22/2016	8/22/2013	4/19/2016	4/20/2016	4/21/2016	
VOCs (µg/L)															
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	0.39 J	0.36 J	0.46 J	0.97 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	0.43 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		50 R	100 U,V-05	50 U	100 U	50 U	50 R	50 R	50 R	100 U,V-16	50 R	50 U	100 U,V-05	100 U,V-16	
2,2-Dichloropropane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	50	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	50 U	16 J	50 U	50 U	50 U	50 U	50 U	6 J	50 U	9.6 J	10 J	10 J	
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U	2 U,R-05	2 U,R-05	5 U,R-05	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U	2 U,R-05	2 U	
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U,V-05	4 U	4 U	8.5	4 U	4 U	4 U	4 U	4 U	
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
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00266415.0000

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		8/22/2013	4/20/2016	1/25/2017	8/18/2017	2/1/2018	8/23/2013	8/21/2013	8/23/2013	4/22/2016	8/22/2013	4/19/2016	4/20/2016	4/21/2016	
VOCs (µg/L)															
Chloroform	7	2 U	2 U	2 U	4 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane		2 UJ	2 U	2 U,V-05	2 U	2 U	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ
cis-1,2-Dichloroethylene	5	1 U	0.21 J	2.2	3.1	19	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		NA	5 U	5 U	5 U	5 U	NA	NA	NA	5 U	NA	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	0.74 J	2 U	0.58 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m+p Xylene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.27 J	2 U	0.25 J	2 U
Methyl Acetate		NA	1 U,L-04	1 U	1 U,L-04	1 U	NA	NA	NA	1 U,L-04	NA	1 U	1 U,L-04	1 U,L-04	1 U,L-04
Methyl Cyclohexane		NA	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	NA	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	3.5	3.4	2.4	2.7	2.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		20 UJ	20 U	20 U	20 U	20 U	20 UJ	20 UJ	20 UJ	20 U,V-16	20 UJ	20 U,V-05	20 U	20 U,V-16	20 U,V-16
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	3.3	2	12	67	260 E	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U,V-05	10 U	10 U	10 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.51 J	0.44 J	0.41 J	0.41 J
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichloroethylene	5	1 U	1 U	1 U	1 U	1.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	0.53 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds															
1,4 Dioxane (by 8270D µg/L)		NA	0.99 B	0.69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (mg/L)	35	NA	0.14	0.17	0.16	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium (mg/L)	20	NA	29	34	35	38	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	2.58	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	6.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	8.54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	7.76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	40.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	Trip Blank										
		1/18/2017	1/19/2017	1/20/2017	1/24/2017	1/25/2017	8/16/2017	8/17/2017	8/18/2017	1/30/2018	2/1/2018	2/2/2018
VOCs (µg/L)												
1,1,1,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	5 U	5 U	5 U,V-05	5 U,V-05	5 U	5 U	5 U	5 U	5 U,V-05	5 U	5 U
1,2,3-Trichloropropane	0.04	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U
1,2,4-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U,V-05
1,2-Dibromoethane (EDB)	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	0.5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		50 U	50 U	50 U,V-16	50 U,V-16	50 U	100 U	100 U	100 U	100 U	50 U	50 U
2,2-Dichloropropane	5	1 U,V-05	1 U	1 U,V-05	1 U,V-05	1 U	1 U	1 U	1 U	1 U,V-05	1 U	1 U
2-Butanone (MEK)	50	20 U	20 U	3.6 J,V-06	3.6 J,V-06	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	50 U	46 J,V-06	49 J	50 J	42 J	4.9 J	50 U	50 U	50 U	50 U	50 U,V-05
Acrylonitrile		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	2 U,R-05	2 U	2 U	2 U	2 U,R-05	5 U	5 U	5 U	5 U	2 U,V-05	2 U
Carbon Disulfide		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U,V-05	4 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Legend:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Analyzed
NS - Not Sampled

Table 1. Jimmy's Dry Cleaners Groundwater Sampling Results
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	Trip Blank										
		1/18/2017	1/19/2017	1/20/2017	1/24/2017	1/25/2017	8/16/2017	8/17/2017	8/18/2017	1/30/2018	2/1/2018	2/2/2018
VOCs (µg/L)												
Chloroform	7	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane		2 U	2 U	0.6 J	0.68 J	2 U,V-05	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U
Cyclohexane		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	2 U	2 U	2 U,L-04	2 U,L-04	2 U	4 U	4 U	4 U	4 U	2 U	2 U
Diethyl Ether		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.13 J	1 U	1 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Isopropylbenzene (Cumene)	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U
m+p Xylene	5	2 U	2 U	0.26 J	0.26 J	2 U	2 U	2 U	2 U	0.37 J	0.4 J	0.4 J
Methyl Acetate		1 U	1 U	1.5 J,V-06	1.5 J,V-06	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	2 U	2 U	2 U	2 U	2 U,V-05	2 U	2 U	2 U	2 U,V-05	2 U,V-05	2 U,V-05
n-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.22 J	0.24 J	0.18 J
p-Isopropyltoluene (p-Cymene)		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U
sec-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U,L-04	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		20 U	7 J,V-06	9.6 J,V-06	9.3 J,V-06	8.1 J,V-06	7.7 J,V-05	20 U	20 U	20 U	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrahydrofuran		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	5	1 U	0.46 J	0.45 J	0.48 J	0.46 J	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U,V-05	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U,V-05
Trichloroethylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Additional Compounds												
1,4 Dioxane (by 8270D µg/L)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (mg/L)	35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium (mg/L)	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorobutanesulfonic acid (PFBS) (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorohexanesulfonic acid (PFHxS) (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluoroheptanoic acid (PFHpA) (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctanoic acid (PFOA) (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctanesulfonic acid (PFOS) (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorononanoic acid (PFNA) (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PFAS (ng/L)	70 ^A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.
The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Constituents detected above this standard are highlighted in orange.
Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).
* - NYSDEC Class GA Groundwater Guidance Value.
** - Applies to sum of cis- and trans-1,3-Dichloropropene.
A - The NYSDEC has currently set a standard of 70 nanograms per liter for individual and total PFAS. Concentrations detected above this standard are highlighted in orange.
B - Due to TestAmerica cooler shipping error, wells were resampled and analyzed in September 2017.

Definitions:
NA - Not Analyzed
NS - Not Sampled
U - Analyte not detected at or greater than the Reporting Limit (RL).
J - Indicates the concentration is an estimated value.
UJ - Indicates the analyte was not detected and the reported quantitation limit is estimated.
B - Indicates analyte was also found in an associated blank.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this analyte is likely to be biased on the low side.
V-05 - Continuing calibration did not meet method specifications and was biased on the low side for this compound.
V-06/V-16/V-20 - Continuing calibration did not meet method specifications and was biased on the high side for this compound.
R-05 - Reduced precision is anticipated for the reported value.
µg/L - micrograms per liter
mg/L - milligrams per liter
ng/L - nanograms per liter

Table 2. Jimmy's Dry Cleaners Groundwater Sampling Results

Onsite Wells
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	MW-C(S)	MW-C(D)	MW-D(S)	MW-D(I)	MW-D(D)	MW-E(I)		MW-E(D)	Trip Blank	
		6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/19/2018	MW-X-06192018 Dup of MW-E(I)	6/19/2018	6/20/2018	6/20/2018
VOCs (µg/L)											
1,1,1,2-Tetrachloroethane	5	20 U	2 U	200 U	1 U	1000 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5	20 U	2 U	200 U	1 U	100 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	10 U	1 U	100 U	0.5 U	200 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	40 U	4 U	400 U	2 U	200 U	2 U	2 U	2 U	2 U	2 U
1,2,3-Trichlorobenzene	5	100 U,V-05	10 U,V-05	1000 U	5 U	100 U	5 U	5 U	5 U	5 U,V-05	5 U
1,2,3-Trichloropropane	0.04	40 U	4 U	400 U	2 U	200 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	20 U	2 U	200 U	1 U	10000 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	0.04	100 U,V-05	10 U,V-05	1000 U	5 U	1000 U	5 U	5 U	5 U	5 U,V-05	5 U
1,2-Dibromoethane (EDB)	5	10 U	1 U	100 U	0.5 U	200 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	3	20 U	2 U	200 U	1 U	2000 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	20 U	2 U	200 U	1 U	2000 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trichlorobenzene		20 U	2 U	200 U	1 U	10000 U,R-05	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	20 U	2 U	200 U	1 U	1000 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	5	20 U	1 U	100 U	0.5 U	200 U	0.5 U	0.5 U	0.5 U	1 U	1 U
1,4-Dichlorobenzene	3	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		2000 U	100 U	10000 U	50 U	100 U	50 U	50 U	50 U	100 U	100 U
2,2-Dichloropropane	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	50	400 U	40 U	3900 J	20 U	400 U	20 U	20 U	20 U	20 U	20 U
2-Chlorotoluene	5	20 U	2 U	200 U	1 U	800 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone (MBK)	50*	200 U	20 U	2000 U	10 U	1000 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		200 U	20 U	2000 U	10 U	100 U	10 U	10 U	10 U	10 U	10 U
Acetone	50*	1000 U	100 U	5500 J,R-05	50 U,R-05	400 U	50 U,R-05	50 U,R-05	50 U,R-05	50 U	50 U,R-05
Acrylonitrile		100 U	10 U	1000 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	400 U	2 U	200 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	5	20 U	2 U	200 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	20 U	2 U	200 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	10 U	1 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50*	20 U	2 U	200 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	100 U	4 U	400 U	2 U	2 U	2 U	2 U	2 U	2 U	5 U
Carbon Disulfide		80 U	8 U	800 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Carbon Tetrachloride	5	100 U	10 U	1000 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	20 U	2 U	200 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane		10 U	1 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	5	40 U	4 U	400 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Notes:

Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.

Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).

* - NYSDEC Class GA Groundwater Guidance Value.

** - Applies to sum of cis- and trans-1,3-Dichloropropene.

Definitions:

U - Analyte not detected at or greater than the Reporting Limit (RL).

J - Indicates the concentration is an estimated value.

L-04 - Reported value for this analyte is likely to be biased on the low side.

R-05 - Reduced precision is anticipated for the reported value.

µg/L - micrograms per liter

Table 2. Jimmy's Dry Cleaners Groundwater Sampling Results

Onsite Wells
Site # 1-30-080
00266415.0000

SAMPLE ID SAMPLE DATE	NYSDEC Class GA Standard or Guidance Value	MW-C(S)	MW-C(D)	MW-D(S)	MW-D(I)	MW-D(D)	MW-E(I)		MW-E(D)	Trip Blank	
		6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/19/2018	MW-X-06192018 Dup of MW-E(I)	6/19/2018	6/20/2018	6/20/2018
VOCs (µg/L)											
Chloroform	7	40 U	8 U	400 U	0.37 J	400 U	0.3 J	0.35 J	2 U	0.22 J	0.32 J
Chloromethane		40 U	4 U	400 U	2 U	400 U	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethylene	5	20 U	2 U	200 U	0.29 J	200 U	0.36 J	0.39 J	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	10 U	1 U	100 U	0.5 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane		100 U	10 U	1000 U	5 U	1000 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)	5	40 U	4 U	400 U	2 U	400 U	2 U	2 U	2 U	2 U	4 U
Diethyl Ether		40 U	4 U	400 U	2 U	400 U	2 U	2 U	2 U	2 U	2 U
Diisopropyl Ether (DIPE)		10 U	1 U	100 U	0.5 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	20 U	1 U	100 U	0.5 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6 U
Isopropylbenzene (Cumene)	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
m+p Xylene	5	40 U	4 U	400 U	2 U	400 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		20 U	2 U	200 U	1 U, L-04	200 U, L-04	1 U, L-04	1 U, L-04	1 U, L-04	1 U	1 U, L-04
Methyl Cyclohexane		20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-Butyl Ether (MTBE)	10	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	100 U	10 U	1000 U	5 U	1000 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	10*	40 U, V-05	4 U, V-05	400 U	2 U	400 U	2 U	2 U	2 U	2 U, V-05	2 U
n-Butylbenzene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene (p-Cymene)		20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl Methyl Ether (TAME)		200 U	1 U	100 U	0.5 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butyl Alcohol (TBA)		400 U	40 U	40000 U	20 U	40000 U	20 U	20 U	20 U	20 U	20 U
tert-Butyl Ethyl Ether (TBEE)		10 U	1 U	100 U	0.5 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	5	38	1.0 J	200 U	38	200 U	67	63	1 U	1 U	1 U
Tetrahydrofuran		2400	290	16000	34	19000	570	620	2.5 J	10 U	10 U
Toluene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	5	20 U	2 U	200 U	1 U	200 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4**	10 U	1 U	100 U	0.5 U	100 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene		40 U, V-05	4 U, V-05	400 U	2 U	400 U	2 U	2 U	2 U	2 U, V-05	2 U
Trichloroethylene	5	20 U	2 U	200 U	0.51 J	200 U	0.58 J	0.54 J	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)	5	40 U	4 U	400 U	2 U	400 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	2	40 U	4 U	400 U	2 U	400 U	2 U	2 U	2 U	2 U	2 U

Notes:

Yellow highlight - Concentration exceeds NYSDEC Class GA Groundwater Standard.

Bold - Concentration represents analytes detected above the Method Detection Limit (MDL).

* - NYSDEC Class GA Groundwater Guidance Value.

** - Applies to sum of cis- and trans-1,3-Dichloropropene.

Definitions:

U - Analyte not detected at or greater than the Reporting Limit (RL).

J - Indicates the concentration is an estimated value.

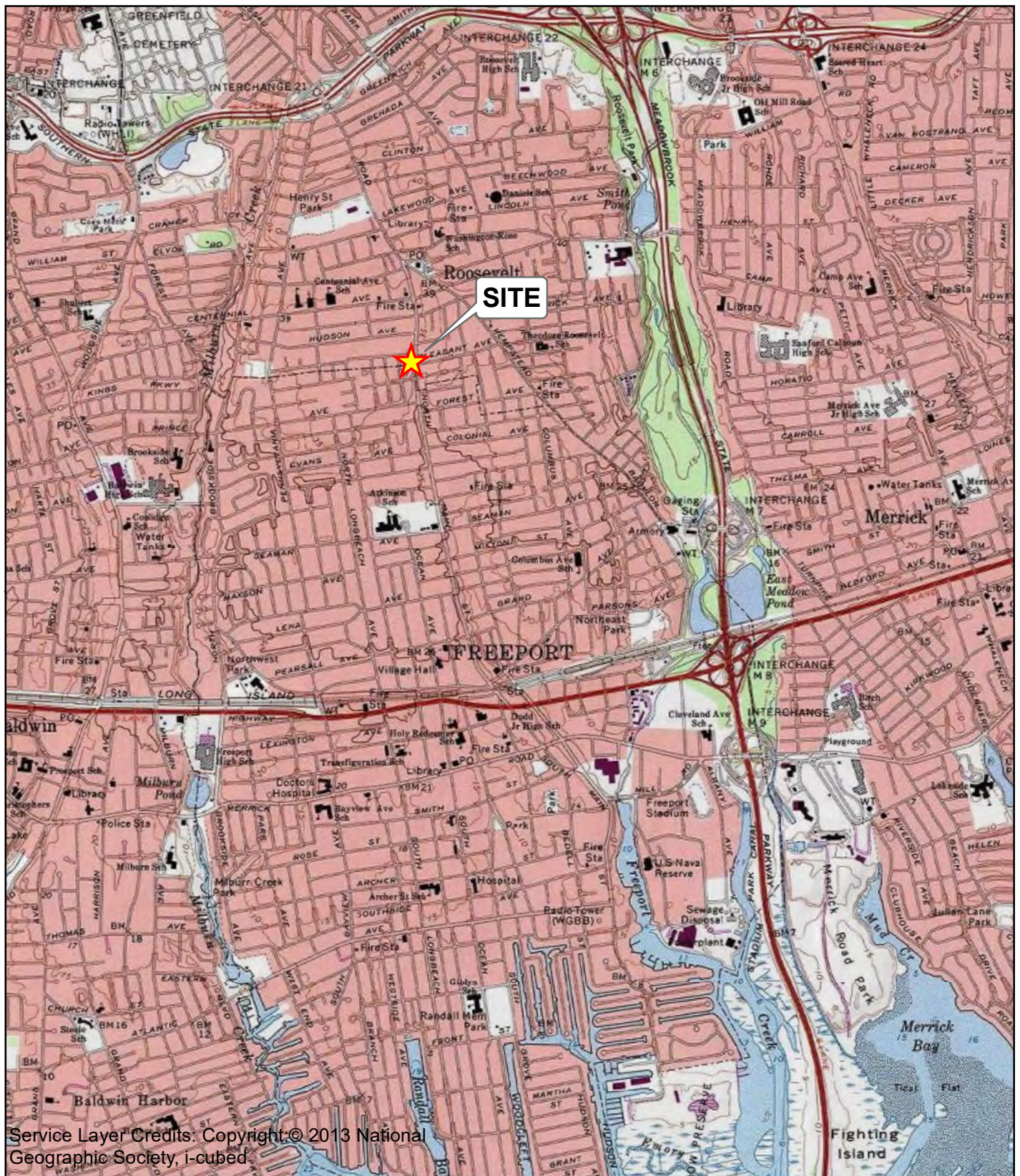
L-04 - Reported value for this analyte is likely to be biased on the low side.

R-05 - Reduced precision is anticipated for the reported value.

µg/L - micrograms per liter

FIGURES





New York State Department of Environmental Conservation
Jimmy's Drycleaner
61 Nassau Road
Roosevelt, NY 11575
SITE MANAGEMENT REPORT

SITE LOCATION



FIGURE

1



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

Monitoring Well

- Not Located
- Located

SVE Fence

Site Boundary and Fence

Approximate Extent of PCE-Impacted Soil



New York State Department of Environmental Conservation
Jimmy's Drycleaner
61 Nassau Road
Roosevelt, NY 11575
SITE MANAGEMENT PLAN

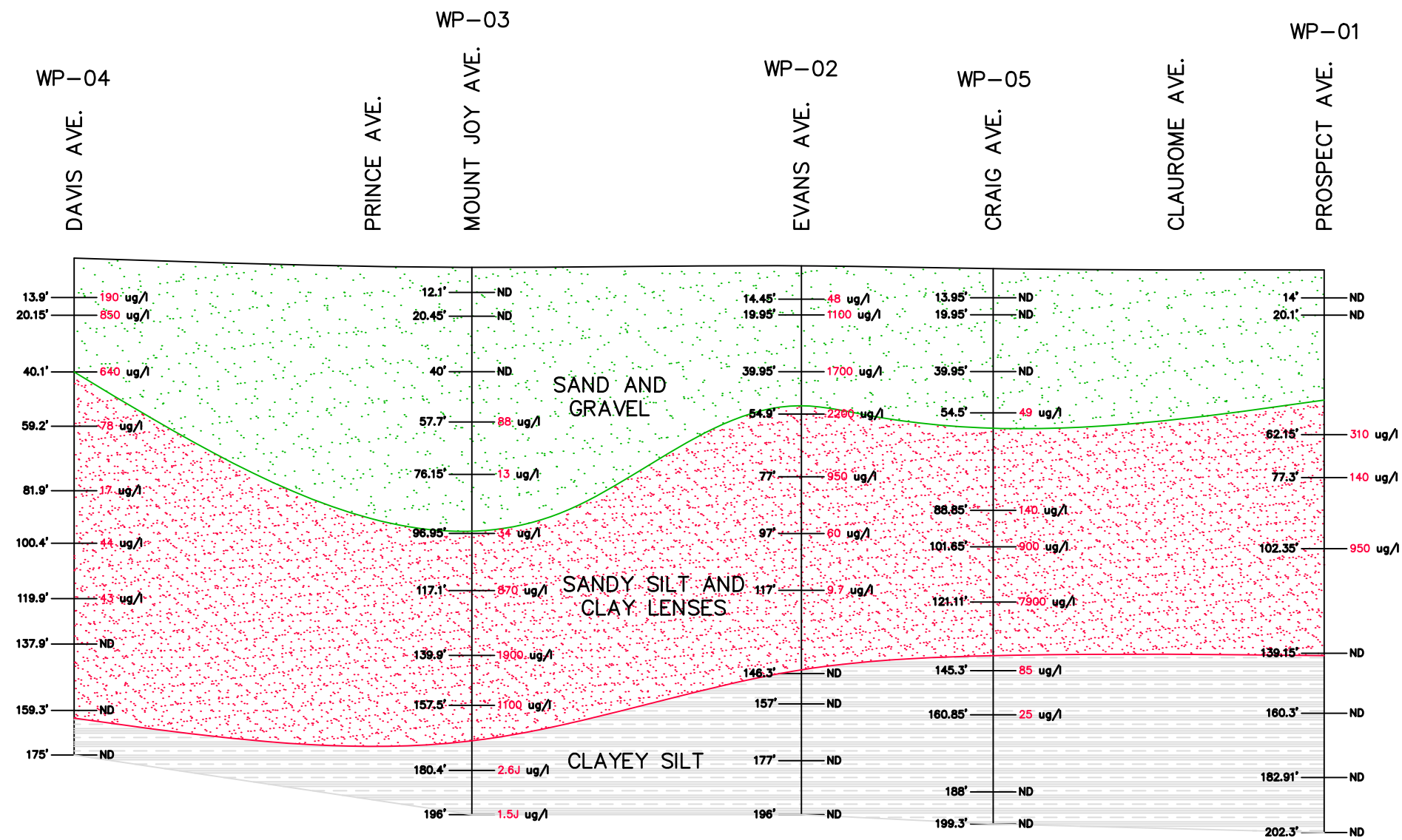
SITE LAYOUT



Design & Consultancy
for natural and
built assets

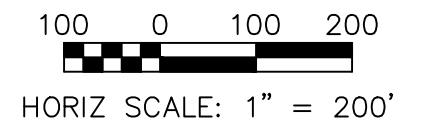
FIGURE

2



NOTES:

- J- RESULT IS ESTIMATED; ug/l - MICROGRAMS PER LITER.
- RESULTS IN RED EXCEEDED NYSDEC GA STANDARD (5ug/l).





J - Estimated concentration.
U - Analyte not detected.
E - Reported result is estimated. Value reported over verified calibration range.
L-04 - Reported value for this compound is likely to be biased on the low side due to control sample recovery being outside of control limits.
R-04 - Duplicate relative percent difference (RPD) is a less useful indicator of sample precision for sample results that are <5 times the reporting limit (RL).

Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

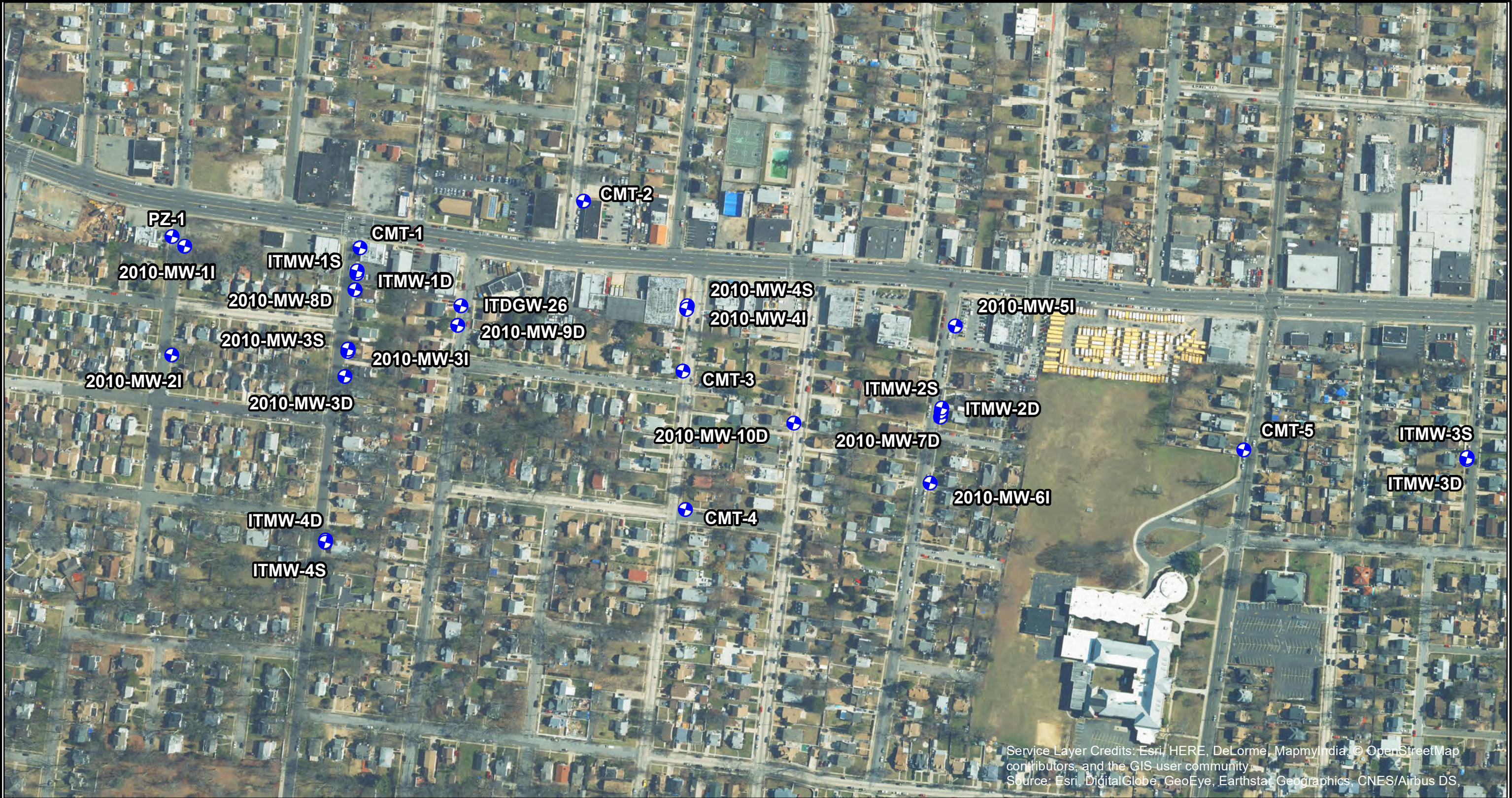
New York State Department of Environmental Conservation
Jimmy's Drycleaner
61 Nassau Road
Roosevelt, NY 11575

GROUNDWATER SAMPLING RESULTS SUMMARY JANUARY AND JUNE 2018

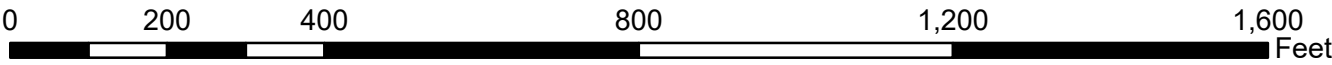


FIGURE

5



Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,



Legend

 Monitoring Well

New York State Department of Environmental Conservation
Jimmy's Drycleaner
61 Nassau Road
Roosevelt, NY 11575

MONITORING WELL LOCATIONS



Design & Consultancy
for natural and
built assets

FIGURE

6

APPENDIX A

Metes and Bounds



OPERABLE UNITS 1&2
NYSDEC DIVISION OF ENVIRONMENTAL REMEDIATION
REMEDIAL CONSTRUCTION PROJECT
CONTRACT NO. D009345
SITE NO. 130080

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 New York Environmental Conservation Law.

THE ENGINEERING AND INSTITUTIONAL CONTROLS for the Easement are set forth in more detail in the Site Management Plan ("SMP"). A copy of the SMP must be obtained by any party with an interest in the property. The SMP may be obtained from the New York State Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@gw.dec.state.ny.us.

DEED(S) REFERENCES:

Deed from Wachovia Bank, N.A. to Breen Capital Investment Corporation, recorded on March 28, 2003 in Liber 11602 at page 279; and from County of Nassau to Town of Hempstead, recorded on March 11, 1997 in Liber 10755 at page 993; and from Lawrence Garafola to Jose A. Echeverria, recorded on April 18, 2007 in Liber 12256 at page 89; and from Celestial Wills-Jackson, Crystal D. Wills, Cleavon Wills and Clarence D. Wills to Crystal D. Wills (50%) and Briven D. Jackson and Celestial Wills-Jackson (50%), recorded on December 6, 2006 in Liber 12205 at page 258; and from Juan Perez to Jorge Armando Gonzalez and Evelyn Gonzalez recorded on October 15, 1984 in Liber 9590 at page 321 as all can be found in the Nassau County Clerk's Office.

DESCRIPTION OF THE ENVIRONMENTAL EASEMENT

Subject Property as described in Liber 11602 of Deeds at Page 279:

All that certain plot, piece, or parcel of land, situate, lying and being in Roosevelt, Town of Hempstead, County of Nassau, State of New York, being part of Plot H on the subdivision map entitled "Revised Map of a Portion of Freeport Lawns," filed October 17, 1934 as Map No. 1006, Case No. 2792, said property being more particularly bounded and described as follows:

Beginning at a point on the westerly boundary line of Nassau Road (North Main Street), said point being South 15° 10' 24" West, a distance of 67.64 feet from the point formed by the intersection of the southerly boundary line of Taylor Avenue (Maple Avenue) and said westerly boundary line of Nassau Road (North Main Street);

Thence, from said point of beginning, continuing along said westerly boundary line of Nassau Road (North Main Street) the following two (2) courses and distances:

1. South 15° 10' 24" West, a distance of 48.01 feet to a point of curvature; thence
2. Southerly, along the arc of a curve to the left having a radius of 1300.00 feet and an arc length of 52.00 feet to a point on the division line between the Subject Property on the north and land now or formerly of Jose A. Echeverria on the south and east;

Thence, North 74° 49' 36" West, along said division line, a distance of 101.04 feet to a point;

Thence, South 15° 10' 24" East, continuing along said division line, a distance of 100.00 feet to a point on the division line between the Subject Parcel on the south and land now or formerly of Town of Hempstead on the north;

Thence, South 74° 49' 36" East, along said division line, a distance of 100.00 feet to the point or place of beginning.

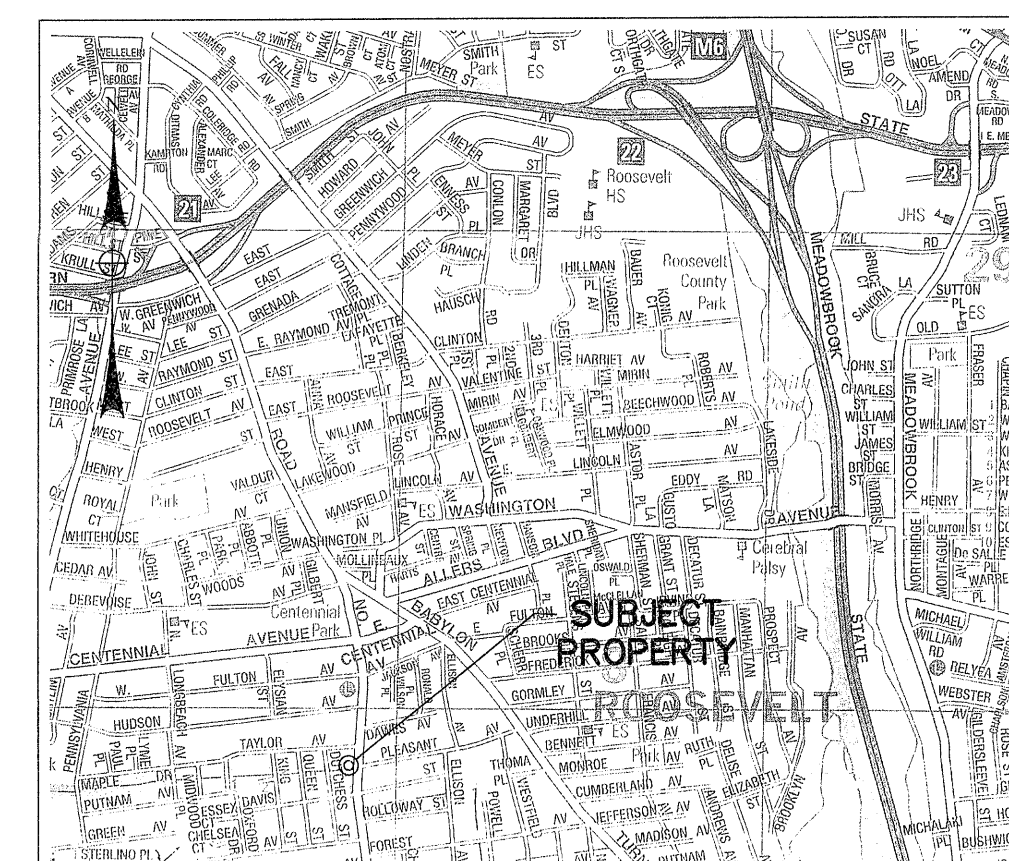
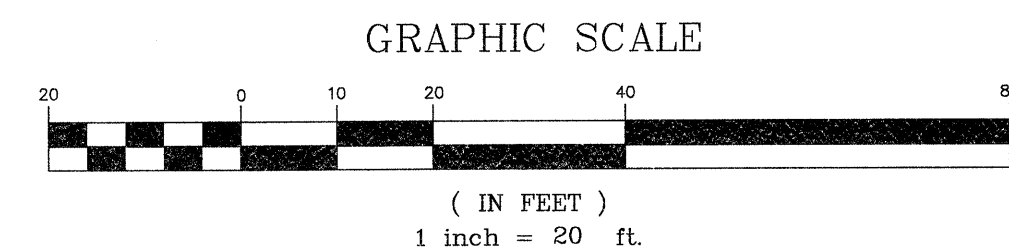
Subject Property area being 10,018 square feet or 0.230 acre, more or less.

Subject Property is also designated as Nassau County Tax Lot 353 in Block 402 of Section 55.

MADE BY: TLS DATE: 2/01/2017
 COMPILED BY: TLS DATE: 7/30/2015
 CHECKED BY: DPJ DATE: 2/02/2017

G:\Vault Working Folder\15074.000\Design Files\Survey\15074.000_DFF_SUR_ALTA_Survey_0.dwg 2/27/2017 9:29 AM Tamara Stillman

ALTA/NSPS LAND TITLE SURVEY OF
PROPERTY OF
BREEN CAPITOL INVESTMENT CORPORATION
PART OF PLOT H ON SUBDIVISION MAP ENTITLED
"REVISED MAP OF A PORTION OF FREEPORT LAWNS"
FILED OCTOBER 17, 1934 AS MAP NO. 1006, CASE NO. 2972
LOCATED AT
61 NASSAU ROAD
ROOSEVELT
TOWN OF HEMPSTEAD
NASSAU COUNTY, NEW YORK



LOCATION SKETCH
 N.T.S.

NOTES

1. MEASUREMENTS ARE IN ACCORDANCE WITH U.S. STANDARDS.
2. BEARINGS SHOWN ARE REFERENCED TO A MAP ENTITLED "REVISED MAP OF A PORTION OF FREEPORT LAWNS," FILED IN THE NASSAU COUNTY CLERK'S OFFICE ON OCTOBER 17, 1934 AS MAP NO. 1006, CASE NO. 2792. THE SUBJECT PROPERTY IS PART OF PLOT H ON SAID MAP.
3. VERTICAL DATUM IS NGVD29 AS SHOWN IN CONTRACT PLANS ENTITLED "REMEDIAL CONSTRUCTION PROJECT, CONTRACT D009345," SUPPLIED BY CONTRACTOR PRIOR TO FIELD SURVEY.
4. UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.
5. ONLY COPIES FROM THE ORIGINAL OF THIS SURVEY MARKED WITH AN ORIGINAL OF THE LAND SURVEYOR'S "EMBOSSED" OR "INKED" SEAL SHALL BE CONSIDERED TO BE VALID TRUE COPIES.
6. CERTIFICATIONS INDICATED HEREON SIGNIFY THAT THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE EXISTING CODE OF PRACTICE FOR LAND SURVEYORS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS. SAID CERTIFICATIONS SHALL RUN ONLY TO THE PERSON FOR WHOM THE SURVEY IS PREPARED AND ON HIS BEHALF TO THE TITLE COMPANY, GOVERNMENTAL AGENCY AND LENDING INSTITUTION LISTED HEREON AND TO THE ASSIGNEES OF THE LENDING INSTITUTION. CERTIFICATIONS ARE NOT TRANSFERABLE TO ADDITIONAL INSTITUTIONS OR SUBSEQUENT OWNERS.
7. RIGHTS-OF-WAY NOT SHOWN ARE NOT CERTIFIED.
8. THE SURVEY CLOSES MATHEMATICALLY.

SURVEYOR'S CERTIFICATION:

Certified to: (1) The People of the State of New York acting through their Commissioner of the Department of Environmental Conservation and (2) The Town of Hempstead

This is to certify that this map or plat and the survey on which it is based were made in accordance with the 2016 Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys, jointly established and adopted by ALTA and NSPS, and does not include any optional items of Table A. Pursuant to the accuracy standards as adopted by ALTA and NSPS and in effect on the date of this certification, undersigned further certifies that in my professional opinion, as a land surveyor registered in the state of New York, the relative positional accuracy of this survey does not exceed that which is specified therein.

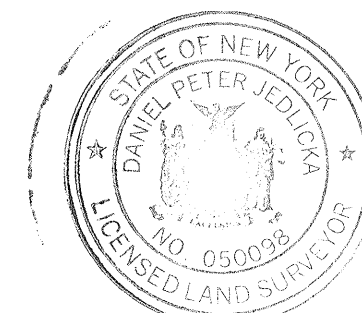
I hereby certify that this map was made from an actual survey completed by me on 01/27/2017.

Daniel P. Jedlicka
 DANIEL P. JEDLICKA, P.L.S.
 NYSPLS No. 50098

L. K. McLEAN ASSOCIATES, P.C.
 CONSULTING ENGINEERS & SURVEYORS
 437 SOUTH COUNTRY ROAD
 BROOKHAVEN, NEW YORK 11719
 (631)286-8668

LEGEND

— GUY WIRE	• FIRE HYDRANT
○ UTILITY LIGHT POLE	• BOLLARD
○ UTILITY POLE	□ PHONE BOOTH
○ TRAFFIC SIGNAL POLE	○ SANITARY MANHOLE
□ TRAFFIC CONTROL BOX	○ DRAINAGE MANHOLE
⊗ GAS VALVE	⊗ ROUND DRAIN INLET
— UNDERGROUND GAS	□ CURB INLET (NO GRATE)
— OVERHEAD WIRES	○ MONITORING WELL
— UNDERGROUND ELECTRIC	• SAMPLE SITE
— UNDERGROUND TRAFFIC	○ DECIDUOUS TREE



APPENDIX B

List of Site Contacts



**APPENDIX B – LIST OF SITE CONTACTS AND RESPONSIBILITIES of
OWNER and REMEDIAL PARTY**

Name	Phone/Email Address
Sam Habibian	sammyhabibian@gmail.com
NYSDEC	

Responsibilities

The responsibilities for implementing the Site Management Plan (“SMP”) for the Jimmy’s Dry Cleaners site (the “site”), number 130080, are divided between the site owner(s) and a Remedial Party, as defined below. The owner(s) is/are currently listed as: Sam Habibian (the “owner”).

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party (“RP”) refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation (“NYSDEC”) is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is: NYSDEC acting agents on behalf of NYSDEC.

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner’s Responsibilities:

- 1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.
- 2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in a(n) Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP’s request, in order to allow the RP to include the certification in the site’s Periodic Review Report (PRR) certification to the NYSDEC.

- 3) In the event the site is delisted, the owner remains bound by the Environmental Easement, and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.
- 4) The owner shall grant access to the site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.
- 5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3 - Notifications.
- 6) In the event some action or inaction by the owner adversely impacts the site, the owner must notify the site's RP and the NYSDEC in accordance with the time frame indicated in Section 1.3 - Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.
- 7) The owner must notify the RP and the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site property. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at <http://www.dec.ny.gov/chemical/76250.html>.
- 8) The owner will maintain fences and SVE System on behalf of the RP. The RP remains ultimately responsible for maintaining the engineering controls.
- 9) Until such time as the NYSDEC deems the SVE system unnecessary, the owner shall operate the system, pay for the utilities for the system's operation, and report any maintenance issues to the RP and the NYSDEC.
- 11) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Remedial Party Responsibilities

- 1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.
- 2) The RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.
- 3) Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.
- 4) If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).
- 5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at <http://www.dec.ny.gov/chemical/76250.html>.
- 6) The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3 - Notifications of the SMP.
- 7) The RP is responsible for the proper maintenance of any installed SVE systems associated with the site, as required in Section 5.0 or Appendix E (Operation , Monitoring and Maintenance Manual) of the SMP.
- 8) The RP is responsible for the proper monitoring and maintenance of any installed drinking water treatment system associated with the site, as required in Section 5.0 or Appendix E (Operation , Monitoring and Maintenance Manual).

- 9) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit to the NYSDEC for approval an amended SMP.
- 10) Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX C

Environmental Easement



APPENDIX C – ENVIRONMENTAL EASEMENT

The Environmental Easement is currently under review by the NYSDEC and will be filed upon completion of this review.

APPENDIX D

Monitoring Well Construction Logs





Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-1S

Page: 1 of 3

Project Jimmy's Dry Cleaners Owner NYSDEC
 Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
 Surface Elev. NA Total Hole Depth 67.0 ft. North _____ East _____
 Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
 Casing: Dia 2 in. Length 54.5 ft. Type PVC
 Fill Material #0 Morie Rig/Core _____
 Drill Co. North Star Drilling Method HSA
 Driller S.Breeds Log By MEF Date 4/2/02 Permit # NA
 Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 20'. No spilt spoons collected.
2							
4							
6							
8							
10						SP	
12							
14							
16							
18							
20	▽	106	75%	4 3 4 4		SP	Brown-orange brown, medium grain, sand, some sub-rounded gravel, wet, no detectable odors.
22							
24							

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02

Continued Next Page



Shaw™
Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-1S

Page: 2 of 3

Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
24							<i>Continued</i>
26		64	65%	3 2 2 3		SP	Brown-light brown, medium grain, sand, some sub-rounded gravel, trace fine-grain, sand, wet.
28							
30		72	95%	9 12 14 21		SP	Brown-light brown, medium grain, sand, some sub-rounded gravel, trace fractured cobbles, trace fine grain, sand at bottom of spoon, wet.
32							
34							
36		650	95%	17 15 12 12		SP	Brown-light brown, medium grain, sand, some sub-rounded gravel, trace cobbles, trace fine-grain, sand, wet.
38							
40		300	95%	12 8 4 3		SP	Light brown, medium grain, sand, and sub-rounded gravel, trace fine grain, sand, wet.
42							
44							
46		875	90%	9 15 33 48		SP	Light brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
48							
50		450	75%	33 48 50		SP	Light brown, medium grain, sand, some fine grain, sand, little sub-rounded gravel, fractured cobble at bottom of split spoon, wet.
52							
54							
56		325	95%	11 33		SP SM	Light brown, fine grain, sand, some medium grain, sand, trace

Continued Next Page

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-1S

Page: 3 of 3

Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
56		325	95%	22		SP SM	<i>Continued</i> sub-rounded gravel, wet. Last ~2" encounter gray, fine grain and medium grain, sand, trace silt, wet.
58				32			
60		1090	95%	8		SP SM	Light brown, fine grain, sand, little silt, little medium grain, sand in middle horizon, trace sub-rounded gravel, wet. Last ~2" the silt content increases.
62				18 22 50			
64		834	30%	50		SP SM	Light brown-gray, fine grain, sand, little silt, trace subrounded gravel, wet. Auger down to 67'.
66							
68							
70							
72							
74							
76							
78							
80							
82							
84							
86							
88							

IT COMMERCIAL Rev. 12/6/89 JIMMYS2.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-1D

Page: 1 of 4

Project Jimmy's Dry Cleaners Owner NYSDEC
 Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
 Surface Elev. NA Total Hole Depth 107.0 ft. North _____ East _____
 Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
 Casing: Dia 2 in. Length 95.5 ft. Type PVC
 Fill Material #0 Morie Rig/Core _____
 Drill Co. North Star Drilling Method HSA
 Driller S.Breeds Log By MEF Date 4/4/02 Permit # NA
 Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 65 feet. No split spoons collected.
2							
4							
6							
8							
10							
12						SM	
14							
16							
18							
20							
22							
24							

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02

Continued Next Page



Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-1D**

Page: 2 of 4

Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
24							Continued
26							
28							
30							
32							
34							
36							
38							
40						SM	
42							
44							
46							
48							
50							
52							
54							
56							

IT COMMERCIAL Rev. 12/6/89 JIMMYS2.GPJ IT CORP.GDT 5/9/02

Continued Next Page



Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-1D

Page: 3 of 4

Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
56							<i>Continued</i>
58							
60						SM	
62							
64							
66		1300	60%	16 22 28 35		SM	Light brown-white, fine grain, sand, little silt, wet. Last ~2" light brown, fine grain, sand, some dark brown fines, wet, no detectable odors.
68							
70		720	85%	9 14 17 22		SM	Light brown-white, fine grain, sand, little silt, wet.
72							
74							
76		1700	95%	5 5 12 17		SM	Gray, fine grain, sand, little silt, wet.
78							
80		>2000	95%	12 19 28 32		SM	Gray, fine grain, sand, little silt, wet. Last ~2" encounter a light gray-white, fine grain, sand, little silt, wet.
82							
84							
86		>2000	95%	10 6 5 10		SM	Gray, fine grain, sand, little silt, wet.
88							<i>Continued Next Page</i>

IT COMMERCIAL Rev. 12/6/99 JIMMYSZ.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-1D**

Page: 4 of 4

Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
88							<i>Continued</i>
90		1500	95%	10 9 8 14		SM	Gray, fine grain, sand, little silt, wet. Last ~4" grades to light gray-white, fine grain, sand, some silt, wet.
92							
94							
96		0	85%	9 9 22 28		SM	Gray, fine grain, sand, some silt, wet. At ~96.5' encounter ~2" lens of gray-brown, silt, trace clay content, very brittle, and grades to gray-light gray, fine grain sand, some silt, wet.
98							
100		79	75%	22 25 25 27		SM	Gray, fine grain, sand, some silt, wet. Auger down to 107'.
102							
104							
106							
108							
110							
112							
114							
116							
118							
120							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-2S**

Page: 1 of 2

Project Jimmy's Dry Cleaners Owner NYSDEC
 Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
 Surface Elev. NA Total Hole Depth 52.0 ft. North _____ East _____
 Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
 Casing: Dia 2 in. Length 39.5 ft. Type PVC
 Fill Material #0 Morie Rig/Core _____
 Drill Co. North Star Drilling Method HSA
 Driller S.Breeds Log By MEF Date 4/8/02 Permit # NA
 Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 20' and view auger cutting coming up from borehole with depth.
2							
4							
6							
8							
10						SP	
12							
14							
16							
18							
20		0					Brown, medium grain, sand, trace sub-rounded gravel, moist.
22						SP	
24							

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-2S

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
24		0				SP	<i>Continued</i>
26							Brown, medium grain, sand, little sub-rounded gravel, wet.
28						SP	
30		0					Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
32						SP	
34		0					Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
36						SP	
38							Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
40		0					Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
42						SP	
44		0					Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
46						SP	
48							Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet.
50		0				SP	Brown, medium grain, sand, some sub-rounded gravel, trace fine grain, sand, wet. Auger down to 52'.
52							
54							
56							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-2D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Surface Elev. NA Total Hole Depth 105.0 ft.

North _____ East _____

Top of Casing NA Water Level Initial ▽ 20.0 ft.

Static NA Diameter 8 in.

Screen: Dia 2 in. Length 10 ft.

Type/Size PVC/010 in.

Casing: Dia 2 in. Length 91.0 ft.

Type PVC

Fill Material #0 Morie

Rig/Core _____

Drill Co. North Star Drilling

Method HSA

Driller S.Breeds

Log By MEF

Date 4/9/02

Permit # NA

Checked By _____

License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 60' and view auger cuttings coming up from borehole with depth. Above lithology described in ITMW-2S.
2							
4							
6							
8							
10							
12						SP	
14							
16							
18							
20							
22							
24							

IT COMMERCIAL Rev. 12/6/99 JIMMY'S2.GPJ IT CORP.GDT 5/9/02

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-2D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
24							Continued
26							
28							
30							
32							
34							
36							
38							
40						SP	
42							
44							
46							
48							
50							
52							
54							
56							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-2D**

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
56							<i>Continued</i>
58						SP	
60		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
62						SP SM	
64		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
66						SP SM	
68		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
70						SP SM	
72		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
74						SP SM	
76		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
78						SP SM	
80		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
82						SP SM	
84		0					Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
86						SP SM	
88							

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IT COMMERCIAL Rev. 12/6/99 JIMMY'S2.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-2D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
88							<i>Continued</i>
90		0				SP SM	Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
92						SP SM	
94		0					
96						SP SM	Brown, medium grain, sand and sub-rounded gravel, some silt, wet.
98						SP SM	
100		0				SP SM	Brown-gray, medium grain, sand and sub-rounded gravel, some fine grain, sand, wet.
102							
104		0				SP SM	Brown-gray, medium grain, sand and sub-rounded gravel, some fine grain, sand, wet.
106							
108							
110							
112							
114							
116							
118							
120							

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-3S**

Page: 1 of 3

Project Jimmy's Dry Cleaners Owner NYSDEC
Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
Surface Elev. NA Total Hole Depth 67.0 ft. North _____ East _____
Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
Casing: Dia 2 in. Length 54.5 ft. Type PVC
Fill Material #0 Morie Rig/Core _____
Drill Co. North Star Drilling Method HSA
Driller S.Breeds Log By MEF Date 4/11/02 Permit # NA
Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 20' and view auger cuttings coming up from borehole with depth.
2							
4							
6							
8							
10						SP	
12							
14							
16							
18							
20		0					Brown, medium grain, sand, some sub-rounded gravel, dry.
22						SP	
24							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-3S

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
24		0				SP	<i>Continued</i>
26							Brown, medium grain, sand, little sub-rounded gravel, wet.
28						SP	
30		0					Brown, medium grain, sand, little sub-rounded gravel, wet.
32						SP	
34							
36		0					Brown, medium grain, sand, little sub-rounded gravel, wet.
38						SP	
40		0					Brown, medium and fine grain, sand, little sub-rounded gravel, wet.
42						SP	
44		0					
46							Brown, medium and fine grain, sand, little sub-rounded gravel, wet.
48						SP	
50		0					Brown, medium and fine grain, sand, little sub-rounded gravel, wet.
52						SP	
54							
56		0					

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-3S

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
56		0				SP	<i>Continued</i> Brown, medium and fine grain, sand, little sub-rounded gravel, wet.
58							
60						SP	Brown, medium and fine grain, sand, little sub-rounded gravel, wet.
62							
64		0				SP	Brown, medium and fine grain, sand, little sub-rounded gravel, wet. Auger down to 67'.
66							
68							
70							
72							
74							
76							
78							
80							
82							
84							
86							
88							

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-3D**

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Project Jimmy's Dry Cleaners Owner NYSDEC
 Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
 Surface Elev. NA Total Hole Depth 92.0 ft. North _____ East _____
 Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
 Casing: Dia 2 in. Length 89.5 ft. Type PVC
 Fill Material #0 Morie Rig/Core _____
 Drill Co. North Star Drilling Method HSA
 Driller S.Breeds Log By MEF Date 4/10/02 Permit # NA
 Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
0							Auger down to 65' and view auger cuttings coming up from borehole with depth. Above lithology described in ITMW-3S.
2							
4							
6							
8							
10							
12						SP	
14							
16							
18							
20							
22							
24							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-3D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
24							Continued
26							
28							
30							
32							
34							
36							
38							
40						SP	
42							
44							
46							
48							
50							
52							
54							
56							

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Drilling Log

Monitoring Well **ITMW-3D**
Page: 3 of 4

Project Jimmy's Dry Cleaners Owner NYSDEC
Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
56							<i>Continued</i>
58							
60						SP	
62							
64							
66							Brown, medium and fine grain, sand, little sub-rounded gravel, wet.
68						SP	
70		0					Brown, medium and fine grain, sand, some sub-rounded gravel, wet.
72						SP	
74		0					
76							Brown, medium and fine grain, sand, some sub-rounded gravel, wet.
78						SP	
80		0					Brown, medium and fine grain, sand, some sub-rounded gravel, wet.
82						SP	
84		0					
86						SP SM	Brown, fine grain, sand, some silt, little sub-rounded gravel, wet.
88							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-3D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
88		0				SP SM	Continued Brown, fine grain, sand, some silt, little sub-rounded gravel, wet. Auger down to 92'.
90						SP SM	
92							
94							
96							
98							
100							
102							
104							
106							
108							
110							
112							
114							
116							
118							
120							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-4S**

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Project Jimmy's Dry Cleaners Owner NYSDEC
 Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
 Surface Elev. NA Total Hole Depth 67.0 ft. North _____ East _____
 Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
 Casing: Dia 2 in. Length 54.5 ft. Type PVC
 Fill Material #0 Morie Rig/Core _____
 Drill Co. North Star Drilling Method HSA
 Driller S.Breeds Log By MEF Date 4/12/02 Permit # NA
 Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 20' and view auger cuttings coming up from borehole with depth.
2							
4							
6							
8							
10						SP	
12							
14							
16							
18							
20		0					Brown, medium and fine grain, sand, little silt, trace sub-rounded gravel, moist.
22						SP	
24							

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-4S

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
24		0				SP	<i>Continued</i>
26							Brown, medium and fine grain, sand, little silt, some sub-rounded gravel, wet.
28						SP	
30		0					Brown, medium and fine grain, sand, little silt, some sub-rounded gravel, wet.
32						SP	
34							
36		0					Brown, medium and fine grain, sand, little silt, some sub-rounded gravel, wet.
38						SP	
40		0					Brown, medium and fine grain, sand, little silt, trace sub-rounded gravel, wet.
42						SP	
44		0					
46							Brown, medium and fine grain, sand, little silt, trace sub-rounded gravel, wet.
48						SP	
50		0					Brown, medium grain, sand, little sub-rounded gravel, wet.
52						SP	
54		0					
56						SP	Brown, medium grain, sand, little sub-rounded gravel, wet.

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-4S

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
56						SP	Continued
58							
60							Brown, medium and fine grain, sand, little sub-rounded gravel, trace silt, wet.
62							
64						SP	Brown, medium and fine grain, sand, little sub-rounded gravel, trace silt, wet. Auger down to 67'.
66							
68							
70							
72							
74							
76							
78							
80							
82							
84							
86							
88							

IT COMMERCIAL Rev. 12/6/99 JIMMYS2.GPJ IT CORP.GDT 5/9/02



Shaw Environmental, Inc.

Drilling Log

Monitoring Well **ITMW-4D**

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Project Jimmy's Dry Cleaners Owner NYSDEC
 Location 61 Nasseau Road, Roosevelt, NY Proj. No. 824324
 Surface Elev. NA Total Hole Depth 107.0 ft. North _____ East _____
 Top of Casing NA Water Level Initial ▽ 20.0 ft. Static NA Diameter 8 in.
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/010 in.
 Casing: Dia 2 in. Length 94.5 ft. Type PVC
 Fill Material #0 Morie Rig/Core _____
 Drill Co. North Star Drilling Method HSA
 Driller S.Breeds Log By MEF Date 4/16/02 Permit # NA
 Checked By _____ License No. _____

COMMENTS

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0							Auger down to 65' and view auger cuttings coming up from borehole with depth. Above lithology described in ITMW-4S.
2							
4							
6							
8							
10							
12							
14							
16							
18							
20							
22							
24							
						SP	

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-4D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
24							Continued
26							
28							
30							
32							
34							
36							
38							
40						SP	
42							
44							
46							
48							
50							
52							
54							
56		0					

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-4D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
56							<i>Continued</i>
58							
60		0				SP	
62							
64		0					
66							Brown, medium and fine grain, sand, little subrounded gravel, trace silt, wet.
68						SP	
70		0					Brown, medium and fine grain, sand, little sub-rounded gravel, trace silt, wet.
72						SP	
74		0					
76							Brown-light brown, medium and fine grain, sand, little silt, trace sub-rounded gravel, wet.
78						SP	
80		0					Brown-light brown, medium and fine grain, sand, little silt, trace sub-rounded gravel, wet.
82						SP	
84		0					
86							Brown-light brown, medium and fine grain, sand, little silt, trace sub-rounded gravel, wet.
88						SP	

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Shaw Environmental, Inc.

Drilling Log

Monitoring Well

ITMW-4D

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Project Jimmy's Dry Cleaners

Owner NYSDEC

Location 61 Nasseau Road, Roosevelt, NY

Proj. No. 824324

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) <small>Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.</small>
88						SP	<i>Continued</i>
90		0				SP SM	Brown-light brown, medium and fine grain, sand, some silt, trace sub-rounded gravel, wet.
92						SP SM	
94		0				SP SM	Brown-light brown, medium and fine grain, sand, some silt, trace sub-rounded gravel, wet.
96						SP SM	
98						SP SM	
100		0				SP SM	Brown-light brown, medium and fine grain, sand, some silt, trace sub-rounded gravel, wet.
102						SP SM	
104		0				SP SM	Brown-light brown, medium and fine grain, sand, some silt, trace sub-rounded gravel, wet. Auger down to 107'.
106						SP SM	
108							
110							
112							
114							
116							
118							
120							

IT COMMERCIAL Rev. 12/6/89 JIMMYS2.GPJ IT CORP.GDT 5/9/02

Well Completion Log

Well ID: CMT-1

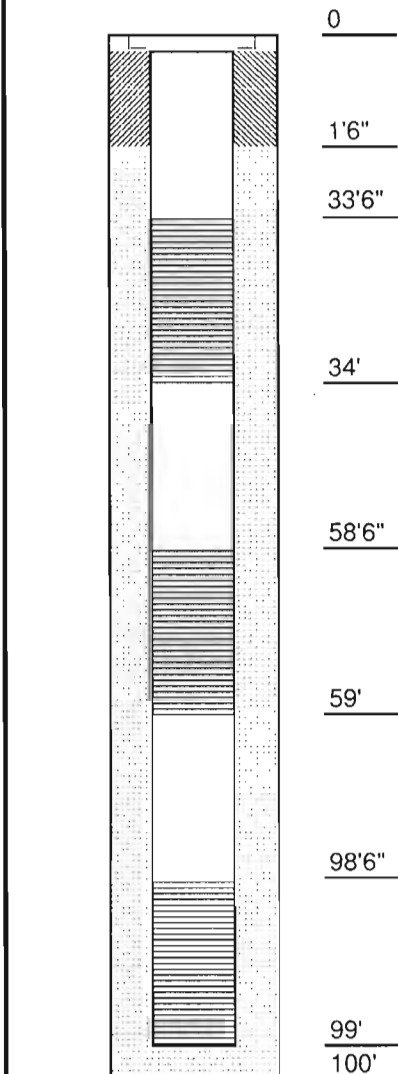
Project: Jimmy's Cleaners
Location: Freeport, NY
Project No.: _____




Client: NYSDEC
Drill Date: 5/30/2006

Construction Notes:

Inspector: Dan Simpson
Drilling Contractor: Aquifer Drilling and Testing Inc.
Well Type: CMT

WELL CONSTRUCTION DETAIL



Screen: 
Filter: 
Seal: 

NOT TO SCALE

Static Water Level (ft bgs): _____

Measuring Point: Grade

Total Depth of Well: 99'

Drilling Method- Overburden:

Type: HSA Diameter: 3"

Casing: NA

Sampling Method - Overburden:

Type: _____ Diameter: _____

Weight: _____ Fall: _____

Interval: _____

Riser Pipe:

Material: PVC Diameter: 1"

Length: 99' Joint Type: N/A

Screen:

Material: Mesh Diameter: 1"

Length: 6" Joint Type: N/A

Slot Size: _____ Intervals: 99', 59', 34'

Filter Pack:

Type: Collapse Grade: NA

Interval: 99'-1'6"

Seal (s):

Type: Cement Interval: 1'6"-0

Type: _____ Interval: _____

Type: _____ Interval: _____

Well Completion Log

Well ID: CMT-2

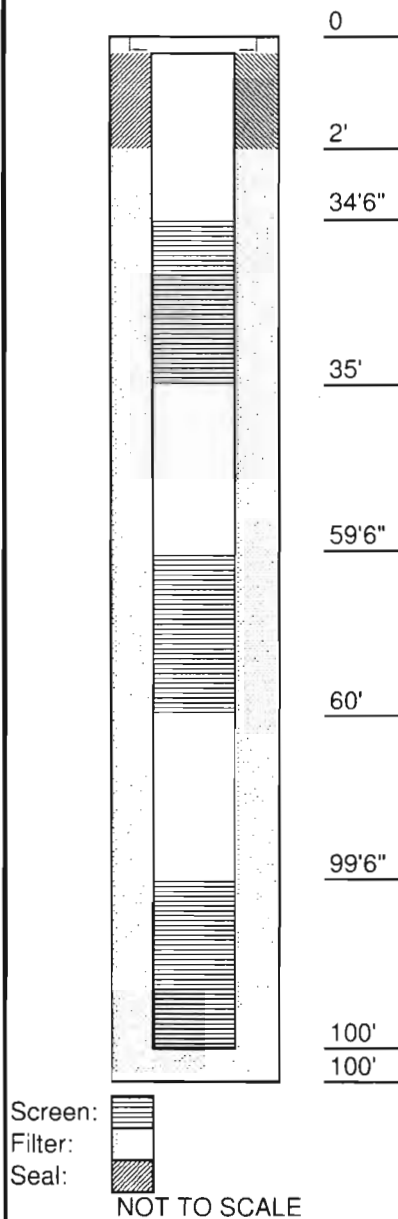
Project: Jimmy's Cleaners
Location: Freeport, NY
Project No.: _____

Client: NYSDEC
Drill Date: 5/17/2006

Construction Notes:

Inspector: Dan Simpson
Drilling Contractor: ADT
Well Type: CMT

WELL CONSTRUCTION DETAIL



Static Water Level (ft bgs): _____
Measuring Point: Grade
Total Depth of Well: _____

Drilling Method- Overburden:

Type: HSA Diameter: 3"
Casing: _____

Sampling Method - Overburden:

Type: _____ Diameter: _____
Weight: _____ Fall: _____
Interval: _____

Riser Pipe:

Material: PVC Diameter: 1"
Length: 100' Joint Type: N/A

Screen:

Material: Mesh Diameter: 1"
Length: 6" Joint Type: N/A
Slot Size: _____ Intervals: 100', 60', 35'

Filter Pack:

Type: Collapse Grade: _____
Interval: 100'-2'

Seal (s):

Type: Cement Interval: 2'-0
Type: _____ Interval: _____
Type: _____ Interval: _____

Well Completion Log

Project: Jimmy's Cleaners
Location: Freeport, NY
Project No.: _____

Well ID: CMT-3

Client: NYSDEC
Drill Date: 5/16/2006

Construction Notes:

Inspector: Dan Simpson
Drilling Contractor: ADT
Well Type: CMT

Static Water Level (ft bgs): _____
Measuring Point: Grade
Total Depth of Well: _____

Drilling Method- Overburden:

Type: HSA Diameter: 3"
Casing: _____

Sampling Method - Overburden:

Type: _____ Diameter: _____
Weight: _____ Fall: _____
Interval: _____

Riser Pipe:

Material: PVC Diameter: 1"
Length: 105' Joint Type: N/A

Screen:

Material: Mesh Diameter: 1"
Length: 6" Joint Type: N/A
Slot Size: _____ Intervals: 105', 65', 40'

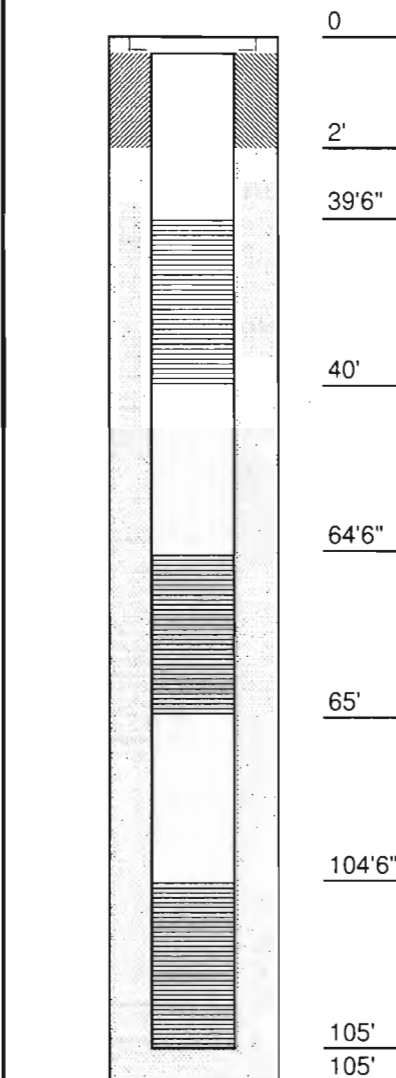
Filter Pack:

Type: Collapse Grade: _____
Interval: 105"-2'

Seal (s):

Type: Cement Interval: 2'-0
Type: _____ Interval: _____
Type: _____ Interval: _____

WELL CONSTRUCTION DETAIL



Screen: 
Filter: 
Seal: 
NOT TO SCALE

Well Completion Log

Well ID: CMT-4

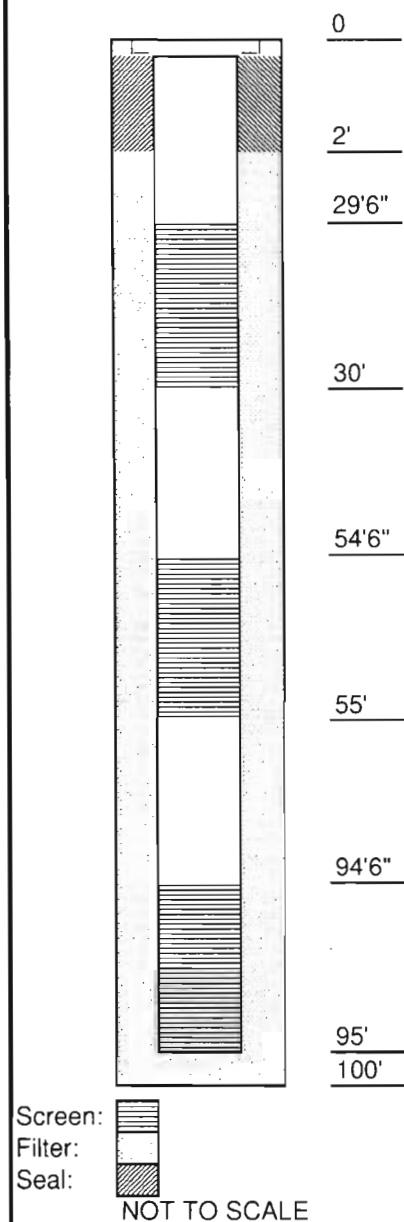
Project: Jimmy's Cleaners
Location: Freeport, NY
Project No.: _____

Client: NYSDEC
Drill Date: 5/18/2006

Construction Notes:

Inspector: Dan Simpson
Drilling Contractor: ADT
Well Type: CMT

WELL CONSTRUCTION DETAIL



Static Water Level (ft bgs): _____
Measuring Point: Grade
Total Depth of Well: _____

Drilling Method- Overburden:

Type: HSA Diameter: 3"
Casing: _____

Sampling Method - Overburden:

Type: _____ Diameter: _____
Weight: _____ Fall: _____
Interval: _____

Riser Pipe:

Material: PVC Diameter: 1"
Length: 95' Joint Type: N/A

Screen:

Material: Mesh Diameter: 1"
Length: 6" Joint Type: N/A
Slot Size: _____ Intervals: 95', 55', 30'

Filter Pack:

Type: Collapse Grade: _____
Interval: 95'-2'

Seal (s):

Type: Cement Interval: 2'-0
Type: _____ Interval: _____
Type: _____ Interval: _____

Well Completion Log

Well ID: CMT-5

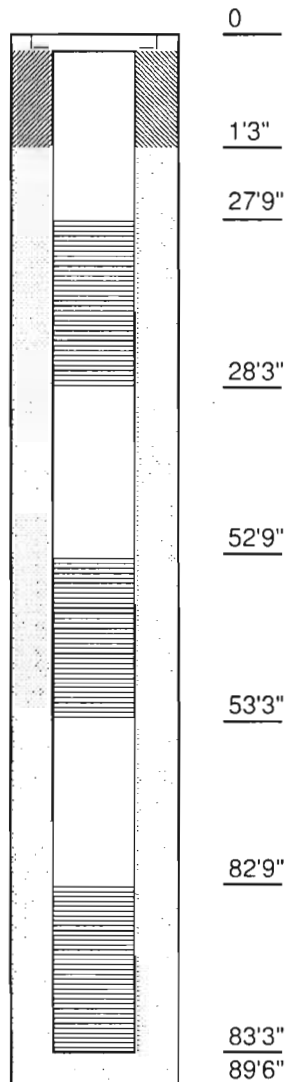
Project: Jimmy's Cleaners
Location: Freeport, NY
Project No.: _____

Client: NYSDEC
Drill Date: 5/15/2006

Construction Notes:

Inspector: Dan Simpson
Drilling Contractor: ADT
Well Type: CMT

WELL CONSTRUCTION DETAIL



Screen:
Filter:
Seal:

NOT TO SCALE

Static Water Level (ft bgs): _____
Measuring Point: Grade
Total Depth of Well: _____

Drilling Method- Overburden:

Type: Direct Push Diameter: 2"
Casing: _____

Sampling Method - Overburden:

Type: _____ Diameter: _____
Weight: _____ Fall: _____
Interval: _____

Riser Pipe:

Material: PVC Diameter: 1"
Length: 83'3" Joint Type: N/A

Screen:

Material: Mesh Diameter: 1"
Length: 6" Joint Type: N/A
Slot Size: _____ Intervals: 83'3", 53'3", 28'3"

Filter Pack:

Type: Collapse Grade: _____
Interval: 83'3"-1'3"

Seal (s):

Type: Cement Interval: 1'3"-0
Type: _____ Interval: _____
Type: _____ Interval: _____

APPENDIX E

SVE System Operation and Maintenance Manual





Startup Plan

Jimmy's Dry Cleaners Site

Site Number: 130080
Contract No.: D009345

Roosevelt, Nassau County, New York

Prepared for:

Remedial Section A, Remedial Bureau E
Division of Environmental Remediation
New York State Department of Environmental
Conservation
625 Broadway, 12th Floor
Albany, New York 12233-7017

Prepared by:

EnviroTrac Ltd.
5 Old Dock Road
Yaphank, NY 11980

March 2016

GENERAL DESCRIPTION:

The following text describes the start up, testing and operation for the Soil Vapor Extraction (SVE) system as constructed by EnviroTrac Ltd., Yaphank, NY. EnviroTrac installed the equipment to The Jimmy's Dry Cleaner's Site, located at 61 Nassau Road, Roosevelt, New York, as per Contract Number D009345.

Section 1 – Visual Inspection

This visual inspection section is to verify that the equipment installed:

- has not been damaged during the shipping process,
- the equipment ordered is included with the shipment,
- the equipment supplied is configured correctly as per the Process & Instrumentation Diagram and are properly identified.

Refer to Section 7, System Drawings for equipment layout and Process & Instrumentation Diagrams (P&ID).

A. Environmental Equipment Enclosure

- q Inspect exterior of equipment enclosure noting any questionable defects or blemishes that could be a result of negligence or damage incurred during construction.
- q Inspect interior of equipment enclosure noting any questionable defects or blemishes that could be a result of negligence or damage incurred during construction.
- q The enclosure is equipped with a heater, exhaust fan, and pair of Louvers.
- q Major remedial system components contained within the Environmental Equipment Enclosure:

SVE System Major Equipmnet

- § Regenerative Blowers (2)
- § Sound Enclosures (2)
- § In-line Air Filters (2)
- § Fresh Air Intake Filters (2)
- § Moisture Separator
- § Off-gas Carbon Canisters (2)

B. SVE System
Equipment Checklist

Equipment	Present	Visual Inspection	Proper Process Configuration	Maintenance / Frequency
Regenerative Blower (B-1) Rotron #HIE757F72XL				None
Regenerative Blower (B-2) Rotron #HIE757F72XL				None
Inline Air Filter (F-1), Solberg #CSL-334P-300				Clean/Replace As Needed
Inline Air Filter (F-3), Solberg #CSL-334P-300				Clean/Replace As Needed
Fresh Air Intake Filter (F-2), Solberg #FS-231P-200				Clean/Replace As Needed
Fresh Air Intake Filter (F-4), Solberg #FS-231P-200				Clean/Replace As Needed
Moisture Separator, ESD #AWS60-4				Drain when Full
Discharge Silencers (2) Solberg SLCR300				None
Vapor Phase Carbon, Carbtrol #G-2S				Replace Carbon As Needed
Vacuum Gauges Thirteen (13) Total 0-100"H2O				Replace as Needed
Temperature Gauge Four (4) Total				None
Pressure Gauge Five (5) Total				Repac as Needed
Rotameter Flow Meters, Nine (9) Total				None
Influent and Effluent Flow Meters, Two (2) Total				None
Vacuum Switch, Dwyer #1823-80				None
Pressure Switch, Dwyer #CS-3				None

C. Master Control Panel & Service Panel

Equipment Checklist

Equipment	Present	Visual Inspection	Proper Process Configuration	Maintenance / Frequency
Master Control Panel				Check indicator lights monthly
Variable Frequency Drive for Blower B-1				None
Variable Frequency Drive for Blower B-2				None
Sensaphone, 4000				None
Service Panel				None

Section 2 – Electrical Inspection

The following checklist is to visually inspect wiring connections noting any obvious wiring insulation flaws and other defects including loose or undesirable connections and to record certain information.

- q Inspect conductor and ground connections at the service panel
- q Inspect main and branch circuit breaker connections at service panel
- q Inspect wiring connections at master control panel (MCP) motor starters
- q Inspect wiring connections at MCP terminal strips
- q Inspect wiring connections at MCP I.S. relay(s)
- q Inspect wiring connections at MCP
- q Inspect and record amperage overload settings of variable frequency drives
VFD1 (Blower 1) _____ Maximum Amps,
VFD2 (Blower 2) _____ Maximum Amps,
- q Inspect motor wiring connections at the Control and VFD Panels
- q Inspect the interior and exterior of the master control panel, variable frequency drive enclosures, and service panel to ensure no dust, dirt or debris is contained within the enclosures. Also check to ensure that no water or condensation has accumulated inside the enclosure or on the components within the enclosure. When this inspection procedure is completed, ensure that all enclosure covers and doors are closed and secured before energizing system.

Notes:

Section 3 – Live Electrical Inspection

Note: Live electrical inspection of the system requires power be supplied to the system while enclosures are open and equipment is energized. Individuals trained and experienced in recording information while high power is present must only perform the following procedures. Ensure that any enclosure that is not being inspected has its cover closed and secured.

- q Check supply voltage at the service panel leg to leg and leg to ground and record:
_____L1 to L2; _____L1 to L3; _____L2 to L3; _____L1 to ground; _____L2 to ground; _____L3 to ground

Proceed only if site voltage is within proper operating parameters.

- q “Bump” Soil Vapor Extraction Blower 1 motor and check for proper rotation
- q “Bump” Soil Vapor Extraction Blower 2 motor and check for proper rotation

The above procedure will require two individuals. One individual will observe if the rotation of the device is correct and the second will energize the device.

Override or alarm condition simulation checklist

- q Manually actuate alarm conditions for the following– check for logic and alarm light:
 - q Phase separator high-high level
 - q SVE High Vacuum Switch
 - q SVE High Pressure Switch

Amperage draw checklist

Note: amperage test on some equipment must be taken during operational testing.

- q Soil Vapor Extraction blower B-1 – check for running amps
_____L1 run amps; _____L2 run amps; _____L3 run amps
- q Soil Vapor Extraction blower B-2 – check for running amps
_____L1 run amps; _____L2 run amps; _____L3 run amps
- q Soil Vapor Extraction blower B-1 Sound Enclosure Exhaust Fan – check for running amps
_____L1 run amps; _____L2 run amps

- q Soil Vapor Extraction blower B-2 Sound Enclosure Exhaust Fan – check for running amps
 _____ L1 run amps; _____ L2 run amps
- q System Enclosure Exhaust Fan – check for running amps
 _____ L1 run amps; _____ L2 run amps

Notes:

Section 4 – INITIAL OPERATION TEST / SYSTEM TESTING

This initial operation test is provided to ensure that the various components operate properly as a system, that the system is free of leaks and operates at the designed flow rate.

The initial operation test shall be conducted with fresh air only. No soil vapor is to be extracted from the SVE wells. As per section XI-45 00 05-3.5K If at any time prior to the start of the SVE Performance Test, the Contractor starts up the SVE System and begins to extract soil vapors for a period of 1 hour or greater, the Contractor shall at a minimum collect soil vapor samples from each vapor extraction well, as well as measure and record vacuum, flow rate and temperature of each vapor extraction well.

Initial Operation Test Start-up Procedure:

1. Ensure all power is locked out / tagged out per all applicable procedures.
2. Open door of master control panel and turn the control circuit breakers to the ON position. Close the door of the master control panel when done.
3. Ensure all enclosures are closed and secured.
4. Close valves to all SVE wells fully.
5. Open SVE manual dilution air filter valves fully.
6. Ensure all selector switches at the master control panel are in the OFF positions.
7. Ensure all circuit breakers in the service panel are in the OFF positions.
8. Apply power to the system and components in the equipment shed by turning the circuit breakers in the service panel to the ON positions.
9. Turn the selector switches for the VFDs to the AUTO, NORMAL, and AFC positions.
10. Turn the selector switches for the SVE Blowers on the MCP to the AUTO position

Initial Operation Test System Process:

While the blower is operating, the green run light on the VFD will illuminate. When the blower shuts off, the green indicator will go out. Once started the SVE Blowers will operate until the one of the alarms interrupt operation or the selector switch is turned to the OFF position.

Forced Alarm Conditions:

During the initial testing, the system will be forced into alarm conditions that can occur along the process stream to ensure the controls are operating as designed.

1. MOISTURE SEPARATOR HIGH LEVEL ALARM

While the entire system is operating automatically manually lift the liquid level switch. Once this occurs, power to the SVE blowers is interrupted and the red MOISTURE SEPARATOR HIGH LEVEL ALARM indicator will illuminate. In addition the Sensaphone will begin to dial out to the programmed phone numbers notifying the shutdown.

2. SVE BLOWER VACUUM ALARM

While the entire system is operating automatically remove the tubing leading from the vacuum switch to the SVE manifold. This will create a false low vacuum alarm, interrupting power to the SVE blowers. The Sensaphone should again call to the programmed numbers.

3. SVE BLOWER HIGH PRESSURE ALARM

While the system is operating, adjust the setting of the pressure switch to below the current pressure on the lead carbon drum. This will result in a high pressure alarm, interrupting power to the SVE blowers. The Sensaphone should again call to the programmed numbers.

To clear alarm conditions hit the Alarm Reset button. All indicator lights should turn off, and the system should then be operable in auto mode.

Visual Mechanical Inspection During Initial Operation Phase

- q Inspect piping, valves, and connections for leaks.
- q Ensure all pressure and vacuum indicators are operational.
- q Ensure proper set points of vacuum and pressure switches.
- q Ensure all flow meters are operational.
- q Ensure all sampling ports are working and closed when finished.

Notes: _____

Initial Operation Test Shutdown Procedure:

The following procedure will represent a normal, non-emergency shutdown of the process equipment in preparation for final well connections or maintenance procedures that may need to be performed.

1. Turn the selector switch for the SVE blowers to the OFF position. The SVE blowers will stop operating.
2. Turn the selector switches on the variable frequency drives to the OFF, NORMAL, and AFC positions.
3. At the service panel, turn the circuit breakers for the MCP and the VFDs to the OFF positions.

Operation & Maintenance Data Sheet
NYSDEC-Jimmy's Dry Cleaners
61 Nassau Road
Roosevelt, NY

EnviroTrac Environmental Services
5 Old Dock Road, Yaphank, NY 11980
(631)924-3001, Fax (631)924-5001

Date:
Weather / Temp:
Technician / Operator:

Arrival Time:
Departure Time:

System Status							
	Arrival	Departure	SVE Blower 1 Run Time (Hrs)				
SVE Blower 1 (ON/OFF)			SVE Blower 2 Run Time (Hrs)				
SVE Blower 2 (ON/OFF)			SVE Blower 1 VFD Frequency (Hz)				
Sensaphone (ON/OFF)			SVE Blower 2VFD Frequency (Hz)				
Soil Vapor Extraction System							
Total Influent Air Flow Rate (cfm)			Total Effluent Air Flow Rate (cfm)				
Blower 1 Inline Air Filter (F-1) Inlet Vacuum ("H2O)			Blower 2 Inline Air Filter (F-3) Inlet Vacuum ("H2O)				
Blower 1 Inlet Vacuum ("H2O)			Blower 2 Inlet Vacuum ("H2O)				
Blower 1 Fresh Air Valve Open (%)			Blower 2 Fresh Air Valve Open (%)				
Blower 1 Inlet Temperature (°F)			Blower 2 Inlet Temperature (°F)				
Blower 1 Outlet Temperature (°F)			Blower 2 Outlet Temperature (°F)				
Blower 1 Outlet Pressure ("H2O)			Blower 2 Outlet Pressure ("H2O)				
VGAC-1 Influent Pressure ("H2O)			VGAC-1 Influent PID (ppm)				
VGAC-2 Influent Pressure ("H2O)			VGAC-2 Influent PID (ppm)				
VGAC-2 Effluent Pressure ("H2O)			VGAC-2 Effluent PID (ppm)				
			Moisture Separator Tank Level (gal)				
SVE Manifold Legs - Vacuum/Flow Rate/PID							
SVE-1R ("H2O)/(cfm)/(ppm)				SVE-6R ("H2O)/(cfm)/(ppm)			
SVE-2R ("H2O)/(cfm)/(ppm)				SVE-7R ("H2O)/(cfm)/(ppm)			
SVE-3R ("H2O)/(cfm)/(ppm)				SVE-8R ("H2O)/(cfm)/(ppm)			
SVE-4R ("H2O)/(cfm)/(ppm)				SVE-9R ("H2O)/(cfm)/(ppm)			
SVE-5R ("H2O)/(cfm)/(ppm)							
Soil Vapor Monitoring Probes - Vacuum Influence/PID				Sound Measurements (dBA)			
SVM-1 ("H2O)/(ppm)				Inside Shed			
SVM-2 ("H2O)/(ppm)				1 m from East Wall			
SVM-3 ("H2O)/(ppm)				1 m from North Wall			
SVM-4 ("H2O)/(ppm)				1 m From West Wall			
SVM-5 ("H2O)/(ppm)				1 m from South Wall			

Notes, Comments & Observations:



Soil Vapor Extraction System O&M Manual

Jimmy's Dry Cleaners Site

Site Number: 130080
Contract No.: D009345

Roosevelt, Nassau County, New York

Prepared for:

Remedial Section A, Remedial Bureau E
Division of Environmental Remediation
New York State Department of Environmental
Conservation
625 Broadway, 12th Floor
Albany, New York 12233-7017

Prepared by:

EnviroTrac Ltd.
5 Old Dock Road
Yaphank, NY 11980

March 2016

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Section 2 – Soil Vapor Extraction Equipment

- Ametek Rotron **#EN757F72XL** Regenerative Blower Specifications, Service and Parts Manual
- Waste2Water Air/Water Separator **#AWS60-4** Specifications
- Solberg **#CSL-334P-300** In-Line Air Filter Specifications
- Solberg **#SLCR300** Discharge Silencer Specifications
- Solberg **#FS-231P-200** Fresh Air Intake Filter/Silencer Specifications
- Carbtrol **#G-2S 170#** Vapor Phase Carbon Drum Specifications
- ArtUSA Sound Enclosure Specifications
- AirTech Pressure and Vacuum Relief Valve **#PC81-Z & #VC81-Z** Specifications

Section 3 – Soil Vapor Extraction Instrumentation/Switches

- NOSHOK Vacuum & Pressure Gauge Specifications, Installation and Maintenance Instructions
- Ametek Rotron **FM40C450Q** Air Flow Meter Specifications, Operation and Maintenance Manual
- Key Instruments **FR5A75PL** Rotameter Air Flow Meter Specifications
- Dwyer Instruments **1823-80** Low Differential Pressure Switch Specifications – Installation and Operating Instructions
- Dwyer Instruments **CS-3** Diaphragm Pressure Switch Specifications – Installation and Operating Instructions
- Wika **TI.20** Bimetal Thermometer Specifications

Section 4 – Heating/Ventilation/Lighting

- Dayton **2CJE9** Hazardous Location Convection Heater Operating Instructions and Parts Manual
- Dayton **4C020** Hazardous Location Exhaust Fan Specifications, Operating Instructions and Parts Manual
- Columbus Electric **EPETD8D** Explosion Proof Thermostat Specifications, Installation and Operation Manual
- Appleton **A-51 Series** Hazardous Location Light Fixture Instruction Sheet

Section 5 – Controls

- Schneider Electric **#8839-EFD-F-H-2-V-Y-A07-B08-A09** Variable Frequency Drive Specifications, Instruction Bulletin
- IDEC **FL1E-H12RCE** Smart Relay Specifications, User's Manual
- Sensaphone **400** User's Manual

- Wiegman Nema 4X Enclosure Specifications
- Finder Slim Control Relays #**34.51.7.024.0010** Specifications
- Omron 24VDC Power Supply #**S8VK-G01524** Specifications
- Weidmuller Din Rail Receptacle #**9915480001** Specifications
- ABB Circuit Breaker Specifications
- Mersen Surge Trap #**ST1201PG** Specifications
- Weidmuller 6mm Terminal Block Specifications
- Finder **46 Series** Control Relays Specifications
- Iboco Wire Channel Specifications
- Idec IS Barrier #**EB3C-R03AN** Specifications
- Curtis Digital Hour Meter #**700QN0010** Instructions
- Idec 22mm Pilot Lights Specifications
- Idec 22mm Panel Switches Specifications

Section 6 – System Drawings

- FIG-1-As-Built Process and Instrumentation Diagram
- FIG-E1-As-Built Control Panel Exterior Layout
- FIG-E2-As-Built Control Panel Interior Layout
- FIG-E3-As-Built Electrical Single Line Diagram
- FIG-E4-As-Built Control Schematic

Operation, Maintenance, and Monitoring Checklist

<u>Procedure</u>	<u>Frequency</u>
Record all gauge readings in system log and field book.	Each Visit
Collect sample with tedlar airbags for analysis with PID from the blower	Monthly
Empty Moisture Separator.	Monthly
Bleed SVE lines.	Monthly
Clean SVE inline filter elements. Replace element when differential pressure across unit reaches 15 in. H ₂ O above the initial differential pressure.	Monthly
Change SVE blower bearings.	15,000 hrs

Sensaphone (859) 285-4680

Zone 1 - General VFD Fault
Zone 2 - Moisture Separator High Level
Zone 3 - High Vacuum
Zone 4 - High Pressure

See SVE component sections for more detailed description of maintenance procedures.

Operation & Maintenance Data Sheet
 NYSDEC-Jimmy's Dry Cleaners
 61 Nassau Road
 Roosevelt, NY

EnviroTrac Environmental Services
 5 Old Dock Road, Yaphank, NY 11980
 (631)924-3001, Fax (631)924-5001

Date:
 Weather / Temp:
 Technician / Operator:

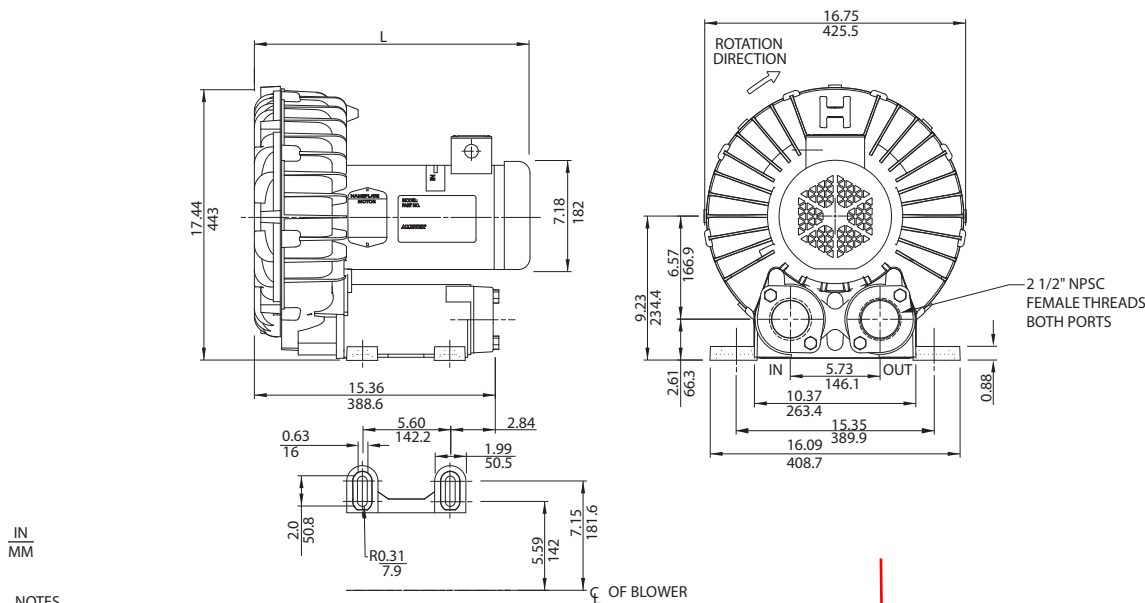
Arrival Time:
 Departure Time:

System Status							
	Arrival	Departure	SVE Blower 1 Run Time (Hrs)				
SVE Blower 1 (ON/OFF)			SVE Blower 2 Run Time (Hrs)				
SVE Blower 2 (ON/OFF)			SVE Blower 1 VFD Frequency (Hz)				
Sensaphone (ON/OFF)			SVE Blower 2VFD Frequency (Hz)				
Soil Vapor Extraction System							
Total Influent Air Flow Rate (cfm)			Total Effluent Air Flow Rate (cfm)				
Blower 1 Inline Air Filter (F-1) Inlet Vacuum ("H2O)			Blower 2 Inline Air Filter (F-3) Inlet Vacuum ("H2O)				
Blower 1 Inlet Vacuum ("H2O)			Blower 2 Inlet Vacuum ("H2O)				
Blower 1 Fresh Air Valve Open (%)			Blower 2 Fresh Air Valve Open (%)				
Blower 1 Inlet Temperature (°F)			Blower 2 Inlet Temperature (°F)				
Blower 1 Outlet Temperature (°F)			Blower 2 Outlet Temperature (°F)				
Blower 1 Outlet Pressure ("H2O)			Blower 2 Outlet Pressure ("H2O)				
VGAC-1 Influent Pressure ("H2O)			VGAC-1 Influent PID (ppm)				
VGAC-2 Influent Pressure ("H2O)			VGAC-2 Influent PID (ppm)				
VGAC-2 Effluent Pressure ("H2O)			VGAC-2 Effluent PID (ppm)				
			Moisture Separator Tank Level (gal)				
SVE Manifold Legs - Vacuum/Flow Rate/PID							
SVE-1R ("H2O)/(cfm)/(ppm)				SVE-6R ("H2O)/(cfm)/(ppm)			
SVE-2R ("H2O)/(cfm)/(ppm)				SVE-7R ("H2O)/(cfm)/(ppm)			
SVE-3R ("H2O)/(cfm)/(ppm)				SVE-8R ("H2O)/(cfm)/(ppm)			
SVE-4R ("H2O)/(cfm)/(ppm)				SVE-9R ("H2O)/(cfm)/(ppm)			
SVE-5R ("H2O)/(cfm)/(ppm)							
Soil Vapor Monitoring Probes - Vacuum Influence/PID							
SVM-1 ("H2O)/(ppm)				SVM-4 ("H2O)/(ppm)			
SVM-2 ("H2O)/(ppm)				SVM-5 ("H2O)/(ppm)			
SVM-3 ("H2O)/(ppm)							

Notes, Comments & Observations:

SVE EQUIPMENT

3.0 / 5.0 HP Sealed Regenerative w/Explosion-Proof Motor



MODEL	L (IN/MM)
EN757M72XL	19.72/500.9
EN757F72XL	21.00/533.4

		Part/Model Number				
Specification	Units	EN757M72XL	EN757M86XL	EN757F72XL	CP757FW72XLR	CP757FU72XLR
		081176	081177	081174	081180	081181
Motor Enclosure - Shaft Mtl.	-	XP-CS	XP-CS	XP-CS	Chem XP-SS	Chem XP-SS
Horsepower	-	3.0	3.0	5.0	XP-CS	3
Voltage	AC	208-230/460	575	208-230/460	208-230/460	208-230/460
Phase - Frequency	-	Three-60 Hz	Three-60 Hz	Three - 60 Hz	Three-60 Hz	Three - 60 Hz
Insulation Class	-	B	B	B	B	B
NEMA Rated Motor Amps	Amps (A)	7.2/3.6	3.0	14/7	14/7	7.2/3.6
Service Factor	-	1.0	1.0	1.0	1.0	1.0
Maximum Blower Amps	Amps (A)	10/5	4.0	15/7.5	15/7.5	10/5
Locked Rotor Amps	Amps (A)	54/47	22	152/76	152/76	54/27
NEMA Starter Size	-	0/0	0	1/1	1/1	0/0
Shipping Weight	Lbs	158	158	158	158	158
	Kg	71.7	71.7	71.7	71.7	71.7

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a $\pm 10\%$ voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

XP Motor Class - Group - See Explosive Atmosphere Classification Chart in Section I

This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

AMETEK TECHNICAL & INDUSTRIAL PRODUCTS
75 North Street, Saugerties, NY 12477
USA: +1 215-256-6601 - Europe: +44 (0) 845 366 9664 - Asia: +86 21 5763 1258
Customer Service Fax: +1 215.256.1338
www.ametektip.com

3.0 / 5.0 HP Sealed Regenerative w/Explosion-Proof Motor

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- Maximum flow: 310 SCFM
- Maximum pressure: 80 IWG
- Maximum vacuum: 75 IWG
- Standard motor: 5.0 HP, explosion-proof
- Cast aluminum blower housing, impeller, cover & manifold; cast iron flanges (threaded); teflon® lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

MOTOR OPTIONS

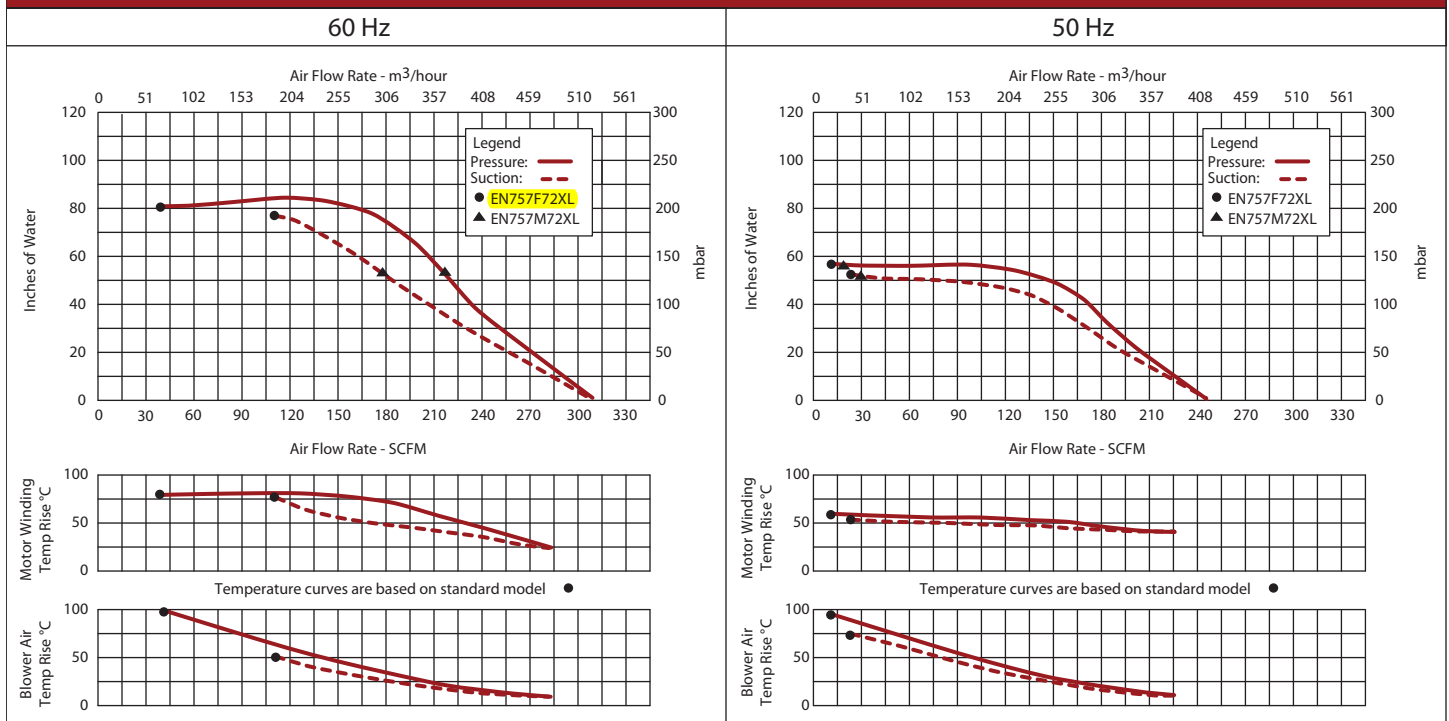
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepower for application-specific needs

BLOWER OPTIONS

- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

**Blower Performance at Standard Conditions**

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Customer Service Fax: +1 215.256.1338

www.ametektip.com

SERVICE AND PARTS MANUAL FOR BLOWER MODEL

EN707 – EN808 SINGLE PHASE

DIRECT DRIVE REGENERATIVE BLOWER



Technical & Industrial Products

627 Lake Street, Kent, Ohio 44240 U.S.A.

Telephone: 330-673-34521 Fax: 330-677-3306

e-mail: rotronindustrial@ametek.com

internet: www.ametektip.com



Your Choice. Our Commitment.™

WARRANTY, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS



TECHNICAL AND INDUSTRIAL PRODUCTS

627 Lake Street, Kent, Ohio 44240 USA

Telephone: 330-673-3452 Fax: 330-677-3306

e-mail: rotronindustrial@ametek.com web site: www.ametektip.com

1. AMETEK Rotron DR, EN and HiE regenerative direct drive blowers are guaranteed for one full year from the date of installation (limited to 18 months from the date of shipment) to the original purchaser only. Should the blower fail we will evaluate the failure. If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
2. AMETEK Rotron Minispiral, Revaflow, Multiflow, Nautilair, remote drive blowers, moisture separators, packaged units, CP blowers, Nasty Gas™ models and special built (EO) products are guaranteed for one full year from date of shipment for workmanship and material defect to the original purchaser only. Should the blower fail, If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
3. **Parts Policy** - AMETEK Rotron spare parts and accessories are guaranteed for three months from date of shipment for workmanship and material defect to the original purchaser only. If failure is determined to be workmanship or material defect related we will at our option repair or replace the part.

Corrective Action - A written report will be provided indicating reason(s) for failure, with suggestions for corrective action. Subsequent customer failures due to abuse, misuse, misapplication or repeat offense will not be covered. AMETEK Rotron will then notify you of your options. Any failed unit that is tampered with by attempting repair or diagnosis will void the warranty, unless authorized by the factory.

Terms and Conditions - Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, outbound and inbound shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Out-of-warranty product and in warranty product returned for failures determined to be caused by abuse, misuse, or repeat offense will be subject to an evaluation charge. Maximum liability will in no case exceed the value of the product purchased. Damage resulting from mishandling during shipment is not covered by this warranty. It is the responsibility of the purchaser to file claims with the carrier. Other terms and conditions of sale are stated on the back of the order acknowledgement.

Installation Instructions for SL, DR, EN, CP, and HiE Series Blowers

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.
2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller

imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

3. **Support the Piping** - The blower flanges and nozzles are designed as connection points only and are not designed to be support members.

Caution: Plastic piping should not be used on blowers larger than 1 HP that are operating near their maximum pressure or suction point. Blower housing and nearby piping temperatures can exceed 200°F. Access by personnel to the blower or nearby piping should be limited, guarded, or marked, to prevent danger of burns.

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.
5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Field representative will need to know the operating pressure/suction to properly diagnose the problem.
6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

Note: Remote Drive (Motorless) Blowers - Properly designed and installed guards should be used on all belts, pulleys, couplings, etc. Observe maximum remote drive speed allowable. Due to the range of uses, drive guards are the responsibility of the customer or user. Belts should be tensioned using belt gauge.

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all standard models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearing should be changed after 15,000 to 20,000 hours, on average. Replacement bearing information is specified on the chart below.

Bearing Part Number	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% +/- 5% Fill	Yes - 325 F
510449 516440 516648	203 202 307	Buna N	Exxon Polyrex Grease	NO
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	Buna N	Exxon Polyrex Grease	NO

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	<ol style="list-style-type: none"> * One phase of power line not connected * One phase of stator winding open Bearings defective Impeller jammed by foreign material Impeller jammed against housing or cover ** Capacitor open 	<ol style="list-style-type: none"> Connect Rewind or buy new motor Change bearings Clean and add filter Adjust Change capacitor
	No Sound	<ol style="list-style-type: none"> * Two phases of power line not connected * Two phases of stator winding open 	<ol style="list-style-type: none"> Connect Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	<ol style="list-style-type: none"> Insufficient fuse capacity Short circuit 	<ol style="list-style-type: none"> Use time delay fuse of proper rating Repair
	Motor Overheated Or Protector Trips	<ol style="list-style-type: none"> High or low voltage * Operating in single phase condition Bearings defective Impeller rubbing against housing or cover Impeller or air passage clogged by foreign material Unit operating beyond performance range Capacitor shorted * One phase of stator winding short circuited 	<ol style="list-style-type: none"> Check input voltage Check connections Check bearings Adjust Clean and add filter Reduce system pressure/vacuum Change capacitor Rewind or buy new motor
	Abnormal Sound	<ol style="list-style-type: none"> Impeller rubbing against housing or cover Impeller or air passages clogged by foreign material Bearings defective 	<ol style="list-style-type: none"> Adjust Clean and add filter Change bearings
	Performance Below Standard	<ol style="list-style-type: none"> Leak in piping Piping and air passages clogged Impeller rotation reversed Leak in blower Low voltage 	<ol style="list-style-type: none"> Tighten Clean Check wiring Tighten cover, flange Check input voltage
	<p>* 3 phase units ** 1 phase units *** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.</p>		

Blower Disassembly:

WARNING: Attempting to repair or diagnose a blower may void Rotron's warranty. It may also be difficult to successfully disassemble and reassemble the unit.

- 1) Disconnect the power leads. **CAUTION:** Be sure the power is disconnected before doing any work whatsoever on the unit.
- 2) Remove or separate piping and/or mufflers and filters from the unit.
- 3) Remove the cover bolts and then the cover. **NOTE:** Some units are equipped with seals. It is mandatory that these seals be replaced once the unit has been opened.
- 4) Remove the impeller bolt and washers and then remove the impeller. **NOTE:** Never pry on the edges of the impeller. Use a puller as necessary.
- 5) Carefully note the number and location of the shims. Remove and set them aside. **NOTE:** If the disassembly was for inspection and cleaning the unit may now be reassembled by reversing the above steps. If motor servicing or replacement and/or impeller replacement is required the same shims may not be used. It will be necessary to re-shim the impeller according to the procedure explained under assembly.

- 6) Remove the housing bolts and remove the motor assembly (arbor/housing on remote drive models).
- 7) Arbor disassembly (Applicable on remote drive models only):
 - a) Slide the bearing retraining sleeve off the shaft at the blower end.
 - b) Remove the four (4) screws and the bearing retaining plate from the blower end.
 - c) Lift the shaft assembly far enough out of the arbor to allow removal of the blower end snap ring.
 - d) Remove the shaft assembly from the arbor.
 - e) If necessary, remove the shaft dust seal from the pulley end of the arbor.

Muffler Material Replacement:

- 1) Remove the manifold cover bolts and then manifold cover.
- 2) The muffler material can now be removed and replaced if necessary. On blowers with fiberglass acoustical wrap the tubular retaining screens with the fiberglass matting before sliding the muffler pads over the screens.
- 3) Reassemble by reversing the procedure.

NOTE: On DR068 models with tubular mufflers it is necessary to remove the cover and impeller accessing the muffler material from the housing cavity.

Blower Reassembly:

- 1) Place the assembled motor (assembled arbor assembly for remote drive models) against the rear of the housing and fasten with the bolts and washer.
- 2) To ensure the impeller is centered within the housing cavity re-shim the impeller according to the procedure outlined below.
- 3) If blower had a seal replace the seal with a new one.
- 4) Place the impeller onto the shaft making sure the shaft key is in place and fasten with the bolt, washer and spacer as applicable. Torque the impeller bolt per the table below. Once fastened carefully rotate the impeller to be sure it turns freely.
- 5) Replace the cover and fasten with bolts.
- 6) Reconnect the power leads to the motor per the motor nameplate.

Bolt Size	Torque Pound-Force-Foot
1/4-20	6.25 +/- 0.25
5/16-18	11.5 +/- 0.25
3/8-16	20.0 +/- 0.5
1/2-13	49.0 +/- 1
5/8 -11	90.0 +/- 2

Impeller Shimming Procedure:

WARNING: This unit may be difficult to shim. Extreme care may be exercised.

Tools Needed: Machinist's Parallel Bar

Vernier Caliper with depth measuring capability

Feeler gauges or depth gauge

Measure the Following:

Distance from the flange face to the housing (A)

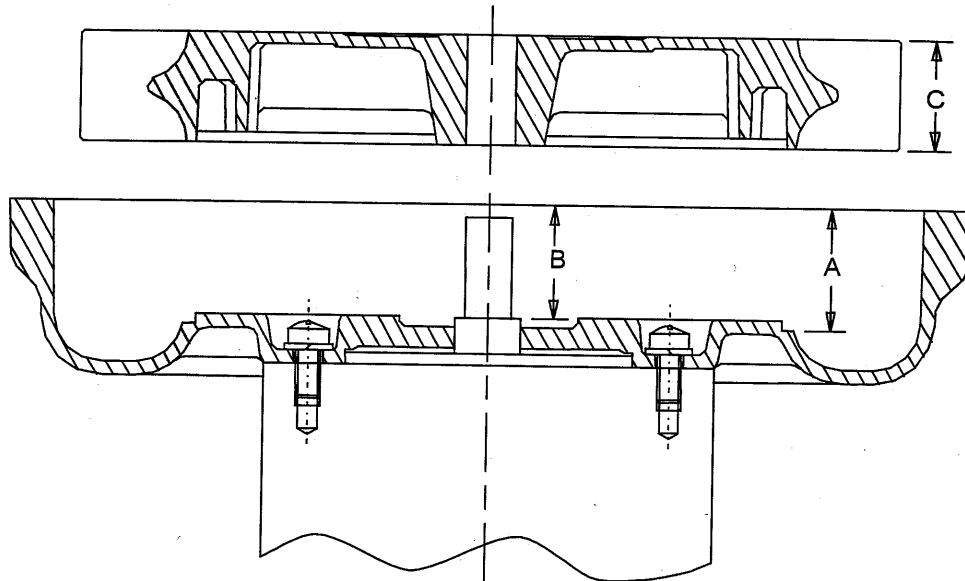
Distance from the flange face to the motor shaft shoulder (B)

Impeller Thickness (C)

Measurements (A) and (B) are made by laying the parallel bar across the housing flange face and measuring to the proper points. Each measurement should be made at three points, and the average of the readings should be used.

$$\text{Shim Thickness} = B - (A+C)/2$$

After the impeller installation (step #4 above) the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be $(A-C)/2$.





ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP

75 North Street
Saugerties, New York 12477
Phone: (845) 246-3401
Fax: (845) 246-3802

EXPLOSION-PROOF BLOWERS



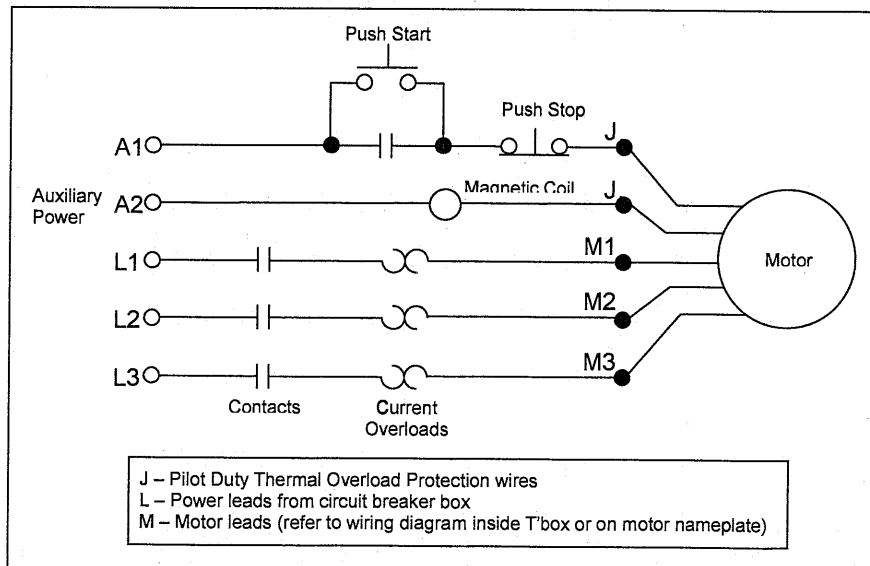
IMPORTANT: Read before wiring this Explosion-proof Blower

This AMETEK Rotron Explosion-proof Regenerative Blower may be equipped with Pilot Duty Thermal Overload (PDTO) or Automatic Thermal Overload (ATO) protection. When properly wired to a motor starter, this protection limits the motor winding temperature rise per the National Electric Code (NEC) article 500. Failure to properly wire this blower is an NEC violation and could cause an explosion. AMETEK Rotron assumes no responsibilities for damages incurred by negligent use of this product, and will not warranty a blower on which the PDTO is not properly connected. Some blowers 1 HP and under do not require PDTO and have built in ATO. Consult the factory if verification of wiring connections is required.

In all cases, follow the motor controller manufacturer's instructions. The following schematic is for conceptual understanding only, and may not apply to all motor/controller combinations.

The manufacturer's wiring diagram found on the motor takes precedent over reference diagrams supplied by AMETEK Rotron Technical Motor Division.

Schematic



The schematic is shown for a three phase motor. For a single phase motor disregard L3 and M3. Pushing the START button completes the auxiliary control circuit, allowing current to flow through the magnetic coil. The contacts are magnetically closed, starting the motor and latching the auxiliary circuit. The motor will continue to run until the STOP push button is depressed, the motor reaches the overload temperature, or the current sensing overloads trip out.

If you have any questions, contact AMETEK Rotron at 914-246-3401 for the location of your area representative.

POLICY REGARDING INSTALLATION OF AMETEK ROTRON REGENERATIVE BLOWERS IN HAZARDOUS LOCATIONS

AMETEK Rotron will not knowingly specify, design or build any regenerative blower for installation in a hazardous, explosive location without the proper NEMA motor enclosure. AMETEK Rotron does not recognize sealed blowers as a substitute for explosion-proof motors. Sealed units with standard TEFC motors should never be utilized where local, state, and/or federal codes specify the use of explosion-proof equipment.

AMETEK Rotron has a complete line of regenerative blowers with explosion-proof motors. Division 1 & 2, Class I, Group D; Class II, Groups F & G requirements are met with these standard explosion-proof blowers.

AMETEK Rotron will not knowingly specify, design or build any regenerative blower for installation in a hazardous, corrosive environment without the proper surface treatment and sealing options.

AMETEK Rotron has a complete line of Chemical Processing and Nasty Gas™ regenerative blowers with Chem-Tough™, stainless steel parts, and seals.

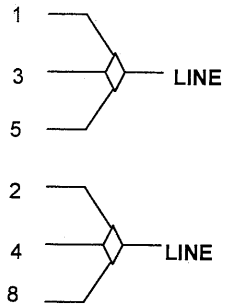
AMETEK Rotron offers general application guidance; however, suitability of the particular blower selection is ultimately the responsibility of the purchaser, not the manufacturer of the blower.

FS2 Rev B 3/10/98

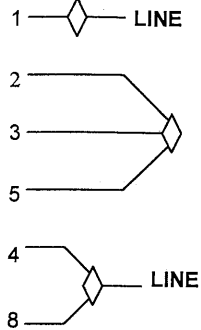
WIRING DIAGRAMS, XP MOTORS

H. 1Ø, 6 WIRE

115 VAC



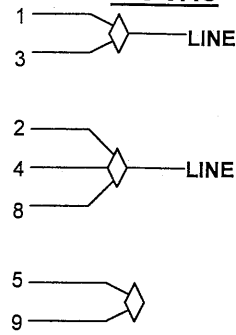
230 VAC



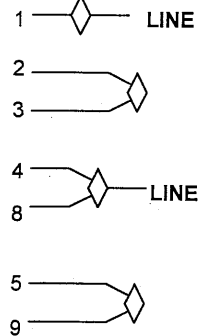
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

I. 1Ø, 7 WIRE

115 VAC



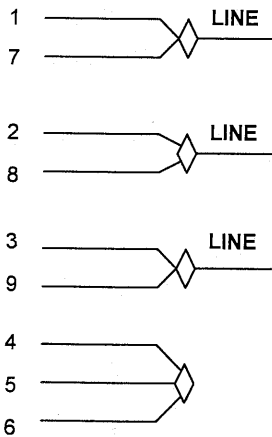
230 VAC



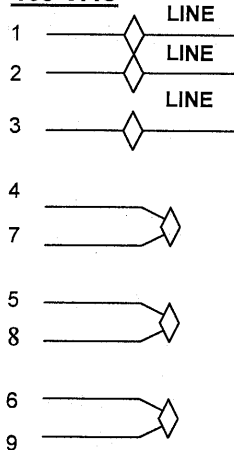
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

K. 3Ø, 9 WIRE

230 VAC



460 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

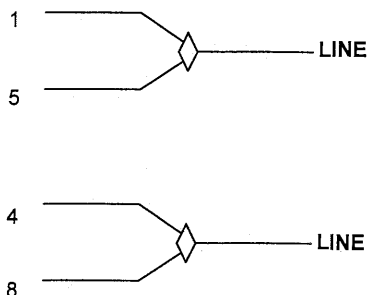
L. PILOT DUTY THERMAL OVERLOADS



HOOK J LEADS TO CONTROL CIRCUITRY

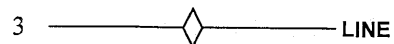
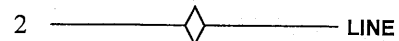
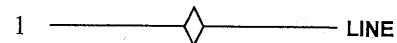
M. 1Ø 230 VAC

SINGLE VOLTAGE



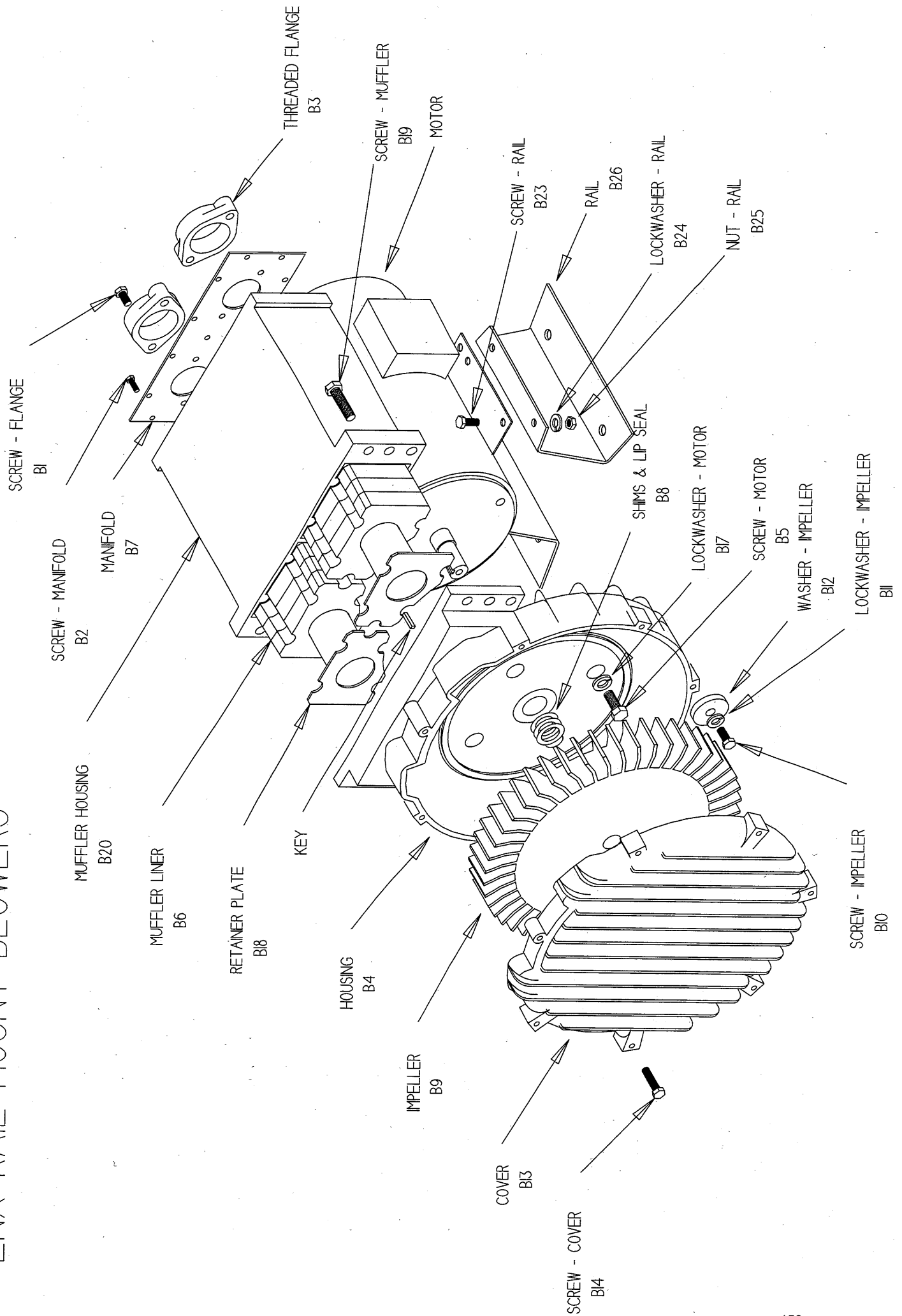
INTERCHANGE LEADWIRES 5 & 8 TO REVERSE ROTATION

N. 3Ø 575 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

ASSEMBLY DIAGRAM ENX RAIL MOUNT BLOWERS



EN 707/808

Service and Parts Manual

Model:

Part No.:

Rev A 1/30/03

Parts Breakdown

EN707FL5WL EN808FL5WL EN757FL5WL
038480 038481 084231

08/333

OBSOLETE **OBSOLETE**

Item No.	Qty.	Req'd	Description	510212	510632	510212	510212	510212
M3	1		Key Motor Shaft					510212
B1	4		Screw, Flange	155095	155025	155067	155067	155067
B2			Screw, Manifold	(13 pcs) 120214	120214	Not Used	Not Used	Not Used
B3	2		Flange	511480	511614	511614	511614	511614
B4	1		Screen, Flange Guard	Not Used	Not Used	Not Used	Not Used	Not Used
B5	4		Housing	516752	516760	516752	516752	552021
B6	7		Screw, Hsg /Motor	251792	251792	251792	251792	251791
B7	1		Muffler Material (Gray)	(40 pcs) 515493	515405	551720	551720	(14 pcs) 552044
B7	1		Muffler Material (White)	Not Used	Not Used	551721	551721	(2 pcs) 552045
B8	*		Manifold Plate	551264	523432	Not Used	Not Used	Not Used
B8	*		Shim .002"	272703	272703	272703	272703	272703
B8	*		Shim .005"	272704	272704	272704	272704	272704
B8	*		Shim .010"	272705	272705	272705	272705	272705
B8	*		Shim .020"	272706	272706	272706	272706	272706
B8	*		Shim .030"	Not Used	Not Used	Not Used	Not Used	Not Used
B9	1		Impeller	515461	516453	515461	515461	552035
B10	1		Bolt, Impeller	251791	155095	251791	251791	120215
B11	1		Lockwasher, Impeller	251787	251787	251787	251787	120203
B12			Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1		Cover	515462	516447	515462	515462	552023
B14	7		Screw, Cover	(7 pcs) 120215	140016	155236	155236	(9 pcs) 155236
B15	1		Eye Bolt	Not Used	Not Used	Not Used	Not Used	Not Used
B16	1		Spacer, Impeller Bolt	478336	478336	478336	478336	510355
B16			Shaft Sleeve	Not Used	Not Used	Not Used	Not Used	Not Used
B17			Lockwasher, Housing	Not Used	Not Used	Not Used	Not Used	Not Used
B18	1		Screen, Muffler Retaining, Right (**)	515492	515604	551723	551723	552046
B19	1		Screen, Muffler Retaining, Left (**)	515491	515603	551723	551723	552046
B19	6		Bolt, Muffler Hsg/Hsg	120251	155025	120251	120251	120007
B19A	4		Bolt, Muffler Hsg/Hsg	Not Used	Not Used	120214	120214	Not Used
B20	1		Muffler Housing	515481	515606	550024	550024	552197

*As needed **Viewed looking at inlet/outlet ports

10/31/02 REV D

	Muffler Discrete	Not Used	Not Used	Not Used	Not Used
	Bolt, Motor/Muffler	Not Used	Not Used	Not Used	Not Used
4	Lockwasher, Motor/Muffler	Not Used	Not Used	Not Used	Not Used
4	Washer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used
	Spacer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used
B21	Heat Slinger	Not Used	Not Used	Not Used	Not Used
B22	Guard Heat Slinger	Not Used	Not Used	Not Used	Not Used
B23	Bolt, Mounting Rail	Not Used	Not Used	Not Used	Not Used
B24	Lockwasher, Rail	120129	120129	120129	120129
B25	Nut, Rail	251787	251787	251787	251787
B26	Rail Mounting	251789	251789	251789	251789
		595301	595301	595301	595301
1	Lip Seal	516691	516691	516691	516691

Model	Part No.	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
EN707FL5MWL	038712	529761	M + L		516840	516648
EN757FL5WL	081333	529761	M + L		516840	516648
EN808FL5MWL	081231	529761	M + L	B19 Washer 155029 4 pcs Lockwasher 120203 4 pcs	516840	516648
<i>Discontinued</i>						
EN707FL5WL	038480	529761	M + L		516840	516648
EN808FL5WL	038481	529761	M + L	Eyebolt 140019	516840	516648
EN808FL5MWL	038732	529761	M + L	B19 Washer 155029 4 pcs Lockwasher 120203 4 pcs	516840	516648

*As needed **Viewed looking at inlet/outlet ports

EN808FL5MWL EN808FL5MWL
038732 081231

OBSOLETE

510632	510632
155067	155067
Not Used	Not Used
511614	511614
Not Used	Not Used
550083	516766
251792	155034
551736	551736
(2) 551737	(2) 551737
Not Used	Not Used
272703	272703
272704	272704
272705	272705
272706	272706
Not Used	Not Used
550072	552075
155095	120210
251787	251788
Not Used	511529
516447	552061
(8 pcs) 140016	(8 pcs) 140016
140019	140019
478336	478336
Not Used	Not Used
Not Used	Not Used
551723	551723
551723	551723
155025	155025
120262	120214
550019	550019

*As needed **Viewed looking at inlet/outlet ports

Not Used	Not Used
Not Used	Not Used
120203	120203
155029	120211
Not Used	Not Used
Not Used	Not Used
Not Used	Not Used
120129	120007
251787	251787
251789	(6 pcs) 251789
595301	595301
516691	516691

m2 was 516844 for old motor

*As needed **Viewed looking at inlet/outlet ports

Air / Water Separators



ESD Waste2Water, Inc. ESD custom fabricates Air / Water Separators for Soil Vapor Extraction and Dual Phase Extraction applications. Made of structurally sound, light-weight marine grade 5052 aluminum, our separators can withstand full vacuum applications and are completely corrosion resistant. Unlike carbon steel based separators, ESD Separators resist both internal chemical corrosion and the harshest external environmental conditions. The aesthetic qualities of ESD Separators are never compromised by oxidation. ESD Separators never experience corrosive pitting leaks, because our designs render expensive internal/external epoxy mastic coatings entirely unnecessary.

ESD Separators are available in many standard sizes and can be custom designed with a wide variety of options, including pump out systems, level gauging, additional particulate filtration, and baffling for high entrained



Certified to UL-508A Standards

Thank you for allowing ESD to provide a solution to your equipment needs.

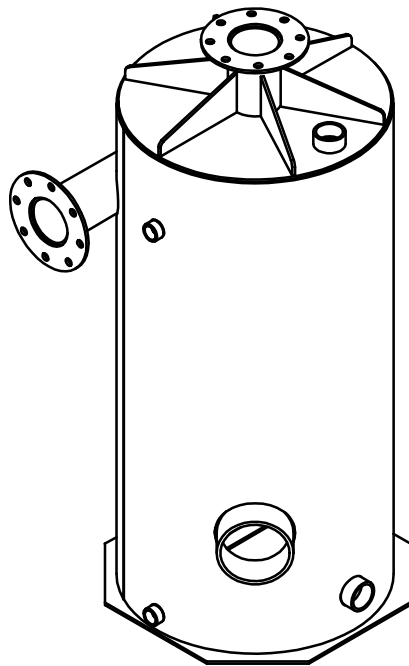
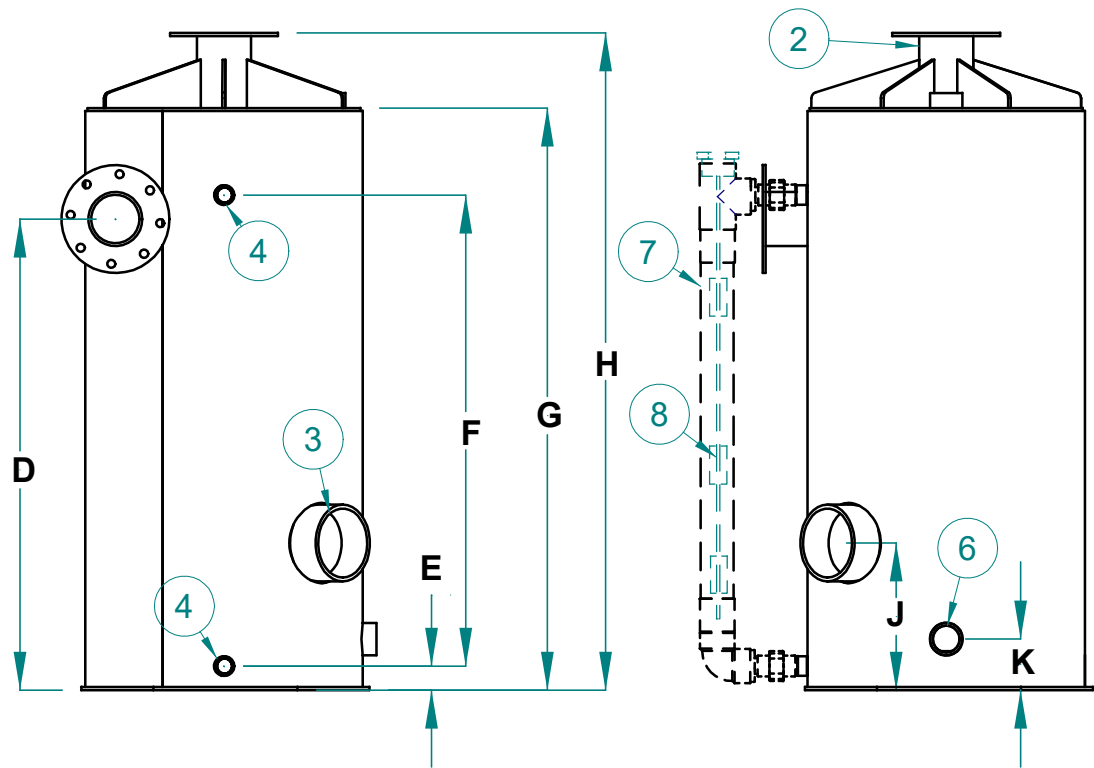
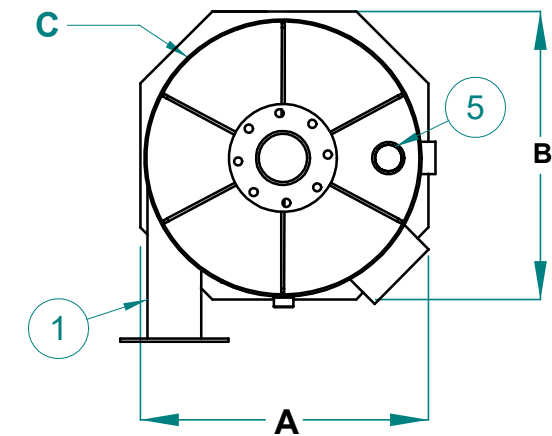


ESD Waste2Water, Inc.
495 Oak Road
Ocala, FL 34472
Tel: 800.277.3279 Fax: 352.680.9278
www.waste2water.com



STANDARD AWS SPECIFICATION																											
TYPE	WORKING VOLUME @ (LSH)	AVAILABLE CONNECTION TYPE															CLEAN OUT PIPE	A	B	C (DIA.)	D	E	F	G	H	J	
		FLANGE						MNPT					FNPT														
		2"	3"	4"	6"	8"	10"	2"	3"	4"	6"	8"	2"	3"	4"	6"											8"
AWS30	12 GAL	X	X	X	-	-	-	X	X	X	-	-	X	X	X	-	-	6"	-	-	16 1/4"	25"	2"	19"	30"	33 1/2"	6"
AWS60	24 GAL	X	X	X	X	-	-	X	X	X	X	-	X	X	X	-	-	6"	24"	24"	23"	25"	2"	23"	30"	36 1/2"	6"
AWS80	47 GAL	X	X	X	X	-	-	X	X	X	X	-	X	X	X	-	-	8"	24"	24"	23"	39"	2"	39"	48"	54 3/4"	12"
AWS120	50 GAL	X	X	X	X	X	-	X	X	X	X	-	X	X	X	-	-	8"	24"	24"	23"	49"	2"	49"	60"	66 3/4"	12"
AWS220	107 GAL	-	X	X	X	X	X	X	X	X	X	-	X	X	X	-	-	8"	34"	34"	33 1/2"	49"	2"	49"	60"	66 3/4"	12"

RECOMMENED AIR FLOW (ACFM)						
	2"	3"	4"	6"	8"	10" *
ACFM	120	280	320	500	750	1000



ITEM #	DESCRIPTION
1	INLET PIPE (SEE TABLE FOR AVAILABLE SIZE AND CONNECTION TYPE)
2	OUTLET PIPE (SEE TABLE FOR AVAILABLE SIZE AND CONNECTION TYPE)
3	CLEAN OUT
4	1" FNPT (MULTI LEVEL PROBE)
5	2" FNPT
6	2" FNPT
7	SIGHT TUBE 2" CLEAR PVC
8	MULTI LEVEL PROBE

NOTES:
1.MATERIAL : 1/8" & 3/16" ALUMINUM SHT 5052
2. PROBE (SIGHT TUBE) : 2" CLEAR PVC
3. CUSTOM SIZES AVAILABLE

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ESD Waste²Water, Inc.

495 Oak Road
Ocala, FL 34472
Phone (800) 277-3279
Fax (352) 680-0059

SCALE VERIFICATION

THIS BAR REPRESENTS ONE INCH ON ORIGINAL DRAWING



USE TO VERIFY DRAWING

SIZE: B
SHEET #: 1 OF 1
SCALE: NTS

UPDATED BY:

DRAWN BY: J.ANDREWS
APPROVED BY: N/A
COMPLETED: 06/15/10
UPDATED:

AWS SPECIFICATIONS
GENERAL LAYOUT

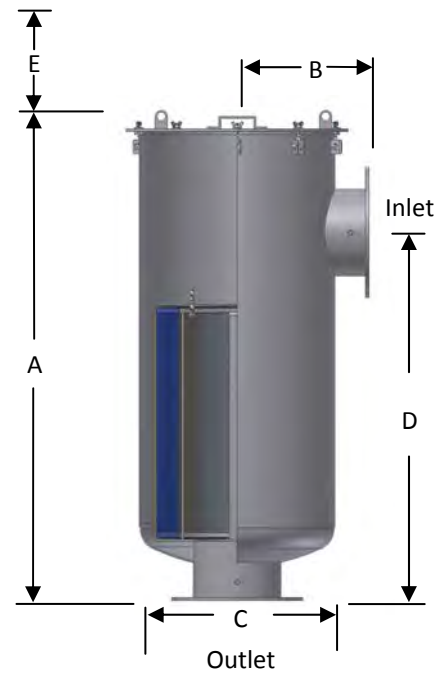
JOB NUMBER:

PRODUCT NUMBER:

AWS

FILE NAME: "AWS SPEC.dft"

"L" Style Vacuum Filters CSL Series 3" - 12" MPT, Flange



Features

- Heavy duty T bolts for easy maintenance
- Rugged all steel construction w/powder coat finish
- Positive engagement O-ring seal system
- Inlet & outlet 1/4" gauge taps

Technical Specifications

- Vacuum Rating: Medium vacuum service**
- Hydrostatically tested to 0.5 bar pressure for vacuum seal
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20" H₂O over initial ΔP
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

** See Vacuum Filter Technical Data for vacuum service data.

Benefits

- Large dirty holding capacity and easy field cleaning, especially when mounted horizontally or inverted
- Low pressure drop construction

Options



- Straight-through configurations
- Various filter media
- Material/Finishes: Stainless steel, Epoxy coating
- Custom connections
- Flange faces free of paint
- Internal surfaces free of paint
- Lifting lugs
- Brackets for optional support legs
- Nameplate bracket

Flange Outlet Connections

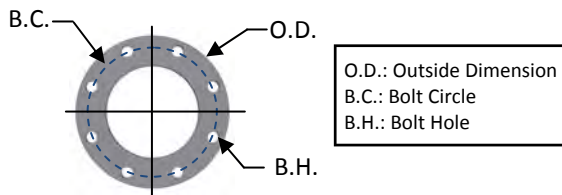
Flange Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Wt. lbs	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D			Polyester	Paper	
4"	520	CSL-235P-400F	CSL-234P-400F	27 1/2	9	14	18 1/2	15	62	235P	234P	570
4"	520	CSL-335P-400F	CSL-334P-400F	27 1/2	9	14	18 1/2	20	64	335P	334P	800
5"	800	CSL-245P-500F	CSL-244P-500F	27 7/8	11	18 1/2	19 1/2	15	88	245P	244P	880
5"	800	CSL-345P-500F	CSL-344P-500F	27 7/8	11	18 1/2	19 1/2	20	90	345P	344P	1100
6"	1100	CSL-275P-600F	CSL-274P-600F	29 1/8	12	18 1/2	20 1/2	15	110	275P	274P	1100
6"	1100	CSL-375P-600F	CSL-374P-600F	29 1/8	12	18 1/2	20 1/2	20	113	375P	374P	1500
8"	1800	CSL-377P-800F	CSL-376P-800F	40	14	20 1/4	25 1/2	20	185	377P	376P	1825
10"	2900	CSL-685P-1000F	CSL-384P(2)-1000F*	59 13/16	16	24 1/4	45	33	380	685P	384P (2)	6600
12"	4950	CSL-485P(2)-1200F*	CSL-484P(2)-1200F*	70	16	24 1/4	57	25	465	485P (2)	484P (2)	9410

See Vacuum Filter Technical Data section for sizing guidelines.

Dimension tolerance $\pm 1/4"$

* Denotes 2 elements stacked in housing.

125/150# Pattern Flg	Dimensions - inches			No. of Holes	Flange Thickness
	O.D.	B.C.	B.H.		
4"	9	7 1/2	0.75	8	0.38
5"	10	8 1/2	0.88	8	0.38
6"	11	9 1/2	0.88	8	0.38
8"	13 1/2	11 3/4	0.88	8	0.38
10"	16	14 1/4	1	12	0.5
12"	19	17	1	12	0.5



All flanges are orientated "split center".

MPT Connections

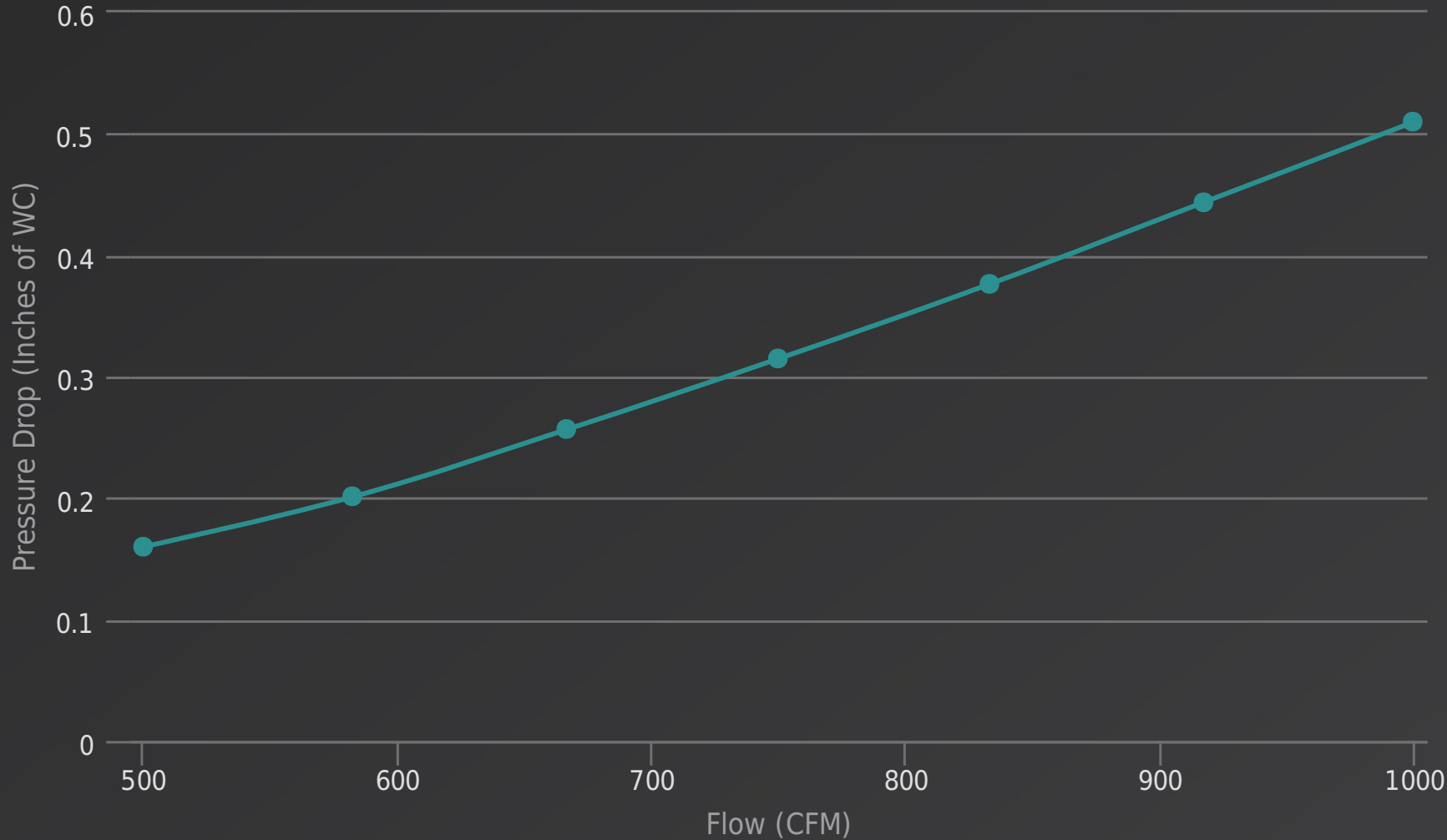
MPT Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Wt. lbs	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D			Polyester	Paper	
3"	300	CSL-235P-300	CSL-234P-300	27 1/4	9	14	18 1/2	10	47	235P	234P	570
3"	300	CSL-335P-300	CSL-334P-300	27 1/4	9	14	18 1/2	15	50	335P	334P	800
4"	520	CSL-235P-400	CSL-234P-400	27 1/4	9	14	18 1/2	10	52	235P	234P	570
4"	520	CSL-335P-400	CSL-334P-400	27 1/4	9	14	18 1/2	15	55	335P	334P	800
5"	800	CSL-245P-500	CSL-244P-500	27 7/8	11	19	19 1/2	10	82	245P	244P	880
5"	800	CSL-345P-500	CSL-344P-500	27 7/8	11	19	19 1/2	15	88	345P	344P	1100
6"	1100	CSL-275P-600	CSL-274P-600	29 1/8	12	19	20 1/2	10	95	275P	274P	1100
6"	1100	CSL-375P-600	CSL-374P-600	29 1/8	12	19	20 1/2	15	97	375P	374P	1500

See Vacuum Filter Technical Data section for sizing guidelines.

Dimension tolerance $\pm 1/4"$

SOLBERG MFG. PRESSURE DROP CURVE

CFM VS INCHES OF WC





Absorptive Silencers

Air Intake and Discharge

"SLCR" Series 1/2" - 4" MPT, FPT

APPLICATIONS & EQUIPMENT

- ♦ Small Air Compressors
- ♦ Centrifugal Blowers
- ♦ Regenerative Blowers
- ♦ Vacuum Pumps & Systems
- ♦ Vacuum Packaging Equipment
- ♦ Vacuum Lifters
- ♦ Small Low Pressure Vents
- ♦ Blowers - Side Channel

FEATURES & SPECIFICATIONS

- ♦ Layered sound absorbent media
- ♦ **Minimal** pressure drop because it does not rely on internal baffles, tubes or other restrictive devices
- ♦ Reduces high frequency noise up to 30 decibels (Due to the wide range of applications and machines these units are used on, please inquire for your specific application.)
- ♦ **Inlet or Discharge** silencing applications with maximum temperature of 212°F (100°C)
- ♦ Durable inline carbon steel construction with baked enamel finish
- ♦ For inline air service

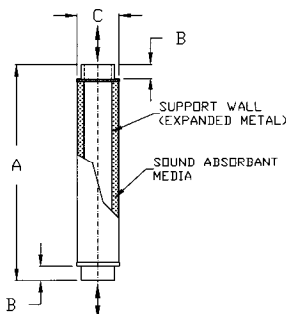
OPTIONS (Inquiries Encouraged)

- ♦ Flange Adapters
- ♦ Larger sizes available

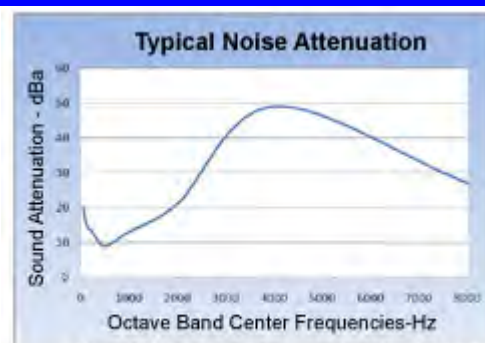
CONFIGURATION



DRAWING



Dimension tolerance $\pm 1/4"$



Note: Noise attenuation may vary due to the wide range of applications and equipment.

Model No.	Inlet & Outlet	Connection Style	DIMENSIONS - inches			Rated Flow SCFM	Approx. Wt. Lbs
			A	B	C		
SLCR100	1"	FPT	12	11/16	2 1/2	42	2
SLCR125	1 1/4"	FPT	12	11/16	2 1/2	55	2
SLCR150	1 1/2"	FPT	12	11/16	3 1/8	155	3
SLCR200	2"	FPT	15 3/4	11/16	3 5/8	270	4
SLCR250	2 1/2"	FPT	21	1 1/2	4 5/8	385	8
SLCR300	3"	FPT	26	1 9/16	5 1/8	575	10
SLCR400	4"	FPT	23 7/8	1 11/16	10	575	26
SLCRT050	1/2"	MPT	14 1/2	2	2 1/2	25	2
SLCRT075	3/4"	MPT	14 1/2	2	2 1/2	35	2
SLCRT100	1"	MPT	14 1/2	2	2 1/2	42	2
SLCRT125	1 1/4"	MPT	14 1/2	2	2 1/2	55	2
SLCRT150	1 1/2"	MPT	14	1 3/4	3 1/8	155	3
SLCRT200	2"	MPT	18 1/2	2 1/8	3 5/8	270	4
SLCRT250	2 1/2"	MPT	23 11/16	2 5/8	4 5/8	385	8
SLCRT300	3"	MPT	28	2 5/8	5 1/8	575	10
SLCRT400	4"	MPT	29 5/16	4	10	575	26

Note: Model offerings and design parameters may change without notice.

1151 Ardmore Ave. • Itasca, IL 60143 USA

Sales/Service: 630.773.1363 • Fax: 630.773.0727

E-mail: sales@solbergmfg.com • Web Site: www.solbergmfg.com

Solberg – Discover the Possibilities

AS-0274

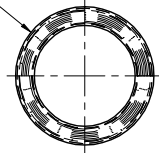
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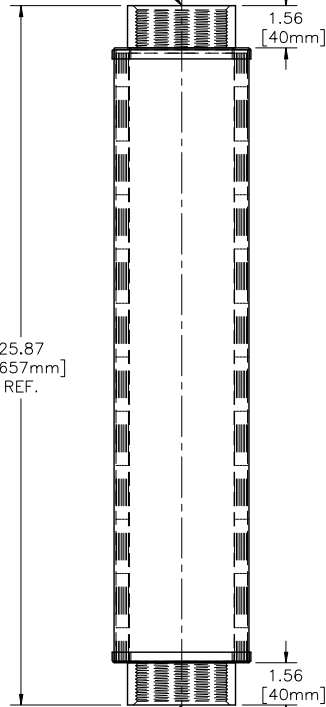
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[Ø130mm]
REF.



3.00 NPT
THREAD

1.56
[40mm]

25.87
[657mm]
REF.



3.00 NPT
THREAD

1.56
[40mm]

REVISIONS						
ZONE	REV	DESCRIPTION	ECN #	CHG BY	DATE	APP'D

MODEL#	HOUSING MATERIAL	FINISH
SLCR300	CARBON STEEL	BAKED ENAMEL GREY

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-REF: APPROXIMATE DIMENSIONS, NO TOLERANCES APPLY
-TOLERANCES ARE:
DECIMALS: .XX ±.25
 : .XXX ±.125
ANGLES: ±2°

CUSTOMER APPROVAL:



SOLBERG MANUFACTURING INC.
1151 W. ARDMORE AVE.
ITASCA, IL 60143
630/773-1363

DESCRIPTION:
SLCR300

SALES REP.: C.SOLBERG		SHEET: 1 of 1	SHEET SIZE: C	SCALE: NTS
APPROVALS	DATE	DRAWING NUMBER: SD12468		
DRAWN: CRW	10/06/06	REV: —		
APPROVED: A.A.	10/06/06			

4

3

2

1

Compact Filter Silencers FS Series 1/2" - 6" MPT, Flange



Filter Silencers

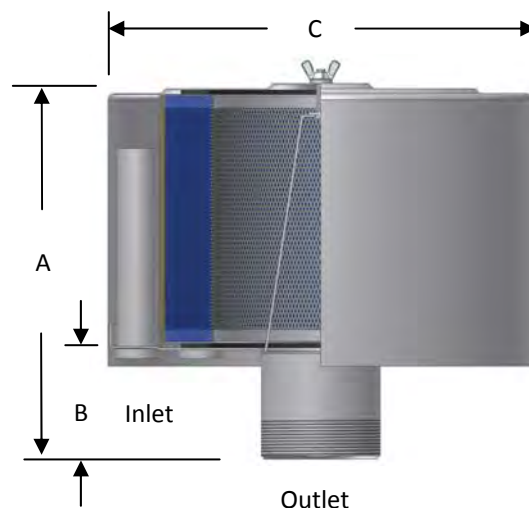


Features

- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tubes are positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish & powder coated weatherhood

Technical Specifications

- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20" H₂O over initial ΔP
- Pressure drop graphs available upon request
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron



Options

- 1/8" tap holes available for 3" and larger connections
- Pressure drop indicator (See page 3-11)
- Various media for different environments
- Stainless steel construction
- Epoxy coated finish
- Special connections
- Side Access Silencer Filters (LQB Series) for space restricted enclosures (select models)

Tidbit: Charlie Solberg Sr. "Senior" designed our first filter silencer in 1966. The FS-15 size filter was created for small air compressors.

Outlet Connections

MPT Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches			No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C			Polyester	Paper	
1/2"	10	FS-15-050	FS-14-050	4	1 1/2	6	1	2	15	14	35
3/4"	25	FS-15-075	FS-14-075	4	1 1/2	6	2	2	15	14	35
1"	35	FS-15-100	FS-14-100	4	1 1/2	6	3	2	15	14	35
1"	55	FS-19P-100	FS-18P-100	6 5/8	1 5/8	6	3	3	19P	18P	100
1 1/4"	70	FS-19P-125	FS-18P-125	6 5/8	1 5/8	6	5	3	19P	18P	100
1 1/2"	85	FS-19P-150	FS-18P-150	6 5/8	1 5/8	6	5	4	19P	18P	100
2"	135	FS-31P-200	FS-30P-200	7 1/4	2 1/4	10	5	8	31P	30P	195
2"	135	FS-231P-200	FS-230P-200	12 1/4	2 1/4	10	5	14	231P	230P	300
2 1/2"	195	FS-31P-250	FS-30P-250	7 1/2	2 1/2	10	5	8	31P	31P	195
2 1/2"	195	FS-231P-250	FS-230P-250	12 1/2	2 1/2	10	9	15	231P	230P	300
3"	300	FS-231P-300	FS-230P-300	13	3	10	9	15	231P	230P	300
3"	300	FS-235P-300	FS-234P-300	13	3	16	9	29	235P	234P	570
3"	300	FS-275P-300	FS-274P-300	13	3	16	9	33	275P	274P	1100
4"	520	FS-235P-400	FS-234P-400	14	4	16	9	30	235P	234P	570
4"	520	FS-275P-400	FS-274P-400	14	4	16	9	34	275P	274P	1100
5"	800	FS-245P-500	FS-244P-500	14	4	16	14	33	245P	244P	880
5"	800	FS-275P-500	FS-274P-500	14	4	16	14	36	275P	274P	1100
6"	1100	FS-275P-600	FS-274P-600	15	5	16	18	38	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance $\pm 1/4"$

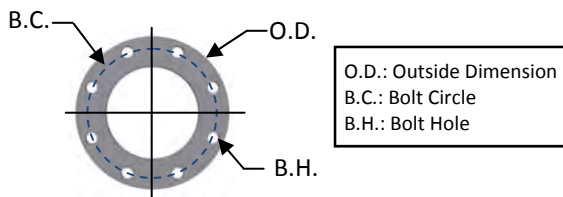
Flange Outlet Connections

Flange Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches			No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C			Polyester	Paper	
4"	520	FS-235P-400F	FS-234P-400F	14	4	16	9	33	235P	234P	570
4"	520	FS-275P-400F	FS-274P-400F	14	4	16	9	39	275P	274P	1100
5"	800	FS-245P-500F	FS-244P-500F	14	4	16	14	38	245P	244P	880
5"	800	FS-275P-500F	FS-274P-500F	14	4	16	14	41	275P	274P	1100
6"	1100	FS-275P-600F	FS-274P-600F	15	5	16	18	42	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

Dimension tolerance $\pm 1/4"$

125/150# Pattern Flg	Dimensions - inches			No. of Holes	Flange Thickness
	O.D.	B.C.	B.H.		
4"	9	7 1/2	0.75	8	0.38
5"	10	8 1/2	0.88	8	0.38
6"	11	9 1/2	0.88	8	0.38



Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

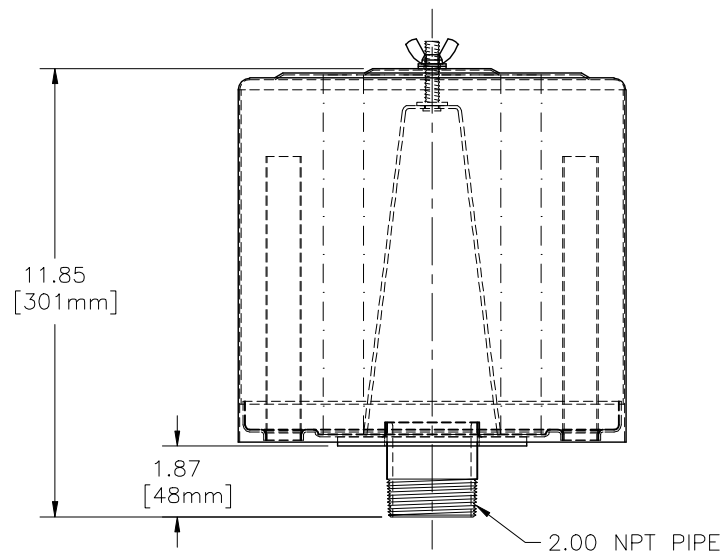
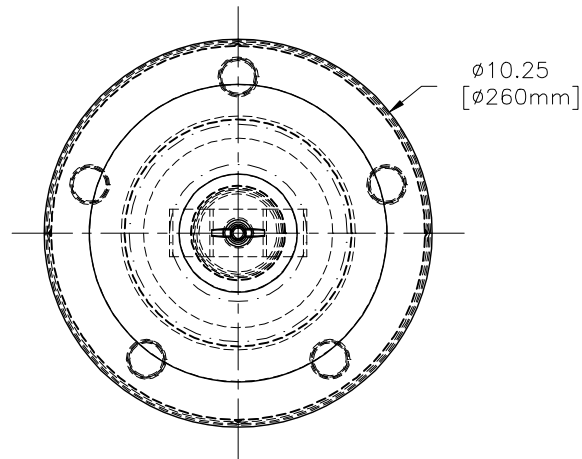
4

3

2

1

REVISIONS						
ZONE	REV	DESCRIPTION	ECN #	CHG BY	DATE	APP'D



REPLACEMENT ELEMENT# 231P	
MATERIAL	POLYESTER
CFM FLOW	300
SURFACE AREA	4.5 SQ. FT.
I.D.	3.63
O.D.	5.75
HEIGHT	9.50

MODEL#	HOUSING MATERIAL	FINISH
FS-231P-200	STAINLESS STEEL	NONE

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 -REF: APPROXIMATE DIMENSIONS, NO TOLERANCES APPLY
 -TOLERANCES ARE:
 DECIMALS: .XX ±.25
 .XXX ±.125
 ANGLES: ±2°

CUSTOMER APPROVAL:



SOLBERG MANUFACTURING INC.
 1151 W. ARDMORE AVE.
 ITASCA, IL 60143
 630/773-1363

DESCRIPTION:
 FS-231P-200

SALES REP.: A. SPICER

APPROVALS

DRAWN: CRW

APPROVED: C.W.

DATE

04/24/03

04/24/03

SHEET: 1 of 1

DRAWING NUMBER:

SD10995

SD10995

SHEET C

SCALE: 1:2

REV:

—

4

3

2

1

AIR PURIFICATION CANISTERS 140-200 LB. ACTIVATED CARBON

G-1
G-2
G-3



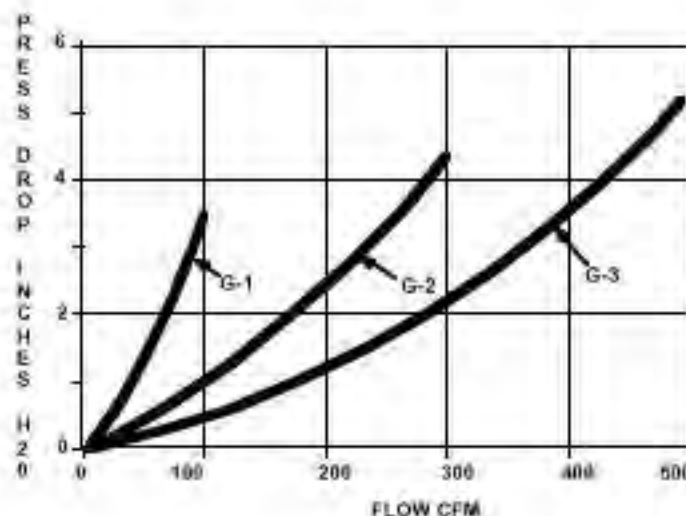
The CARBOTROL "G" Canisters handles flows up to 500 CFM.

FEATURES

- High activity carbon.
- Epoxy lined steel or polyethylene construction.
- Acceptable for transport of hazardous spent carbon.
- Side drain for removal of accumulated condensate.
- Low pressure drop.
- PVC internal piping.
- High temperature (180°F) steel units available.

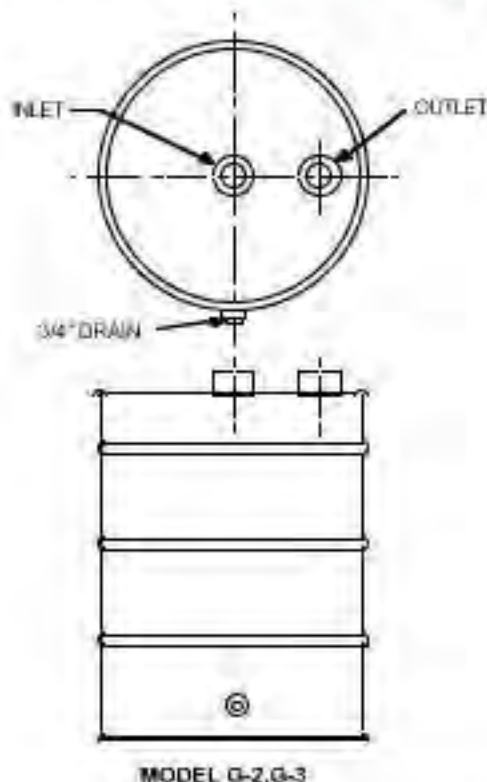
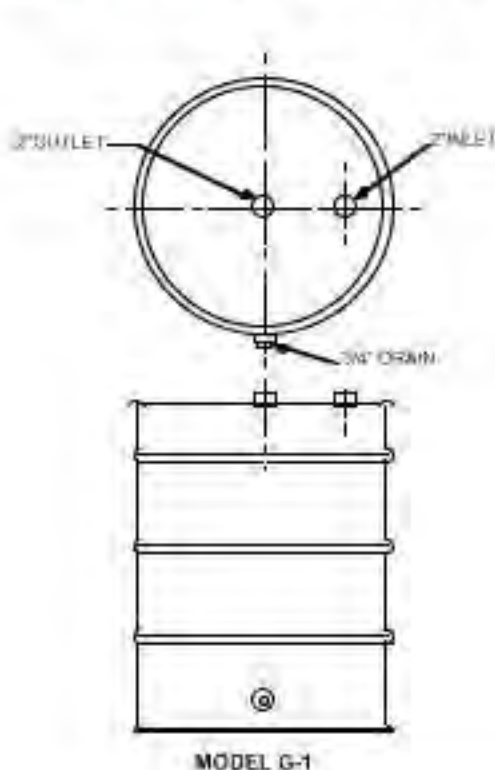
APPLICATIONS

- Soil vapor remediation
- Air stripper exhausts
- Tank vents
- Exhaust hoods
- Work area purification
- Sewage plant odor control



AIR PURIFICATION CANISTERS 140-200 LB. ACTIVATED CARBON

G-1
G-2
G-3



SPECIFICATIONS

MODEL	DIAMETER/HEIGHT	CARBON WEIGHT	INLET/OUTLET	MAXIMUM RATED FLOW	APPROXIMATE SHIP WEIGHT
G-1*	24"/36"	200 lbs.	2"/2"	100 CFM	250 lbs.
G-2*	24"/36"	170 lbs.	4"/4"	300 CFM	220 lbs.
G-3P	24"/36"	140 lbs.	6"/6"	500 CFM	190 lbs.
G-3S	24"/34"	140 lbs.	4"/4"	500 CFM	180 lbs.

* Specify: Polyethylene (P) or **Epoxy Lined Steel (S)**

SAFETY

Certain chemical compounds in the presence of activated carbon may oxidize, decompose or polymerize. This could result in temperature increases sufficient to cause ignition of the activated carbon or adsorbed material. If a compound's reaction with activated carbon is unknown, appropriate tests should be considered.



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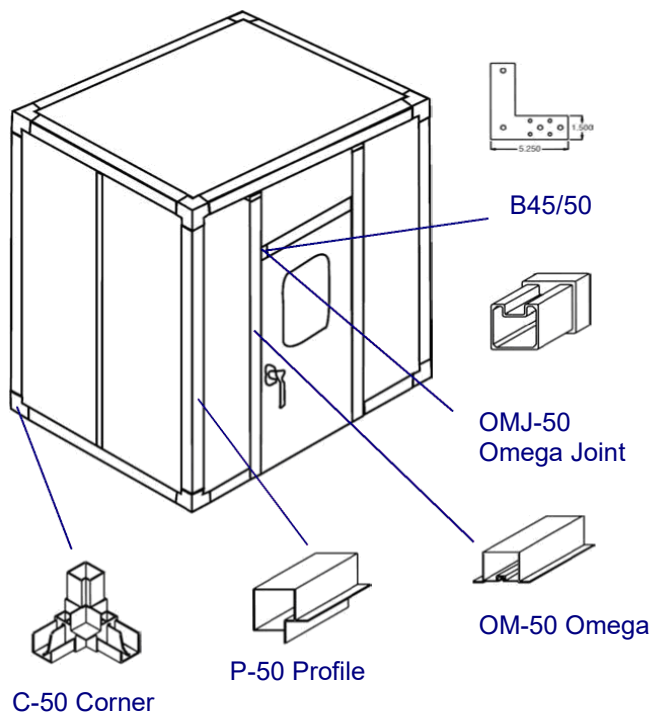


Modular Acoustical Panels



... Call the Experts at **ArtUSA Industries**

You've done everything you can to create a highly functional and aesthetic manufacturing environment. The enclosures you use should enhance rather than detract from your manufacturing facility. That's why it makes sense to put **ArtUSA** on your team. At **ArtUSA** we've been specializing in the design and manufacturing of machine enclosures for over 25 years. We understand how to control noise, splash, mist, dirt and other environmental factors. Our experience includes a variety of different applications such as screw machines, stamping presses, machining centers, grinding machines, lathes and cut-off saws to name a few. So if you are a machine tool user, you can get the highest quality, best looking, custom designed enclosures from **ArtUSA Industries**, allowing you to concentrate your efforts on producing the highest quality products. For complete information and assistance, call today.



Options:

- ◆ STC Rated Panels up to 55 dBA
- ◆ Mylar, Polyethylene or Fiberglass Cloth Lining
- ◆ Framed Cutouts/Openings
- ◆ Primer or Finish Paint
- ◆ Multiple Gauge Construction
- ◆ Variety of materials available
- ◆ Custom Designs per Your Acoustical/Thermal Requirements
- ◆ Multiple Insulation Materials and Densities
- ◆ Available in Quick Removable Panels

Thermal Performance:

Individual panels will have a "U" factor 0.07 and an entire panel enclosure will have a 0.14

Fire Hazard Rating:

Standard acoustical fill will have the following UL Fire Hazard Ratings as per ASTM E-84:

Flame Spread -15 / Fuel Contributed -0 / Smoke Developed -0

Acoustical Performance* - Standard Construction

Sound Transmission Loss (ASTM E-90-81)				*All acoustical tests were performed and reported by an Independent Accredited Acoustical Laboratory. Copies of test reports furnished upon request.			
Octave Band Center Frequency (Hz)	125	250	500	1000	2000	4000	STC
4" Panel (TL in dB)	22	29	40	48	54	60	41
2" Panel (TL in dB)	21	24	35	43	52	57	37

Sound Absorption Coefficients (ANSI/ASTM C243-81 and E795)

Octave Band Center Frequency (Hz)	125	250	500	1000	2000	4000	NRC
4" Panel	.86	1.09	1.22	1.06	1.05	1.04	1.10
2" Panel	.31	.82	1.19	1.12	1.07	1.06	1.11

Noise Enclosure

1. Enclosure shall be designed to be a tight fitting to the perimeter/envelope of the equipment. A 1”to 2” clearance shall be provided between the enclosure and the equipment on all sides and the top.
2. Each sound enclosure should be factory assembled and skidded. The enclosure shall be designed to incorporate: forced air ventilation with acoustically treated air intake.
3. The enclosure frame shall be made of a heavy-duty aluminum square tubing frame that allows each wall and roof panel to be removable. A three directional slip fit aluminum corner fitting piece shall be provided at each of the eight corners to connect all aluminum frame pieces together.
4. Acoustical panels shall have 16 gauge galvanized steel channel provided for bottom caps and top caps and opening.
5. Acoustical Panels:
 - a. All the wall and roof panels shall have exterior skin of 16-gauge damped galvanized steel. Skin shall be 2.5#/sq.ft.
 - b. 1” absorption material on all fixed and removable side panels
6. All doors should be provided with acoustic seals on all four sides with quick release retainers and handles.
7. Acoustical seal strips provided between panels and aluminum frame and aluminum frame and the floor.
8. Panel Acoustical Performance shall have been tested by an independent laboratory and achieve an STC=34 & NRC=0.75. Reduce sound emissions up to 15 dba at a distance of 3 feet.

RELIEF VALVES PRESSURE / VACUUM

CATALOG PART NUMBER

NPT SIZE

VC 51-Z/PC 51-Z

1 1/4"

VC 61-Z/PC 61-Z

1 1/2"

VC 81-Z/PC 81-Z

Vacuum Relief Valve #VC81-Z set @ 70"H2O VAC
Pressure Relief Valve #PC81-Z set @ 75"H2O

2"

VC 88-Z/PC 88-Z

2 1/2"

VC 91-Z/PC 91-Z

3"

VC 100-Z/PC 100-Z

4"

VC 110-Z/PC 110-Z

5"



VACUUM GAUGES

CATALOG PART NUMBER

VCG-40

Capsule Gauge (0-40 Torr)

VCG-100

Capsule Gauge (0-100 Torr)

VCG-760

Capsule Gauge (0-760 Torr)

VCG-2-30HG

Bourdon Tube Gauge 2" (0-30" Hg)

VCG-4-30HG

Bourdon Tube Gauge 4" (0-30" Hg)

VCG-2-200H2O

Bourdon Tube Gauge 2" (0-200" H2O)

VCG-4-200H2O

Bourdon Tube Gauge 4" (0-200" H2O)



PRESSURE GAUGES

CATALOG PART NUMBER

PG-A1

Ex. Filter Box P. Gauge (1 Bar)

PG-A10

Capsule Gauge P. Gauge (10 Bar)

INLET FILTER ASSEMBLIES

CATALOG PART NUMBER

PORT SIZE

REPLACEMENT CARTRIDGE

AF-20-125-10

1 1/4"

ATC-20

AF-20-150-10

1 1/2"

ATC-20

AF-30-200-10

2"

ATC-30

AF-30-250-10

2 1/2"

ATC-30

AF-230-250-10

2 1/2"

ATC-230

AF-230-300-10

3"

ATC-230

AF-234-400-10

4"

ATC-234

AF-244-500-10

5"

ATC-244



INLET FILTER ASSEMBLIES WITH SILENCERS

CATALOG PART NUMBER

PORT SIZE

REPLACEMENT CARTRIDGE

AFS-20-125-10

1 1/4"

ATC-20

AFS-20-150-10

1 1/2"

ATC-20

AFS-30-200-10

2"

ATC-30

AFS-30-250-10

2 1/2"

ATC-30

AFS-230-250-10

2 1/2"

ATC-230

AFS-230-300-10

3"

ATC-230

AFS-234-400-10

4"

ATC-234

AFS-244-500-10

5"

ATC-244



SVE INSTRUMENTS

SVE Vacuum Gauges (0-100" H₂O)
Model#25-200-100-In.H₂O Vac

SVE Pressure Gauges (0-100" H₂O)
Model#25-200-100-In.H₂O



GENERAL INFORMATION

NOSHOK 200 Series Diaphragm Gauges are designed for extremely low pressure or vacuum measurement. The ultra sensitive diaphragm capsules are rated for pressure (or vacuum) as low as 0-10 **inches of water** and as high as 0-10 **psi**.

The cases are constructed of black painted steel on the 2 1/2" size and 304 Stainless Steel on the 4" size. The lenses are molded plexiglass on the 2 1/2" size and instrument glass on the 4" size for strength and clarity. The diaphragm capsules are phosphor bronze and when coupled to the precision all-brass movements, provide extremely accurate indication over the service life of the gauge.

Available options include a recalibrator on the 2 1/2" size (accessible through the front of the dial) and overpressure protection of up to 200% of the dial range. Mounting options include 304 stainless steel or black steel triangular bezels and U-Clamps in addition to chrome or black steel front flanges.

Applications for **NOSHOK 200 Series Gauges** include medical, biomedical, heating-ventilating and air conditioning, gas distribution, filtration, burner and gas combustion service, waste water treatment and everywhere low pressure and vacuum measurement is required.

Pressure Gauge Series 100, 200, 300, 400, 500, 600, 700, 800 and 900

Installation

Prior to pressure gauge installation, the following conditions should be considered: temperature, humidity, vibration, pulsation, shock, and other climatic and environmental conditions of the application, as well as the potential need for protective accessories and/or special installation requirements.

Always use a wrench on the gauge socket when installing a NOSHOK pressure gauge into position; never use force on the gauge case to tighten into position. This may result in a loss of accuracy, excessive friction and/or mechanical damage to the measuring element and case of the NOSHOK pressure gauge. When surface or panel mounting a gauge, be sure the surface is flat and the panel cutout and/or the mounting hole configuration is correct (please refer to the NOSHOK Pressure Gauge catalog NK95G for these specifications). If the surface is uneven or the panel cutout is larger than the gauges diameter, use an adapter ring to remove mounting strain and/or adapt the gauge to the larger diameter panel cutout. When connecting a gauge to a rigid pipe service, use flexible tubing where possible as a connector to eliminate plumbing strain. Rapid pressure pulsation and extreme mechanical vibration may be damaging to some NOSHOK pressure gauge movement gearing, bushings, and linkage. In extreme cases, steps should be taken to dampen these forces. In pressure ranges over 600 psi, a NOSHOK orifice is recommended for pulsation dampening, but in extreme pulsation applications a NOSHOK Piston Type Pressure Snubber may be required.

When installing a gauge into a corrosive situation be sure to select a pressure gauge or pressure gauge and diaphragm seal combination suitable for your application. Gauges to be used on high temperature service should have a five foot or longer leg of pipe or tubing connecting the gauge to dissipate heat and protect the gauge measuring element from damage.

A gauge to be used on steam pressure service should be installed with a water filled NOSHOK pigtail steam siphon between the gauge and the steam line.

Maintenance

Apart from occasional calibration, NOSHOK pressure gauges require little or no maintenance. Some applications may be more aggressive than others, resulting in an increased frequency in the need for calibration. The environmental limitations for the specific NOSHOK pressure gauge series should be observed in all cases, and gauges applied in situations outside these requirements may result in premature wear and/or failure of the gauge.

Warranty

All NOSHOK pressure gauges carry a one or three year warranty. NOSHOK warrants for three years our 300, 500, 600, 700 and 900 series liquid filled pressure gauges to be free from defects in materials and workmanship, to remain within the cataloged accuracy and performance specifications, and to maintain the integrity of the hermetically sealed case preventing leakage. NOSHOK warrants for one year our 100, 200, 400, 600, 700, and 800 series non-liquid filled pressure gauge. Certain limitations do apply; for more information please consult page three of the NOSHOK Pressure Gauges catalog (NK95G).

Please do not hesitate to contact us with any additional questions.



1010 WEST BAGLEY ROAD
BEREA, OHIO 44017
440/243-0888 FAX 440/243-3472
E-MAIL: noshok@noshok.com
WEBSITE: www.noshok.com

ROTRON® Regenerative Blowers

Measurement Accessories

Blower Connection Key

NPT – American National Standard Taper Pipe Thread (Male)

NPSC – American National Standard Straight Pipe Thread for Coupling (Female)

SO – Slip On (Smooth – No Threads)

Air Flow Meter

FEATURES

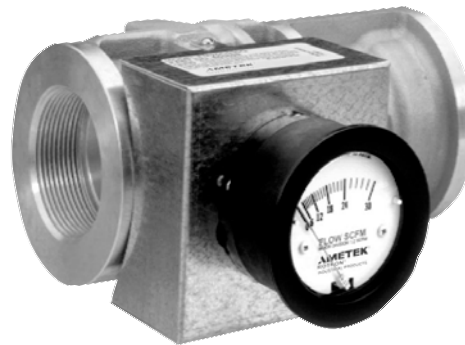
- Direct reading in SCFM
- Low pressure drop (2-4" typical) across the flow meter
- Non-clogging, low impedance air stream
- Light weight aluminum
- No moving parts
- Large easy-to-read dial
- Accurate within 2% at standard conditions
- Good repeatability
- Available in 2", 3" and 4" sizes
- Factory configured for quick installation
- .048" Allen key supplied for gauge adjustment

OPTIONS

- Corrosion-resistant version with Chem-Tough™ or in stainless steel
- FDA-approved Food Tough™ surface conversion

BENEFITS

- **OPTIMIZE SYSTEM EFFICIENCY**
Measuring the correct air flow can assist you in fine-tuning to your system's optimal efficiency.
- **BALANCE MULTI-PIPING SYSTEMS**
When evacuating CFM from more than one pipe, different run lengths or end system impedance can cause one pipe to handle more CFM than the other. With an accurate CFM reading, piping can be balanced by bleeding air in/out or by creating an extra impedance.
- **DETECT CHANNELING OR PLUGGING**
For systems in which channeling or plugging can occur, a change in the CFM measured can help indicate the unseen changes in your system.



Current Models		Flow Range (SCFM)	B Threads	C Length	D Width	E	F
Model	Part #						
FM20C030Q	550599	6-30	2" - 11.5 NPSC	7.18"	7.0"	2.0"	3.75"
FM20C045Q	550600	9-45					
FM20C065Q	550601	13-65					
FM20C125Q	550602	25-125					
FM20C175Q	550603	35-175					
FM20C225Q	550604	45-225					
FM30C250Q	550605	50-250	3" - 8 NPSC	7.52"	7.4"	2.5"	4.43"
FM30C350Q	550606	70-350					
FM30C475Q	550607	95-475					
FM40C450Q	550608	90-450	4" - 8 NPSC	8.00"	7.7"	2.7"	5.43"
FM40C600Q	550609	120-600					
FM40C850Q	550610	170-850					

Rev. 2/04

G-5

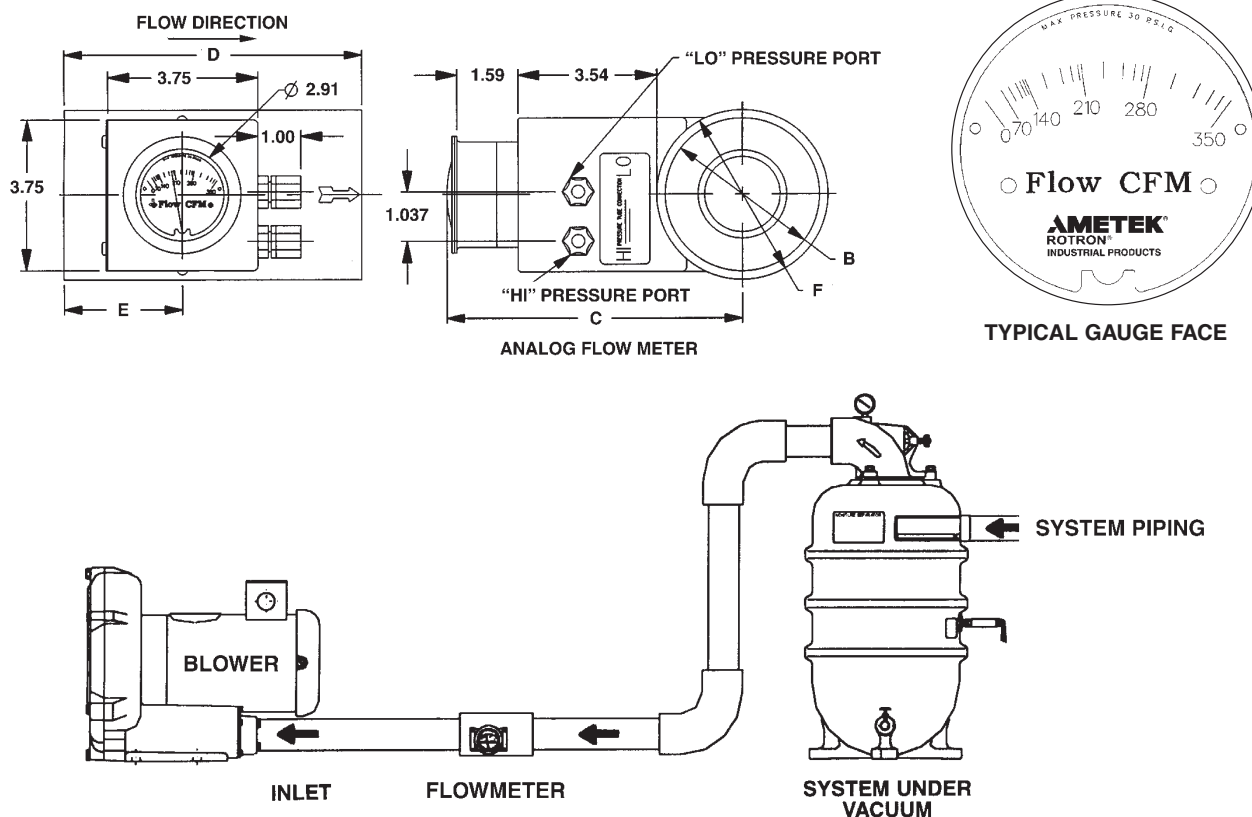
AMETEK Technical and Industrial Products, Kent, OH 44240 • e mail: rotronindustrial@ametek.com • internet: www.ametektmd.com

ROTRON® Regenerative Blowers

Blower Model Reference Key	
A = SPIRAL	E = DR/EN/CP 656, 6, 623, S7
B = DR/EN/CP 068, 083, 101, 202	F = DR/EN/CP 707, 808, 858, S9, P9 (Inlet Only)
C = DR/EN/CP 303, 312, 313, 353	G = DR/EN/CP 823, S13, P13 (Inlet Only)
D = DR/EN/CP 404, 454, 513, 505, 555, 523	H = DR/EN/CP 909, 979, 1223, 14, S15, P15 (Inlet Only)

Measurement Accessories

TYPICAL FLOW METER ARRANGEMENT



HIGH TEMPERATURE/PRESSURE CORRECTION

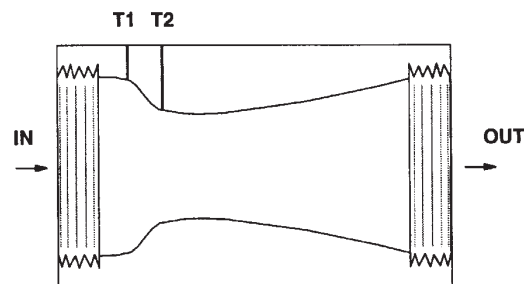
$$SCFM_2 = \frac{SCFM_1}{\sqrt{\left(\frac{14.7}{P_{f2}}\right) \times \left(\frac{530}{T_{f2} + 460}\right)}}$$

P_{f2} = Absolute Pressure in PSIA

T_{f2} = Temperature in °F

- Use on inlet to limit need to correct for high pressure or elevated outlet temperature
- Standard model limits = 140°F and 30 PSIG

HOW IT WORKS



Rotron's flow meter is a venturi style design. After air enters the inlet, the pressure is measured in the T1 tap. The second tap, T2, measures the pressure at the throat. The differential between T1 and T2 registers across a special calibrated CFM gauge to provide accurate readings. The throat is then expanded back to the original size to keep pressure loss to under 2-4 IWG.

Rev. 2/04

OPERATION & MAINTENANCE MANUAL

**AMETEK**

ROTRON® INDUSTRIAL PRODUCTS

75 North Street, Saugerties, NY 12477 U.S.A.

Telephone: 845-246-3401 Fax: 845-246-3802

e-mail: rotronindustrial@ametek.com website: www.rotronindustrial.com

Air Flow Meter

Thank you for purchasing an AMETEK Rotron Flow Meter. When matched with the correct Rotron blower, and properly installed and maintained, this meter will quickly and accurately measure the pipe flow. To ensure good results, please take the time to read these instructions before starting the installation of your air flow meter.

Sizing for Optimal Efficiency

CURRENT MODELS		FLOW RANGE (SCFM)	THREADS	LENGTH	WIDTH	GAUGE PART #	BODY STYLE	PRIOR MODELS	
MODEL	PART #							MODEL	PART #
FM20C030Q	550599	6-30	2.0" 11.5 NPSC	6.94"	5.49"	550321	A	FM20A030Q	550312
FM20C045Q	550600	9-45				550322		FM20A045Q	550313
FM20C065Q	550601	13-65				550323		FM20A065Q	550314
FM20C125Q	550602	25-125	2.0" 11.5 NPSC	5.34"	5.49"	550290	B	FM20A125Q	550256
FM20C175Q	550603	35-175				550291		FM20A175Q	550255
FM20C225Q	550604	45-225				550292		FM20A225Q	550254
FM30C250Q	550605	50-250	3.0" 8.0 NPSC	7.38"	7.62"	550293	C	FM30A250Q	550259
FM30C350Q	550606	70-350				550294		FM30A350Q	550258
FM30C475Q	550607	95-475				550295		FM30A475Q	550257
FM40C450Q	550608	90-450	4.0" 8.0 NPSC	7.68"	8.62"	550296	D	FM40A450Q	550262
FM40C600Q	550609	120-600				550297		FM40A600Q	550261
FM40C850Q	550610	170-850				550298		FM40A850Q	550260

Installation

- Piping** – The flow meter should be installed horizontally on the inlet side of the blower. Since this device is directional, please observe the flow direction arrow. Rotron suggests using a length of straight pipe equivalent to three to five pipe diameters prior to the meter for any elbows, valves, etc., unless there is a tee. If there is a tee, the suggested equivalent length is eight to ten pipe diameters. The flow meter should have two pipe diameters of straight pipe after the flow exits the meter before any elbows, tees, valves, etc.
- Continuous Service** – Moisture and debris should not be allowed to enter the tubes leading into the gauge, as it may affect the gauge. Orient the gauge between 10 o'clock and 2 o'clock when viewed from end. (See Figure 1).

If the gauge does not read zero, gently press down on gauge cover while turning counterclockwise to remove cover. Zero the gauge with the Allen wrench and reattach cover.

INSTALL GAUGE
10 O'CLOCK TO 2 O'CLOCK

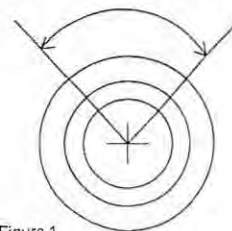


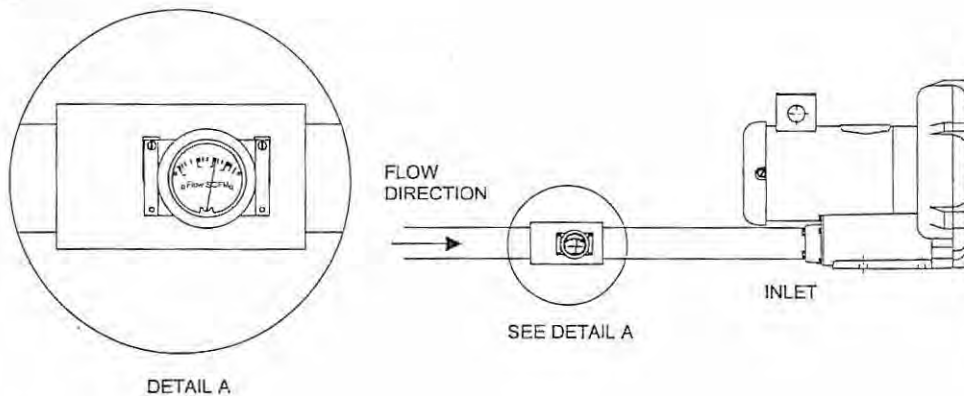
Figure 1

3. Interchangeability – Gauges within a body style are interchangeable to better match your systems actual flow rate to the Gauge Scale. For example:

<i>Body Style</i>	<i>Gauges Available</i>	<i>Flow Range Available</i>
A	550599	6-30 SCFM
A	550600	9-45 SCFM
A	550601	13-65 SCFM

Similar options for each body style are available. **Gauges** may be purchased separately and field installed without removing the flow meter from the piping.

Typical Arrangement



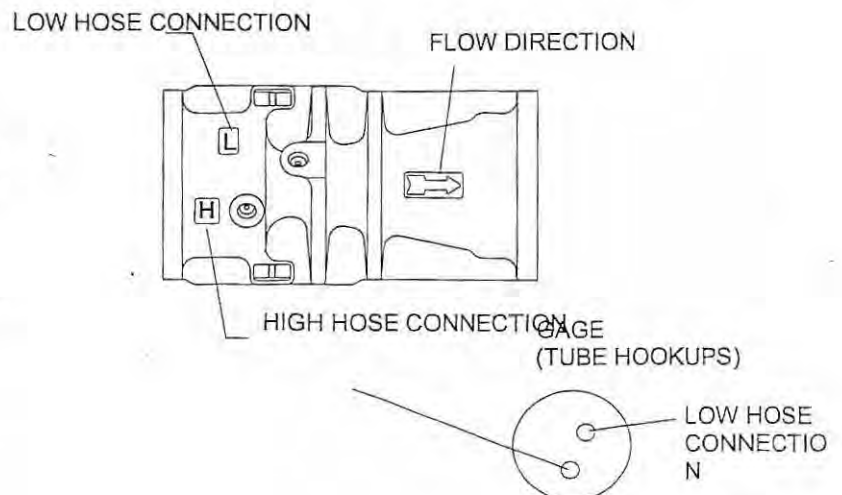
Operation

Rotron's Flow Meter is a venturi style design. After air enters the inlet, the pressure is measured in the high-pressure tap. The second tap measures the pressure at the throat. The differential between the taps registers across a specially calibrated gauge to provide accurate readings. The throat is then expanded back to the original size to keep pressure loss to under 2-4 IWG.

Maintenance

This air flow meter has been designed to require minimal maintenance. During normal operation, little maintenance is required. Care should be taken to ensure no debris enters the meter.

If the tubes become plugged, remove and clean. Do not switch the low and high hoses. Note proper orientation of hoses.



Series FR5500 Acrylic Flowmeters



KEY INSTRUMENTS

SERIES FR5500 ACRYLIC FLOWMETERS

SPECIFICATIONS

ACCURACY	+/-5% OF FULL SCALE
METER BODY	MACHINED ACRYLIC METERING TUBE
FLOAT	STAINLESS STEEL
FITTINGS	1-1/2" OR 2" FNPT UNION FITTINGS MADE OF PVC OR STAINLESS STEEL
O-RINGS	VITON®
PRESSURE	100 PSIG MAXIMUM OPERATING PRESSURE
TEMPERATURE	150°F/65°C MAXIMUM OPERATING TEMPERATURE

FEATURES

- Easy-to-read scales for GPM or LPM H₂O and SCFM or LPM air
- Durable one-piece clear acrylic construction
- Stable, easy-to-read stainless steel floats
- Integrated union fittings for easy installation
- PVC or stainless steel fitting options
- Easy disassembly and assembly for maintenance
- Superior quality

SERIES FR5500 FLOW RATES- 1-1/2" MODELS

Model	SCFM AIR*	Model	LPM AIR*
→ 5A75	10-110	5A87	300-3000
5A76	15-160	5A88	450-4600
5A77	20-200	5A89	550-5500

Model	GPM H ₂ O	Model	LPM H ₂ O
5L78	3-30	5L90	10-120
5L79	4-40	5L91	15-150
5L80	5-50	5L92	20-200

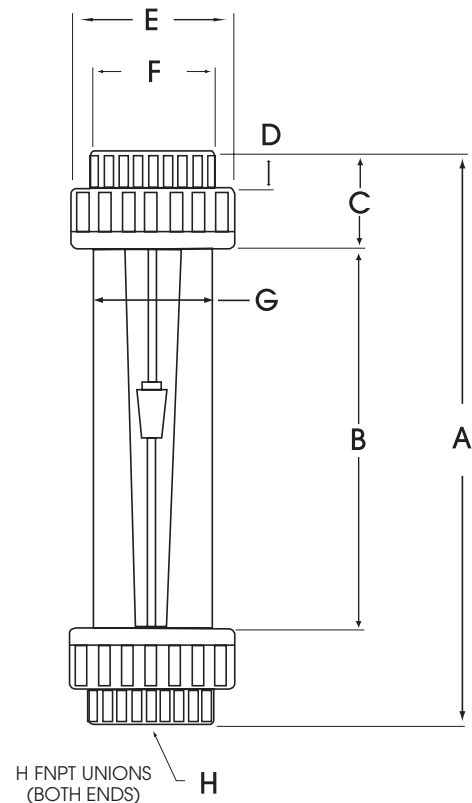
*Air Ranges-Stainless Steel Fittings Only

SERIES FR5500 FLOW RATES- 2" MODELS

Model	SCFM AIR*	Model	LPM AIR*
5A81	25-250	5A93	700-7000
5A82	30-330	5A94	800-9000
5A83	40-400	5A95	1000-11000

Model	GPM H ₂ O	Model	LPM H ₂ O
5L84	6-60	5L96	25-230
5L85	8-80	5L97	30-300
5L86	10-100	5L98	40-400

VITON® IS A REGISTERED TRADEMARK OF E.I. DUPONT.



ORDERING EXAMPLE

FR	MODEL CODE	FITTINGS
	5A81	SI

SAMPLE: FR5A81SI
25-250 SCFM AIR with 2" SI UNIONS

FITTINGS:
PI=PVC
SI=Stainless steel

	FR5500 Dimensions Inches						
H	A	B	C	D	E	F	G
→ 1-1/2" PVC	13-1/4	9	2-1/4	7/8	3-1/2	2-1/2	2-1/2
1-1/2" S.S.	13-3/8	9-1/8	2-1/8	7/8	3-1/2	2-1/2	2-1/2
2" PVC	13-7/8	8-15/16	2-1/2	1	4-1/8	3-1/16	3
2" S.S.	13-1/2	9-3/16	2-5/32	15/16	4	3	3



KEY INSTRUMENTS

250 Andrews Road, Trevoze, PA 19053

800.356.7483 • 215.357.0893
Fax: 215.357.9239

www.keyinstruments.com
e-mail: sales@keyinstruments.com
187 Sept. 2001



Series 1800 Low Differential Pressure Switches for General Industrial Service

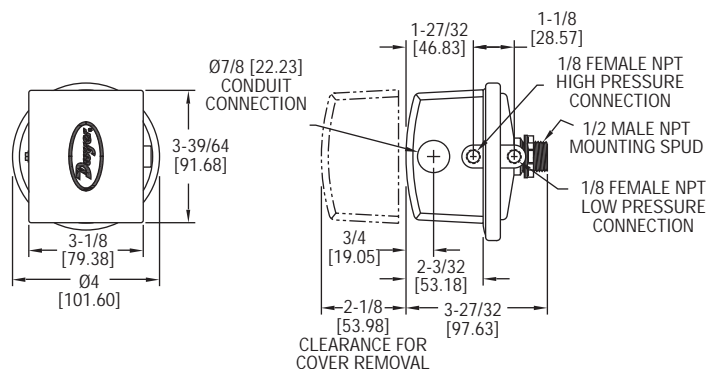
Specifications — Installation and Operating Instructions



Model 1823 pressure switch. UL and CSA Listed, FM and CENELEC approved.



Series 1823 pressure switch. Conduit enclosure removed to show electric switch.



Construction and dimensions. Series 1823 pressure switches.

One of our most popular pressure switches. Combines small size and low price with 2% repeatability for enough accuracy for all but the most demanding applications. Set point adjustment inside the mounting switch on one side of a wall or panel with adjustment easily accessible on the opposite side.

*Model 1823 shown; (1823 replaces 1820, 1821 and 1822 which are similar).

Environmental (MIL) Switch

Unlisted Model 1820 can be furnished with special snap switch sealed against the environment for high humidity and/or for government applications. Similar to standard Model 1823 except dead band is slightly greater. Specify Model 1820 (Range No.) "MIL" in ordering.

SERIES 1823 SWITCHES — OPERATING RANGES & DEADBANDS

Model Number	Operating Range, Inches W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1823-00	0.07 to 0.22	0.05	0.05
1823-0	0.15 to 0.5	0.06	0.06
1823-1	0.3 to 1.0	0.08	0.08
1823-2	0.5 to 2.0	0.10	0.12
1823-5	1.5 to 5.0	0.14	0.28
1823-10	2.0 to 10	0.18	0.45
1823-20	3 to 22	0.35	0.70
1823-40	5 to 44	0.56	1.10
1823-80	9 to 85	1.30	3.0

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.

Wetted Materials: Consult Factory.

Temperature Limits: -30 to 180°F (-34 to 82.2°C). 1823-00, -20 to 180°F (-28.9 to 82.2°C).

Pressure Limits: 10 psig (68.95 kPa) continuous, 25 psig (172.4 kPa) surge.

Switch Type: Single-pole double-throw (SPDT).

Repeatability: ±2%.

Electrical Rating: 15 A @ 120-480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz. De-rate to 10 A for operation at high cycle rates.

Electrical Connections: 3 screw type, common, normally open and normally closed.

Process Connections: 1/8" female NPT.

Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.

Set Point Adjustment: Screw type inside mounting spud.

Weight: 1 lb, 5 oz (595 g).

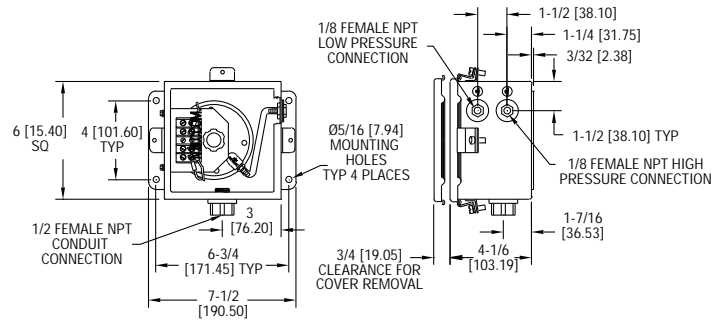
Agency Approvals: CE, UL, CSA, FM.

INSTALLATION

1. Select a location free from excessive vibration and where oil or water will not drip upon the switch. See special housings for unusual conditions.
2. **While not required, positioning the pressure connections down is recommended.** Mount the switch with the diaphragm in a vertical plane. Switch with the diaphragm in a vertical plane. Switch must be recalibrated for each change in operating position.
3. Connect switch to source of pressure differential. Metal tubing with 1/4" O.D. is recommended but any tubing system which will not restrict the air flow is satisfactory. Note that the low pressure connection may be made to the 1/2" spud at the back of the switch if desired. If so connected, drill 1/16" diameter holes in the Spring Retainer flange and the head of Adjustment Screw to provide opening to the switch interior and plug the other low pressure connection.
4. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common", "norm open", and "norm closed". The normally open contacts close and the normally closed contact open when pressure increases beyond the set point.
5. Switch loads should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with high load inductance or rapid cycle rates. Whenever 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 prolonged switch life.

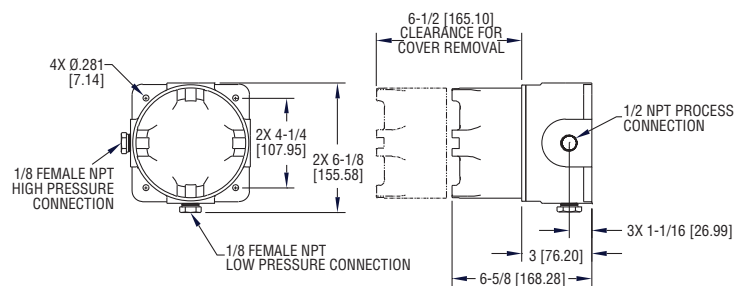
ADJUSTMENT

1. If the switch has been factory preset, check the set-point before placing in service to assure it has not shifted in transit.
2. If switching has not been preset or it is desired to change the point, observe the following procedure:
 - a. To adjust the set point turn the slotted Adjustment Screw clockwise to increase the set point and counterclockwise to decrease the set point.
 - b. The following is a recommended procedure for calibrating or checking calibration: Use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point slowly. Note the manometer and pressure switch will have different response characteristics due to different internal volumes, lengths of tubing, oil drainage, etc. Be certain switch is checked in position it will assume in use, i.e. vertical, horizontal, etc.



Weatherproof Enclosure

16 ga. steel enclosure for unusually wet or oily conditions. Withstands 200 hour salt spray test. Gasketed cover. Weight 5-1/2 lb (2.5 kg). Switch must be installed at factory. Specify "WP" in addition to switch catalog number.



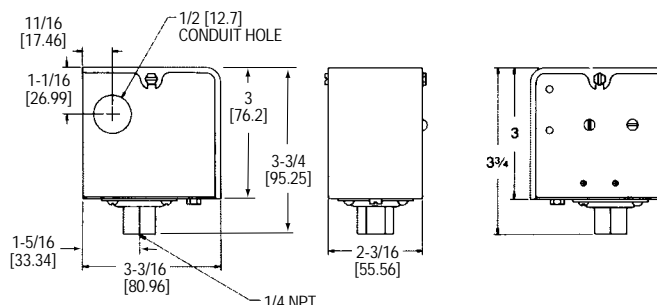
Explosion-Proof Housing

Cast iron base and aluminum dome cover. Approximate weight 7-1/2 lb (3.4 kg). Specify "EXPL" in addition to switch catalog number. Rated Class I, Groups C & D, Div. 1. Class II, Groups E, F, & G, Div. 1.



Series CS Low Cost Diaphragm Pressure Switches

Specifications – Installation and Operating Instructions



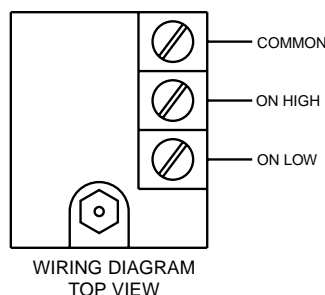
The **Series CS Low Cost Diaphragm Pressure Switch** is ideal for instrument panels, small compressors and general industrial applications. Visible set point and easy-to-wire SPDT snap switch reduce installation time. This switch operates in any position and is vibration resistant.

INSTALLATION/MOUNTING

The control can be pipe mounted. Do not twist the case when installing. Use wrench on the pressure connection flats.

WIRING

All wiring must conform to the National Electrical code and local regulations. Do not install control to handle loads in excess of electrical rating shown in specifications or as indicated on instructions inside control cover. Connect wiring to screw terminals depending on the action required. Common and High contacts will close and Common and Low contacts will open when increasing pressure (or vacuum) reaches set point. The reverse will occur when pressure (or vacuum) drops below the set point less the deadband.



CAUTIONS: Do not oil any parts. Mount control securely. Never exceed electrical rating for switch. Use only with compatible.

WARNING

A failure resulting in injury or damage can be caused by over-pressure, excessive vibration or pressure pulsation, excessive temperature, corrosion of pressure containing parts and movement assembly, electrical overload or other misuse.

PHYSICAL DATA

Temperature Limits: -30 to 150°F (-34.4 to 65.6°C)

Pressure Connections: 1/4" NPT(F)

Electrical Ratings: 12 A @ 120 VAC; 8 A @ 240 VAC; 7A @ 277 VAC; 1/8 HP @ 120 VAC; 1/4 HP @ 240 VAC

Switch Type: SPDT snap acting

Conduit Opening: 1/2"

Wiring Connections: Three screw type, common, N.O., N.C.

Set Point Adjustment: Screw type, inside cover

Housing: Galvanized steel, NEMA 1

Diaphragm: Buna-N/Nylon

Calibration Spring: Plated steel

Installation: Any position

Weight: 1/2 lb. (0.23 kg)

Model No.	Adjustable Operating Range	Fixed Deadband		Max. Pressure
		Maximum	Minimum	
CS-1	1-30" Hg. Vac. 2.5-75 cm Hg. Vac	1.5" Hg. 3.8 cm Hg. Vac	1" Hg. VAC 2.5 cm Hg. Vac	30 psig
CS-3	10-100" w.c. 2.5-250 cm w.c.	7" w.c. 17.8 cm w.c.	5" w.c. 12.7 cm w.c.	30 psig
CS-10	1-10 psig 0.07-0.7 kg/cm ²	0.4 psig 0.03 kg/cm ²	0.25 psig 0.02 kg/cm ²	30 psig
CS-30	1-30 psig 0.07-2.1 kg/cm ²	1.0 psig 0.07 kg/cm ²	0.5 psig 0.035 kg/cm ²	50 psig
CS-150	10-150 psig 0.07-10.5 kg/cm ²	5 psig 0.35 kg/cm ²	1.5 psig 0.1 kg/cm ²	175 psig

Bimetal Thermometer

Model TI.20, All Stainless Steel Construction

Datasheet TI.20

Application

- Suitable fluid medium which does not corrode 304 stainless steel

Special features

- Back connection without external reset
- Industrial design
- All Stainless steel construction

Standard version

Size

2" (50.8 mm) - Type TI.20

Accuracy

± 1.0% full scale value (ASME B40.3)

Min. / Max. Ranges

-100 °F to 1000 °F (and equivalent Celsius)

Working Range

Steady: full scale value
Short time: 110% of full scale value

Under / Over Range Protection

Temporary over or under range tolerance of 50% of scale up to 500 °F (260°C). For ranges above 500°F, maximum over range is 800°F; continuous. 1000°F intermittent.

Connection

Material: 304 stainless steel
Center back mount (CBM)
1" NPT

Stem

Material: 304 stainless steel
Diameter: 1" (6.35 mm)
Length: 2 ½" to 24" (63.5 mm to 609.6 mm)

Measuring Element

Bi-metal helix



Thermometer TI.20

Case

Material: 304 stainless steel; hermetically sealed per ASME B40.3 standard

Dial

White aluminum, dished, with black markings

Pointer

Black aluminum

Standard Scales

Single: Fahrenheit or Celsius
Dual: Fahrenheit (outer) and Celsius (inner)

Window

Flat instrument glass

Weight

2" - 5 oz.; Add 1 oz. for every 2" of stem length

Dampening

Inert gel to minimize pointer oscillation

Order Options (min. order may apply)

Special scales and dial markings; Acrylic windows
Calibration certification traceable to NIST

Warranty

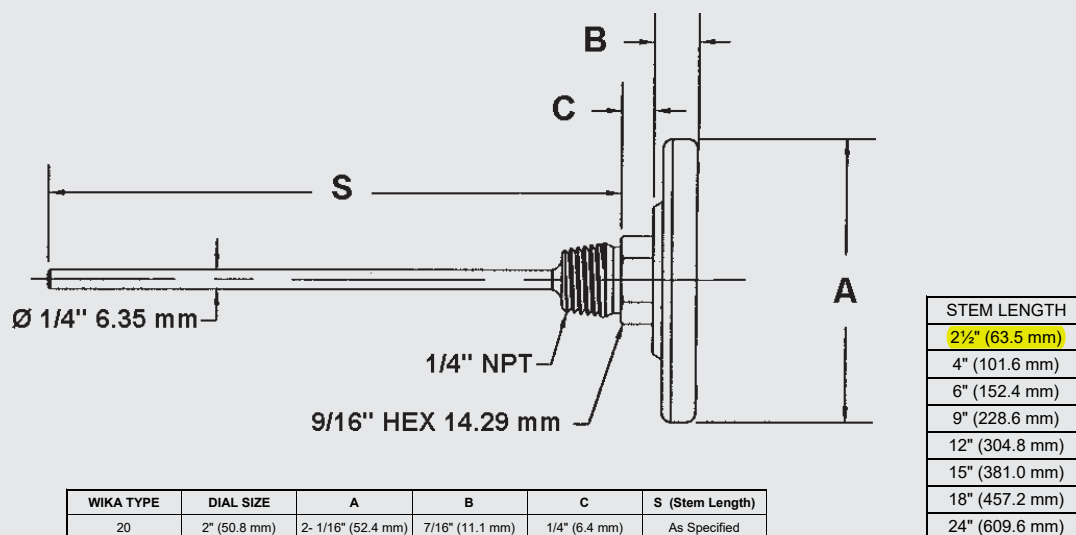
Limited one year warranty as stated in WIKA's Terms & Conditions of Sale.

STANDARD RANGES		
Fahrenheit	Dual Scale F & C	Celsius
Single Scale	F Outer, C Inner	Single Scale
-100/150 F	-100/150 F & -70/70 C	-50/50 C
-40/120 F	40/120 F & -40/50 C	-20/120 C
0/140 F	0/140 F & -20/60 C	0/50 C
0/200 F	0/200 F & -15/90 C	0/100 C
0/250 F	0/250 F & -20/120 C	0/150 C
20/240 F	20/240 F & -5/115 C	0/200 C
25/125 F	25/125 F & -5/50 C ¹	0/250 C
50/300 F	50/300 F & 10/150 C	0/300 C
50/400 F	50/400 F & 10/200 C	0/450 C ¹
50/550 F	50/500 F & 10/260 C	100/550 C ¹
150/750 F	150/750 F & 65/400 C	
200/1000 F ¹	200/1000 F & 100/540 C ¹	

¹Not recommended for continuous service over 800°F (425°C)

Dimensions

Standard versions



Note: Thermowells for temperature instruments are recommended for all process systems where pressure, velocity, or viscous, abrasive and corrosive materials are present individually or in combination. A properly selected thermowell protects the temperature instrument from possible damage resulting from these process variables. Furthermore, a thermowell permits removal of the temperature instrument for replacement, repair or testing without effecting the process media or the system.

Ordering information

State computer part number (if available) /type number/size/range/connection size and locations/options required. WIKA reserves the right to make changes without prior notice.



WIKAI Instrument Corporation

1000 Wiegand Boulevard
Lawrenceville, GA 30043
1-888-WIKA-USA /770-513-8200 (in GA)
Fax 770-338-5118
info@wika.com www.wika.com

HEATING/VENTILATION/LIGHTING

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Hazardous Location Electric Convection Heaters

Description

These hazardous location heaters have been designed for installation in areas where potentially explosive, flammable vapors may be in the atmosphere, but a comfortable range of heat is maintained and desired.

Features

Heavy duty 16 ga. steel cabinet with epoxy textured powder coat finish.

Stainless steel cartridge element inserted into aluminum finned copper sheath.

Standard unit is NEMA 4 rated.

Specifications

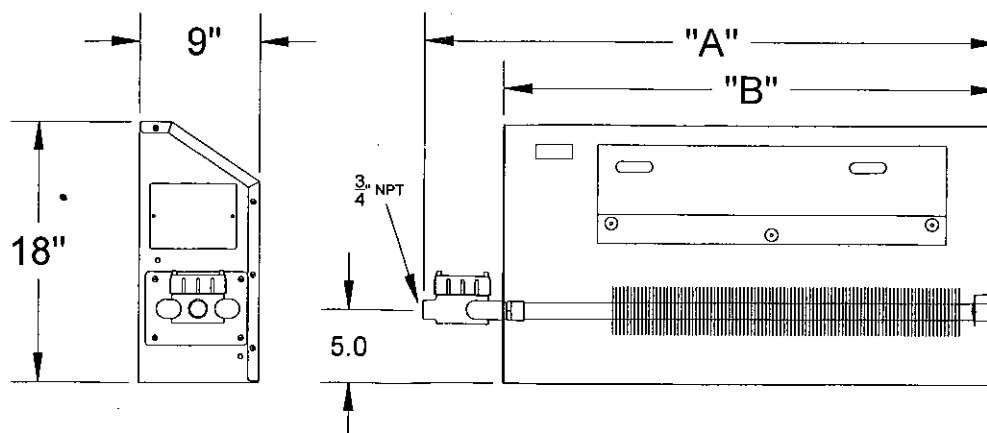
Temperature Code: Do not install in areas where vapors or gases having an ignition temperature less than 280°C (536°F) for T-2A models, and 180°C (356°F) for T-3A models.

Ratings: Class 1, Groups B, C, and D. Division 1 and 2, T-2A (280°C/536°F) or T-3A (180°C/356°F) depending on specific wattage models. NEMA 4.

For additional information on Div., Class and Groups, refer to NEC Article 500 HAZARDOUS (CLASSIFIED) LOCATIONS.

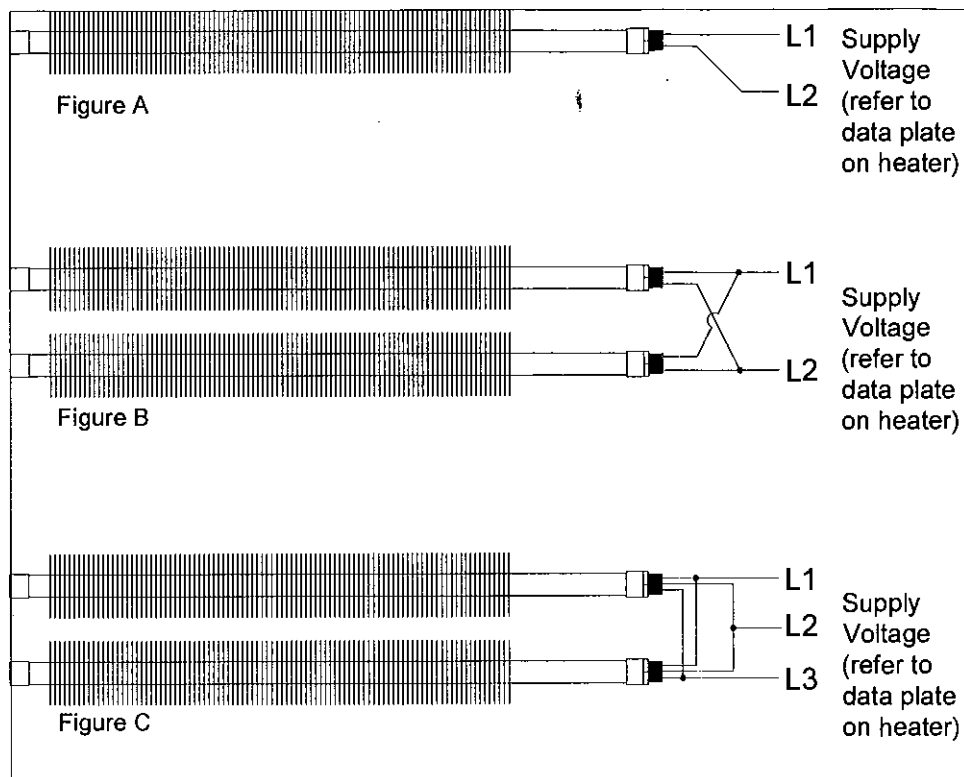
Dimensions

MODEL	A	B
2CJE8, 2CJE9, 2CJF1, 2CJF2, 2CJF3, 2CJF4	39 1/2	34
2CJF5, 2CJF6	63 1/2	58



Models 2CJE8, 2CJE9 AND 2CJF1 thru 2CJF6

Wiring Diagrams



Operation

This heater may be controlled by a thermostat or a contactor and thermostat. If control equipment is located in a hazardous location, it too must be approved for this location. It is essential that over-current protection be provided for the heater alone and should be of a value as near as possible to the current rating indicated on the heater data plate.

Do not operate the heater at voltages in excess of that stamped on the heater, since excess voltage will shorten heater life and cause high element temperatures. These may exceed allowable temperatures of operation in a hazardous atmosphere.

⚠ WARNING Never operate the heater with the front panel off. Air flow across the heating elements requires the front panel in place. Injury from hot heating elements is possible with the front panel removed.

Maintenance

Always disconnect the heater from the power source before performing any service or maintenance.

1. Keep heater clean, especially the heating elements.
2. Remove dust, lint and accumulation of other material.

3. Never allow the heater to operate with restriction to the free circulation of air through it.

4. Check that the heater has not been damaged or deformed, and that all conduit joints are secure.

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Notes

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For more information on fan sizing and terminology, see page 3937.

12 to 24" Hazardous Location Aluminum Panel Exhaust Fans

- Vertical mount
- Capacitor-start, totally enclosed air-over, ball bearing motors are 115/230V, 60 Hz

Rugged fans ventilate spaces containing flammable or explosive vapors, gases, or dusts (per NEC 500). Fans meet NEC classes and groups as shown in table below. Aluminum propellers and steel frames feature baked-on charcoal gray

polyester finish to resist corrosion. UL and C-UL listed.

Note: OSHA complying guards are required when fan is installed within 7 ft. of floor, working level, or within reach of personnel. Please review OSHA codes.

Note: Consult local ventilation contractor or fire inspector for local code requirements. Do not use where motor or blades will accumulate paint residue. Electrically ground all components in hazardous location system.



Dayton Electric Mfg. Co. certifies that the ventilators shown herein are licensed to bear the AMCA seal. The ratings shown are based on tests and procedures

performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

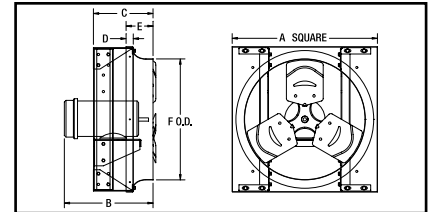


No. 3XK51

Propeller Diameter (In.)	A (Sq.)	B	Dimensions (In.)	C	D	E	F	Venturi Clearance Dia. (In.)	Recommended Intake Guards Item No.	\$ Each	Recommended Aluminum Wall Shutters Item No.	\$ Each
Aluminum Blade Venturi Fan Dimensions												
12	16	14 1/4	8 1/2	1	2 1/4	12 1/4	14	14	1WB78	97.55	4C556	33.85
16	20	14 1/4	7 3/4	1	3 3/4	16 1/4	18	18	1WB79	105.00	4C557	42.20
18	22	14 1/4	9	1 1/4	4 1/4	18 1/4	20	20	1WB1	112.85	4C558	47.65
20	24	15 3/4	9 1/4	1	4 1/2	20 3/4	22	22	1WB2	120.85	4C559	51.10
24	28	17 1/2	11 1/4	1	4 1/4	24 1/4	26	26	1WB3	179.75	3C308	61.40

Propeller Dia. (In.)	0.0"	CFM Air Delivery @ Static Pressure Shown*	0.125"	0.250"	0.375"	0.500"	Motor HP	RPM	Full-Load Amps	Sones @ 0.00" SP @ 5 Ft.**	Watts	Item No.	\$ Each	Shpg. Wt.
12	1263	1125	980	680	—	—	1/4	1725	3.9/2.0	14.1	200	3XK51	✓ 599.50	33.0
16	2662	2375	1950	1330	1130	—	1/4	1725	3.9/2.0	20	345	3XK37	✓ 642.50	41.0
18	3231	2950	2490	2025	1550	—	1/3	1725	6.2/3.1	19.3	420	3XK55	✓ 720.00	55.0
20	4295	4060	3810	3460	2795	—	1/2	1725	7.8/3.9	24	614	3XK59	✓ 812.00	67.0
24	5521	5050	4550	4000	3420	—	1/2	1725	7.8/3.9	27	687	3XK61	✓ 826.00	78.0
24	6384	5960	5550	5000	4300	—	3/4	1725	10.8/5.4	28	766	3XK64	✓ 912.00	82.0

(*) Performance shown is for installation type A: free inlet, free outlet. Speed (RPM) shown is nominal. Performance is based on actual speed of test. Performance ratings do not include the effects of appurtenances in the airstream. (**) The sound ratings shown are loudness values in fan sones at 5 ft. (1.5m), in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet fan sone levels.



Item No.	Propeller Dia. (In.)	Class I Groups	Meets NEC Class II Groups
3XK51	12	D	F & G
3XK37	16	D	F & G
3XK55	18	C & D	F & G
3XK59	20	C & D	F & G
3XK61	24	C & D	F & G
3XK64	24	C & D	F & G

12 to 30" Hazardous Location Aluminum Ring Exhaust Fans

- Mount vertically or horizontally
- Totally enclosed air-over hazardous location motors for classes and groups listed in table

Efficient fans provide heavy-duty ventilation of air containing flammable or explosive vapors, gases, or dusts (per NEC 500). Charcoal gray steel circular frame is epoxy-coated to resist corrosion; features prepunched mounting holes for fast and easy installation. Fixed-position motor base is attached to rigid tubular supports.

Spark-resistant aluminum propellers. Motorized shutters are not recommended. UL and C-UL listed.

Note: OSHA complying guards are required when fan is installed within 7 ft. of floor, working level, or within reach of personnel. Please review OSHA codes.

Note: Consult local ventilation contractor or fire inspector for local code requirements. Do not use where motor or blades will accumulate paint residue. Electrically ground all components in hazardous location system.



Dayton Electric Mfg. Co. certifies that the ventilators shown herein are licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.



No. 2C856

Propeller Diameter (In.)	Outside Dia. (In.)	Venturi Clearance Dimensions (In.)	Recommended Intake Guard Item No.	\$ Each	Recommended Aluminum Wall Shutters Item No.	\$ Each	Item No.	Propeller Dia. (In.)	Class I Groups	Meets NEC Class II Groups
Hazardous Location Exhaust Fan Dimensions										
12	16 1/4	13 1/2	1WB79	105.00	4C556	33.85	4C020	12	D	F & G
16	20 1/4	17 1/2	1WB1	112.85	4C557	42.20	4C369	16	D	F & G
18	22 1/4	19 1/2	1WB2	120.85	4C558	47.65	4C370	18	C & D	F & G
20	24 1/4	21 1/2	1WB3	179.75	4C559	51.10	2C963	20	C & D	F & G
24	28 1/4	25 1/2	1WB4	216.50	3C308	61.40	2C856	24	C & D	F & G
30	33 1/2	30 1/2	1WB4	216.50	3C309	73.85	4C371	24	C & D	F & G
							3C772	30	C & D	E, F & G

Propeller Dia. (In.)	No. of Blades	CFM Air Delivery @ Static Pressure Shown*	0.0"	0.125"	0.25"	0.375"	0.500"	Motor HP	RPM	Full Load Amps	Sones @ 0.00" SP @ 5 Ft.**	Phase	Volts	Hz	Item No.	\$ Each	Shpg. Wt.
12	4	800	650	360	150	—	—	1/4	1725	3.9/2.0	13.8	1	115/230	60	4C020	✓ 598.50	44.8
16	4	1890	1510	1270	1100	760	—	1/4	1725	3.9/2.0	24	1	115/230	60	4C369	✓ 647.00	44.7
18	4	2150	1750	1500	1200	900	—	1/4	1725	3.9/2.0	27	1	115/230	60	4C370	✓ 720.00	42.5
20	4	2380	1970	1700	1500	1200	—	1/4	1725	3.9/2.0	28	1	115/230	60	2C963	✓ 702.00	45.3
24	3	3600	2900	2150	1730	1100	—	1/3	1725	6.6/3.1/3.3	28	1	115/208-230	60	2C856	✓ 872.50	54.0
24	3	4500	3900	3350	2700	2250	—	1/2	1725	8.8/4.1/4.4	34	1	115/208-230	60	4C371	✓ 991.50	50.3
30	3	8270	7400	6400	5200	3900	—	3/4	1140	9.6/4.8	30	1	115/230	60	3C772	✓ 1097.00	78.0

(*) Performance shown is for installation type A: free inlet, free outlet. Speed (RPM) shown is nominal. Performance is based on actual speed of test. Performance ratings include the effects of guard and shutter in the airstream. (**) The sound ratings shown are loudness values in fan sones at 5 ft. (1.5m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet fan sone levels.

Hazardous Location Fan Motor Conduit Box

Description	Item No.	\$ Each	Shpg. Wt.
Conduit Box	4X788	39.85	1.6

Use with Dayton brand hazardous location fan motors. Has hole for self-tapping grounding screw. Easily installed. Gray finish. UL Listed.



Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Hazardous Location Direct Drive Exhaust Fans

Description

NOTE: Manufacturer assumes no obligation or liability on account of any unauthorized recommendations, opinions, or advice as to the choice, installation or use of products.

Each unit is equipped with a non-sparking, aluminum propeller and a U.L. Listed Class I, totally enclosed, hazardous location, ball bearing motor with automatic reset thermal protection. Refer to the NEC Class and Group Ratings for Hazardous Fans chart below.



Model	Propeller Dia.	A	B	C	D	E
3GPA9	12"	13 1/2"	16 1/4"	12 1/8"	9 1/4"	2 3/8"
4C020F	12	13 1/2	16 1/4	12 1/8	9 1/4	2 3/8
3GPC1	16	17 1/2	20 1/4	12 1/8	8 3/4	3 3/8
4C369F	16	17 1/2	20 1/4	12 1/8	8 3/4	3 3/8
3GPC2	18	19 1/2	22 1/4	12 1/8	8 1/2	3 3/8
4C370G	18	19 1/2	22 1/4	12 1/8	8 1/2	3 3/8
3GND6	20	21 1/2	24 1/2	12 3/8	8 3/4	3 3/8
2C963G	20	21 1/2	24 1/2	12 3/8	8 3/4	3 3/8
2C856F	24	25 1/2	28 1/4	15 1/8	11 1/8	4
3GND7	24	25 1/2	28 1/4	15 1/8	11 1/8	4
3GPC3	24	25 1/2	28 1/4	15 1/8	11 1/8	4
4C371F	24	25 1/2	28 1/4	15 1/8	11 1/8	4
3C772F	30	30 1/2	33 1/2	16	11 1/2	4 1/2

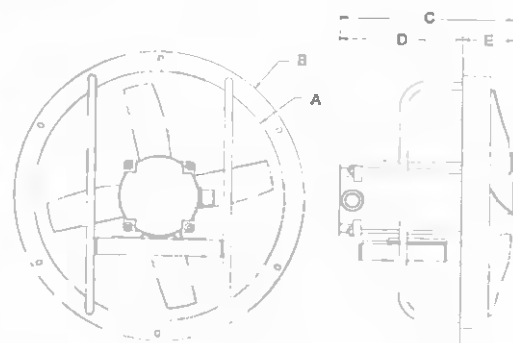


Figure 1 - Dimensions

Unpacking

Receiving and Inspection. Immediately upon receipt of shipment, carefully inspect for damage and/or shortage. Turn the impeller by hand to see that it turns freely and does not bind. If any damage and/or shortage is detected or suspected, the carrier must be notified to conduct an inspection. The customer should not accept shipment without a notation on the delivery receipt indicating items not delivered or the apparent extent of damage.

When shipment is opened and damage is found which was not evident externally (concealed damage), it is mandatory that the customer request an immediate inspection by the carrier. Report any damage to the carrier within 15 days. Failure to report damage within the above time limit could result in rejection of claim.

Handling. When handling fans and their accessories, always use equipment and methods that will not cause damage. To avoid damage fans should be lifted using slings and padding or spreaders.

CAUTION Always make sure that all lifting and handling equipment and techniques conform to current safety standards.

Avoid lifting fans in a way that will bend or distort fan parts. Never pass slings or timbers through the fan orifice.

NEC Class and Group Ratings for Hazardous Location Exhaust Fans

Exhaust Model	Class I Groups	Class II Groups
4C020	C & D	F & G
4C369	C & D	F & G
4C370	C & D	F & D
2C963	C & D	F & D
2C856	C & D	F & G
4C371	C & D	F & G
3C772	C & D	E, F & G
3GPA9	C & D	F & G
3GPC1	C & D	F & G
3GPC2	C & D	F & G
3GND6	C & D	F & G
3GND7	C & D	F & G
3GPC3	C & D	F & G

Dayton® Hazardous Location Direct Drive Exhaust Fans

Performance

Model	Prop. Dia. (in.)	No. of Blades	CFM Air Delivery @ Static Pressure Shown*					Sones**	RPM	Full Load Amps	Motor HP	Volts 60 Hz
			0.000" S.P.	0.125" S.P.	0.250" S.P.	0.375" S.P.	0.500" S.P.					
4C020	12	4	800	650	360	150	—	13.8	1725	3.9/2.0	1/4	115/230/1 Phase
4C369	16	4	1890	1510	1270	1100	760	24	1725	3.9/2.0	1/4	115/230/1 Phase
4C370	18	4	2150	1750	1500	1200	900	27	1725	3.9/2.0	1/4	115/230/1 Phase
2C963	20	4	2380	1970	1700	1500	1200	28	1725	3.9/2.0	1/4	115/208-230/1 Phase
2C856	24	3	3600	2900	2150	1730	1100	28	1725	6.6/3.1/3.3	1/3	115/208-230/1 Phase
4C371	24	3	4500	3900	3350	2700	2250	34	1725	8.8/4.1/4.4	1/2	115/208-230/1 Phase
3C772	30	3	8270	7400	6400	5200	3900	30	1140	9.6/4.8	3/4	115/230/1 Phase
3GPA9	12	4	800	650	360	150	—	13.8	1725	1.1-1.1/1.55	1/4	208-230/460/3 Phase
3GPC1	16	4	1890	1510	1270	1100	760	24	1725	1.1-1.1/1.55	1/4	208-230/460/3 Phase
3GPC2	18	4	2150	1750	1500	1200	900	27	1725	1.1-1.1/1.55	1/4	208-230/460/3 Phase
3GND6	20	4	2380	1970	1700	1500	1200	28	1725	1.1-1.1/1.55	1/4	208-230/460/3 Phase
3GND7	24	3	3600	2900	2150	1730	1100	28	1725	1.3-1.2/1.60	1/3	208-230/460/3 Phase
3GPC3	24	3	4500	3900	3350	2700	2250	34	1725	2.3-2.4/1.2	1/2	208-230/460/3 Phase

(*) Performance shown is for installation type A: free inlet, free outlet. Speed (rpm) shown is nominal. Performance is based on actual speed of test. Performance ratings include the effects of guard and shutter in the airstream.

(**) The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet fan sone levels.

Unpacking (Continued)

Storage. Fans are protected against damage during shipment. If they cannot be installed and put into operation immediately upon receipt, certain precautions are necessary to prevent deterioration during storage. Responsibility for integrity of fans and accessories during storage must be assumed by the user. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user, who shall make his own decision as to whether to use any or all of them.

Indoor Storage. The ideal storage environment for fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained at between 70°F and 105°F (wide temperature swings may cause condensation and "sweating" of metal parts). Windows should be covered to prevent temperature variations caused by sunlight. Provide thermometers and humidity indicators at several points

and maintain the atmosphere at 40% relative humidity, or lower.

It may be necessary to use desiccant or a portable dehumidifier to remove moisture from the air in the storage enclosure.

Thermostatically controlled portable heaters (vented to outdoors) may be required to maintain even temperatures inside the enclosure.

▲ CAUTION Provide fire extinguishers, fire alarms, or emergency response communication to protect building and equipment against fire damage. Be sure that building and storage practices meet all local, state and federal fire and safety codes.

The following fans or accessories must be stored indoors, in a clean dry atmosphere:

- Propeller wall fans not in wall housings.
- Any fan protected by a cardboard carton.

- Motors dismounted from fans.
- Spare wheels or propellers.
- Belts, sheaves, bushings and other parts when not mounted on fan.
- Boxes, bags or cartons of hardware.
- Curbs
- Shutters

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. Allow cold parts to reach room temperature to avoid "sweating" of metal parts. Open boxes or cartons. Remove any accumulated moisture; if necessary use portable electric heaters to dry parts and packages. Leave coverings loose to permit air circulation and to permit periodic inspection.

Rotate impeller by hand to distribute bearing grease over the entire bearing surfaces.

Models 2C856F, 2C963G, 3C772F, 3GPA9, 3GPC1, 3GPC2, 3GND6, 3GND7, 3GPC3, 4C020F, 4C369F, 4C370G and 4C371F

Unpacking (Continued)

Store at least 3 1/2" above the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Provide aisles between parts and along all walls to permit air circulation and space for inspection.

Outdoor Storage. Fans designed for outdoor use may be stored outdoors, if absolutely necessary. The storage area should be reasonably level and drained or ditched to prevent accumulation of water. Fencing and lighting for security are desirable. Roads or aisles for portable cranes and hauling equipment are needed. Consider the use of drift fencing to minimize accumulation of blowing snow or dirt.

The following fans may be stored outdoors, if dry indoor storage space is not available:

- Fans intended for outdoor use that are crated in wood.
- Wall fans installed in wall housings.

All fans must be supported on wooden blocks or timbers above water or normal snow levels. Provide enough blocking to prevent settling into soft ground. Fans should be set in place using the directional arrow markings on the crate as a guide.

Locate pieces far enough apart to permit air circulation, sunlight, and space for periodic inspection. Place all parts on their supports so that rain water will run off, or to minimize water accumulation.

IMPORTANT: Do not cover parts with plastic film or tarps — these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan impellers should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance

During Storage. Inspect fans and accessories at least once per month, while in storage. Log results of

inspection and maintenance performed. A typical log entry should include the following:

- Date
- Inspector's Name
- Name of Fan
- Location
- Condition of Paint or Coating
- Is moisture present?
- Is dirt accumulated?
- Corrective steps taken?

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. Fan impellers should be rotated at each inspection by hand ten to fifteen revolutions to redistribute the motor and bearing lubricant.

If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. The most critical items are pulleys, shafts and bearing locking collars. At the first sign of rusting on any of the above parts, remove the original rust preventive coating with petroleum solvent and clean lint-free cloths. Polish any remaining rust from surfaces with crocus cloth or fine emery paper and oil.

IMPORTANT: Do not destroy the continuity of the surfaces. Wipe clean with lint-free cloths and recoat surfaces evenly and thoroughly with Tectly 506 (Ashland Oil Company) or equal. For hard to reach internal surfaces or for occasional use, consider using Tectly 511M Rust Preventive or WD40 or equal.

Removing from Storage. As fans are removed from storage to be installed in their final location, they should be protected and maintained in similar fashion, until the fan

equipment goes into operation.

General Safety Information

- Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA) in the United States.
- Motor must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system by using a separate ground wire connected to the bare metal of the motor frame, or other suitable means.
- Always disconnect power source before working on or near a motor or its connected load. If the power disconnect point is out-of-sight, lock it in the open position and tag to prevent unexpected application of power.
- All moving parts should be guarded.
- Be careful when touching the exterior of an operating motor - it may be hot enough to be painful or cause injury. With modern motors this condition is normal if rated at normal load and voltage - modern motors are built to operate at higher temperatures.
- Make certain that the power source conforms to the requirements of your equipment.
- Wiping or cleaning rags and other flammable waste materials must be placed in a tightly closed metal container and disposed of later in the proper fashion.
- When cleaning electrical or electronic equipment, always use an approved cleaning agent such as dry cleaning solvent.

Dayton® Hazardous Location Direct Drive Exhaust Fans

Installation

▲ WARNING If gases, other than clean air, are to be exhausted using the fan, then the user bears the responsibility of determining that the fan is appropriate and safe for the application.

▲ WARNING Not for use where paint residue can accumulate on motor.

▲ WARNING Disconnect power source before installing or servicing. Failure to disconnect power source can result in fire, shock, or serious injury.

1. Mount the fan to a panel securely anchored to studs or wall framing.
2. Connect power leads to motor, using an approved wiring method (Motor terminal connection data is provided on motor nameplate or on motor terminal box cover plate. Use adequate size wire for all branch and feeder runs). Incorrect motor connections will cause poor fan performance and/or motor failure.

▲ CAUTION For safety, a lockable disconnect switch should be located near fan so power can be positively disconnected while servicing fan.

▲ WARNING Fan frame and motor must be electrically grounded to a suitable electrical ground such as a grounded water pipe, or properly grounded metallic raceway or ground wire system.

3. Before applying power to the fan, check for obstructions which would interfere with fan operation.

NOTE: Propeller must turn clockwise when facing the shaft of the motor. If rotation is incorrect, refer to motor nameplate for reversing instructions.

▲ CAUTION This fan has rotating parts. Exercise applicable safety precautions during its handling, assembly, operation and maintenance. Disconnect power before handling, assembling, operating or maintaining. If disconnect means is out of sight, lock it in the open position to prevent unexpected starts.

▲ WARNING Do not use in hazardous environments where the fan's electrical system could provide ignition to combustible or flammable materials, unless the unit is specifically built for hazardous environments.

▲ CAUTION Guards must be installed when the fan is within reach of personnel or within eight (8) feet (2.5 m) of working level or when deemed advisable for safety.

▲ CAUTION Before proceeding, make sure electrical service to the fan is locked in the "OFF" position.

▲ WARNING Check the voltage at the fan to see if it corresponds with the motor nameplate. High or low voltage can seriously damage the motor. Extra care should be taken when wiring two speed motors since improper connections will damage the motor and void the motor warranty.

4. Apply power momentarily and compare the rotation of the impeller with the directional arrow on fan.

▲ WARNING Operation in the wrong direction will deliver air but will overload the motor to the extent of blowing fuses and seriously damaging the motor. In the case of three phase motors, the direction can be changed by interchanging any two of the

three motor leads. In the case of single phase motors, the reversing instructions will appear on the wiring diagram in the motor wiring compartment.

Maintenance

▲ WARNING Do not depend on any switch as sole means of disconnecting power when installing or servicing the fan. If the power disconnect is out-of-sight, lock it in the open position and tag to prevent application of power. Failure to do so may result in fatal electrical shock.

CLEANING

It is advisable to clean motor and propeller at regular intervals. This will remove any accumulated dirt which would cause unbalance and result in excessive vibration. If guarding has been added, it should be removed and cleaned at regular intervals to maintain power air flow and prevent possible motor overloading.

▲ CAUTION The fan motor must be securely and adequately grounded to a suitable electrical ground such as a grounded water pipe or ground wire system!

▲ CAUTION Before proceeding, make sure electrical service to the fan is locked in the "OFF" position.

▲ WARNING Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.

Models 2C856F, 2C963G, 3C772F, 3GPA9, 3GPC1, 3GPC2, 3GND6, 3GND7, 3GPC3, 4C020F, 4C369F, 4C370G and 4C371F

SET SCREW TIGHTENING SCHEDULE

1. Before initial operation of the fan, tighten set screws according to the procedure outlined below.
2. After 500 operating hours or three months, whichever comes first, tighten set screws to the full recommended torque.
3. At least once a year, tighten set screws to the full recommended torque.

PROCEDURE FOR TIGHTENING SET SCREWS IN BEARINGS AND HUBS

One Set Screw Application

Using a torque wrench, tighten the set screw to the torque recommended in Table 1.

Two Set Screw Application

1. Using a torque wrench, tighten one set screw to half of the torque recommended in Table 1.

2. Tighten the second set screw to the full recommended torque.
3. Tighten the first set screw to the full recommended torque.

VARIABLE FREQUENCY DRIVES AND MOTORS

There are occasions when a Variable Frequency Drive (VFD) will cause poor motor performance and possible damage. To avoid these problems, the manufacturer recommends the following:

1. Select compatible motor and VFD converter; if possible, the motor and the converter should be from the same manufacturer or at least the converter selected should be recommended by the motor manufacturer.
2. A motor shaft grounding system should be used to prevent motor bearing damage from eddy currents.

Table 1. Recommended Tightening Torque for Set Screws

Set Screw Diameter	Torque (in-lbs)
#10	35
1/4	80
5/16	126
3/8	240
7/16	384
1/2	744
9/16	1080
5/8	1500
3/4	2580
7/8	3600
1	5400

NOTE: The manufacturer will not honor motor warranty claims if the customer fails to follow these recommendations.

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. DAYTON® HAZARDOUS LOCATION DIRECT DRIVE EXHAUST FAN 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. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.

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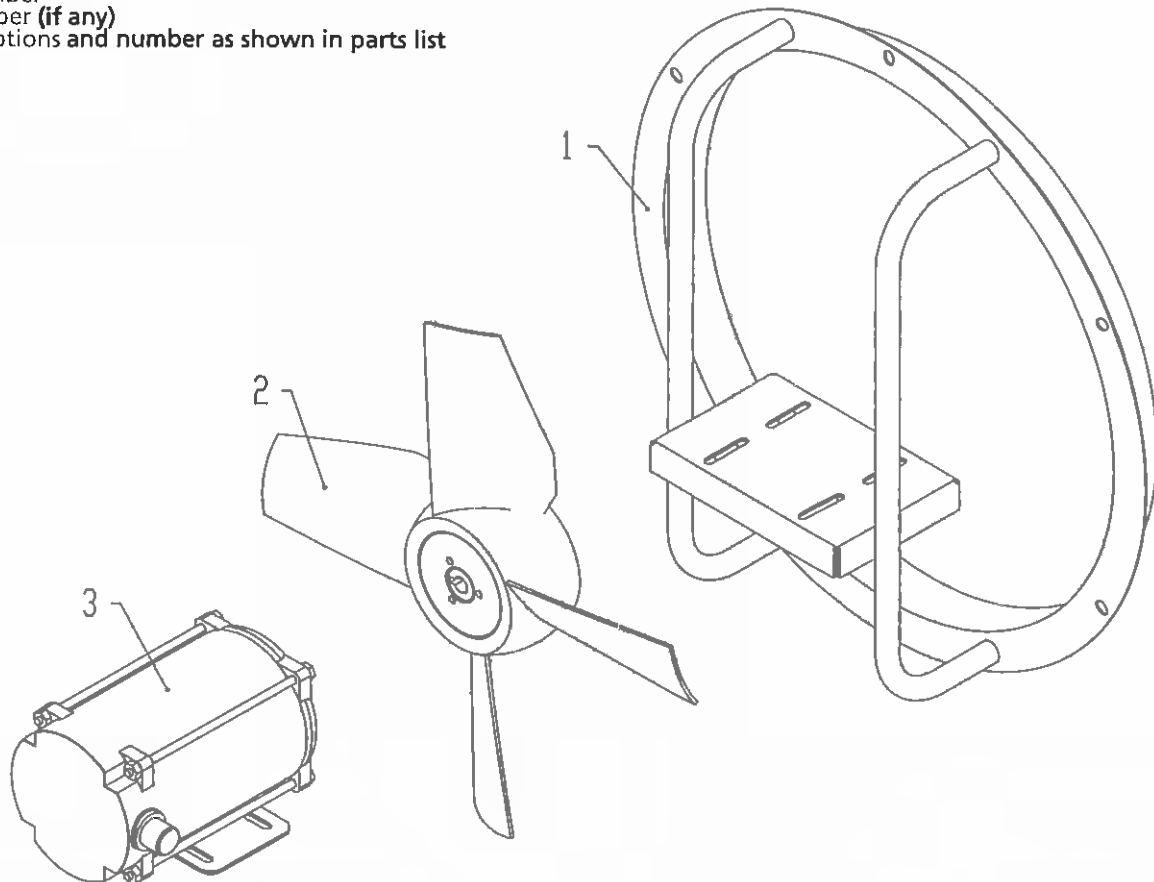
Product Suitability. Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While attempts are made to assure that Dayton products comply with such codes, Dayton cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them. Certain aspects of disclaimers are not applicable to consumer products; e.g., (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, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. A good faith effort will be made for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 U.S.A.

For Repair Parts, call 1-800-323-0620**24 hours a day - 365 days a year**Please provide **following information:**

- Model number
- Serial number (if any)
- Part descriptions and number as shown in parts list

**Figure 2 - Repair Parts Illustration**

Ref. No.	Description	Part Numbers for Models							Qty.
		2C856F	2C963G	3C772F	4C020F	4C369F	4C370G	4C371F	
1	Ring Fan Frame Assembly	506585	506558	506586	506555	506556	506557	506585	1
2	Prop Assembly	506587	506547	506552	506524	506545	506546	506551	1
3	Motor	922254	921745	994229	921745	921745	921745	922753	1

Ref. No.	Description	Part Numbers for Models						Qty.
		3GND7	3GND6	3GPA9	3GPC1	3GPC2	3GPC3	
1	Ring Fan Frame Assembly	506585	705708	705705	705706	705707	506585	1
2	Prop Assembly	506587	705728	506590	506523	705727	506551	1
3	Motor	994251G	994250G	994250G	994250G	994250G	994252G	1

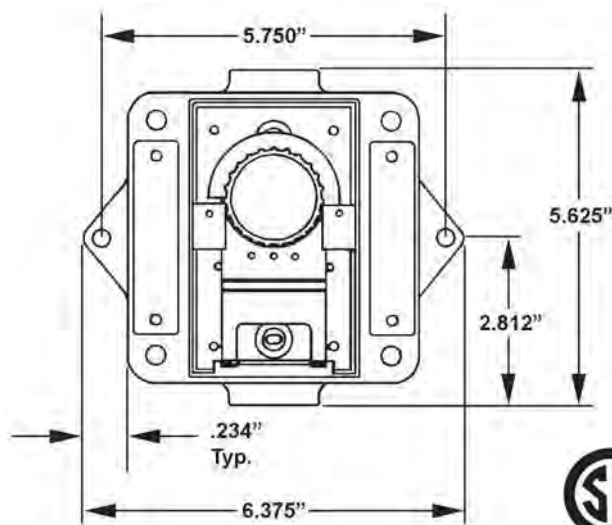
EPET Series

Hazardous Location Thermostats



4.5" Thick

From base to top of knob



Features:

- SPDT Models
- DPDT Models
- Snap Action Switches
- Casting Tapped Top & Bottom for 3/4" Conduit
- 1/2" Thick Cast Aluminum Explosion/Dust Proof Case
- Includes (1) 3/4" to 1/2" Conduit adapter
- Includes (1) Conduit Plug
- Screw Terminal Connections
- Bi-Metal Temperature Sensor

Operational Specifications

Setpoint Temperature Range

50-90°F / 10-32°C

Rated Differential

2-4°F

Voltage

120-277VAC or 480VAC

Amp Rating

22 Amps, Resistive Max.

Approvals

Class I Group C & D

Class II Group E, F, & G

NEMA Class Seven Div I

Packaging Specifications

Product Size

5.5"H x 6.375"W x 5.625"D

Depth is from wall to top of knob.

Individual Carton Size

6.5"L x 7"W x 5.75"D

Individual Carton Weight

6 lb

Master Carton Qty

4 Pcs

Master Carton Size

16"L x 14.5"W x 6"H

Master Carton Weight

24 LBS (varies slightly by model)

Model	PCN #	DESCRIPTION	Voltage	Amps	Positive Off	Anticipator
EPETD8D	05380702	DPDT Hazardous Location	120-277VAC	22 Amps Max	No	No
EPETD8S	05381002	SPDT Hazardous Location	120-277VAC	22 Amps Max	No	No
EPETP8D	05280702	DPDT Hazardous Location	480VAC	22 Amps Max	No	No
EPETP8S	05280602	SPDT Hazardous Location	480VAC	22 Amps Max	No	No

INSTALLATION AND OPERATION MANUAL

EPET SERIES EXPLOSION PROOF THERMOSTATS

The Columbus Electric EPET Series thermostat is designed to control heating only, cooling only, heating and cooling or ventilation systems in oil refineries, grain elevators, munitions plants, hospital operating rooms and other hazardous locations.

The switching mechanism is enclosed in a 1/2" thick cast aluminum case which is dust proof and dust resistant. A reliable sensing element provides accurate response to temperature change and does not require leveling during installation.

The casing is tapped top and bottom for 3/4" conduit. A 1/2" adapter is included.

SPECIFICATIONS

Electrical Ratings: 22 Amp @ 125 - 277 VAC
3/4 HP @ 125VAC
1 1/2 HP @ 250 - 277 VAC

Dimensions: 5.62" x 6.37" x 4.43"
Approvals: UL and CSA
Class I Groups C & D
Class II Groups E, F & G
Temperature adjustment range: 50-90°F

Differential : Heat- 2°F / Cool- 4°F

INSTALLATION

ALL WIRING MUST COMPLY WITH NFPA-70 (NEC), LOCAL AND STATE CODES.

Locate the thermostat approximately five feet (5') above the floor in a location that will best sense the average temperature of the area to be controlled. Do not mount the thermostat adjacent to water pipes, in drafty areas, or other locations that would adversely affect the operation of the thermostat.

- 1) Remove the thermostat cover assembly from the base by removing the four corner screws. Set the cover assembly aside. **CAUTION: Marring of the mating surfaces of the enclosure could destroy the integrity of the seal causing unsafe conditions during thermostat operation.**
- 2) Mount the thermostat base on the surface selected. See Fig. 1 for dimensions.
- 3) The base is tapped for 3/4" conduit; a 1/2" conduit adapter and a 3/4" plug is provided. Two threaded openings are provided for wiring. Unused openings must be properly plugged with the plug provided prior to applying power to the unit.
- 4) Connect the conduit to the mounted base and pull the required wires into the base.
- 5) Connections are to be made to the switch terminals on the rear of the cover assembly. See Fig. 2. The cover assembly can then be attached to the base using the four mounting screws. **TIGHTEN TO A MINIMUM OF 40 INCH POUNDS.**
- 6) The installer must seal each conduit run within 18" of the thermostat enclosure. This seal must be a suitable, listed hazardous location fitting.

DIAGRAMS

FIG. 1

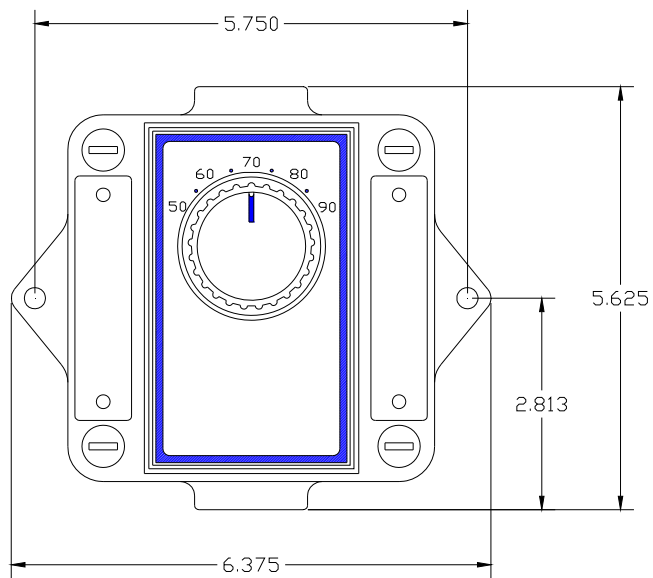
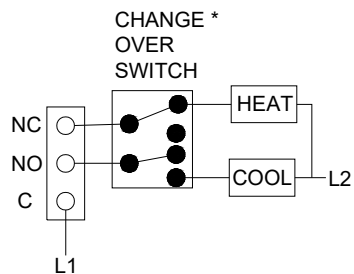
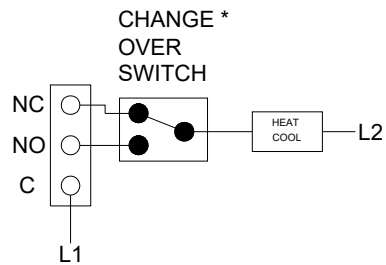
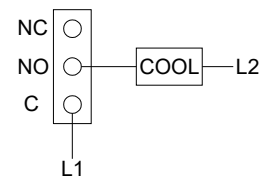
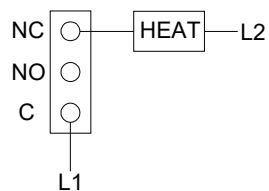
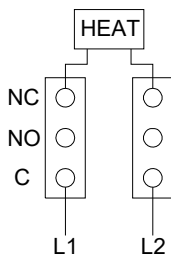
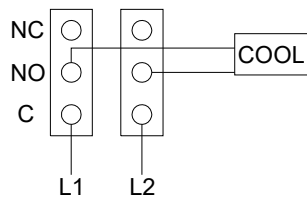


FIG. 2

TYPICAL WIRING DIAGRAMS



* TO BE PROVIDED BY OTHERS

INSTALLATION AND MAINTENANCE DATA SHEET

A51 Series lighting fixtures for:
Class I, Division 1, Groups C and D;
Class II, Division 1, Groups E, F, and G

DIRECTIONS FOR FIXTURE INSTALLATION

⚠ WARNING GENERAL

1. DO NOT MODIFY UNIT IN ANY WAY. Modification may affect safety and reliability.
2. Improper use or failure to follow these instructions could result in serious injury or property damage.
3. Operator should be instructed in the safe and proper usage and maintenance of this product.

⚠ WARNING ELECTRICAL

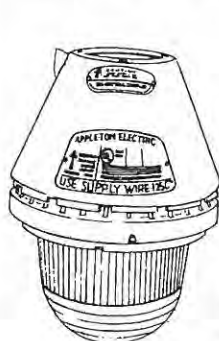
1. Disconnect electrical power before installation, adjustment and maintenance.
2. DO NOT overload; the amperage and voltage indicated on the nameplate must not be exceeded.
3. Check continuity before connecting electrical power.
4. All installations must comply with applicable local and/or National Electrical Code.
5. Before installing check fixture unit nameplate and carton labels to be sure you have correct fixture and mounting hood. Circuit must be deactivated before installing fixture.

⚠ CAUTION GENERAL

1. All A-51 Series Fixtures are to be mounted vertically with lamp base up.

The fixture unit must be installed with one of the following mounting hoods for safe operation. Failure to use fixture unit with one of the following mounting hoods voids warranty as well as the U.L. Listing and creates the risk of fire or explosion.

Fixture unit must be installed with:



AAP-50, AAP-75 or AAP-100
Pendant Hood



AAC-50, AAC-75 or AAC-100
Ceiling Hood



AALB-50, AALB-75 or AALB-100
Long Wall Bracket Hood

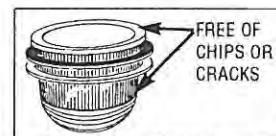


AASB-50, AASB-75
Short Wall Bracket Hood

1. Use the installation drawing as a guide. Install mounting hood first as all wiring connections are made in the mounting hood. The fixture unit requires no internal wiring connections.
 - Install mounting hood to conduit system (and/or wall, ceiling or stanchion). If using pendant or stanchion mounting hood, secure the hood to the conduit system with the set screw.
2. Remove the connection block (VPT7) from the mounting hood by loosening (but not removing) the two Phillips head screws. Turn connection block counter-clockwise to remove.
3. When using ceiling bracket (AAC-), long wall bracket (AALB-), or short wall bracket (AASB-), mounting hoods, threaded adapter (59064050000) can be removed by lifting gasket (59064034000) to access set screw.
 - Loosen set screw and turn adapter counter-clockwise for easier access to junction box. If long bracket (AALB-) is being used, bracket can be removed from junction box by loosening set screw in flange and turning counter clockwise.
4. Pull supply wires from the conduit into the junction box. Make connection of supply wires to the VPT-7 connection block by attaching "HOT" voltage lead to the brass terminal and common "neutral" lead to silver terminal.
5. Secure threaded adapter (where applicable) or long bracket (where applicable) to junction box and tighten all set screws.
6. Secure VPT-7 connection block to threaded adapter or mounting hood by slipping over Phillips head screws, turning clockwise and tightening screws.
7. Install lamp into fixture unit. See directions under "Lamp Installation Instructions".
8. Inspect threads of mounting hoods and the fixture unit to be sure they are clean and free of damage.
 - Inspect globe for any chips, scratches or cracks.

⚠ CAUTION GENERAL

Chipped, scratched or cracked globes will fail. Replace any such defective lamp housing.

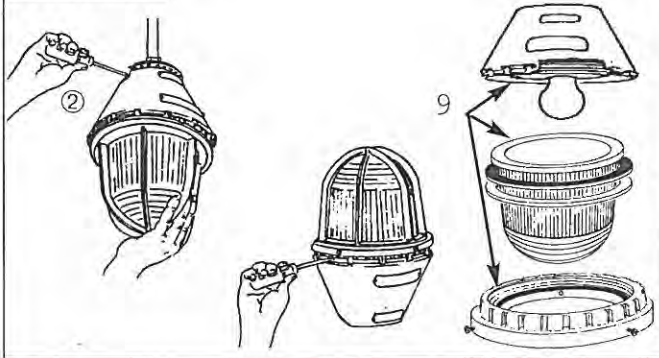


9. Thread the fixture unit into mating threads of mounting hood until tight against gasket of mounting hood. Locking spring of fixture unit should engage with notches on mounting hood.
10. Install guard and/or reflector if desired. Check tightness of set screws and all threaded joints. Activate supply circuit to test fixture.

KEEP THIS MANUAL FOR FUTURE REFERENCE

LAMP INSTALLATION INSTRUCTIONS

FIGURE 1



CAUTION: All A-51 series fixtures are to be mounted vertically with lamp base up.

NOTE: All installations must comply with applicable local and/or National Electrical Code.

- A lamp may be safely and easily installed into the fixture at a work bench.
- 1. Disconnect fixture from supply circuit.
- 2. Remove fixture unit from mounting hood by inserting screw driver into canopy notches and using release lugs for leverage.
 - Once loosened from mounting hood, fixture unit can be quickly unscrewed by hand. **Do not remove fixture unit from mounting hood under load.**
- 3. Place fixture unit on bench with globe side up.
- 4. Remove globe ring using pry notches if necessary.
- 5. Remove aluminum and fiber gaskets.
- 6. Lift globe carefully off of fixture and place safely on clean surface.
- 7. Refer to fixture nameplate for proper lamp wattage and types.
- 8. Inspect globe for chips or scratches as such defects will result in globe failure.
- 9. Wipe ground surface of globe and mating surface of fixture with soft clean cloth to eliminate dust, oil or grit.
- 10. Carefully place globe back on ground surface of fixture unit.
- 11. Place the fiber gasket on globe flange first, then place aluminum gasket on top of fiber gasket.
 - **This sequence is important for safe operation of fixture.**
- 12. Replace globe ring carefully and screw onto fixture unit until globe ring is tightly in place.
- 13. Thread fixture unit into mounting hood as per "Directions for Fixture Installation, Numbers 9 and 10".

CAUTION : Disconnect supply circuit before opening or relamping fixture.

MAINTENANCE DATA

- To relamp, see "Lamp Installation Instructions."
 - To maintain maximum light output from this fixture, it should be cleaned periodically as follows:
1. The aluminum exterior of this fixture should be cleaned only with a mild soap or cleaner, and should be rinsed with water immediately. *Alkaline or acidic cleaners will attack the protective coating of epoxy on the fixture and should not be used.* This will allow the epoxy to protect the fixture from corrosive elements in the atmosphere and result in longer fixture life.
 2. The glass globe should be cleaned using a soft cloth and a non-abrasive cleaner. The globe should be regularly inspected for scratches or chips. If the globe is scratched or chipped, it must be replaced.
 3. The porcelain enamel reflector may be cleaned with any non-abrasive detergent or glass cleaner.
 - These periodic cleaning procedures are important to prevent the accumulation of dust and dirt which will impair the light output of the fixture.
 - When relamping, be careful not to damage the external threaded areas, since they maintain the fixture's explosion-proof properties.
 - When removing and repairing fixture, lubricate threads only with Appleton TLC-3 conductive, high temperature lubricant. This should only be necessary if threads are no longer coated with the blue or black color of the dry film lubricant.
 - See attached drawing for replacement parts list

OPERATIONAL DATA

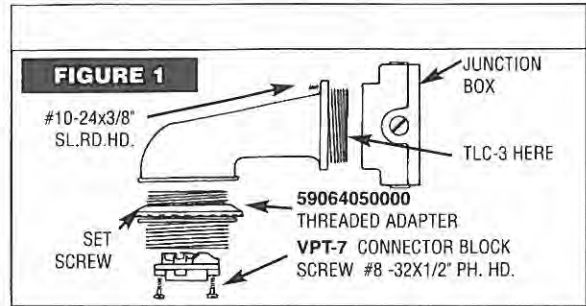
- The fixture must be operated in an environment that does not exceed 40°C.
- The fixture may be operated on AC power only up to 300 volts. Use lamp rated for operating voltage.

WARNING:

- To reduce the risk of fire or explosion, do not install where the operating temperature exceeds ignition temperature of hazardous atmospheres.
- Refer to the nameplate on the fixture for maximum operating temperature and for proper fixture classification.

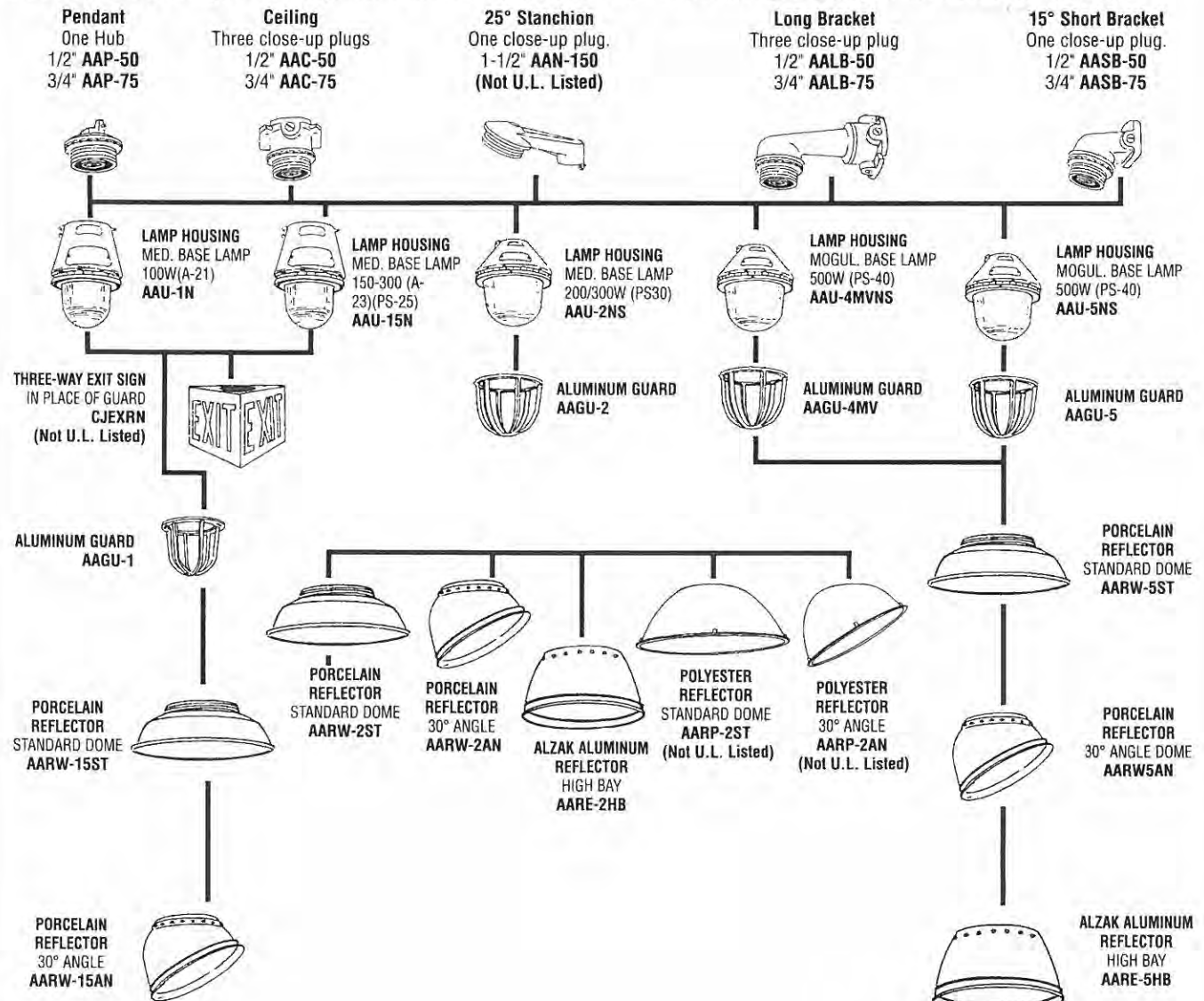
LONG BRACKET INSTALLATION

1. Remove bracket from junction box, pull through leads to connector block. Attach ground wire to grounding screw.
2. Remove Connector block from threaded adapter, pull leads through to connect wires to correct terminal screws.
3. Push block into place and tighten screws — Install fixture. **NOTE:** Plugs should be removed and resealed with pipe sealant.

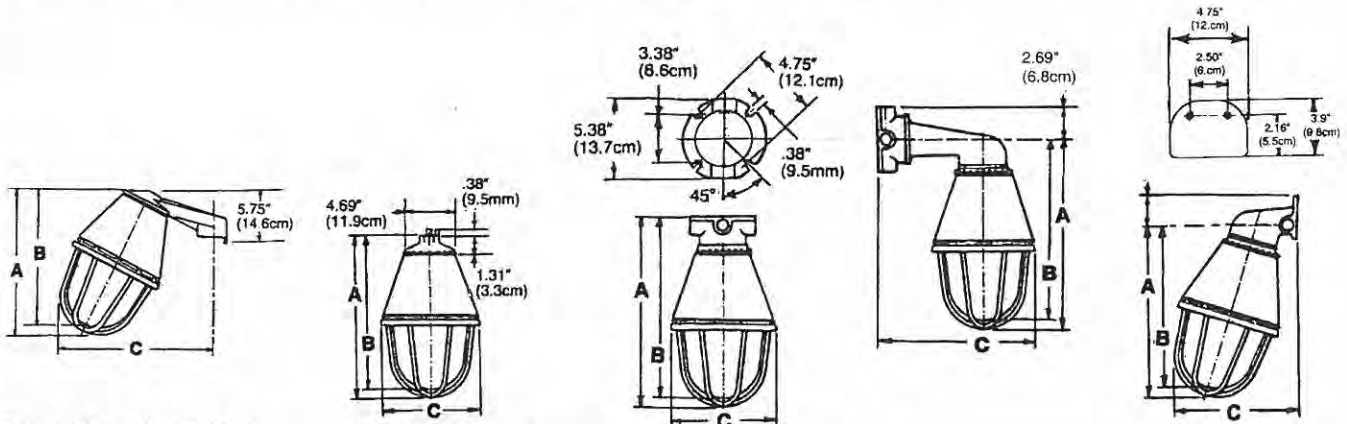


A-51 GROUPS C & D LIGHTING FIXTURES FAMILY TREE

MOUNTING HOODS (Use of components marked "Not U.L. Listed" voids the U.L. Listing of the assembled fixture.)



Dimensions: A-51 Incandescent Lighting Fixtures.

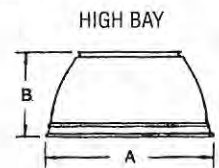
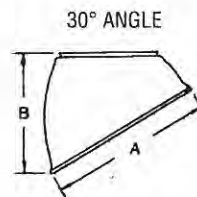
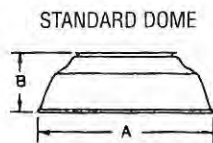


Dimensions in Inches

Size (Watts)	Stanchion			Pendant			Ceiling			Long Bracket			Short Bracket		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
60-100	11.47	10.85	11.50	12.25	11.63	7.06	13.75	13.13	7.06	13.75	13.13	12.38	13.56	12.94	9.13
150-300	11.47	10.85	11.50	12.25	11.63	7.06	13.75	13.13	7.06	13.75	13.13	12.38	13.56	12.94	9.13
200-300	13.07	12.38	12.71	13.94	13.25	8.81	15.44	14.75	8.81	15.50	14.75	13.25	15.19	14.50	10.13
300-500	15.09	14.34	14.64	16.00	15.25	12.13	17.50	17.75	12.13	17.50	16.75	14.88	17.25	16.50	11.94

A-51 Series Reflectors

Size Watts	STD. DOME		30° ANGLE		HIGH BAY	
	A	B	A	B	A	B
60-100	12.00	4.50	10.00	7.63	—	—
150-200	14.00	4.38	10.00	7.63	—	—
200-300	16.00	5.19	12.00	7.88	12.00	6.06
300-500	20.00	6.84	18.00	13.13	18.00	9.13



CONTROLS

Altivar 61

variable speed drives

E-Flex

Introduction



E-Flex Product Webpage

Introduction

Schneider Electric's Square D brand E-Flex AC drives provide the optimum combination of efficiency and economy for HVAC and pump applications in both commercial and industrial environments. Well suited for commercial buildings, hospitals, airports, schools, and water/wastewater facilities HVAC pump and fan applications, the Square D brand E-Flex™ enclosed drive controller provides an efficient and economical AC drive solution.

Designed to withstand harsh environments in demanding commercial buildings, the E-Flex™ Enclosed Drive Controller meets building code seismic specifications for ground level and roof mounted applications.

Square D E-Flex enclosed drive controllers can meet both indoor and outdoor application requirements with Type 1, Type 12/12K and Type 3R enclosures.

Applications

AC drives help increase the energy efficiency of HVAC equipment by reducing motor speeds, thereby reducing electricity usage in:

- Air handling units
- Supply and return fans
- Ventilation fans
- Cooling tower pumps and fans
- Hot water pumps
- Chilled water pumps

Features

The E-Flex™ Enclosed Drive Controller is available in:

- 1 to 50 hp at 208 Vac and 230 Vac
- 1 to 100 hp at 460 Vac

Built to provide an efficient and economical application solution, the E-Flex™ Enclosed Drive Controller offers:

Performance under pressure

- UL 508C Listed to exceed minimum UL short-circuit requirements
- 100,000 AIC short circuit protection without current limiting fuses
- Advanced technology platform increases reliability and uptime; reducing the number of components needed on hand.
- Industrial-rated control operators and pilot devices

Easy to Control

- Large backlit LCD graphic screen with customizable display
- Clear text in six languages
- Navigation wheel for easy scrolling through menus
- Pre-programmed for HVAC variable torque operation
- Light indicators for Power, Fault, Run, and Bypass
- Test-Normal selector switch permits testing of the drive controller

Fully Protected

- Circuit breaker disconnect provides short circuit protection
- 3% line reactor provides transient protection from surge and overvoltage conditions, and minimizes line harmonics
- Enclosure designed to reduce radio frequency interference
- Meets International Building Code and ASCE1 standards for seismic specifications
- Thermal management system for operation in extreme temperatures 14 °F to 122 °F (-10 °C to 50 °C) for Type 3R enclosures

Expandable Capabilities

- LonWorks®, BACnet, Modbus®, Unitelway, Ethernet TCP/IP, Apogee P1, Profibus, and Metasys® N2 communications capability
- HVAC controls provide end damper, smoke purge relays, and fire/freeze stat for full speed fire safety override

Enclosure Styles

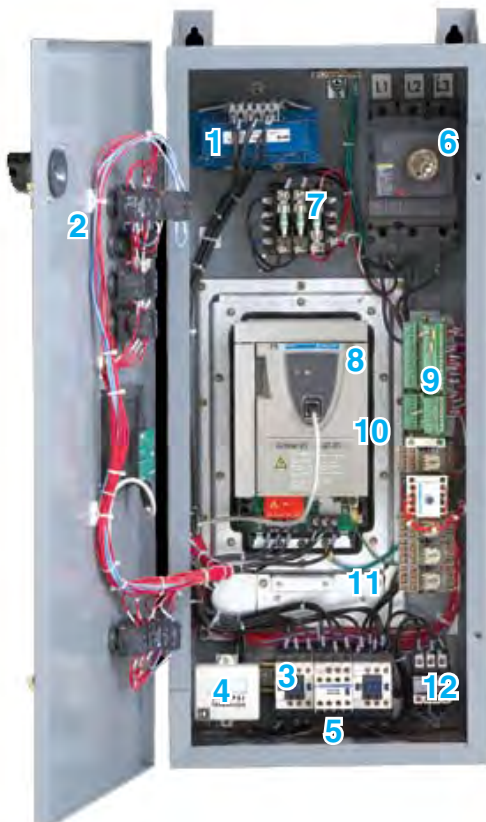
- Type 1 enclosures are designed specifically for indoor, non-dusty environments
- Type 12/12K enclosures are designed for protection from dust and dripping liquid
- Type 3R enclosures permit installation on rooftops or other outdoor locations to free up space in mechanical equipment rooms, and allow operations in temperature ranges from +14 to +122 degrees F (-10 to +50 degrees C).

Altivar 61 variable speed drives

E-Flex Introduction



- [1](#) Red power light
- [2](#) Yellow AFC detected fault light
- [3](#) Green AFC run light
- [4](#) Yellow bypass light
- [5](#) Graphic screen with customizable display in plain text
- [6](#) Navigation wheel for easy surfing through the menus
- [7](#) Test normal selector switch allows drive testing
- [8](#) Pre-punched top and bottom conduit entry knock-outs simplify electrical installation and prevent metal filings from getting inside the enclosure (Type 3R enclosures have bottom conduit entry only)
- [9](#) Disconnect means with lock out/tag out provisions
- [10](#) Hand off auto selector switch
- [11](#) Start push button
- [12](#) Stop push button
- [13](#) AFC off bypass switch
- [14](#) Side air vents (Type 1 only)



- [1](#) A 3% equivalent DC choke is included as standard minimizes line harmonic currents 5% line reactor (shown) is optional
- [2](#) Type 2B wiring simplifies wiring identification and termination to industrial-rated terminals
- [3](#) Drive output and bypass contactors for emergency full-speed operation
- [4](#) 3-15PSI pressure transducer input for pneumatic applications (optional)
- [5](#) UL 508C listed and coordinated with NEMA ICS 7.1 standards 100ka symmetrical exceeds UL short-circuit requirements
- [6](#) Circuit breaker disconnect (L1, L2, L3) provides short circuit protection without current limiting fuses
- [7](#) Control transformer
- [8](#) Altivar 61 drive power converter with 6-pulse bridge rectifier input and IGBT inverter with pulse width modulated output
- [9](#) Customer interface terminal blocks
- [10](#) Integrated Modbus® and CANopen port; Serial communication card options include LonWorks®, BACnet®, Ethernet, Profibus, Modbus® Unitelway, Apogee P1 and Metasys® N2 protocols
- [11](#) Front removable heat sink fan assembly eliminates rear access requirements, improving maintenance and minimizing downtime
- [12](#) Motor terminal connection (T1, T2, T3)

Electrical Specifications

Input Voltage	208V \pm 10%, 230V \pm 10%, 460V \pm 10%
Short Circuit Current Rating	100,000A symmetrical
Displacement Power Factor	98% through speed range
Input Frequency	60Hz \pm 5%
Output Voltage	Three-phase output Maximum voltage equal to input voltage
Galvanic Isolation	Galvanic isolation between power and control (inputs, outputs and power supplies)
Frequency Range of Power Converter	0.1 to 500Hz (factory setting of 60Hz)
Torque/Overtorque	VT: 110% of nominal motor torque for 60s
Current (Transient)	VT: 110% of controller rated current for 60s
Switching Frequency	Selectable from 0.5 to 16 kHz. ^[1] Factory setting: VT: 8 kHz for 208 V, 230 V, and 1–100 hp @460 V 2 kHz for 125–500 hp @ 460 V The drive reduces the switching frequency automatically in the event of excessive heatsink temperature.
Speed Reference	AI1: 0 to +10V, Impedance = 30k Ω Can be used for speed potentiometer, 1–10k Ω AI2: Factory setting: 4 to 20mA, Impedance = 242 Ω (reassignable, X–Y range with graphic display terminal). Factory modification J10 allows 0–10 Vdc reference signal to AI2, Z= 30 k Ω .
Factory Resolution in Analog Reference	0.1 for 100 Hz (11 bits)
Speed Regulation	V/f control: equal to the motor's rated slip SLFV (sensorless flux vector): 10% of motor's rated slip from 20% to 100% of nominal motor torque
Efficiency	Varies from 93% to 97% full load typical
Reference Sample Time	2ms \pm 0.5ms
Acceleration and Deceleration Ramps	0.1 to 999.9s (definition in 0.1s increments)
Drive Controller Protection	Thermal protection of power converter Phase loss of AC mains' enclosure short circuit protection rated at 100kAIC
Motor Protection	Class 10 electronic overload protection Class 20 electromechanical overload protection with bypass ^[2]
Graphic Display Terminal	Self diagnostics with status messages in three languages. Plain user language with ability to customize the display
Codes and Standards	UL Listed per UL 508C under category NMMS Conforms to applicable NEMA ICS, NFPA and IEC standards Manufactured under ISO 9001 standards

Environmental Specifications

Temperature	Storage for all enclosures: -13 to +149 °F (-25 to +65 °C). Operation: NEMA Type 1, 12, 12K: +14 to +104 °F (-10 to 40 °C); NEMA Type 3R: +14 to +122 °F (-10 to 50 °C). For 1–100 hp drives (208, 230 & 460 V) operating between 40 and 50 °C, derate the current 2% per °C above 40°C.
Humidity	95% with no condensation or dripping water, conforming to IEC 60068-2-3.
Altitude	3,300 ft. (1,000m) maximum without derating; derating of current by 1% for each additional 330ft. (100m) up to 3000m
Enclosure	Type 1, Type 12/12K, and Type 3R Plenum rated: suitable for placement in a compartment handling conditioned air
Polution Degree	Type 1: Pollution degree 2 per NEMA ICS-1 Annex A and IEC 60664-1 Type 12/12K: Pollution degree 3 per NEMA ICS-1 and IEC 17.560664-1
Operational Test Vibration	Conforming to IEC 60721-3-3-3M3 amplitude 1.5 peak to peak from 3Hz to 13Hz 1g from 13Hz to 200Hz
Transit Test to Shock	Conforming to National Safe Transit Association and International Safe Transit Association test for packages
Operational Shock	15g, 11ms conforming to IEC/EN 60068-2-27
Seismic Qualification	2003 IBC, NFPA 5000, and ASCE 7 ICC ES AC156 acceptance criteria test protocol with importance factor of 1.5
Certifications	American Bureau of Ship Building (ABS) Type Approval in compliance with marine specifications

1. On 1–100 hp VT controllers, above 8 kHz, select the next largest size drive. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle), this is not necessary.

2. Class 10 electromechanical for 1 hp at 460 V.

8839 EFD F H 2 V Y A07 B08 A09
1 2 3 4 5 6 7 8 9 10

E-Flex Installation Manual

Class
1 Combination device
8839 = Circuit breaker disconnect

Type
2 Design
EFD = E-Flex™ controller

3 Horsepower rating
C = 1 **L** = 25
D = 2 **M** = 30
E = 3 **N** = 40
F = 5 **P** = 50
G = 7.5 **Q** = 60 (460 V only)
H = 10 **R** = 75 (460 V only)
J = 15 **S** = 100 (460 V only)
K = 20

4 Enclosure environmental rating
A = Type 12K
G = Type 1
H = 3R
Replace ● with desired enclosure rating

5 Voltage code
2 = 208 V, 60 Hz
3 = 230 V, 60 Hz
4 = 460 V, 60 Hz

6 Application type
V = Variable torque

7 Power circuit type
W = Without bypass
Y = Bypass

Mods
8 Control Option
A07 = Hand-Off-Auto, Speed Potentiometer
B07 = Hand-Off-Auto, Start-Stop, Speed Potentiometer
C07 = Start-Stop, Speed Potentiometer
D07 = Hand-Off-Comm, Speed Potentiometer
E07 = Hand-Off-Comm, Start-Stop, Speed Potentiometer
N07 = None

9 Light Option
A08 = Red Power On, Green AFC Run, Yellow AFC Detected Fault, Yellow Auto
B08 = Red Power On, Green AFC Run, Yellow AFC Detected Fault, Yellow Bypass
C08 = Red Power On, Green AFC Run, Yellow AFC Detected fault
N08 = No lights

10 Miscellaneous Option
A09 = Line Reactor, 5%
B09 = Line Contactor
C09 = 3-15PSI Transducer
D09 = Omit Keyboard
E09 = Smoke Purge (Fireman's override)
F09 = Profibus
H09 = I/O Extension Card, 0-20mA
J09 = 0-10Vdc Differential input
K09 = cUL Listing certification
L09 = LonWorks
M09 = Modbus Unitelway
O09 = Apogee P1
P09 = Metasys N2
Q09 = Ethernet TCP/IP
R09 = BACnet
S09 = End Damper Control
T09 = Service entrance
U09 = Seismic qualification
V09 = Ethernet IP
X09 = Line Reactor, 3%

E-Flex Replace ● with desired enclosure rating

HP Reference Code	HP Ratings	Controller Output Current	Enclosure Frame Size	Power Circuits	
				Variable Torque - Duty Rating (110% current Limit)	
				Power Circuit W	Power Circuit Y

208V, 60 Hz

C	1	4.6 A	C	C●2VW	C●2VY
D	2	7.5 A		D●2VW	D●2VY
E	3	10.6 A		E●2VW	E●2VY
F	5	16.7 A		F●2VW	F●2VY
G	7.5	24.2 A	D	G●2VW	G●2VY
H	10	30.8 A		H●2VW	H●2VY
J	15	46.2 A	E	J●2VW	J●2VY
K	20	59.4 A		K●2VW	K●2VY
L	25	74.8 A		L●2VW	L●2VY
M	30	88 A	F	M●2VW	M●2VY
N	40	114 A		N●2VW	N●2VY
P	50	143 A		P●2VW	P●2VY

230 V, 60 Hz

C	1	4.2 A	C	C●3VW	C●3VY
D	2	6.8 A		D●3VW	D●3VY
E	3	9.6 A		E●3VW	E●3VY
F	5	15.2 A		F●3VW	F●3VY
G	7.5	22 A	D	G●3VW	G●3VY
H	10	28 A		H●3VW	H●3VY
J	15	42 A	E	J●3VW	J●3VY
K	20	54 A		K●3VW	K●3VY
L	25	68 A		L●3VW	L●3VY
M	30	80 A	F	M●3VW	M●3VY
N	40	104 A		N●3VW	N●3VY
P	50	130 A		P●3VW	P●3VY

460 V, 60 Hz

C	1	2.1 A	C	C●4VW	C●4VY
D	2	3.4 A		D●4VW	D●4VY
E	3	4.8 A		E●4VW	E●4VY
F	5	7.6 A		F●4VW	F●4VY
G	7.5	11 A		G●4VW	G●4VY
H	10	14 A		H●4VW	H●4VY
J	15	21 A		J●4VW	J●4VY
K	20	27 A		K●4VW	K●4VY
L	25	34 A		L●4VW	L●4VY
M	30	40 A	E	M●4VW	M●4VY
N	40	52 A		N●4VW	N●4VY
P	50	65 A		P●4VW	P●4VY
Q	60	77 A	F	Q●4VW	Q●4VY
R	75	96 A		R●4VW	R●4VY
S	100	124 A		S●4VW	S●4VY

Modifications

Control Options		
A07	Hand-Off-Auto Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Speed Potentiometer	ATVPOT25K Speed potentiometer assembly
B07	Hand-Off-Auto Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Stop/Start Push Buttons	ZB5AA2 Black push button w/ mounting base ZB5AA4 Red push button w/ mounting base ZB5AZ101 Mounting collar w/ additional contact block (1 N.O.) ZB5AZ102 Mounting collar w/ additional contact block (1 N.C.) (2) ZBZ32 Legend plate holder
	Speed Potentiometer	ATVPOT25K Speed potentiometer assembly
C07	Stop/Start Push Buttons	ZB5AA2 Black push button w/ mounting base ZB5AA4 Red push button w/ mounting base ZB5AZ101 Mounting collar w/ additional contact block (1 N.O.) ZB5AZ102 Mounting collar w/ additional contact block (1 N.C.) (2) ZBZ32 Legend plate holder
	Speed Potentiometer	ATVPOT25K Speed potentiometer assembly
D07	Hand-Off-Comm Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Speed Potentiometer	ATVPOT25K Speed potentiometer assembly
E07	Hand-Off-Comm Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 Mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Stop/Start Push Buttons	ZB5AA2 Black push button w/ mounting base ZB5AA4 Red push button w/ mounting base ZB5AZ101 Mounting collar w/ additional contact block (1 N.O.) ZB5AZ102 Mounting collar w/ additional contact block (1 N.C.) (2) ZBZ32 Legend plate holder
	Speed Potentiometer	ATVPOT25K Speed potentiometer assembly
N07	No operators; wired for remote operation	No drive control options are supplied on the front door of the drive. For use in remote-mounted operator applications. Refer to Section 3, Power Circuit Descriptions, for remote mounting information.

Light Options		
A08 Pilot Light Option #1 Cluster	Red Power On	ZB5AV04 Red pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Green AFC Run	ZB5AV03 Green pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Detected Fault	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Auto	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
B08 Pilot Light Option #2 Cluster	Red Power On	ZB5AV04 Red pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Green AFC Run	ZB5AV03 Green pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Detected Fault	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Bypass	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
C08 Pilot Light Option # 3 Cluster	Red Power On	ZB5AV04 Red pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Green AFC Run	ZB5AV03 Green pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Detected Fault	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder

Miscellaneous Options		
A09	Line Reactor	Factory-mounted line reactor within enclosure. Standard = 3% DC Choke Mod A09 = 5% Line Reactor
B09	Line Contactor	A line contactor can be added between the circuit breaker and the drive (Type 1 and 12K only).
C09	3–15 PSI Transducer	Allows the controller to follow a user-supplied 3–15 PSI input.
D09	Omit Door-Mounted Graphic Display Terminal	The graphic display terminal is not supplied. The user must buy the terminal as a separate device to program the drive.
E09	Smoke Purge	Provides a smoke purge operating mode controlled by a user-supplied 120 Vac signal wired to customer's terminal block.
F09	Profibus Serial Communication	Provides a factory-installed plug-in Profibus card, VW3A3307.
H09	I/O Extension	0–20 mA analog output for customer use. Factory programmed for motor frequency. Includes I/O extension card VW3A3202. Reassignable x–y range with keypad display. Also includes logic inputs, logic outputs, analog inputs, analog outputs, configurable relay outputs, PTC probe input, and frequency control input.
J09	0–10 Vdc Auto Speed Reference	Provides for a 0–10 Vdc user-supplied auto speed reference signal to the AI2 input.
K09	cUL Listing	Provides Canadian cUL certification when required by local code requirements.
L09	LonWorks® Serial Communication	Provides a factory installed LonWorks card, VW3A3312.
M09	Modbus® Serial Communication	Provides a factory installed plug-in Modbus card VW3A3303.
P09	Metasys® N2 Serial Communication	Provides a factory installed plug-in Metasys N2 card VW3A3313.
O09	P1 Serial Communication	Provides a factory installed plug-in Apogee™ P1 card VW3A3314.
Q09	Ethernet Serial Communication	Provides a factory installed plug-in Ethernet card VW3A3310D.
R09	BACnet Serial Communication	Provides a factory installed plug-in BACnet card VW3A3315.
S09	End Damper Control	Provides a circuit to delay drive operation until the damper is fully open.
T09	Service Entrance Rating	Provides a factory-installed insulated ground neutral assembly with ground wire and label for use as service entrance rated equipment.
U09	Seismic Qualified	Provides a certification label and hardware qualified to seismic rating ICC ES AC156 acceptance criteria test protocol with an importance factor of 1.5.
V09	Ethernet IP	Provides a factory installed plug-in Ethernet IP card VW3A3316.
X09	Line Reactor	Factory-mounted line reactor within enclosure Standard = 3% DC Choke Mod X09 = 3% Line Reactor

LEGEND

○ = DEVICE TERMINAL (18 NUMBER, 115V AC LETTER = 10/24 VDC)

208V TRANSFORMER CONNECTION
(H1) 208V (H2) 115V (X1) 0 (X2) 115V GND

DETAIL A

208V TRANSFORMER CONNECTION
(H1) 208V (H2) 115V (X1) 0 (X2) 115V GND

DETAIL B

208V TRANSFORMER CONNECTION
(H1) 208V (H2) 115V (X1) 0 (X2) 115V GND

WIRING DIAGRAM

The diagram shows the electrical connections for the drive system. It includes the 208V transformer, control transformer, and various relays and contacts. Key components include:

- 208V TRANSFORMER:** Connected to the main power supply.
- CONTROL TRANSFORMER:** Provides 115V AC for control circuits.
- RELAYS:** Includes the RCR (Run Control Relay), RPR (Run Protection Relay), and RFR (Run Fault Relay).
- CONTACTS:** Various interlocking contacts (e.g., RCR, RPR, RFR, RCR, RPR, RFR) are shown.
- WIRING:** Shows the connection of wires (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26) to the various components.

NOTES:

1. RCR TIED CONTACT USED ONLY IF LINE CONTACTOR IS SUPPLIED.
2. CONTROL TRANSFORMER SHOWN FOR 480V PRIMARY. FOR 240V PRIMARY, JUMPER H2-H3 IS REMOVED AND JUMPS H1-H2, AND H2-H4 ARE INSTALLED. FOR 208V PRIMARY, REFER TO DETAIL A.
3. USER SUPPLIED FIRE/FREEZE STAT INTERLOCK CONTACT.
4. USER SUPPLIED 115V AC SIGNAL TO ENGAGE SMOKE PURGE FUNCTION. (REMOVE JUMPS BETWEEN TERMINALS 2 AND 3 IF USED)
5. USER SUPPLIED 115V AC SIGNAL TO ENGAGE SMOKE PURGE FUNCTION. (REMOVE JUMPS BETWEEN TERMINALS 2 AND 3 IF USED)
6. PROGRAMMED I/O SEE CONTROLLER FUNCTION CONFIGURATION TABLE.
7. IF A COMMUNICATION CARD IS APPLIED FOR MONITORING PURPOSES, PROGRAM L14 TO FORCED LOCAL.
8. USER SUPPLIED AUTO-START SWITCH.
9. JUMPER USED WHEN START-STOP PUSH BUTTONS NOT USED.
10. REPLACE RCR CONTACT WITH RPR CONTACT IF END DAMPER CONTROL OPTION (MOD SD9) IS SELECTED.

USER CONNECTIONS

1. USER SUPPLIED AUTO-START CONTACT

2. AUTO SPEED REFERENCE

3. 4-20 mA DC SIGNAL OR (MOD J09) F USED

4. FIRE/FREEZE STAT INTERLOCK (REMOVE JUMPER F USED)

5. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

6. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

7. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

8. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

9. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

10. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

11. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

12. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

13. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

14. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

15. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

16. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

17. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

18. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

19. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

20. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

21. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

22. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

23. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

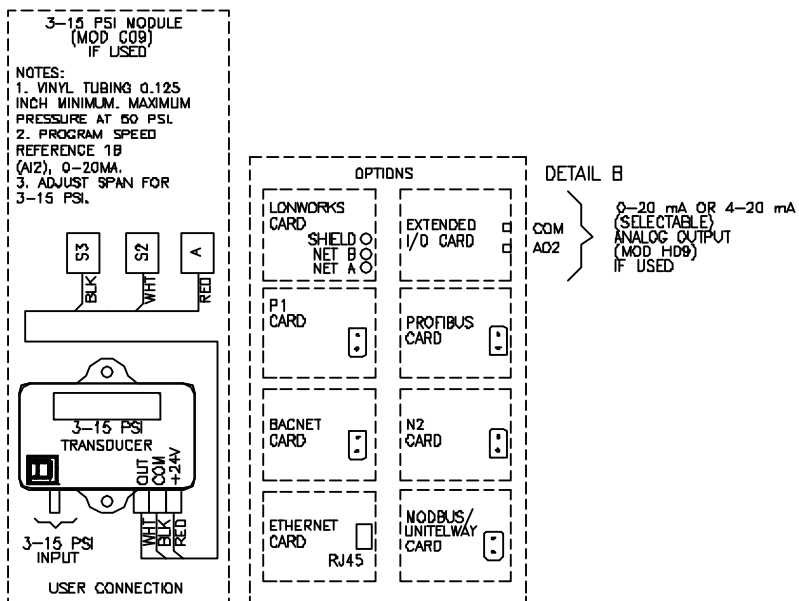
24. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

25. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

26. SMOKE PURGE RELAY (MOD G09) (120 VAC WILL RUN MOTOR AT FULL SPEED)

Figure 30: Power Circuit Y (With Bypass): Hand-Off-Auto and Speed Potentiometer
(Drawing No. 80461-072-01) (continued)

ATV61 FACTORY CONFIGURATION					
MENU	No	SUB-MENU	DESCRIPTION	CODE	Adj.
SIM	1.1	----	2/3 WIRE CONTROL	tCC	2C
SIM	1.1	----	PUMPS/FANS	CFG	PnF
SIM	1.1	----	STANDARD MOT. FREQ (HZ)	bFr	60
SIM	1.1	----	ACCELERATION (SEC)	ACC	10
SIM	1.1	----	DECELERATION (SEC)	dEC	10
SIM	1.1	----	LOW SPEED (HZ)	LSP	3
SEt	1.3	----	SWITCHING FREQ. (HZ)	SFr	8
I-O	1.5	----	2 WIRE TYPE	tCt	LEL
I-O	1.5	A12 CONFIG.	A12 MIN. VALUE (mA)(W/O MOD J09)	C12	4
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn
CTL	1.6	----	REF. 1 CHAN	FR1	HMI
CTL	1.6	----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1	A1
CTL	1.6	----	PROFILE(W/O MOD H03 OR D09 ONLY)	CHCF	SEP
FUn	1.7	STOP CONFIG.	FREEWHEEL STOP ASSIGN	nST	U2
FUn	1.7	REFERENCE SWITCH.	REF. 1B SWITCHING	rCb	U3
FUn	1.7	REFERENCE SWITCH.	REF. 1B CHAN	Fr1b	A12
FLT	1.8	FAULT RESET	FAULT RESET	rSF	U4
FLT	1.8	CATCH ON THE FLY	CATCH ON THE FLY	FLR	YES
FLT	1.8	OUTPUT PHASE LOSS	OUTPHASE LOSS	OPL	NO
COM	1.9	FORCED LOCAL	FORCED LOCAL ASSIGN.	FLO	U4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD					
MENU	No	SUB-MENU	DESCRIPTION	CODE	Adj.
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	QFr
WHEN MOD J09 SELECTED - 0-10V DC SPEED REF.					
MENU	No	SUB-MENU	DESCRIPTION	CODE	Adj.
I-O	1.5	A12 CONFIG.	A12 TYPE	A12t	10U
DESCRIPTION		TYPE 1	TYPE 12K	TYPE 3R	
±STIRRING FANS		NA	10-100HP 460V, 7.5-50HP 208/230V	NA	
±VENTILATION FAN		NA	NA	ALL HP	
±SPACE HEATER		NA	NA	ALL HP	



E-Flex™

Adjustable Speed Drive Controllers for HVAC and Pumping Applications

Instruction Bulletin

30072-451-51D

Retain for future use.



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MOD O09	
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HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of the lightning bolt or ANSI man symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exist which, as indicated below, can or will result in personal injury if the instructions are not followed.

The exclamation point symbol is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Symbol	Name
	Lightning Bolt
	ANSI Man
	Exclamation Point

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

PRODUCT SUPPORT

For support and assistance, contact the Product Support Group. The Product Support Group is staffed from Monday through Friday, 8:00 am until 6:00 pm Eastern time, to assist with product selection, start-up, and diagnosis of product or application problems. Emergency phone support is available 24 hours a day, 365 days a year.

Toll free: 888-SquareD (888-778-2733)

E-Mail: drive.products.support@us.schneider-electric.com

Fax: 919-217-6508

QUALIFIED PERSONNEL

For the protection of personnel and equipment, a qualified person must perform the procedures detailed in this instruction bulletin.

A qualified person is one who has skills and knowledge related to the construction and operation of this electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved. Refer to the most current release of NFPA 70E®, "Standard for Electrical Safety in the Workplace," for safety training requirements.

In addition, the person must be:

- Able to read, interpret, and follow the instructions and precautions in this instruction bulletin and the other documentation referenced.
- Able to use the required tools listed in this instruction bulletin in a safe and correct manner.

SECTION 1— INTRODUCTION AND TECHNICAL CHARACTERISTICS

INTRODUCTION

The E-Flex enclosed drives are tailored for commercial market specifications in wall-mounted Type 1, Type 12K, or Type 3R enclosures. With a circuit breaker disconnect, these drives can be configured with or without bypass.

This instruction bulletin covers receiving, installation, start-up, configuration, and troubleshooting of the 1 to 100 hp, 460 V and 1 to 50 hp, 208/230 V variable torque E-Flex drives.

RELATED DOCUMENTATION

For further information, refer to the latest revision of the following instruction bulletins which ship with the drive when the corresponding option is selected and are available from the Technical Library at www.Schneider-Electric.us.

Table 1: Instruction Bulletins

Bulletin No.	Title
1760643 (VT)	<i>Installation Manual, 0.5–60 hp, 230 V and 0–100 hp, 460 V</i>
1760649 (VT)	<i>Programming Manual</i>
1755861	<i>Communication Parameters</i>
W817574030111	<i>Altivar 61 CD-ROM</i>
30072-200-50	<i>Handling, Installation, Operation, and Maintenance of Electrical Control Equipment</i>
1755867 30072-451-27	<i>Modbus/Unitelway™ Card, VW3A3303 Supplementary Instructions for ATV71 Option Cards</i>
AAV33578	<i>Option Card (Metasys® N2 Card, VW3A3313)</i>
1755879	<i>Ethernet Modbus TCP/IP Card, VW3A3310D</i>
1765273	<i>Option Card (LonWorks® Card, VW3A3312)</i>
1755877 30072-451-27 30072-451-44	<i>DeviceNet™ Card, VW3A3309 Supplementary Instructions for ATV71 Option Cards Addendum to ATV71 DeviceNet™ Card</i>
1755873 30072-451-27 30072-451-45	<i>Profibus DP Card, VW3A3307 Supplementary Instructions for ATV71 Option Cards Addendum to ATV71 Profibus™ DP VW3A3307</i>
—	<i>I/O Extension Card, VW3A3202: Refer to the Installation Manual.</i>
BBV10543	<i>Option Card (Apogee P1 Card, VW3A3314)</i>
1765274	<i>Option Card (BACnet Card, VW3A3315)</i>
1754480	<i>Option Card (Ethernet IP, VW3A3316)</i>

TERMINOLOGY

The following terminology is used throughout this instruction bulletin in reference to the E-Flex drives. These terminology distinctions are made to minimize confusion when discussing installation and adjustment practices.

When used as a component of the E-Flex drive, devices with part numbers beginning in ATV61 are referred to as *power converters*.

The combination of the power converter, the enclosure, and the power and control circuits that constitute the E-Flex product is referred to as the *drive*, the *controller*, or the *adjustable frequency controller (AFC)*.

BEFORE YOU BEGIN

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this bulletin in its entirety before installing or operating E-Flex drives. Installation, adjustment, repair, and maintenance of the drives must be performed by qualified personnel.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in this drive, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT short across DC bus capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Before servicing the drive:
 - Disconnect all power including external control power that may be present before servicing the drive.
 - Place a “DO NOT TURN ON” label on the drive disconnect.
 - Lock disconnect in the open position.
 - WAIT 15 MINUTES for the DC bus capacitors to discharge. Then follow the DC bus voltage measurement procedure on page 42 to verify that the DC voltage is less than 42 V. The drive LEDs are not indicators of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the drive.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

For 460 V units:

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.
- Do not use renewable link fuses in fused switches.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

Before turning on the drive or upon exiting the configuration menus, ensure that the inputs assigned to the Run command are in a state that will not cause the drive to run. Otherwise, the motor can start immediately.

Failure to follow these instructions will result in death, or serious injury.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

For 208 and 230 V units:

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of anticipated transmission delays or failures of the link¹.
- Each implementation of an E-Flex enclosed drive must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems."

⚠ CAUTION

INCOMPATIBLE LINE VOLTAGE

Before turning on and configuring the drive, ensure that the line voltage is compatible with the line voltage range specified on the drive nameplate. The drive can be damaged if the line voltage is not compatible.

Failure to follow these instructions can result in injury or equipment damage.

Follow these precautions before installing the E-Flex drive:

- The Type 1 or Type 3R controller is suitable for installation in a Pollution Degree 2 environment as defined in NEMA ICS1 and IEC 90664-1. The Type 12K controller is suitable for installation in a Pollution Degree 3 environment as defined in NEMA ICS1 and IEC 90664-1. The expected environment must be compatible with this rating.
- When attaching wall-mountable controllers to their mounting surfaces, use fasteners rated for the weight of the apparatus, the expected shock and vibration of the installation, and the expected environment.
- Provide sufficient cooling for the expected heat load. Refer to Tables 15–17 on page 34.

CATALOG NUMBERS

The controller catalog number, located on the nameplate on the inside of the door, is coded to describe the configuration and options present. Use the following grid to translate the catalog number into a description of the drive.

Class Type

8839	EFD	•	•	•	V	•
①	②	③	④	⑤	⑥	

Modifications

Control	Light	Misc.
•	•	•
⑦	⑧	⑨

① Product

Code	Drive Type
EFD	E-Flex Controller

② Horsepower Code

Code	hp Rating	Code	hp Rating
C	1 hp	L	25 hp
D	2 hp	M	30 hp
E	3 hp	N	40 hp
F	5 hp	P	50 hp
G	7.5 hp	Q	60 hp (460 V only)
H	10 hp	R	75 hp (460 V only)
J	15 hp	S	100 hp (460 V only)
K	20 hp		

③ Enclosure Type

Code	Environment Rating
A	Type 12K
G	Type 1
H [5]	Type 3R

④ Voltage Rating

Code	Voltage
2	208 V
3	230 V
4	460 V

⑤ Application Type

Code	Applied Rating
V	Variable Torque

⑥ Device Type

Code	Power Circuit
W [5]	Without Bypass
Y [8]	Bypass

⑦ Control Option

Code	AFC Controls
A07 [7]	Hand/Off/Auto, Speed Potentiometer
B07 [7]	Hand/Off/Auto, Start/Stop, Speed Potentiometer
C07 [1]	Start/Stop, Speed Potentiometer
D07 [15]	Hand/Off/Comm, Speed Potentiometer
E07 [15]	Hand/Off/Comm, Start/Stop, Speed Potentiometer
N07	No operators; wired for remote operation

⑧ Light Option

Code	Light Cluster
A08 [2]	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Auto
B08 [2], [3]	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Bypass
C08 [2], [4]	Red Power On
	Green AFC Run
	Yellow AFC Fault

⑨ Misc. Options

Code	Feature
A09	Line Reactor, 5%
B09	Line Contactor
C09 [10]	3–15 PSI Transducer
D09 [13]	Omit Door-Mounted Graphic Display Terminal
E09 [6]	Smoke Purge (Fireman's Override)
F09 [9], [14]	Profibus
H09 [11]	I/O Extension: 4 logic inputs, 2 logic outputs, 2 analog inputs, 1 differential analog output
J09 [12]	0–10 Vdc Auto Speed Reference
K09	cUL Listing
L09 [14], [9]	LonWorks
M09 [14], [9]	Modbus®/ Unitelway
O09 [9], [14]	Apogee™ P1
P09 [14], [9]	Metasys® N2
Q09 [9], [14]	Ethernet
R09 [9], [14]	BACnet
S09	End Damper Control
T09 [16]	Service Entrance Rating
U09	Seismic Qualified
V09	Ethernet IP
X09	Line Reactor, 3%



- [1] Control option C07 (Start/Stop, Speed Potentiometer) is not compatible with Power Circuit Y (Bypass) or light cluster A08 or B08.
- [2] Light cluster A08, B08, and C08 cannot be selected together. Select only one.
- [3] Light cluster B08 is not compatible with Power Circuit W (Without Bypass).
- [4] Light cluster C08 is not compatible with A07 (Hand/Off/Auto, Speed Potentiometer), or B07 (Hand/Off/Auto, Start/Stop, Speed Potentiometer).
- [5] Line contactor B09 is not compatible with this option.
- [6] Smoke purge E09 permits the motor to run at full speed.
- [7] Place the Hand-Off-Auto switch in the Off position for AFC reset after detected fault is cleared.
- [8] Includes AFC/Off/Bypass switch and Test/Normal switch.
- [9] E07 or D07 must be selected for control. A07 or B07 may be used for monitoring only.
- [10] 3–15 PSI Transducer C09 is not compatible with Start/Stop, Speed Potentiometer C07, 0–10 V Auto Speed Reference J09, or Analog Card H09.

- [11] I/O Extension Card H09 is not compatible with 3–15 PSI Transducer C09.
- [12] 0–10 V Auto Speed Reference J09 is not compatible with C07 Start/Stop Potentiometer or C09 3–15 PSI Transducer.
- [13] Omit the keypad D09. User must buy separate device to program the controller.
- [14] Serial communication F09, L09, M09, O09, P09, Q09, and R09 cannot be selected together. Select only one. Serial communication cannot be selected with H09.
- [15] 3–15 PSI Transducer C09 and 0–10 Vdc Auto Speed Reference J09 are not available with D07 and E07.
- [16] Available only with NEMA Type 3R configurations.

NAMEPLATE IDENTIFICATION

The nameplate for the E-Flex drive is located on the inside of the door. This nameplate, shown in Figure 1, identifies the controller class, type, and modification (options) listing. When identifying or describing E-Flex drives, use the data from this nameplate.

Figure 1: E-Flex Nameplate

Options (MOD) Code			SQUARE D		E-FLEX™				LISTED IND. CONT. EQ.
ALTIVAR MOTOR CONTROLLER									
Class Number	CLASS 8839		SER B	POWER CONVERTER		ATV61HD18N4			
Controller Type Code	TYPE EFDMG4VY		MOD A07						
Permissible Input Voltage	INPUT VOLTS 460 ± 10 %		PH 3		Hz 60		Input Frequency		
Maximum Input Current Ratings	33.7 AMPS AT 100 KA 460 volts SHORT-CIRCUIT RATING with 3% DC Choke								
	AMPS AT 100 KA 460 volts SHORT-CIRCUIT RATING with 5% Line Reactor								
	OUTPUT AT 8 KHz SWITCHING FREQUENCY								
	VOLTS 0-460 ±10 %		PH 3		Hz 0 - 60		AMPS 40.0		Motor Rating
Power (Line) Circuit Breaker	OVERLOAD CAPACITY 0		AMPS FOR 60 S		HP / KW 30/22		Control Transformer Secondary Fuse		
Control Transformer Primary Fuses	CIRCUIT BREAKER HLL36100LV		TRANSFORMER FUSES PRIMARY 1.0		CLASS CC, 600 V, TIME-DELAY SECONDARY 1.4				
Line Terminations	ENCLOSURE TYPE 1		OVERLOAD RELAY CLASS 20		WIRE TYPE / TEMPERATURE 75° C CU				
	POWER WIRING		LINE		LOAD		Load Terminations		
	AWG #14 - #10 #8 - 3/0		TORQUE lb-in 50 120		AWG #14 - 1/0 50		Date Code		
Factory Order Number (Q2C and item number)	REFERENCE MANUALS 30072-451-51 Instruction Bulletin								
	MADE IN USA		46		50015325003		6010		80461 - 035 - 01

COMPONENT LOCATIONS

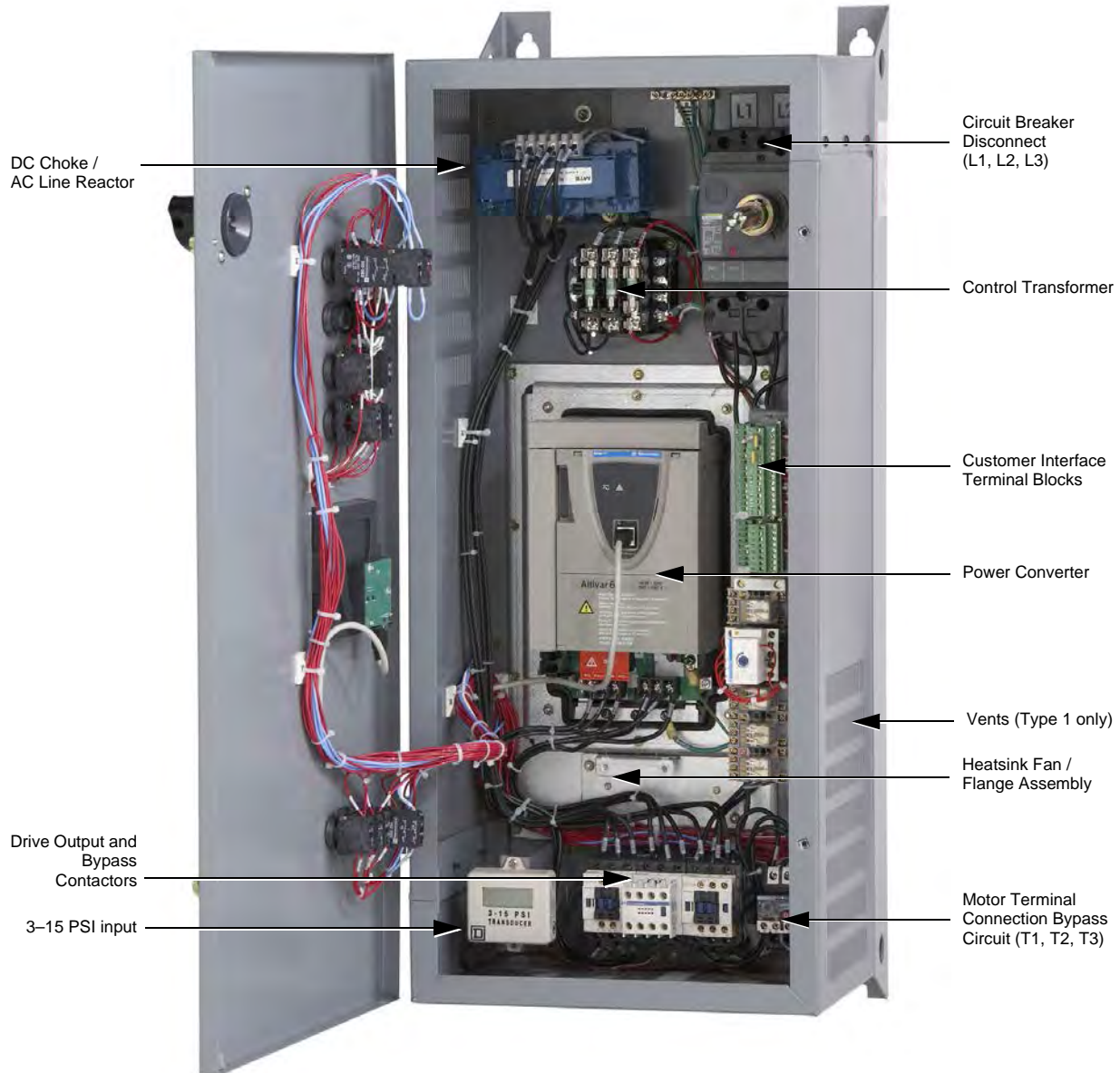
Figure 2: Typical Type 1/12K Front Component Locations for Controller: 1–100 hp @ 460 V and 1–50 hp @ 208/230 V (Class 8839 Type EFDG4VY, Mods: B07, B08, A09, C09, E09, and P09 shown)



Figure 3: Typical Type 3R Front Component Locations for Controller: 1–100 hp @ 460 V and 1–50 hp @ 208/230 V (Class 8839 Type EFDKH2VY, Mods: B07, B08, A09, E09, J09, and F09 shown)



Figure 4: Typical Inside Component Locations for Controller: 1–100 hp @ 460 V and 1–50 hp @ 208/230 V (Class 8839 Type EFDFG4VY, Mods: B07, B08, A09, C09, E09, P09, and X09 shown)



TECHNICAL CHARACTERISTICS

DRIVE RATINGS

Table 2: E-Flex Drive Ratings, 460 V

Drive Catalog Number ¹	Motor Power ² 460 V 60 Hz (hp)	Max. Continuous Output Current ³ (A)	Max. Transient Output Current (60 s) (A)	Power Converter Part Number ⁴
EFDC•4V_	1	2.1	2.3	ATV61H075N4
EFDD•4V_	2	3.4	3.7	ATV61H015N4
EFDE•4V_	3	4.8	5.3	ATV61HU15N4
EFDF•4V_	5	7.6	8.4	ATV61HU30N4
EFDG•4V_	7.5	11	12.1	ATV61HU40N4
EFDH•4V_	10	14	15.4	ATV61HU55N4
EFDJ•4V_	15	21	23.1	ATV61HU75N4
EFDK•4V_	20	27	29.7	ATV61HD11N4
EFDL•4V_	25	34	37.4	ATV61HD15N4
EFDM•4V_	30	40	44.0	ATV61HD18N4
EFDN•4V_	40	52	57.2	ATV61HD22N4
EFDP•4V_	50	65	71.5	ATV61HD30N4
EFDQ•4V_	60	77	84.7	ATV61HD37N4
EFDR•4V_	75	96	105.6	ATV61HD45N4
EFDS•4V_	100	124	136.4	ATV61HD55N4

¹ "•" can be "A", "G", or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure; "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² Power shown is for a carrier switching frequency of 8 kHz. For a switching frequency between 12 and 16 kHz, select the next largest size drive. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle) this is not necessary.

³ Continuous output current is based on NEC 2005 table 430.250. The E-Flex controller nameplate rating conforms to the NEC table, not the current value listed in the graphic display lookup table.

⁴ All E-Flex adjustable speed drives use the ATV61 (or HTV61) power converter in a customized hardware and software configuration in which the product gains a horsepower rating for devices configured in IP00 with a DC choke (or 3% line reactor). 3% impedance may be internal or external to the power converter or a combination of internal and external impedances to total 3%. The power converter is programmed by quality assurance personnel so that these settings match NEC2005 Table 430.250 for 460 V and 230 V configurations only. The hp/kW sticker (or imprint) on the cover of the power converter component may not reflect the marking of the enclosed device. However, the graphic display terminal reflects the correct rating and matches the enclosed drive nameplate. Use the graphic display terminal to observe the horsepower rating for the application.

Table 3: E-Flex Drive Ratings, 230 V

Drive Catalog Number ¹	Motor Power ² 230 V 60 Hz (hp)	Max. Continuous Output Current ³ (A)	Max. Transient Output Current (60 s) (A)	Power Converter Part Number ⁴
EFDC•3V_	1	4.2	4.6	ATV61H075M3
EFDD•3V_	2	6.8	7.5	ATV61HU15M3
EFDE•3V_	3	9.6	10.5	ATV61HU15M3
EFDF•3V_	5	15.2	16.7	ATV61HU30M3
EFDG•3V_	7.5	22	24.2	ATV61HU40M3
EFDH•3V_	10	28	30.8	ATV61HU55M3
EFDJ•3V_	15	42	46.2	ATV61HU75M3
EFDK•3V_	20	54	59.4	ATV61HD11M3X
EFDL•3V_	25	68	74.8	ATV61HD15M3X
EFDM•3V_	30	80	88	ATV61HD18M3X
EFDN•3V_	40	104	114.4	ATV61HD22M3X
EFDP•3V_	50	130	143	ATV61HD30M3X

¹ "•" can be "A", "G", or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure; "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² Power shown is for a carrier switching frequency of 8 kHz. For a switching frequency between 12 and 16 kHz, select the next largest size drive. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle) this is not necessary.

³ Continuous output current is based on NEC 2005 table 430.250. The E-Flex controller nameplate rating conforms to the NEC table, not the current value listed in the graphic display lookup table.

⁴ All E-Flex adjustable speed drives use the ATV61 (or HTV61) power converter in a customized hardware and software configuration in which the product gains a horsepower rating for devices configured in IP00 with a DC Choke (or 3% line reactor). 3% impedance may be internal or external to the power converter or a combination of internal and external impedances to total 3%. The power converter is programmed by quality assurance personnel so that these settings match NEC2005 Table 430.250 for 460 V and 230 V configurations only. The hp/kW sticker (or imprint) on the cover of the power converter component may not reflect the marking of the enclosed device. However, the graphic display terminal reflects the correct rating and matches the enclosed drive nameplate. Use the graphic display terminal to observe the horsepower rating for the application.

Table 4: E-Flex Drive Ratings, 208V

Drive Catalog Number ¹	Motor Power ² 208 V 60 Hz (hp)	Max. Continuous Output Current ³ (A)	Max. Transient Output Current (60 s) (A)	Power Converter Part Number ⁴
EFDC•2V_	1	4.6	5.1	ATV61HU15M3
EFDD•2V_	2	7.5	8.3	ATV61HU30M3
EFDE•2V_	3	10.6	11.7	ATV61HU30M3
EFD•2V_	5	16.7	18.4	ATV61HU40M3
EFDG•2V_	7.5	24.2	26.6	ATV61HU55M3
EFDH•2V_	10	30.8	33.9	ATV61HU75M3
EFDJ•2V_	15	46.2	50.8	ATV61HD11M3X
EFDK•2V_	20	59.4	65.3	ATV61HD15M3X
EFDL•2V_	25	74.8	82.3	ATV61HD18M3X
EFD•2V_	30	88	96.8	ATV61HD22M3X
EFDN•2V_	40	114	125.4	ATV61HD30M3X
EFD•2V_	50	143	157.3	ATV61HD37M3X

¹ "•" can be "A", "G", or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure; "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² Power shown is for a carrier switching frequency of 8 kHz. For a switching frequency between 12 and 16 kHz, select the next largest size drive. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle) this is not necessary.

³ Continuous output current is based on NEC 2005 table 430.250. The E-Flex controller nameplate rating conforms to the NEC table, not the current value listed in the graphic display lookup table.

⁴ The first five characters of the power converter part number may be "ATV61," indicating an IP20 device, or "HTV61," indicating an IP00 device.

INPUT CURRENT RATINGS

All branch circuit components and equipment such as feeder cables, disconnect devices, and protective devices must be rated for the higher of the following two currents: the input current of the drive, or the motor full load current (MFLC). The input current and MFLC are printed on the nameplate (see Figure 1 on page 15). The branch circuit feeder protection must be sized according to the NEC.

DC link chokes and AC line reactors are used to add reactance to the branch circuit, minimize drive input line current, reduce controller nuisance tripping due to transient overvoltage, reduce harmonic distortion, and help improve controller immunity to voltage imbalance. The supplied DC chokes have an impedance of 3%. Impedance may be internal or external to the power converter or a combination of internal and external impedance to total 3%. A 5% line reactor is available as Mod A09.

In systems that use bypass contactors, the line reactor must only be connected between the breaker load terminals in the controller and the power converter. A line reactor in a bypass motor-starting circuit will reduce the motor's ability to produce starting torque.

Table 5: Short-Circuit Current Ratings (SCCR)

Range (hp)	Minimum UL (kA)	High Fault UL (kA)
1–50	5	100
51–200	10	100
201–400	18	100
450–500	30	100

Table 6: Input Line Currents for Selection of Branch Circuit Feeders, 460 V¹

Drive Catalog Number ²	Motor Power 460 V 60Hz (hp)	Input Current Ratings					
		Standard 3% DC Choke/ 3% Line Reactor MOD X09 ³			Factory Mounted 5% Line Reactor ⁴ MOD A09		
		5 kA (A)	22 kA (A)	100 kA (A)	5 kA (A)	22 kA (A)	100 kA (A)
EFDC•4V_	1	1.5	1.5	1.5	1.5	1.4	1.4
EFDD•4V_	2	2.9	2.9	2.9	2.7	2.7	2.7
EFDE•4V_	3	4.0	4.0	4.0	3.8	3.8	3.8
EFDF•4V_	5	6.9	6.9	6.9	6.6	6.6	6.6
FDG•4V_	7.5	9.2	9.2	9.2	8.8	8.8	8.8
FDH•4V_	10	12.5	12.5	12.5	11.8	11.8	11.8
FDJ•4V_	15	17.5	17.6	17.6	16.8	16.8	16.8
FDK•4V_	20	23.5	23.6	23.7	22.4	22.4	22.4
FDL•4V_	25	28.8	29.0	29.1	27.9	27.9	27.8
FDM•4V_	30	33.5	33.7	33.7	33.1	33.1	33.1
FDN•4V_	40	45.1	45.3	45.3	44.7	44.7	44.6
FDP•4V_	50	55.5	55.6	55.7	54.7	54.7	54.6
FDQ•4V_	60	67.4 ⁵	67.4	67.4	66.9 ⁵	66.9	66.8
FDR•4V_	75	82.3 ⁵	82.4	82.6	81.5 ⁵	81.5	81.4
FDS•4V_	100	111.1 ⁵	111.2	111.3	109.9 ⁵	109.9	109.8

¹ Select conductor based on the input line current or motor FLA, whichever is greater.

² "•" can be "A", "G", or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure; "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

³ Factory modification X09 is an optional 3% line reactor available for drives of all hp ratings.

⁴ Factory modification A09 is an optional 5% line reactor available for drives of all hp ratings.

⁵ 10 kA.

Table 7: Input Line Currents for Selection of Branch Circuit Feeders, 230 V¹

Drive Catalog Number ²	Motor Power 230 V 60Hz (hp)	Input Current Ratings					
		Standard 3% DC Choke/ 3% Line Reactor MOD X09 ³			Factory Mounted 5% Line Reactor ⁴ MOD A09		
		5 kA (A)	22 kA (A)	100 kA (A)	5 kA (A)	22 kA (A)	100 kA (A)
EFDC•3V_	1	3.2	3.2	3.2	3.0	3.0	3.0
EFDD•3V_	2	6.0	6.0	6.0	5.6	5.6	5.6
EFDE•3V_	3	8.3	8.4	8.4	8.0	8.0	8.0
EFDF•3V_	5	14.3	14.3	14.3	13.7	13.8	13.8
EFDG•3V_	7.5	19.5	19.5	19.5	18.4	18.4	18.4
EFDH•3V_	10	25.6	25.8	25.8	24.4	24.6	24.6
EFDJ•3V_	15	36.4	36.5	36.6	35.0	35.0	35.0
EFDK•3V_	20	47.4	47.5	47.6	46.2	46.4	46.3
EFDL•3V_	25	59.6	59.7	59.7	58.0	58.0	57.9
EFDN•3V_	30	69.7	69.7	69.7	68.8	68.9	68.9
EFDN•3V_	40	94.2	94.2	93.9	93.5	93.6	93.4
EFDN•3V_	50	116.4	116.5	116.2	116.0	116.0	115.8

¹ Select conductor based on the input line current or motor FLA, whichever is greater.² “•” can be “A”, “G”, or “H”. “A” denotes a Type 12K enclosure; “G” denotes a Type 1 enclosure; “H” denotes a Type 3R enclosure. “_” indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.³ Factory modification X09 is an optional 3% line reactor available for drives of all hp ratings.⁴ Factory modification A09 is an optional 5% line reactor available for drives of all hp ratings.**Table 8: Input Line Currents for Selection of Branch Circuit Feeders, 208 V¹**

Drive Catalog Number ²	Motor Power 208 V 60Hz (hp)	Input Current Ratings					
		Standard 3% DC Choke/ 3% Line Reactor MOD X09 ³			Factory Mounted 5% Line Reactor ⁴ MOD A09		
		5 kA (A)	22 kA (A)	100 kA (A)	5 kA (A)	22 kA (A)	100 kA (A)
EFDC•2V_	1	3.3	3.3	3.3	3.3	3.3	3.3
EFDD•2V_	2	6.3	6.3	6.2	6.2	6.2	6.2
EFDE•2V_	3	8.5	8.6	8.7	8.8	8.8	8.8
EFDF•2V_	5	15.3	15.3	15.3	15.1	15.2	15.2
EFDG•2V_	7.5	20.3	20.3	20.3	20.3	20.3	20.3
EFDH•2V_	10	27.1	27.3	27.3	27.0	27.1	27.1
EFDJ•2V_	15	38.7	38.8	38.8	38.7	38.7	38.7
EFDK•2V_	20	50.9	50.9	51.0	51.4	51.4	51.3
EFDL•2V_	25	63.5	63.6	63.6	64.1	64.2	64.1
EFDN•2V_	30	75.2	75.2	76.1	76.1	76.1	76.1
EFDN•2V_	40	103.5	103.5	103.6	102.5	102.5	103.5
EFDN•2V_	50	127.3	127.4	127.7	127.4	127.5	127.0

¹ Select conductor based on the input line current or motor FLA, whichever is greater.² “•” can be “A”, “G”, or “H”. “A” denotes a Type 12K enclosure; “G” denotes a Type 1 enclosure; “H” denotes a Type 3R enclosure. “_” indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.³ Factory modification X09 is an optional 3% line reactor available for drives of all hp ratings.⁴ Factory modification A09 is an optional 5% line reactor available for drives of all hp ratings.

Table 9: 3% DC Choke Reactance Distribution¹

Drive Catalog Number ²	Motor Power (hp)	208 V		230 V		460 V	
		Power Converter Impedance	External Impedance	Power Converter Impedance	External Impedance	Power Converter Impedance	External Impedance
		(mH)	(mH)	(mH)	(mH)	(mH)	(mH)
EFDC***_	1	—	4.000	—	7.500	—	15.000
EFDD***_	2	—	4.000	—	4.000	—	15.000
EFDE***_	3	—	1.275	—	4.000	—	7.500
EFDF***_	5	—	0.750	—	1.275	—	3.750
FDG***_	7.5	—	0.750	—	0.750	—	3.750
FDH***_	10	—	0.625	—	0.750	—	1.780
FDJ***_	15	0.120	0.400	—	0.625	—	1.750
FDK***_	20	0.080	0.300	0.120	0.400	—	1.620
FDL***_	25	0.170	0.220	0.080	0.300	—	1.000
FDM***_	30	0.170	0.220	0.170	0.220	0.300	0.625
FDN***_	40	0.100	0.220	0.170	0.220	0.500	0.320
FDP***_	50	0.100	0.120	0.100	0.220	0.380	0.310
FDQ***_	60	—	—	—	—	0.270	0.250
FDR***_	75	—	—	—	—	0.180	0.220
FDS***_	100	—	—	—	—	0.180	0.120

¹ 3% impedance may be internal or external to the power converter (ATV61_ or HTV61_) or a combination of internal and external impedances to total 3% as shown in this table.

² "•" can be "A", "G", or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure; "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

SPECIFICATIONS

Table 10: Specifications for Drives

Input voltage	460 V \pm 10%, 230 V \pm 10%, 208 V \pm 10%
Displacement power factor	98% through speed range
Input frequency	60 Hz \pm 5%
Output voltage	Three-phase output Maximum voltage equal to input voltage
Galvanic isolation	Galvanic isolation between power and control (inputs, outputs, and power supplies)
Frequency range of power converter	0.1 to 500 Hz (factory setting of 60 Hz)
Torque/overtorque	VT: 110% of nominal motor torque for 60 s
Current (transient)	VT: 110% of controller rated current for 60 s
Switching frequency	Selectable from 0.5 to 16 kHz. ^[1] Factory setting: VT: 8 kHz for 208 V, 230 V, and 1–100 hp @ 460 V 2 kHz for 125–500 hp @ 460 V The drive reduces the switching frequency automatically in the event of excessive heatsink temperature.
Speed reference	AI1: 0 to +10 V, Impedance = 30 k Ω . Can be used for speed potentiometer, 1–10 k Ω . AI2: Factory setting: 4 to 20 mA. Impedance = 242 Ω (reassignable, X–Y range with graphic display terminal). Factory modification J10 allows 0–10 Vdc reference signal to AI2, Z = 30 k Ω .
Frequency resolution in analog reference	0.1 for 100 Hz (11 bits)
Speed regulation	V/f control: equal to the motor's rated slip. SFVC: 10% of the motor's rate slip from 20% to 100% of nominal motor torque.
Efficiency	97% at full load typical
Reference sample time	2 ms \pm 0.5 ms
Acceleration and deceleration ramps	0.1 to 999.9 s (definition in 0.1 s increments)
Drive protection	<ul style="list-style-type: none"> Thermal protection of power converter Phase loss of AC mains Circuit breaker rated at 100 kAIC
Motor protection	Class 10 electronic overload protection Class 20 electromechanical overload protection with bypass ^[2]
Graphic display terminal	Self diagnostics with messages in three languages; also refer to the <i>Programming Manual</i> , supplied on CD-ROM W817574030111 with the power converter. ^[3]
Temperature	Storage for all enclosures: -13 to +149 °F (-25 to +65 °C). Operation: NEMA Type 1, 12, 12K: +14 to +104 °F (-10 to 40 °C); NEMA Type 3R: +14 to +122 °F (-10 to 50 °C). For 1–100 hp drives (208, 230 & 460 V) operating between 40 and 50 °C, derate the current 2% per °C above 40 °C.
Humidity	95% with no condensation or dripping water, conforming to IEC 60068-2-78.
Altitude	3,300 ft (1000 m) maximum without derating; derating of the current by 1% for each additional 330 ft (100 m)
Enclosure	Type 1: all controllers Type 3R: all controllers Type 12/12K: all controllers
Pollution degree	Type 1, Type 3R: Pollution degree 2 per NEMA ICS-1 Annex A and IEC 60664-1 Type 12: Pollution degree 3 per NEMA ICS-1 and IEC 17.560664-1
Operational test vibration	Conforming to IEC 60721-3-3-3M3 amplitude 1.5 mm peak to peak from 3 to 13 Hz 1 g from 13 to 200 Hz
Transit test to shock	Conforming to National Safe Transit Association and International Safe Transit Association test for packages.
Operational shock	15 g, 11 ms
Seismic qualification	2003 IBC, NFPA 5000, and ASCE 7 ICC ES AC156 acceptance criteria test protocol with an importance factor of 1.5.
Codes and standards	UL Listed per UL 508C under category NMMS. Conforms to applicable NEMA ICS, NFPA, and IEC standards. Manufactured under ISO 9001 standards. Factory modification G10 provides Canadian cUL certification per C22.2 No. 14.

- On 1–100 hp VT controllers, above 8 kHz, select the next largest size drive.
If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle), this is not necessary.
- Class 10 electromechanical for 1 hp at 460 V.
- Refer to Table 1 for the instruction bulletin number.
- Plenum rated; suitable for placement in a compartment handling conditioned air.

SHORT CIRCUIT RATINGS

All E-Flex devices include a PowerPact® H- or J-frame circuit breaker as the overcurrent protective device (OCPD). All configurations have a coordinated short circuit current rating of 100,000 A symmetrical.

- 460 Volt, 1–100 hp, VT, 100,000 A
- 230 Volt, 1–50 hp, VT, 100,000 A
- 208 Volt, 1–50 hp, VT, 100,000 A

STANDARD FEATURES

The E-Flex drive includes the following standard features:

With or Without Bypass

- Circuit breaker disconnect
- Form C AFC fault contact wired to customer terminal block
- Form C AFC run contact wired to customer terminal block
- Fire/freezestat interlock location provided to customer terminal block
- Graphic display terminal
- Factory-mounted link choke (see Table 14 on page 29)
- Modbus and CANopen

Bypass Only

- Drive output and bypass contactors
- AFC-Off-Bypass selector switch
- Test-Normal selector switch
- Class 20 overload protection (Class 10 for 1 hp @ 460 V)

Table 11: Parts List for Bypass Circuit Selector Switches and Circuit Breaker Handle

Selector Switch or Handle	Part No.	Description
Test-Normal Selector Switch	ZB5AD2	Two-position selector switch
	ZB5AZ009	Mounting collar with contact block (1 N.O.)
	ZBE204	Additional contact block (2 N.C.)
	ZBE101	Additional contact block (1 N.O.)
	65170-166-72	Engraved legend plate, "Test-Normal"
	ZBZ32	Legend plate holder
AFC-Off-Bypass Selector Switch	ZB5AD3	Three-position selector switch
	ZB5AZ103	Mounting collar with contact block (2 N.O.)
	65170-166-43	Engraved legend plate "AFC-Off-Bypass"
	ZBZ32	Legend plate holder
Circuit Breaker Handle	29338C	Disconnect switch handle, black

NOTE: Legend plate part numbers beginning with 65170 are not available as an ordered part. Please contact your local field sales office.

FACTORY MODIFICATIONS

CONTROL OPTIONS

Table 12: Control Options (Required Selection)

Control Option	Description	Parts List
A07	Hand-Off-Auto Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Speed Potentiometer ¹	ATVPOT25K Speed potentiometer assembly
B07	Hand-Off-Auto Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Stop/Start Push Buttons	ZB5AA2 Black push button w/ mounting base ZB5AA4 Red push button w/ mounting base ZB5AZ101 Mounting collar w/ additional contact block (1 N.O.) ZB5AZ102 Mounting collar w/ additional contact block (1 N.C.) (2) ZBZ32 Legend plate holder
	Speed Potentiometer ¹	ATVPOT25K Speed potentiometer assembly
C07	Stop/Start Push Buttons	ZB5AA2 Black push button w/ mounting base ZB5AA4 Red push button w/ mounting base ZB5AZ101 Mounting collar w/ additional contact block (1 N.O.) ZB5AZ102 Mounting collar w/ additional contact block (1 N.C.) (2) ZBZ32 Legend plate holder
	Speed Potentiometer ¹	ATVPOT25K Speed potentiometer assembly
D07	Hand-Off-Comm Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Speed Potentiometer ¹	ATVPOT25K Speed potentiometer assembly
E07	Hand-Off-Comm Selector Switch	ZB5AD3 Three-position selector switch ZB5AZ009 Mounting collar ZBE205 Additional contact block (1 N.O., 1 N.C.) (2) ZBE102 Additional contact block (1 N.C.) ZBE203 Additional contact block (2 N.O.) ZBZ32 Legend plate holder
	Stop/Start Push Buttons	ZB5AA2 Black push button w/ mounting base ZB5AA4 Red push button w/ mounting base ZB5AZ101 Mounting collar w/ additional contact block (1 N.O.) ZB5AZ102 Mounting collar w/ additional contact block (1 N.C.) (2) ZBZ32 Legend plate holder
	Speed Potentiometer ¹	ATVPOT25K Speed potentiometer assembly
N07	No operators; wired for remote operation	No drive control options are supplied on the front door of the drive. For use in remote-mounted operator applications. Refer to Section 3, Power Circuit Descriptions, for remote mounting information.

¹ For Type 3R controllers and if the graphic display is deleted (MOD D09). In all other cases, the speed potentiometer is the control on the graphic display terminal.

LIGHT OPTIONS

Table 13: Light Options (Optional Selection)

Light Option	Description	Parts List
A08 Pilot Light Option #1 Cluster	Red Power On	ZB5AV04 Red pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Green AFC Run	ZB5AV03 Green pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Detected Fault	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Auto	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
B08 Pilot Light Option #2 Cluster	Red Power On	ZB5AV04 Red pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Green AFC Run	ZB5AV03 Green pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Detected Fault	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Bypass	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
C08 Pilot Light Option # 3 Cluster	Red Power On	ZB5AV04 Red pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Green AFC Run	ZB5AV03 Green pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder
	Yellow Detected Fault	ZB5AV05 Amber pilot light head ZB5AV6 Mounting collar with light module ZBZ32 Legend plate holder

MISC. OPTIONS

Table 14: Miscellaneous Options (Optional Selection)

Misc. Option	Name	Description
A09	Line Reactor	Factory-mounted line reactor within enclosure. Standard = 3% DC Choke Mod A09 = 5% Line Reactor
B09	Line Contactor	A line contactor can be added between the circuit breaker and the drive (Type 1 and 12K only).
C09	3–15 PSI Transducer	Allows the controller to follow a user-supplied 3–15 PSI input.
D09	Omit Door-Mounted Graphic Display Terminal	The graphic display terminal is not supplied. The user must buy the terminal as a separate device to program the drive.
E09	Smoke Purge	Provides a smoke purge operating mode controlled by a user-supplied 120 Vac signal wired to customer's terminal block.
F09	Profibus Serial Communication	Provides a factory-installed plug-in Profibus card, VW3A3307.
H09	I/O Extension	0–20 mA analog output for customer use. Factory programmed for motor frequency. Includes I/O extension card VW3A3202. Reassignable x–y range with keypad display. Also includes logic inputs, logic outputs, analog inputs, analog outputs, configurable relay outputs, PTC probe input, and frequency control input.
J09	0–10 Vdc Auto Speed Reference	Provides for a 0–10 Vdc user-supplied auto speed reference signal to the AI2 input.
K09	cUL Listing	Provides Canadian cUL certification when required by local code requirements.
L09	LonWorks® Serial Communication	Provides a factory installed LonWorks card, VW3A3312.
M09	Modbus® Serial Communication ¹	Provides a factory installed plug-in Modbus card VW3A3303.
P09	Metasys® N2 Serial Communication	Provides a factory installed plug-in Metasys N2 card VW3A3313.
O09	P1 Serial Communication	Provides a factory installed plug-in Apogee™ P1 card VW3A3314.
Q09	Ethernet Serial Communication	Provides a factory installed plug-in Ethernet card VW3A3310D.
R09	BACnet Serial Communication	Provides a factory installed plug-in BACnet card VW3A3315.
S09	End Damper Control	Provides a circuit to delay drive operation until the damper is fully open.
T09	Service Entrance Rating	Provides a factory-installed insulated ground neutral assembly with ground wire and label for use as service entrance rated equipment.
U09	Seismic Qualified	Provides a certification label and hardware qualified to seismic rating ICC ES AC156 acceptance criteria test protocol with an importance factor of 1.5.
V09	Ethernet IP	Provides a factory installed plug-in Ethernet IP card VW3A3316.
X09	Line Reactor	Factory-mounted line reactor within enclosure Standard = 3% DC Choke Mod X09 = 3% Line Reactor

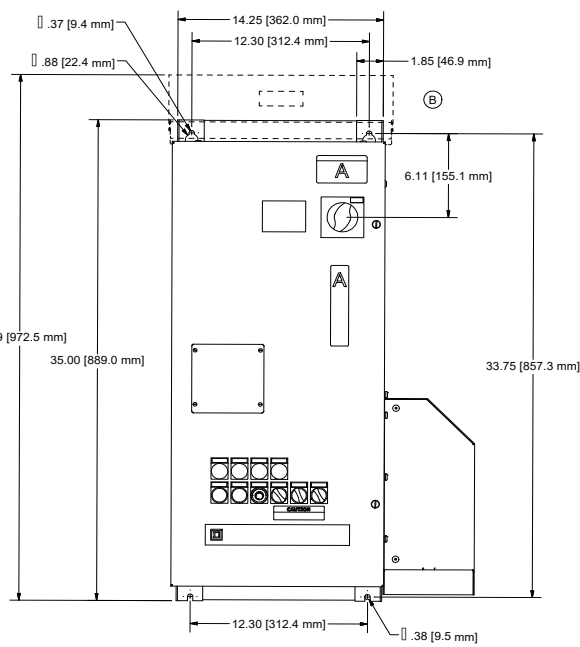
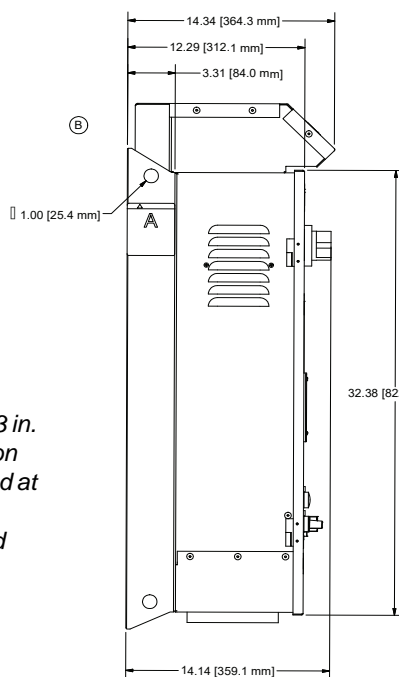
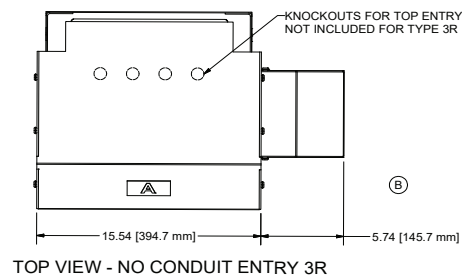
¹ The 9-pin to 15-pin connector cable that ships with the Modbus card when ordered from the distributor does not ship with an E-Flex unit.

DIMENSIONS AND WEIGHT FOR WALL MOUNTING

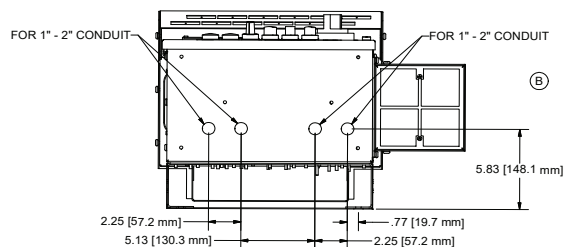
Figure 5: Mounting Information for 1–7.5 hp Controllers @ 480 V and 1–5 hp Controllers @ 208/230 V, with or without Bypass

Dimensions: in. (mm)

SIZE A
460V - 1-7.5HP (VT)
230V - 1-5HP (VT)
208V - 1-5HP (VT)



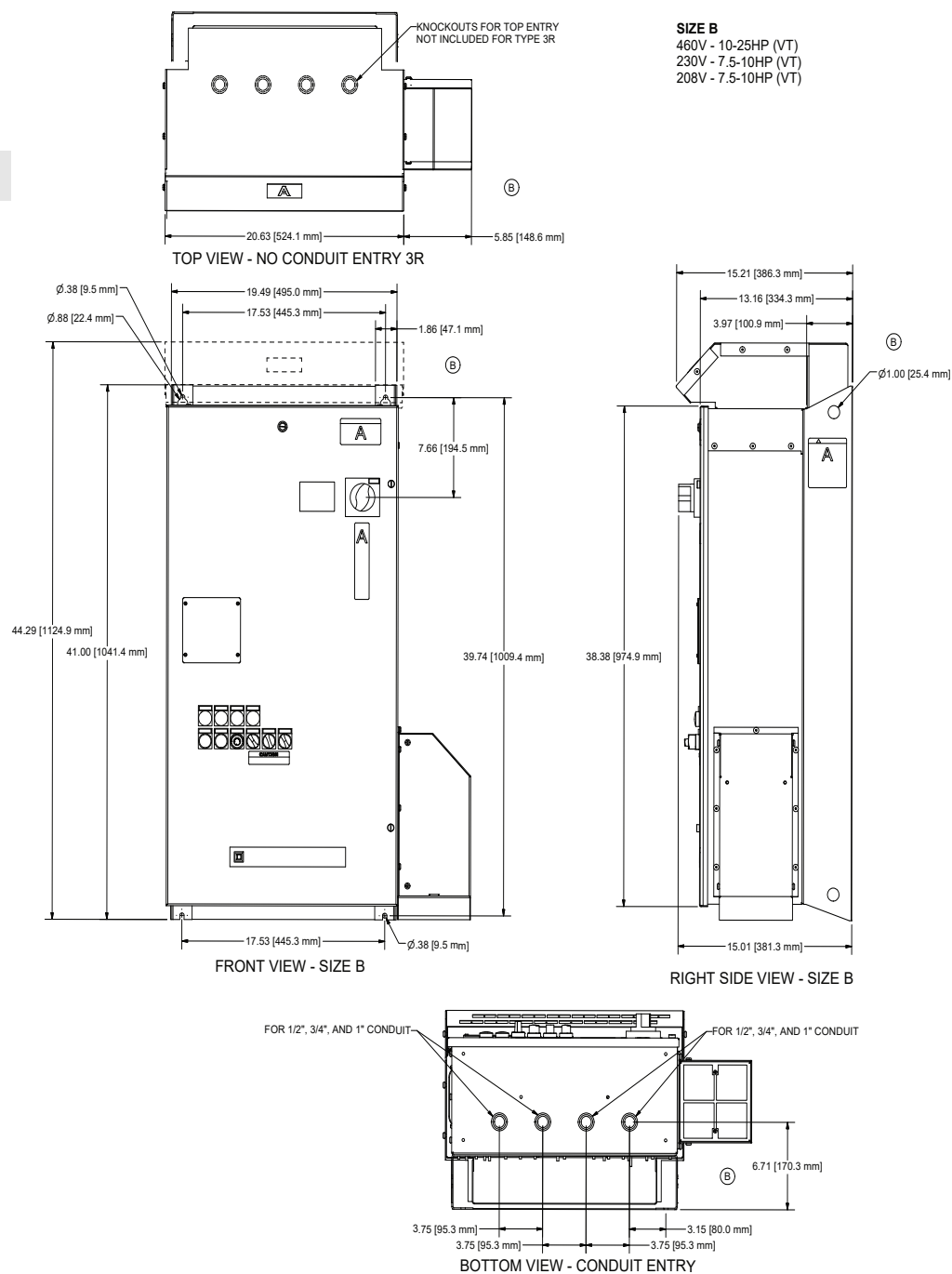
NOTE: Provide at least 3 in. of mounting clearance on each side of the drive and at least 6 in. of mounting clearance at the top and bottom of the drive.



hp		Weight	
460 V	208/230 V	lb	kg
1–7.5	1–5	83	37.7
10–25	7.5–10	126	57.2

Figure 6: Mounting Information for 10–25 hp Controllers @ 480 V and 7.5–10 hp Controllers @ 208/230 V, with or without Bypass

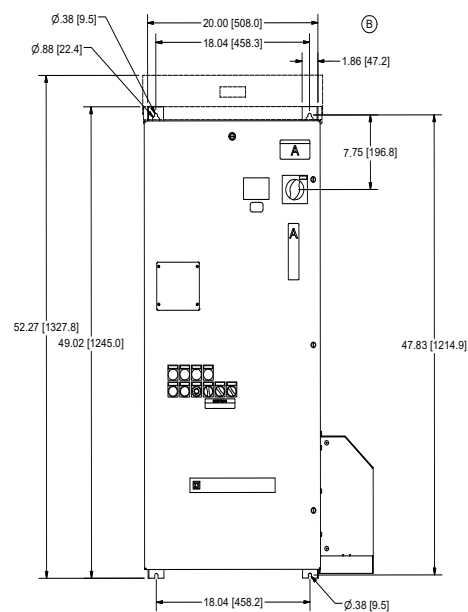
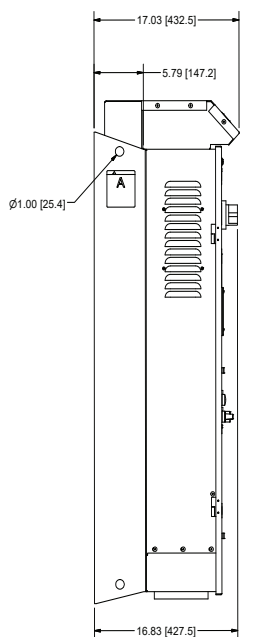
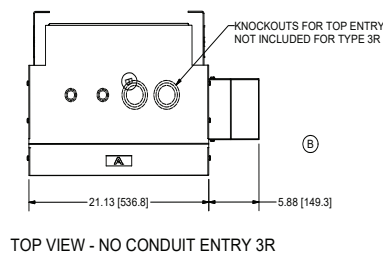
Dimensions: in. (mm)



hp		Weight	
460 V	208/230V	lb	kg
30–50	15–25	177	80.5
60–100	30–50	211	95.9

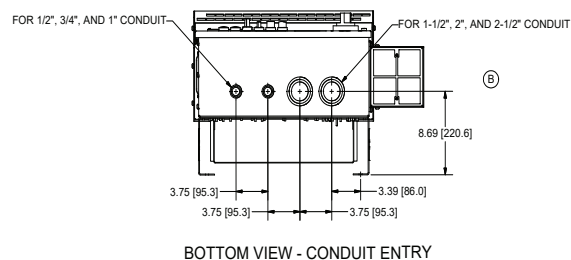
Figure 7: Mounting Information for 30–100 hp Controllers @ 480 V and 15–25 hp Controllers @ 208/230 V, with or without Bypass

Dimensions: in. (mm)



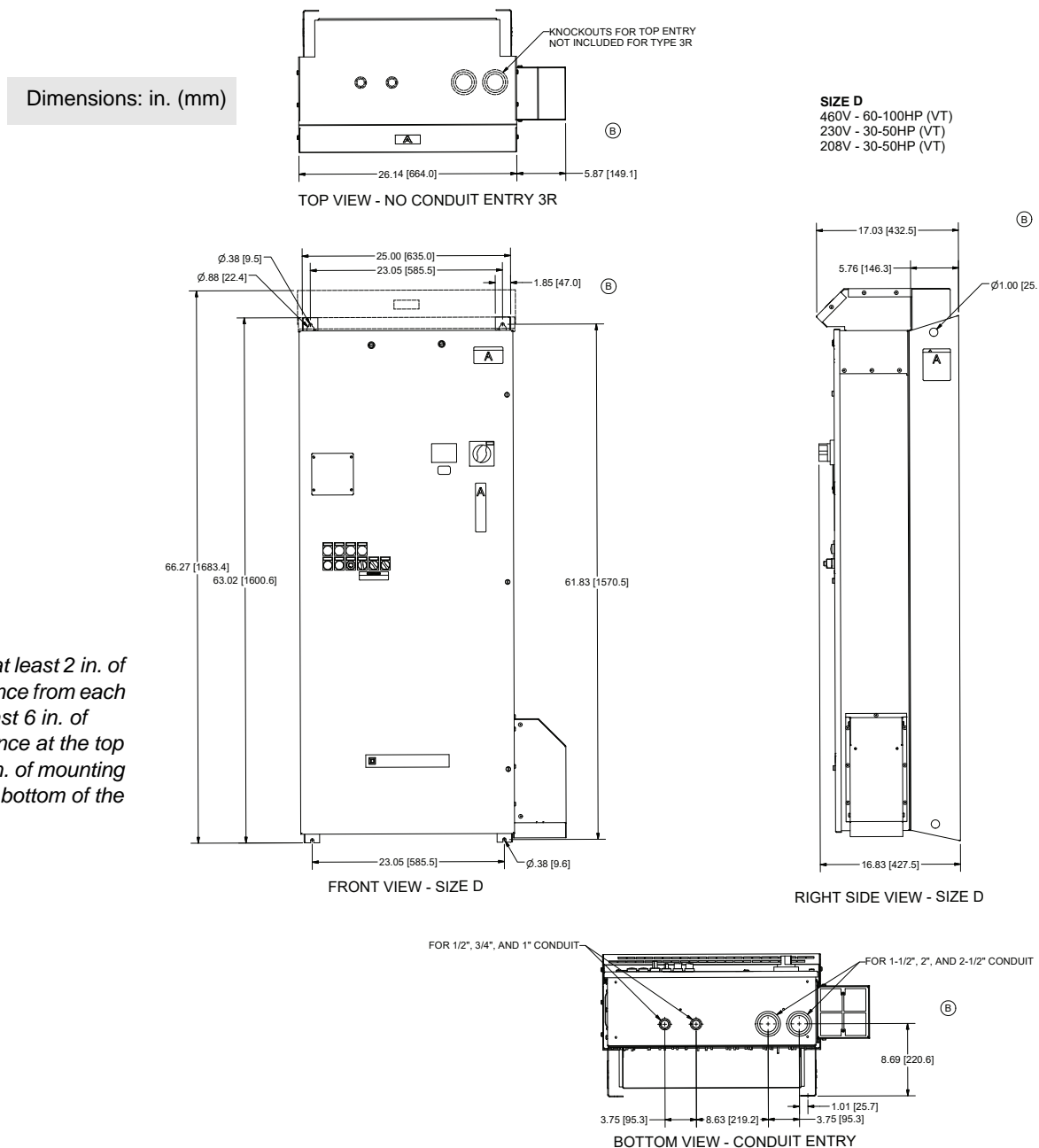
NOTE: Provide at least 2 in. of mounting clearance from each side hood, at least 6 in. of mounting clearance at the top and at least 12 in. of mounting clearance at the bottom of the drive.

SIZE C
460V - 30-50HP (VT)
230V - 15-25HP (VT)
208V - 15-25HP (VT)



hp		Weight		Maximum Enclosure Dimensions					
460 V	208/ 230V	lb	kg	Height		Width		Depth	
				in	mm	in	mm	in	mm
1–7.5	1–5	115	52.3	35	889	24.43	620.52	13.69	347.73
10–25	7.5–10	163	74.1	41	1041.4	30.19	766.83	13.69	347.73
30–50	15–25	213	96.8	52.22	1326.39	30.32	770.13	16.34	415.04
60–100	30–50	247	112.3	66.22	1681.99	35.32	897.13	16.34	415.04

Figure 8: Mounting Information for 60–100 hp Controllers @ 480 V and 30–50 hp Controllers @ 208/230 V, with or without Bypass



hp		Weight		Maximum Enclosure Dimensions					
460 V	208/ 230V	lb	kg	Height		Width		Depth	
				in	mm	in	mm	in	mm
1–7.5	1–5	115	52.3	38.3	973	21.3	541	14.3	364
10–25	7.5–10	163	74.1	44.3	1125	26.5	673	15.2	386
30–50	15–25	213	96.8	52.3	1328	27.0	686	17.0	433
60–100	30–50	247	112.3	66.3	1683	32.0	813	17.0	433

TOTAL DISSIPATED WATTS LOSS

Notes to Table 15:

¹ "•" can be "A" or "G". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² To convert to BTU/hr, multiply Watts Loss by 3.41.

The total dissipated watts loss in Tables 15–17 is provided for sizing the environment HVAC cooling requirements based upon worst-case operating conditions for Type 1 and Type 12K enclosures.

Table 15: Total Dissipated Watts Loss, 460 V

Drive Catalog No. ¹	hp	Total Dissipated Watts Loss ²
EFDC•4V_	1	174
EFDD•4V_	2	193
EFDE•4V_	3	194
EFDF•4V_	5	249
EFDG•4V_	7.5	287
EFDH•4V_	10	317
EFDJ•4V_	15	367
EFDK•4V_	20	474
EFDL•4V_	25	559
EFDM•4V_	30	664
EFDN•4V_	40	913
EFDP•4V_	50	1203
EFDQ•4V_	60	1392
EFDR•4V_	75	1603
EFDS•4V_	100	1833

Notes to Table 16:

¹ "•" can be "A" or "G". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² To convert to BTU/hr, multiply Watts Loss by 3.41.

Table 16: Total Dissipated Watts Loss, 230 V

Drive Catalog No. ¹	hp	Total Dissipated Watts Loss ²
EFDC•3V_	1	195
EFDD•3V_	2	236
EFDE•3V_	3	236
EFDF•3V_	5	294
EFDG•3V_	7.5	347
EFDH•3V_	10	454
EFDJ•3V_	15	546
EFDK•3V_	20	771
EFDL•3V_	25	848
EFDM•3V_	30	1014
EFDN•3V_	40	1110
EFDP•3V_	50	1426

Notes to Table 17:

¹ "•" can be "A" or "G". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² To convert to BTU/hr, multiply Watts Loss by 3.41.

Table 17: Total Dissipated Watts Loss, 208 V

Drive Catalog No. ¹	hp	Total Dissipated Watts Loss ²
EFDC•2V_	1	234
EFDD•2V_	2	293
EFDE•2V_	3	293
EFDF•2V_	5	337
EFDG•2V_	7.5	454
EFDH•2V_	10	544
EFDJ•2V_	15	769
EFDK•2V_	20	838
EFDL•2V_	25	1055
EFDM•2V_	30	1099
EFDN•2V_	40	1409
EFDP•2V_	50	1668

SECTION 2— RECEIVING, INSTALLATION, AND START-UP

PRELIMINARY INSPECTION

⚠ CAUTION

DAMAGED CONTROLLER EQUIPMENT

Do not operate any drive that appears damaged.

Failure to follow these instructions can result in injury or equipment damage.

The drive must be thoroughly inspected before it is stored or installed. Upon receipt:

- A. Remove the drive from its packaging and visually inspect the exterior for shipping damage.
- B. Ensure that the Class, Type, and MOD specified on the drive nameplate agree with the packing slip and corresponding purchase order. See Figure 1 on page 15.
- C. If you find any shipping damage, notify the carrier and your sales representative.
- D. If you plan to store the drive after receipt, replace it in its original packaging material and store it at the temperature specified in Table 10 on page 25.

⚠ CAUTION

DAMAGE TO INSULATED PARTS IN AIR DUCT

- Protect the air duct at the rear of the enclosure from entry of foreign material.
- Do not place loose objects on top of the enclosure.
- Do not block air flow from the duct.

Failure to follow these instructions can cause breaker trip, resulting in process shutdown or equipment damage.

Before installation:

1. Open the door of the drive. To open the door, turn the circuit breaker and handle assembly to the Off position.
2. Visually verify that all internal mounting and terminal connection hardware is properly seated, securely fastened, and undamaged.
3. Visually verify that the control board on the power converter is properly seated, securely fastened, and undamaged. Verify that the internal wiring connections are tight. Inspect all connections for damage.
4. Close and secure the drive door.

HANDLING THE DRIVE

⚠ WARNING

HANDLING AND LIFTING HAZARD

Keep the area below any equipment being lifted clear of all personnel and property. Use the lifting method shown in Figure 9.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Drives are shipped on a pallet on their back. To avoid damage, do not stack drives on top of each other. Store the drive in its original packaging until it is at the final installation site. The packaging protects the drive and prevents damage to its exterior.

Handle the drive carefully to avoid damage to the internal components, frame, or exterior. When handling a drive, balance it carefully to keep it from tipping. After removing packaging materials, drives require some type of mechanical lifting.

When handling drives:

- Always work with another person. The weight, size, and shape of the drive is such that two people are required to handle it.
- Use gloves.
- Attach a spreader bar to the two top lifting holes on the drive back panel (see Figures 5–7 on pages 30–32 for location of lifting holes) and hoist the controller with chains or straps. See Figure 9 for the proper hoisting method.
- Raise the drive from a horizontal position (that is, the back of the controller resting on a pallet).
- Place the drive in an upright position.

NOTE: The bottom of the drive is on an angle.

- Mount the drive on a flat, solid, noncombustible vertical surface, capable of supporting the controller weight.
- Secure all four corners of the controller with hardware of a sufficient size and type capable of supporting the controller weight.

⚠ WARNING

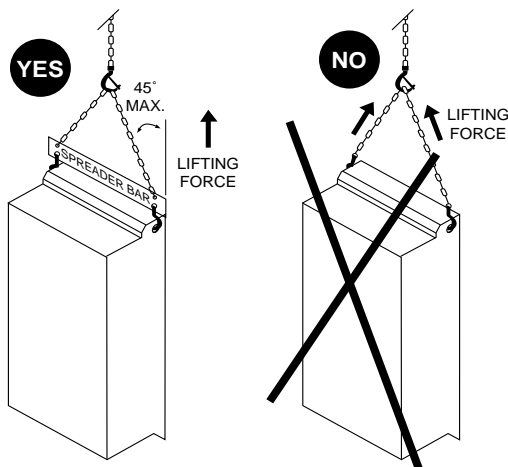
IMPROPER MOUNTING

Before removing the lifting mechanism:

- Ensure that all hardware is of sufficient size and type for the controller weight.
- Secure and tighten all hardware.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Figure 9: Hoisting E-Flex Drives



INSTALLATION

MECHANICAL INSTALLATION

Refer to Table 10 on page 25 for Specifications.

- The Type 1 or 12K controller must be mounted vertically against a solid, flat surface to allow for proper ventilation.
- If drilling for conduit entry, exercise care to prevent metal chips from falling on parts and electronic printed wiring boards.
- See Figure 5 on page 30, Figure 6 on page 31, or Figure 7 on page 32 for mounting dimensions, mounting clearances, conduit entry areas, and controller weights.
- Do not mount the drive on hot surfaces.
- Do not mount the Type 1 or 12K drives in direct sunlight.
- Use water-tight rated conduit hubs to make connections between the conduit and Type 3R drives.

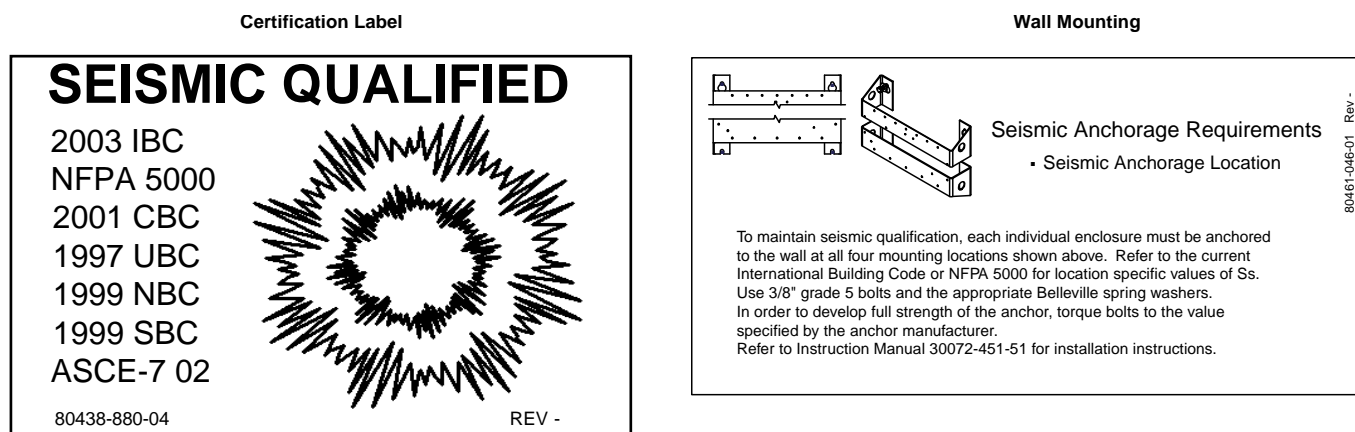
SEISMIC QUALIFICATION MOUNTING CRITERIA

Seismic qualification (MOD U09) harmonizes the following standards in compliance to ICC ES AC156 acceptance criteria test protocol with an importance factor of 1.5:

- 2003 IBC (International Building Code)
- NFPA 5000 (Building Code – National Fire Protection Agency)
- 2001 CBC (Canadian Building Code)
- 1997 UBC (Uniform Building Code)
- 1999 NBC (BOCA National Building Code)
- 1999 SBC (Standard Building Code)
- ASCE 7 (American Society of Civil Engineers)

For seismic rating installation compliance, follow the specific labels attached to the drive (see Figure 10) for anchorage, lateral and mounting guidelines using **SAE Grade 5 hardware bolts and washers**. These guidelines apply for all wall mounted Type 1, 12K and 3R construction.

Figure 10: Seismic Qualification Labels



ELECTRICAL INSTALLATION

General Wiring Practices

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power (main and remote) before installing the equipment.

Failure to follow these instructions will result in death or serious injury.

Before wiring the drive, perform the bus voltage measurement procedure on page 42. Good wiring practice requires the separation of control circuit wiring from all power wiring. Power wiring to the motor must have the maximum possible separation from all other power wiring, whether from the same drive or other drives. **Do not run power and/or control or multiple power wiring in the same conduit.** This separation reduces the possibility of coupling electrical transients from power circuits into control circuits or from motor power wiring into other power circuits.

CAUTION

IMPROPER WIRING HAZARD

Follow the wiring practices described in this document in addition to those already required by the National Electrical Code and local codes.

Failure to follow these instructions can result in injury or equipment damage.

Follow the practices below when wiring the E-Flex drive:

- Before applying power assure that the wiring termination points have been checked of proper torque. See Tables 22–24 on pages 51–53 for torque values.
- Use the supplied knockouts to feed control wiring into the cabinet. Do not run control wires through the drive vents or through the rear air intake.
- Use metallic conduit for all drive wiring. Do not run control and power wiring in the same conduit.
- Separate metallic conduits carrying power wiring or low-level control wiring by at least 3 inches (76 mm).
- Separate existing, non-metallic conduits or cable trays used to carry power wiring from metallic conduit carrying low-level control wiring by at least 12 inches (305 mm).
- Whenever power and control wiring cross, the metallic conduits and non-metallic conduits or trays must cross at right angles.
- Equip all inductive circuits near the controller (relays, contactors, solenoid valves) with noise suppressors.

INPUT POWER

The E-Flex drive operates from a three-phase, 460 Vac \pm 10%, 230 Vac \pm 10%, or 208 Vac \pm 10%, 60 Hz \pm 5% supply connected to the input circuit breaker disconnect. The circuit breaker disconnect is coordinated and tested with the controller power circuit for a short circuit current rating of 100,000 A.

BRANCH CIRCUIT CONNECTIONS

All branch circuit components and equipment (such as feeder cables, disconnect devices, and protective devices) must be rated for the maximum input current of the E-Flex drive, or the FLA of the motor, whichever is

greater. The drive input current and motor full load current is stamped on the nameplate. Refer to Tables 23, 24, or 25 on pages 22–23 for drive input currents.

Connect input power leads L1, L2, and L3 to the input of the circuit breaker. Refer to Figures 12–16 (pages 46–50) for location. Refer to Tables 22, 23, or 24 (pages 51–53) for lug data and wire size range for drive input terminals L1, L2, and L3.

⚠ WARNING

IMPROPER OVERCURRENT COORDINATION

- Protective devices must be properly coordinated.
- Do not connect the drive to a power feeder whose short circuit capacity exceeds the short circuit rating listed on the drive nameplate.

Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION

EQUIPMENT DAMAGE FROM IMPROPER WIRING

- Do not connect input power leads to the drive output terminals (T1, T2, T3 or U, V, W). This damages the controller and voids the warranty.
- Check the power connections before energizing the controller.

Failure to follow these instructions can result in injury or equipment damage.

INPUT WIRING

The ampacity of the input power conductors should be sized according to the National Electrical Code, and applicable local codes, based on:

- Drive input current when controller has no bypass.
- Drive input current or motor full load current (whichever is greater) when controller has a bypass circuit.

GROUNDING

Ground the drive according to the National Electrical Code and all local codes. To ground the drive:

- Connect a copper wire from the ground bar terminal to the power system ground.
- Verify that the resistance to ground is 1 Ω or less. Improper grounding causes intermittent and unreliable operation.

⚠ DANGER

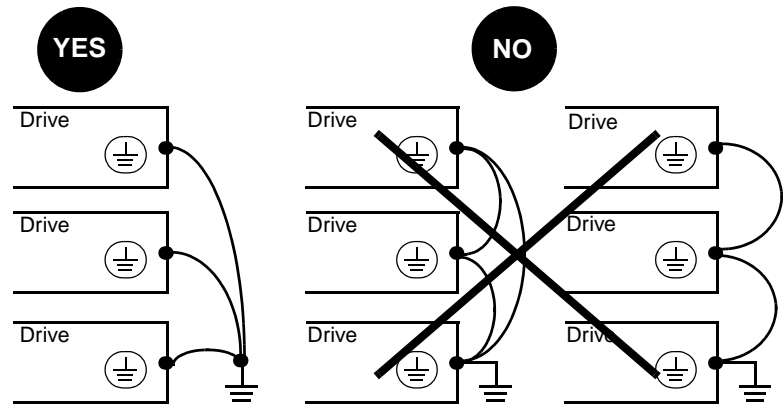
HAZARD OF ELECTRIC SHOCK FROM IMPROPER GROUNDING

- Ground equipment using the provided ground connection point as shown in Figures 12–16 starting on page 46. The drive panel must be properly grounded before power is applied.
- Do not use metallic conduit as a ground conductor.

Failure to follow these instructions will result in death or serious injury.

Ground multiple drives as shown in Figure 11 on page 40. Use one grounding conductor per device. Do not loop ground conductors or install them in series.

Figure 11: Grounding Multiple Drives



Wiring and Electromagnetic Compatibility

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and over travel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of anticipated transmission delays or failures of the link¹.
- Each implementation of a E-Flex enclosed drive must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems."

The high frequency equipotential ground connection between the drive, motor, and cable shielding does not eliminate the need to connect the ground (PE) conductors (green-yellow) to the appropriate terminals on each unit. To help accomplish this, follow these guidelines:

- To avoid communication interference, grounds between the drive, motor and cable shields must have high frequency equipotentiality.
- When using shielded cable for the motor, use a 4-conductor cable so that one wire will be the ground connection between the motor and the drive. Size of the ground conductor must be selected in compliance with local and national codes. The shield can then be grounded at both ends.

Metal ducting or conduit can be used for part or all of the shielding length, provided there is no break in continuity.

- When using shielded cable for control signals, if the cable is connecting equipment that is close together and the grounds are bonded together, then both ends of the shield can be grounded. If the cable is connected to equipment that may have a different ground potential, then ground the shield at one end only to prevent large currents from flowing in the shield. The shield on the ungrounded end may be tied to ground with a capacitor (for example: 10 nF, 100V or higher) in order to provide a path for the higher frequency noise.
- Ensure maximum separation between the power supply cable (line supply) and the motor cable and also ensure maximum separation between the control cables and any power cables.

OUTPUT WIRING

The ampacity of motor power conductors should be sized according to the motor full load current, National Electrical Code, and applicable local codes.

Connect motor conductors to the lugs provided and connect the motor ground to the ground bar provided. Connect motor conductors to T1, T2, and T3 on the overload relay when the controller is supplied with a bypass circuit. Connect motor conductors to T1/U, T2/V, and T3/W on the power converter, or T1, T2, and T3 on the distribution block (if supplied) when the controller is supplied without a bypass circuit. See Figures 12–16 starting on page 46 for location. See Tables 22, 23, and 24 (pages 51–53) for lug data and wire size range. Refer to the nameplate for torque requirements.

The drive is sensitive to the amount of capacitance (either phase-to-phase or phase-to-ground) present on the output power conductors. If excessive capacitance is present, the drive may trip on overcurrent.

Output Cable

Follow the guidelines below when selecting output cable:

- Cable type: the cable selected must have a low capacitance phase-to-phase and to ground. Do not use mineral-impregnated cable because it has a very high capacitance. Immersion of cables in water increases capacitance.
- Cable length: the longer the cable, the greater the capacitance. Cable lengths greater than 150 ft (50 m) may cause ground faults. For installation where cable capacitances may be a problem, a reactor or motor protection filter can be installed between the drive and the motor.

The following guidelines are designed to address maximum cable length for typical drive/motor applications:

These limits are based on the maximum recommended peak voltage that can be allowed at the motor terminals, which is due to the reflected wave phenomenon. This increase in voltage is primarily determined by the degree of impedance mismatch between the power conductor and the motor in combination of the dV/dt of the specific semiconductors used in the inverter section of the drive feeding the motor, both of which vary depending on the horsepower involved. Many variables can affect the performance of the drive, the motor, and the cables in long lead applications. Motor protection filters can provide substantial benefits when you are using:

- 460 V or higher rated AC drives
- Existing inverter duty motors subject to retrofit to an AC drive
- Shielded cables

NEMA MG-1 Part 31 compliant motors are recommended but not required. However, it is prudent to consult the motor manufacturer or vendor literature to address any specific limitations governing the application.

- Proximity to other output cables: because of high frequency switching and increased capacitance, the drive may trip under some conditions.
- **Do not use lightning arrestors or power factor correction capacitors on the output of the drive.**

For proper drive short circuit protection, certain values of inductance may be required in the output power wiring. Inductance can be supplied by the power wiring or auxiliary inductors.

⚠ CAUTION

INSUFFICIENT OUTPUT INDUCTANCE

A minimum inductance is needed to protect the drive output from short circuits. Provide at least 20 in. (500 mm) of cable at the drive outputs, T1/U, T2/V, and T3/W, and on distribution block terminals T1, T2, and T3 (for a controller without bypass) or overload relay terminals T1, T2, and T3 (for a controller with bypass).

Failure to follow these instructions can result in injury or equipment damage.

Table 18: Maximum Cable Length for Inverter Duty Motors

Drive Rating hp @ 480 V	Type of cable	Approximate length of motor cables							
		20 in. to 164 ft. (0.5 to 50 m)	164 to 328 ft. (50–100 m)	328 to 492 ft. (100–150 m)	492 to 656 ft. (150–200 m)	656 to 984 ft. (200–300 m)	984 to 1,312 ft. (300–400 m)	1,312 to 1,968 ft. (400–600 m)	1,968 to 3,280 ft. (600–1000 m)
1 to 20 hp CT 1 to 25 hp VT	Shielded		3% Load Reactor						
	Unshielded			3% Load Reactor					
25 to 100 hp CT 30 to 125 hp VT	Shielded			3% Load Reactor					Consult Factory
	Unshielded				3% Load Reactor				
125 to 450hp CT 150 to 500 hp VT	Shielded			3% Load Reactor					
	Unshielded				3% Load Reactor				

DC BUS VOLTAGE MEASUREMENT PROCEDURE

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand the DC Bus Voltage Measurement Procedure before performing the procedure. Measurement of bus capacitor voltage must be performed by qualified personnel.
- DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Many parts in this drive, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.

Failure to follow these instructions will result in death or serious injury.

The DC bus voltage level is determined by monitoring the PA/+ and PC/– terminals. The location of these terminals varies by power converter model number. Read the model number of the power converter from the nameplate, and identify the corresponding PA/+ and PC/– terminals. The power converter model number is listed on the nameplate. Refer to ATV61 installation manual for location of drive terminals.

To measure the DC bus capacitor voltage:

1. Observe the lockout/tagout procedures as identified in OSHA Standard 29 CFR, Subpart J covering:
 - 1910.147: The control of hazardous energy (lockout/tagout)
 - 1910.147: App A, Typical minimal lockout procedures.
2. Be sure to remove all external control power that may be present such as on the control board and the option board terminals.
3. Wait fifteen minutes for the DC bus capacitors to discharge.
4. Open the door of the drive.
5. Set the voltmeter to the 1000 Vdc scale. Measure the voltage between the PA/+ and PC/– terminals.
6. Verify that the DC bus voltage has discharged below 42 V before servicing the drive. If the DC bus capacitors will not discharge below 42 V, contact your local Schneider Electric representative. **Do not operate the drive.**
7. After servicing the drive, close and secure door.

WIRE ROUTING AND INTERCONNECTION

Wire Class

The Wire Class describes the compatibility of the field wiring terminal with the conductor material and insulation system. When used in conjunction with the required conductor current rating and controller ambient temperature rating, the Wire Class forms the basis for selecting a conductor size that limits the temperature on the conductor insulation at the field wiring terminal to acceptable limits. Although it is permissible to use conductors with operating temperatures exceeding those given by the Wire Class, conductor **size** must fall within the Wire Class limits.

Noise Class

The Noise Class categorizes the electromagnetic properties of the voltages and currents present. The Noise Class comprises of the six categories shown in Table 19.

Table 19: Noise Class Categories

Noise Class	Definition
Quiet Wiring 1 (QW1)	High susceptibility analog and digital control signals. Signals falling under this classification include digital communication/network circuits, controller analog I/O and analog process signals.
Quiet Wiring 2 (QW2)	Medium susceptibility, analog and digital control signals. Signals falling under this classification include 24 Vdc and Vac control circuits.
Standard Wiring 1 (SW1)	Low susceptibility control or power circuits rated less than 600 Vac (250 Vdc) and less than 15 A (voltage and current spectra are generally contained within 0.05–9 kHz). Signals falling under this classification include 120 Vac control circuits.
Standard Wiring 2 (SW2)	Power circuits rated greater than 15 A (voltage and current spectra are generally contained within 0.05–9 kHz). Signals falling under this classification include line power to controllers.
Standard Wiring 3 (SW3)	Reserved.
Pulse Wiring 1 (PW1)	Control or power circuits whose voltage or current spectra significantly exceed 9 kHz. Signals falling under this classification include motor and dynamic braking circuits fed from pulse width modulated (PWM) power converters.

Voltage Class

The Voltage Class categorizes the voltages present into recognized conductor insulation categories (30, 150, 300, and 600 V) for selection of the conductor voltage rating and physical segregation purposes.

Wiring Methods

Based upon the Noise Class and Voltage Class of the conductors, apply the wiring methods in Table 20 to the drive system.

Table 20: Wire Routing and Interconnection

Wiring Methods and Considerations	Noise Class of Conductors				
	QW1	QW2	SW1	SW2	PW1
Conductor Grouping in Wireways/Conduits					
1. All conductors of 1 or 3 phase AC power circuits must be bundled to minimize stray magnetic fields.			X	X	X
2. All conductors of a DC power circuit must be bundled to minimize stray magnetic fields.			X	X	X
3. When parallel conductors must be run in separate wireways or conduit, bundle conductors into groups that minimize stray magnetic fields.				X	X
4. Maintain conductor runs as short and direct as practical.	X	X	X	X	X
Separation of Circuits					
1. DO NOT run different Noise Class conductors in the same conduit.	X	X	X	X	X
2. DO NOT run different Voltage Class conductors in the same conduit unless all conductors are insulated for the maximum Voltage Class present.	X	X	X	X	X
3. All pulse wiring (PW) conductor groups must be individually segregated using metallic conduit.					X
4. Segregate all conductors by Noise Class. Use the following circuit separation when conductors can run parallel for more than 12 in.					
• Metallic conduit: 3 in. between quiet wiring (QW) to standard wiring (SW) / pulse wiring (PW)	X	X	X	X	X
• Metallic tray: 3 in. between SW to PW			X	X	X
• Metallic tray: 6 in. between QW to SW/PW	X	X	X	X	X
• Against continuous metal surface: 3 in. between SW to PW			X	X	X
• Against continuous metal surface: 6 in. between QW to SW/PW	X	X	X	X	X
• Metallic conduit housing QW: 12 in. to non-metallic conduit SW/PW	X	X	X	X	X
• Non-metallic conduit: 3 in. between SW to PW			X	X	X
• Non-metallic conduit: 24 in. between QW to SW/ PW	X	X	X	X	X
5. If QW and SW1 wiring must cross SW2 or PW1 wiring, the bundles must cross at right angles.	X	X	X	X	X
Common Mode Noise Issues					
1. Provide adjacent signal returns using twisted pair cable.	X	X			
2. Galvanically isolate signal and associated signal return path when possible.	X	X			
Shielding					
1. Use metallic conduit for all power and control circuits external to the controller enclosure.	X	X	X	X	X
2. Shields should be continuous and equipped with a drain wire.	X	X	X		
3. DO NOT group different Noise Class conductors within the same shield.	X	X	X	X	X
4. Minimize the non-shielded portion of conductor at the ends of shielded cable.	X	X	X	X	X
5. When shielding AC or DC power conductors, group conductors to minimize magnetic field in shield.			X	X	X
Grounding					
1. Ground shields only at the controller end.	X	X	X	X	X
2. Use separate ground wire for each shield ground.	X	X	X	X	X
3. Provide a ground wire with all conductor groups whether in tray or conduit.			X	X	X
4. When multiple grounds must be made to a shielded power cable, the shield must have the same short circuit withstand capability as the ground conductor in the power cable.			X	X	X
5. Terminate all power grounds and power shield grounds to the controller grounding point or bar.			X	X	X
6. Terminate all signal shield grounds to the terminals provided.	X	X			
7. Always supply a separate equipment grounding conductor with the controller power feed. DO NOT depend upon metallic conduit for ground connection.			X	X	X

COMPONENT IDENTIFICATION AND TERMINAL STRIP LOCATIONS

Figure 12 shows component identification and terminal strip locations for E-Flex drives 1–7.5 hp at 460 V and 1–5 hp at 208/230 V.

Tables 22, 23, and 24 (pages 51–53) list wire size range and terminal torque requirements.

NOTE: A typical device is shown with options. The Type 3R ventilation fan and space heater are not shown.

Figure 12: Typical Component Identification and Terminal Strip Locations for 1–7.5 hp @ 460 V and 1–5 hp @ 208/230 V

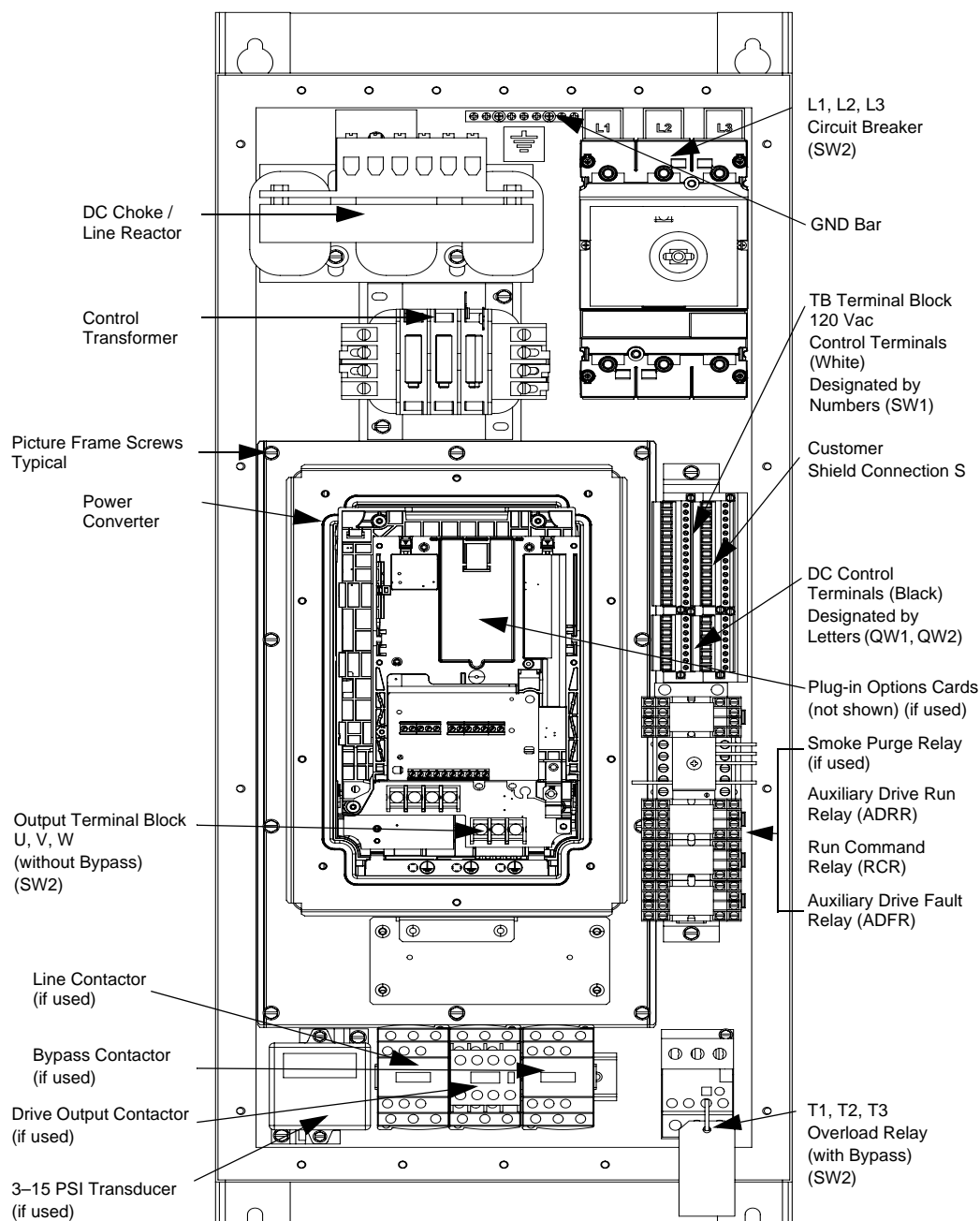


Figure 13 shows component identification and terminal strip locations for E-Flex drives 10–25 hp at 460 V and 7.5–10 hp at 208/230 V. Tables 22, 23, and 24 (pages 51–53) list wire size range and terminal torque requirements.

NOTE: A typical device is shown with options. The Type 3R ventilation fan and space heater are not shown.

Figure 13: Typical Component Identification and Terminal Strip Locations for 10–25 hp @ 460 V and 7.5–10 hp @ 208/230 V

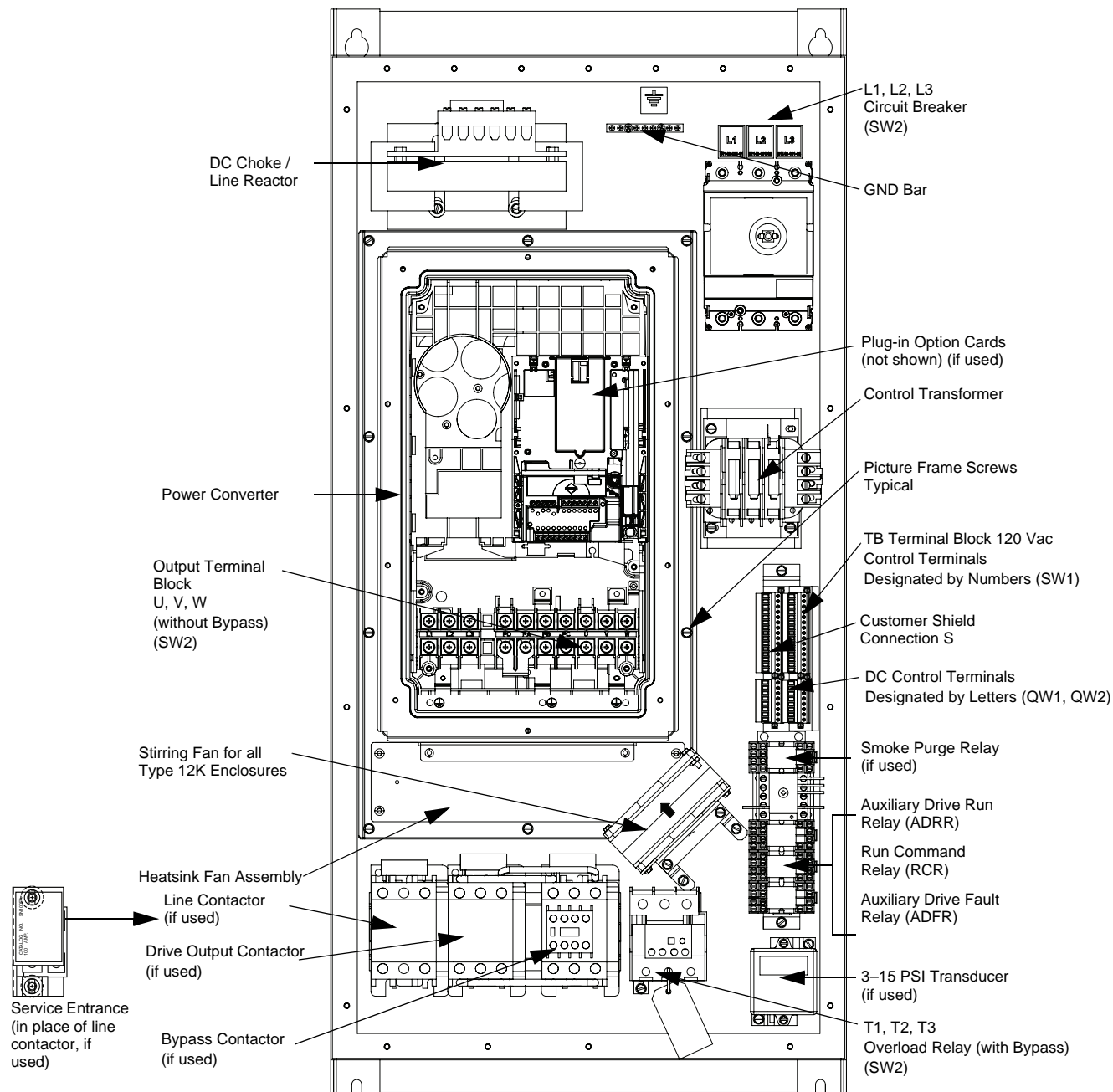


Figure 14 shows component identification and terminal strip locations for E-Flex drives 30–50 hp at 460 V and 15–25 hp at 208/230 V. Tables 22, 23, and 24 (pages 51–53) list wire size range and terminal torque requirements.

NOTE: A typical device is shown with options. The Type 3R ventilation fan and space heater are not shown.

Figure 14: Typical Component Identification and Terminal Strip Locations for 30–50 hp @ 460 V and 15–25 hp @ 208/230 V

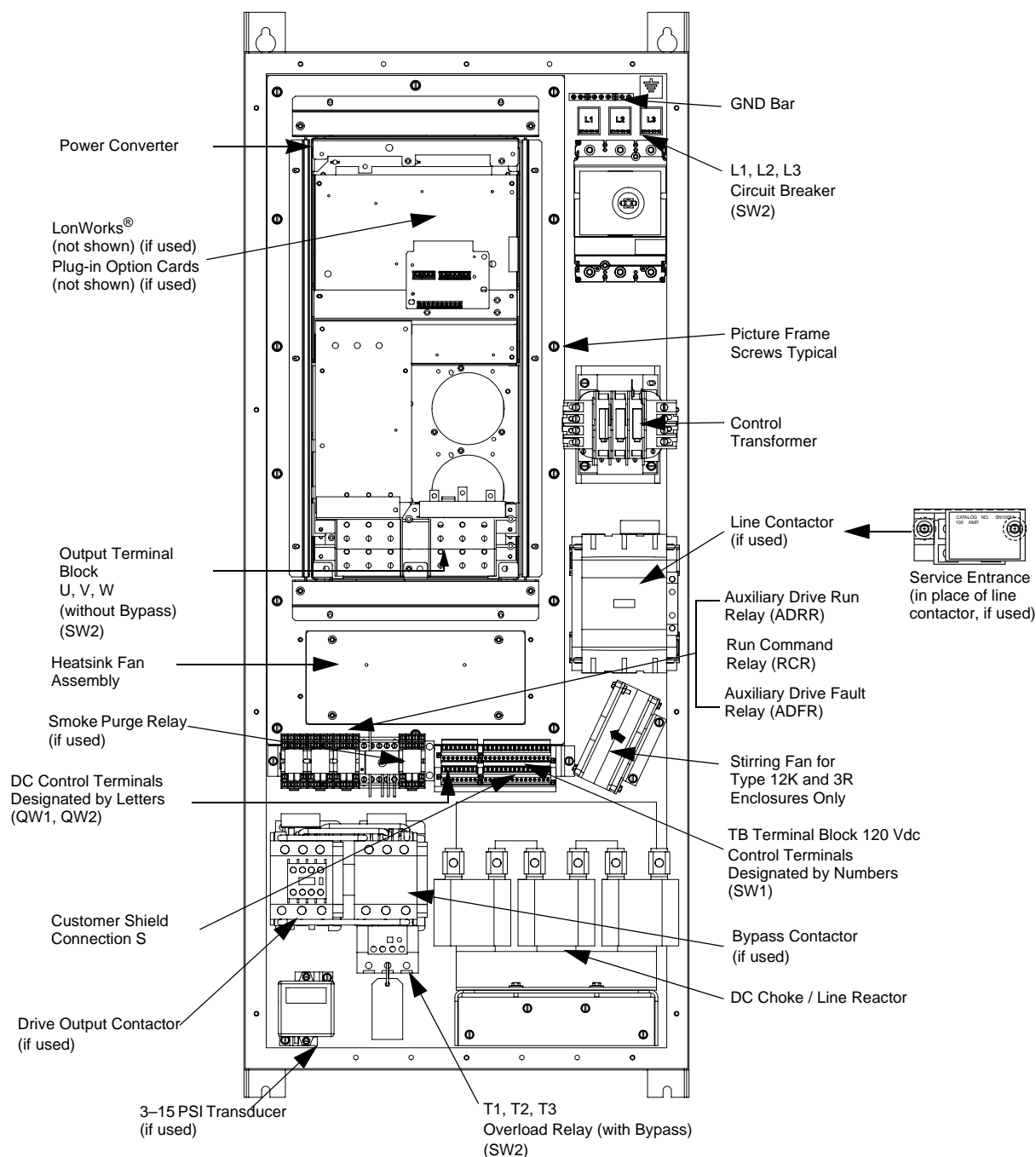


Figure 15 shows component identification and terminal strip locations for E-Flex drives 60–100 hp at 460 V and 30–50 hp at 208/230 V. Tables 22,

23, and 24 (pages 51–53) list wire size range and terminal torque requirements.

NOTE: A typical device is shown with options. The Type 3R ventilation fan and space heater are not shown.

Figure 15: Typical Component Identification and Terminal Strip Locations for 60–100 hp With Bypass @ 460 V and 30–50 hp @ 208/230 V

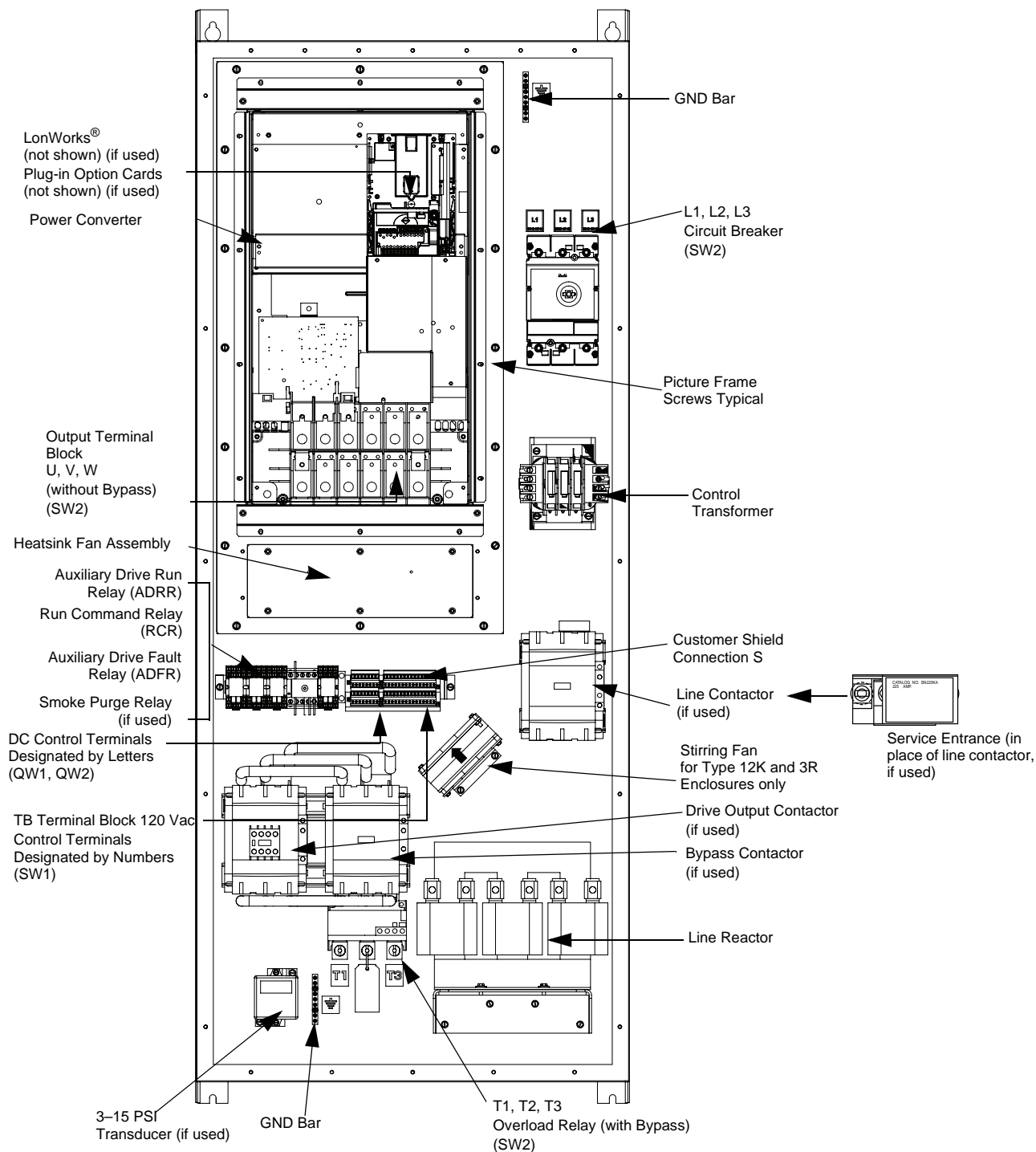
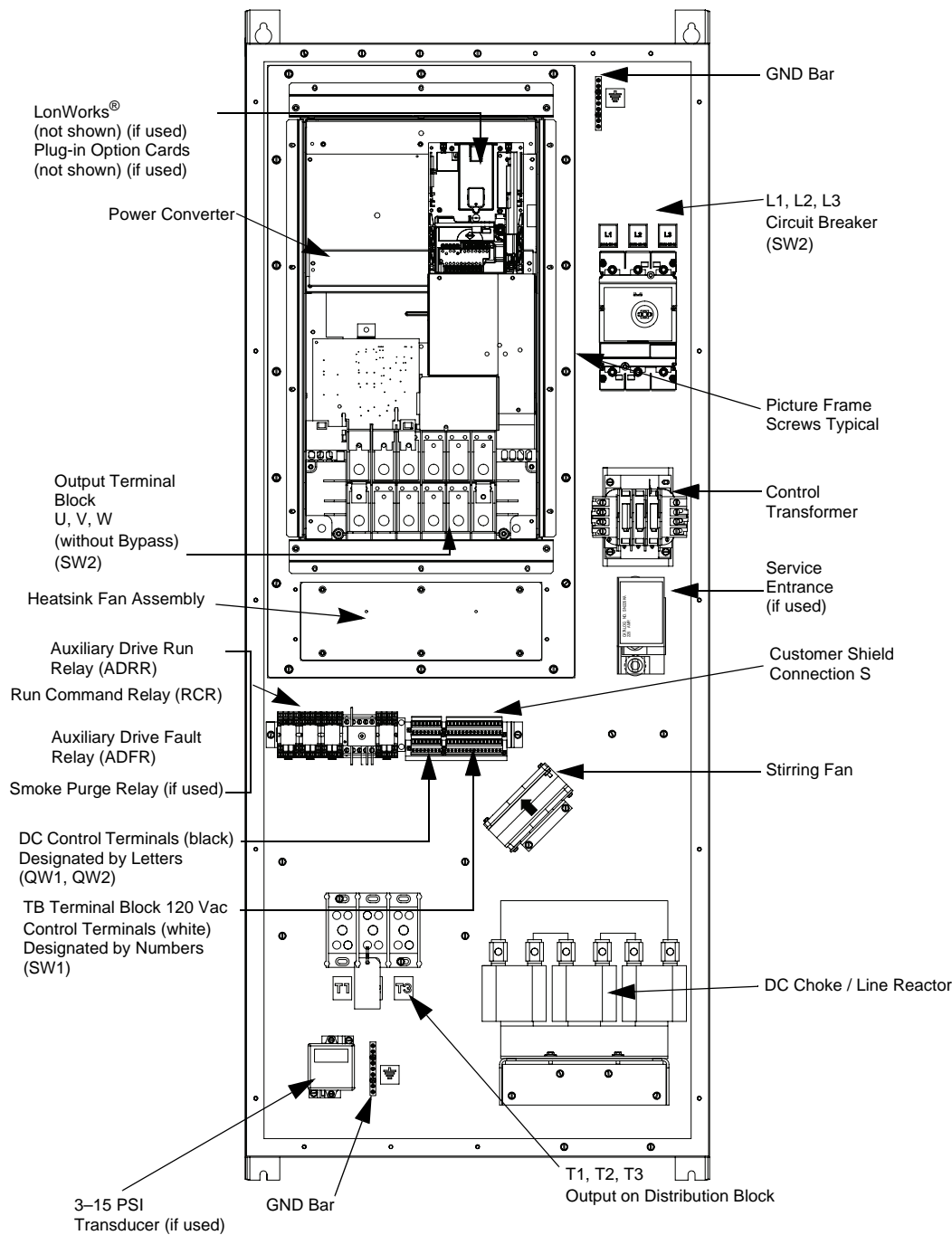


Figure 16: Typical Component Identification and Terminal Strip Locations Without Bypass for 60–100 hp @ 460 V and 30–50 hp @ 208/230 V



POWER WIRING

Table 21: Power Terminal Functions

Terminal	Function
GND	Ground Bar
L1 L2 L3	3-phase input power supply (at top of circuit breaker)
T1 T2 T3	Output connections to motor for controller with bypass (at bottom of overload relay), or distribution block for controller without bypass
T1/U T2/V T3/W	Output connections to motor for controller without bypass (power converter output terminal)

Table 22: Power Terminal Wire Range, 460 V

VT	Terminals									
	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)
hp	L1, L2, L3 (Line)		T1/U, T2/V, T3/W (Load)		Distribution Block Terminals (Non-Bypass) T1, T2, T3 (load)		Overload Relay Output Terminals (Bypass) T1, T2, T3 (Load)		GND Bar	
1	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
2	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
3	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
5	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
7.5	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
10	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	8 (6)	26.5 (3)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
15	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	8 (6)	26.5 (3)	2/0 (67.4)	40 (4.5)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
20	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	4 (16)	26.5 (3)	2/0 (67.4)	40 (4.5)	6 (13.3)	15 (1.69)	4 (21.15)	20 (2.26)
25	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	2 (35)	47.7 (5.4)	2/0 (67.4)	40 (4.5)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
30	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	2 (35)	47.7 (5.4)	2/0 (67.4)	120 (3.6)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
40	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	1/0 (50)	106.2 (12)	2/0 (67.4)	120 (3.6)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
50	14–10 (2.5–6) 8–3/0 (10–95)	50 (5) 120 (14)	1/0 (50)	106.2 (12)	350 (177)	250 (28.3)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
60	1/0–4/0 (50–95)	225 (25)	1/0 (50)	106.2 (12)	350 (177)	250 (28.3)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
75	3/0–350 (120–185)	225 (25)	300 (150)	360 (41)	350 (177)	250 (28.3)	250 (127)	300 (33.9)	4 (21.15)	20 (2.26)
100	3/0–350 (120–185)	225 (25)	300 (150)	360 (41)	350 (177)	250 (28.3)	250 (127)	300 (33.9)	4 (21.15)	20 (2.26)

Table 23: Power Terminal Wire Range, 230 V

VT	Terminals									
	Maximum Wire Size	Terminal Torque	Maximum Wire Size	Terminal Torque	Maximum Wire Size	Terminal Torque	Maximum Wire Size	Terminal Torque	Maximum Wire Size	Terminal Torque
	AWG (mm ²)	lb-in (N•m)	AWG (mm ²)	lb-in (N•m)	AWG (mm ²)	lb-in (N•m)	AWG (mm ²)	lb-in (N•m)	AWG (mm ²)	lb-in (N•m)
hp	L1, L2, L3 (Line)		T1/U, T2/V, T3/W (Load)		Distribution Block Terminals (Non-Bypass) T1, T2, T3 (load)		Overload Relay Output Terminals (Bypass) T1, T2, T3 (Load)		GND Bar	
1	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
2	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
3	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
5	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
7.5	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	40 (4.5)	6 (13.3)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
10	14–10 (2.5–6)	50 (5)	8 (6)	26.5 (3)	2/0 (67.4)	40 (4.5)	6 (13.3)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
15	14–10 (2.5–6)	50 (5)	4 (16)	26.5 (3)	2/0 (67.4)	120 (13.5)	6 (13.3)	75 (8.47)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
20	14–10 (2.5–6)	50 (5)	2 (35)	47.7 (5.4)	400 (203)	250 (28.3)	6 (13.3)	75 (8.47)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
25	1/0–4/0 (50–95)	225 (25)	2 (35)	47.7 (5.4)	400 (203)	250 (28.3)	6 (13.3)	75 (8.47)	4 (21.15)	20 (2.26)
30	3/0–350 (120–185)	225 (25)	1/0 (50)	106.2 (12)	350 (177)	250 (28.3)	3/0 (85)	200 (22.6)	4 (21.15)	20 (2.26)
40	3/0–350 (120–185)	225 (25)	1/0 (50)	106.2 (12)	350 (177)	250 (28.3)	3/0 (85)	200 (22.6)	4 (21.15)	20 (2.26)
50	3/0–350 (120–185)	225 (25)	300 (150)	360 (41)	350 (177)	250 (28.3)	3/0 (85)	200 (22.6)	4 (21.15)	20 (2.26)

Table 24: Power Terminal Wire Range, 208 V

VT	Terminals									
	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)
hp	L1, L2, L3 (Line)		T1/U, T2/V, T3/W (Load)		Distribution Block Terminals (Non-Bypass) T1, T2, T3 (load)		Overload Relay Output Terminals (Bypass) T1, T2, T3 (Load)		GND Bar	
1	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
2	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
3	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
5	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	35 (4.0)	10 (5.26)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
7.5	14–10 (2.5–6)	50 (5)	10 (4)	12.3 (1.4)	2/0 (67.4)	40 (4.5)	6 (13.3)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
10	14–10 (2.5–6)	50 (5)	8 (6)	26.5 (3)	2/0 (67.4)	40 (4.5)	6 (13.3)	15 (1.69)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
15	14–10 (2.5–6)	50 (5)	4 (16)	26.5 (3)	2/0 (67.4)	120 (13.5)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
20	14–10 (2.5–6)	50 (5)	2 (35)	47.7 (5.4)	400 (203)	250 (28.3)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
	8–3/0 (10–95)	120 (14)								
25	1/0–4/0 (50–95)	225 (25)	2 (35)	47.7 (5.4)	400 (203)	250 (28.3)	1/0 (53.5)	75 (8.47)	4 (21.15)	20 (2.26)
30	3/0–350 (120–185)	225 (25)	1/0 (50)	106.2 (12)	350 (177)	250 (28.3)	3/0 (85)	200 (22.6)	4 (21.15)	20 (2.26)
40	3/0–350 (120–185)	225 (25)	1/0 (50)	106.2 (12)	350 (177)	250 (28.3)	3/0 (85)	200 (22.6)	4 (21.15)	20 (2.26)
50	3/0–350 (120–185)	225 (25)	300 (150)	360 (41)	350 (177)	250 (28.3)	3/0 (85)	200 (22.6)	4 (21.15)	20 (2.26)

Table 25: Service Entrance Ground Wire Range

VT	Terminals			
	208/230 V		460 V	
	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)	Maximum Wire Size AWG (mm ²)	Terminal Torque lb-in (N•m)
hp	Service Entrance Ground Lug			
1	—	—	—	—
2	—	—	—	—
3	—	—	—	—
7.5	14–1/0 (2–54) ¹	75 (8.47) ¹	—	—
10	14–1/0 (2–54) ¹	75 (8.47) ¹	14–1/0 (2–54) ¹	75 (8.47) ¹
15	14–1/0 (2–54) ¹	75 (8.47) ¹	14–1/0 (2–54) ¹	75 (8.47) ¹
20	14–1/0 (2–54) ¹	75 (8.47) ¹	14–1/0 (2–54) ¹	75 (8.47) ¹
25	14–1/0 (2–54) ¹	75 (8.47) ¹	14–1/0 (2–54) ¹	75 (8.47) ¹
30	3–300 (27–150) ¹	250 (28.2) ²	14–1/0 (2–54) ¹	75 (8.47) ¹
40	3–300 (27–150) ²	250 (28.2) ²	14–1/0 (2–54) ¹	75 (8.47) ¹
50	3–300 (27–150) ²	250 (28.2) ²	3–300 (27–150) ²	250 (28.2) ²
60	—	—	3–300 (27–150) ²	250 (28.2) ²
75	—	—	3–300 (27–150) ²	250 (28.2) ²
100	—	—	3–300 (27–150) ²	250 (28.2) ²

¹ Specifications are for the mail lug only. See the component label for wire and torque specifications for other grounding terminals.

CONTROL WIRING

Table 26: I/O Extension (MOD H09)

Terminal ^{1,2}	Function	Characteristics
AO2, AO3 ³	Analog output programmed for motor frequency	0–20 mA Z = 500 Ω Reassignable x–y range with keypad
COM	Common for analog output	0 V

¹ See the Control Circuit Elementary Diagrams in Section 5.

² The green Phoenix terminals are rated 250 V, 12 A.
Max. wire size for the Phoenix terminals:
12 AWG (2.5 mm²)—1 wire
16 AWG (1.5 mm²)—2 wire
Tightening torque: 4.5 lb-in (0.5 N•m) min.

³ Analog output “AO1” is standard on the terminal block

Table 27: 0–10 V Auto Speed Reference (MOD J09)

Terminal ^{1,2}	Function	Characteristics
G1, S2+	AI2 Input	0–10 V, Z = 30 kΩ
J/S3	COM	

¹ See the Control Circuit Elementary Diagrams in Section 5.

² The green Phoenix terminals are rated 250 V, 12 A.
Max. wire size for the Phoenix terminals:
12 AWG (2.5 mm²)—1 wire
16 AWG (1.5 mm²)—2 wire
Tightening torque: 4.5 lb-in (0.5 N•m) min.

NOTE: Refer to Table 26 for characteristics of the analog output available with MOD H09.

Table 28: Terminal Block Characteristics

Terminal ^{[1][2]}	Function	Characteristics
A, A1	+24 V (+24 V control supply)	Minimum: 21 V; Maximum: 27 V; I = 200 mA maximum ^[5]
B	LI3 (Logic Input 3) programmed for Reference Switching Auto/Manual	24 Vdc, 10 mA State 0: V<5 V; State 1: V>11 V; Z = 3.5 kΩ
C	LI4 (Logic Input 4) programmed for Fault Reset. Communication option programmed for Forced Local.	24 Vdc, 10 mA State 0: V<5 V; State 1: V>11 V; Z = 3.5 kΩ
D	LI2 (Logic Input 2) programmed for Freewheel Stop on bypass. Also programmed for Freewheel Stop on Hand-Off-Comm. Without bypass, not assigned.	24 Vdc, 10 mA State 0: V<5 V; State 1: V>11 V; Z = 3.5 kΩ
E F	Line contactor auxiliary contact or jumper LI1 (Logic Input 1) programmed for Run Forward	24 Vdc, 10 mA State 0: V<5 V; State 1: V>11 V; Z = 3.5 kΩ
G1, S2+ +10 ^[10]	AI2 (Analog Input 2 programmed for Speed Reference Current or Voltage) +10 V Reference Supply	4–20 mA ^[6] , Z = 250 Ω, 0–10 V, 30 kΩ 10 V, I = 10 mA maximum
AI1+ ^[10]	AI1 (Analog Input 1) programmed for Speed Reference Voltage	0–10 V, Z = 30 kΩ (bipolar differential)
J/S3	COM (Speed Reference Common)	0 V
S1	Shield	
1 2	Fire/Freezestat Interlocks	Provision for user-supplied, N.C. fire/freezestat contact.
2	Control Transformer (Ungrounded)	115 Vac, 60 Hz [100 VA Type 1 and 12K, ^[8] 350 VA Type 3R ^[9]
2 3	Smoke Purge Relay Contact ^[7]	Normally-jumpered or N.C. SPR contact when option is supplied.
3 4	AFC Select ^[7]	Supplied with bypass circuit

Notes to Table 28:

- ¹ See the Control Circuit Elementary Diagrams in Section 5.
- ² All green Phoenix terminals are rated 250 V, 12 A.
Max. wire size for all Phoenix terminals: 12 AWG (2.5 mm²)—1 wire; 16 AWG (1.5 mm²)—2 wire; Tightening torque: 4.5 lb-in (0.5 N•m) min.
- ³ Relay coil deenergizes on detected fault. Contacts are shown in detected fault mode.
- ⁴ Contact state with drive deenergized.
- ⁵ Total current of +24 V internal supply is 200 mA. If more current is required, an external supply must be used.
- ⁶ 0–20 mA, X–Y programmable with keypad display.
- ⁷ Available only when option is provided.
- ⁸ Approximately 45 VA available when all mods are selected.
- ⁹ Approximately 58 VA available when all mods are selected.
- ¹⁰ Terminal located on power converter.

Table 28: Terminal Block Characteristics (continued)

Terminal ^{[1][2]}	Function	Characteristics	Notes to Table 28:
3 5	Bypass Select ^[7]	Supplied with bypass circuit	¹ See the Control Circuit Elementary Diagrams in Section 5.
6 7	Auto Enabled	User-supplied auto start contact (run permissive)	² All green Phoenix terminals are rated 250 V, 12 A. Max. wire size for all Phoenix terminals: 12 AWG (2.5 mm ²)—1 wire; 16 AWG (1.5 mm ²)—2 wire; Tightening torque: 4.5 lb-in (0.5 N•m) min.
6A 8	Stop Push Button ^[7]		³ Relay coil deenergizes on detected fault. Contacts are shown in detected fault mode.
6 8	Start Push Button and Interlock ^[7]		⁴ Contact state with drive deenergized.
9	AFC Fault Pilot Light ^[7]		⁵ Total current of +24 V internal supply is 200 mA. If more current is required, an external supply must be used.
10A	Auto Pilot Light ^[7]		⁶ 0–20 mA, X–Y programmable with keypad display.
10	AFC Run Pilot Light ^[7]		⁷ Available only when option is provided.
11	Line Contactor Coil ^[7]		⁸ Approximately 45 VA available when all mods are selected.
12 13	Normal Contact of Test-Normal Switch ^[7]		⁹ Approximately 58 VA available when all mods are selected.
14 -15	Bypass Pilot Light ^[7]		¹⁰ Terminal located on power converter.
16 17 18	AFC Run Contacts ^[4] Auxiliary N.C. Contact (AFC Run) COM Auxiliary N.O. Contact (AFC Run)	Minimum: 10 mA, 24 Vdc; Maximum: Inductive load of: <ul style="list-style-type: none"> • 2.0 A @ 120 Vac; maximum 0.10 J/operation, 80 operations/minute • 1.0 A @ 220 Vac; maximum 0.25 J/operation, 25 operations/minute • 2.0 A @ 24 Vac; maximum 0.10 J/operation, 80 operations/minute 	
19 20 21	AFC Fault Contacts ^[3] Auxiliary N.C. Contact (AFC Fault) COM Auxiliary N.O. Contact (AFC Fault)	Minimum: 10 mA, 24 Vdc; Maximum: Inductive load of: <ul style="list-style-type: none"> • 2.0 A @ 120 Vac; maximum 0.10 J/operation, 80 operations/minute • 1.0 A @ 220 Vac; maximum 0.25 J/operation, 25 operations/minute • 2.0 A @ 24 Vac; maximum 0.10 J/operation, 80 operations/minute 	
22 23	120 Vac Smoke Purge Relay coil ^[7]	115–120 Vac/60 Hz supply (user supplied)	
24	Control Transformer (Grounded), End Damper Solenoid (–)	115 Vac, 60 Hz	
25	End Damper Solenoid (+) ^[7]	User supplied	
25, 26	Customer Damper End Switch	User supplied	
3, 3A	Fire/Freezestat Interlock for H-O-C with bypass	Provision for user supplied with N.C. contact	
A, D	Fire/Freezestat Interlock for H-O-C without bypass	Provision for user supplied with N.C. contact	
A01	Analog output configurable for voltage or current (programmed for Motor Frequency)	0–10 V, min., Z = 470 Ω 0–20 mA, max., Z = 500 Ω ^[6]	
COM	Common, Analog I/O Common	0 V	
A, A1	Smoke Purge Relay Contact ^[7]	Normally jumpered; N.C. SPR contact when option is supplied.	

INITIAL START-UP PROCEDURE

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Before working on this equipment, turn off all power supplying it and perform the bus voltage measurement procedure on page 42.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK

- Properly ground the controller panel before applying power.
- Close and secure the enclosure door before applying power.
- Certain adjustments and test procedures require that power be applied to this controller. Extreme caution must be exercised as hazardous voltages exist. The enclosure door must be closed and secured while turning on power or starting and stopping this controller.

Failure to follow these instructions will result in death or serious injury.

DANGER

UNQUALIFIED PERSONNEL

- This equipment must be installed and serviced only by qualified personnel.
- Qualified personnel performing diagnostics or troubleshooting requiring electrical conductors to be energized must comply with NFPA 70 E - Standard for Electrical Safety Requirements for Employee Workplaces and OSHA Standards – 29 CFR Part 1910 Subpart S Electrical.

Failure to follow these instructions will result in death or serious injury.

The E-Flex drive has been configured for the installed options and tested at the factory. Minor adjustments to complete the field installation may be required based upon the application requirements. This initial start-up procedure should be followed step by step. In case of difficulty, refer to Section 4, Troubleshooting and Maintenance, beginning on page 87.

A door-mounted or remote-mounted graphic display must be used to perform the initial start-up procedure. Type 3R enclosures include a graphic display terminal cable and graphic display terminal located inside the enclosure.

To perform any programming on the Type 3R enclosure:

1. **Remove all power**, then test for the absence of voltage.
NOTE: Verify the voltage tester is functioning properly before and after testing for the absence of voltage.
2. Open the door of the drive. To open the door, turn the circuit breaker and handle assembly to the Off position.
3. Remove the graphic display terminal and cable from inside the enclosure.
4. Connect the graphic display terminal cable to the power converter and graphic display terminal.
5. Place the graphic display terminal cable outside the enclosure by positioning the cable in the bottom left corner between the hinge and bottom of the door.
6. Close and secure the enclosure door.
7. Close the equipment disconnect means.
8. Perform programming on keypad.
9. When programming is completed, **remove all power**, then test for the absence of voltage.
10. Open the enclosure door.
11. Remove the graphic display terminal cable from the power converter.
12. Place the graphic display terminal and cable inside the enclosure.
Ensure that the graphic display terminal is not left in the bottom of the enclosure.
13. Close and secure the enclosure door.

After replacing the power converter or installing any plug-in option card, the programming parameters must be set as listed in the elementary diagram that corresponds to the options ordered. See pages 100–114.

In addition, after installing any plug-in option card for the first time, previously-saved parameters downloaded from the graphic display terminal or PC software will not be correct because they do not include the additional parameters available with the card. The I/O extension card parameters must be set as listed in the elementary diagram that corresponds to the options ordered. See pages 100–114.

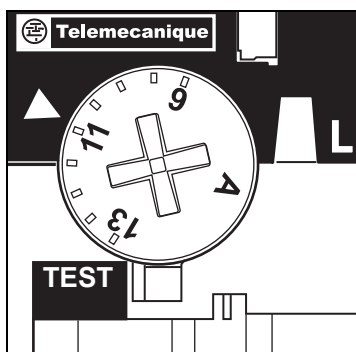
With all incoming power removed, make the following equipment checks:

- A. Verify that all equipment disconnects are open.
- B. Set the Hand-Off-Auto or Hand-Off-Comm selector switch (controller mounted or remotely mounted) to Off and the AFC-Off-Bypass switch (if used) to Off.
- C. Set the speed potentiometer (controller mounted or remotely mounted) to its minimum setting (full counterclockwise position).
- D. Open the enclosure door. To open the door, turn the circuit breaker and handle assembly to the Off position.
- E. Check the wiring of the input power ground, motor ground, speed potentiometer (if remotely mounted), and Hand-Off-Auto or Hand-Off-Comm circuit connections (if remotely mounted). See the control circuit elementary diagrams in Section 5 beginning on page 99 for the wiring of the remote control operators.
- F. When using the bypass circuit, check that the motor conductors are wired to the T1, T2, and T3 terminals of the overload relay. When using the power circuit *without* bypass, check the motor conductors wired to T1/U, T2/V, and T3/W of the controller, or T1, T2, and T3 of the distribution block.
- G. If the controller includes a bypass option for running the motor across the line, set the overload relay dial (on the load side of the bypass contactor) to the full load ampere rating on the nameplate of the connected motor. See the example at left.
- H. Using a voltmeter set at the 1000 Vac scale, verify that the incoming line voltage at the line side of the disconnecting means is within $\pm 10\%$ of the input voltage rating on the controller nameplate.
- I. Close and secure the enclosure door. Close the equipment disconnect means. The Power On pilot light (if used) illuminates.

This drive does not provide direct thermal protection for the motor. Consult the motor manufacturer for the thermal capability of the motor when operated over the desired speed range.

Figure 17: Overload Relay Dial

NOTE: The LR2D1516 overload relay is shown. Your dial setting range may be different.



⚠ CAUTION

MOTOR OVERHEATING HAZARD

Use a thermal sensor in the motor as required by the motor manufacturer to help facilitate motor overheating protection at all speeds and load conditions.

Failure to follow these instructions can result in injury or equipment damage.

- J. Press the ESC key on the graphic keypad until "MAIN MENU" is displayed and "DRIVE MENU" is highlighted. Press the keypad knob (ENT) twice. The "SIMPLY START" menu is displayed. Rotate the keypad knob clockwise until "Mot. therm. current" is highlighted. Press ENT. Rotate the keypad knob until the display indicates the correct motor nameplate full load amperes. Press ENT. The controller is now

calibrated to provide motor overload protection. Press ESC three times to return to the monitor screen.

NOTE: The settings listed in this procedure are suitable for most applications. If your application requires different operating characteristics, refer to the Programming Manual, on CD-ROM W817574030111 for more information.

⚠ WARNING

HAZARDOUS MOVING PARTS

Before starting the drive, ensure that the motor and its connected load are clear from personnel and are ready to run.

Failure to follow these instructions can result in death or serious injury.

- K. Set the AFC-Off-Bypass selector switch (if used) to AFC; the Normal-Test selector switch (if used) to Normal; and the Hand-Off-Auto or Hand-Off-Comm selector switch to Hand (push Start if the Start/Stop push buttons are used). If using a manual speed potentiometer, slowly turn it clockwise to accelerate the motor. If using the graphic keypad knob for potentiometer mode, rotate the keypad knob clockwise until "HMI frequency ref." is highlighted. Press ENT. Slowly rotate the keypad knob clockwise to accelerate the motor. Check the direction of motor rotation. If correct, proceed to step P. If incorrect, stop the drive. **Remove all power!**

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying this equipment and perform the bus voltage measurement procedure on page 42 before proceeding.

Failure to follow these instructions will result in death or serious injury.

- L. Correct the direction of motor rotation by reversing any two motor leads connected to the controller output (see Step F, page 57).
- M. Reset the speed potentiometer to minimum speed (counterclockwise) or until graphic display terminal motor frequency reads zero. Close and secure the enclosure door, then reapply power and restart the controller.
- N. If using a manual speed potentiometer, slowly turn it clockwise to accelerate the motor. If using the graphic keypad knob for potentiometer mode, rotate the keypad knob clockwise until "HMI frequency ref." is highlighted. Press ENT. Slowly rotate the keypad knob clockwise to accelerate the motor. Check the direction of motor rotation. If correct, this completes the controller mode, motor rotation check.

CAUTION

RISK OF CONTROLLER DAMAGE

- Move the Hand-Off-Auto switch to the Off position before moving the AFC-Off-Bypass switch from AFC to the Off position.
- Avoid repeated opening of the drive output contactor while under load.

Failure to follow these instructions can result in equipment damage.

- O. Set the AFC-Off-Bypass selector switch (if used) to Off, leaving the Hand-Off-Auto or Hand-Off-Comm selector switch in the Hand position.

NOTE: If the controller circuit breaker trips during this test, a higher trip setting may be required. Refer to "Circuit Breaker Trip Adjustment Procedure" on page 56.

- P. Momentarily set the AFC-Off-Bypass selector switch to Bypass to check the direction of motor rotation, then return it immediately to the Off position. If the direction of motor rotation is correct, proceed to Step S. If incorrect, stop the drive. **Remove all power!**

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying this equipment and perform the bus voltage measurement procedure on page 42 before proceeding.

Failure to follow these instructions will result in death or serious injury.

- Q. Correct the direction of motor rotation by reversing any two incoming leads to the circuit breaker disconnect means marked L1, L2, or L3.
- R. Momentarily set the AFC-Off-Bypass selector switch to Bypass to check the direction of motor rotation, then return it immediately to the Off position. If correct, this completes the bypass mode motor rotation check.
- S. Check the High Speed (HSP) setting (maximum motor speed setting). Press the ESC key on the graphic keypad until "MAIN MENU" is displayed and "DRIVE MENU" is highlighted. Press the keypad knob (ENT) twice. The "SIMPLY START" menu is displayed. Rotate the keypad knob clockwise until "High Speed" is highlighted. Press ENT. Rotate the keypad knob until the display indicates the maximum output frequency required for the application (factory default is 60 Hz), then press ENT. The controller HSP setting is now complete.
Refer to the *Programming Manual, W817574030111 (CD-ROM)*.¹
- T. Check the Low Speed (LSP) setting (minimum motor speed setting). Continuing from step S above, rotate the keypad knob counter-clockwise until "Low Speed" is highlighted. Press ENT. Rotate the keypad knob until the display indicates the minimum output frequency required for the application (preset value is 3 Hz; factory default is 0 Hz), then press ENT. The controller LSP setting is now complete. Press ESC three times to return to the monitor screen.
Refer to the *Programming Manual, W817574030111 (CD-ROM)*.¹
- U. The application may require changing the setting of acceleration (ACC) and deceleration (dEC) times. Preset value is 10 seconds. If the power converter has been replaced or reset to factory default, the value will be 3 seconds. To change the setting, press the ESC key on the graphic keypad until "MAIN MENU" is displayed and "DRIVE MENU" is highlighted. Press the keypad knob (ENT) twice. The "SIMPLY START" menu is displayed. Rotate the keypad knob clockwise until "Acceleration" is highlighted. Press ENT. Rotate the keypad knob until the display indicates the acceleration time required for the application, then press ENT. Rotate the keypad knob counter-clockwise until "Deceleration" is highlighted. Press ENT. Rotate the keypad knob until the display indicates the deceleration time required for the application, then press ENT. The controller acceleration and deceleration time setting is now complete. Press ESC three times to return to the monitor screen.

¹ See the ATV61 Installation Manual and the ATV61 Programming Manual. These manuals are available from the Technical Library at www.Schneider-electric.us.

**CIRCUIT BREAKER TRIP ADJUSTMENT
PROCEDURE**

All circuit breakers with an “H” prefix have no adjustment; they have fixed trip units. All circuit breakers with a “J” prefix have adjustable trip settings, and should be set as shown in the tables for the controller selected.

Table 29: Circuit Breaker Trip Adjustment, 460 V

hp-VT	Circuit Breaker	Fixed Trip Unit Short-Circuit Protection		Adjustable Trip Unit Short-Circuit Protection			
		Hold (A)	Trip (A)	Low (A)	High (A)	Drive only Set (A)	Drive w/ Bypass Set (A)
1	HLL36015	350	750	—	—	—	—
2	HLL36015	350	750	—	—	—	—
3	HLL36015	350	750	—	—	—	—
5	HLL36015	350	750	—	—	—	—
7.5	HLL36025	350	750	—	—	—	—
10	HLL36025	400	850	—	—	—	—
15	HLL36050	400	850	—	—	—	—
20	HLL36060	800	1450	—	—	—	—
25	HLL36080	800	1450	—	—	—	—
30	HLL36100	900	1700	—	—	—	—
40	HLL36125	900	1700	—	—	—	—
50	HLL36150	900	1700	—	—	—	—
60	JLL36175	—	—	875	1750	876	1001
75	JLL36225	—	—	1125	2250	1125	1248
100	JLL36250	—	—	1250	2500	1447	1612

Table 30: Circuit Breaker Trip Adjustment, 230 V

hp-VT	Circuit Breaker	Fixed Trip Unit Short-Circuit Protection		Adjustable Trip Unit Short-Circuit Protection			
		Hold (A)	Trip (A)	Low (A)	High (A)	Drive only Set (A)	Drive w/ Bypass Set (A)
1	HLL36015	350	750	—	—	—	—
2	HLL36015	350	750	—	—	—	—
3	HLL36025	350	750	—	—	—	—
5	HLL36040	400	850	—	—	—	—
7.5	HLL36060	800	1450	—	—	—	—
10	HLL36070	800	1450	—	—	—	—
15	HLL36110	900	1700	—	—	—	—
20	HLL36125	900	1700	—	—	—	—
25	JLL36175	—	—	875	1750	875	884
30	JLL36200	—	—	1000	2000	1000	1040
40	JLL36250	—	—	1250	2500	1250	1352
50	JLL36250	—	—	1250	2500	1511	1690

Table 31: Circuit Breaker Trip Adjustment, 208 V

hp-VT	Circuit Breaker	Fixed Trip Unit Short-Circuit Protection		Adjustable Trip Unit Short-Circuit Protection			
		Hold (A)	Trip (A)	Low (A)	High (A)	Drive only Set (A)	Drive w/ Bypass Set (A)
1	HLL36015	350	750	—	—	—	—
2	HLL36015	350	750	—	—	—	—
3	HLL36025	350	750	—	—	—	—
5	HLL36040	400	850	—	—	—	—
7.5	HLL36060	800	1450	—	—	—	—
10	HLL36070	800	1450	—	—	—	—
15	HLL36110	900	1700	—	—	—	—
20	HLL36125	900	1700	—	—	—	—
25	JLL36175	—	—	875	1750	875	973
30	JLL36200	—	—	1000	2000	1000	1144
40	JLL36250	—	—	1250	2500	1347	1482
50	JLL36250	—	—	1250	2500	1660	1860

Table 32: PowerPact Circuit Breaker Derating for Temperature and Altitude¹, 480 V/100 kA and 240 V/125 kA

Circuit Breaker	Circuit Breaker (A)			Altitude Current Derating Value		
	≤ 40° C	≤ 50° C	≤ 60° C	≤ 2000 m	2600 m	3900 m
	≤ 104° F	≤ 122° F	≤ 140° F	≤ 6600 ft	8500 ft	13000 ft
HLL36015	15	12	9	1	0.99	0.96
HLL36020	20	17	14	1	0.99	0.96
HLL36025	25	21	17	1	0.99	0.96
HLL36030	30	25	20	1	0.99	0.96
HLL36035	35	30	24	1	0.99	0.96
HLL36040	40	34	28	1	0.99	0.96
HLL36045	45	38	31	1	0.99	0.96
HLL36050	50	43	35	1	0.99	0.96
HLL36060	60	53	46	1	0.99	0.96
HLL36070	70	62	53	1	0.99	0.96
HLL36080	80	72	63	1	0.99	0.96
HLL36090	90	80	70	1	0.99	0.96
HLL36100	100	86	72	1	0.99	0.96
HLL36110	110	95	80	1	0.99	0.96
HLL36125	125	109	93	1	0.99	0.96
HLL36150	150	131	111	1	0.99	0.96
JLL36150	150	131	111	1	0.99	0.96
JLL36175	175	150	124	1	0.99	0.96
JLL36200	200	176	151	1	0.99	0.96
JLL36250	225	193	160	1	0.99	0.96
JLL36250	250	214	177	1	0.99	0.96

¹ Derating applies to the thermal magnetic circuit breaker, not the overall drive.

SECTION 3— CIRCUIT DESCRIPTIONS AND OPTIONS

INTRODUCTION

This section describes basic sequences of operation for the two pre-engineered power circuit configurations and available options. The options are:

- Power Circuit W: Without Bypass (see page 64)
- Power Circuit Y: Bypass (see page 69)

TERMINAL VERSUS KEYPAD COMMAND OPERATION

For factory and user-supplied pilot devices and controls to be recognized, the E-Flex drive is factory-configured to operate from the terminal strip. Changing settings in Menu 1.6 COMMAND disables certain power converter logic inputs. Factory and user-provided control devices are ignored. For this reason, do not operate the drive with Menu 1.6 settings different than those shown in the ATV61 Factory Configuration tables (see Figures 29–35 on pages 100–114).

Changing certain factory settings will affect the performance of the E-Flex drive.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The controller has been factory-programmed. Alteration of factory programming may create incompatibilities with the supplied controller configuration.
- Read and understand the *Programming Manual*, on CD-ROM W817574030111 supplied with the power converter, as well as the programming information found in the applicable control circuit elementary diagrams provided with each controller.
- If the power converter unit or the main control board of the power converter is replaced, or if any option cards are field installed, the power converter must be re-programmed according to the programming instructions found in the applicable control circuit elementary diagrams provided with each controller.

Failure to follow these instructions can result in death or serious injury.

NOTE: The factory program can be saved in the graphic display terminal. Refer to the ATV61 Programming Manual for saving and retrieving factory settings.¹

GRAPHIC DISPLAY TERMINAL OPERATION

The graphic display terminal is for programming and display. The FWD/REV, Run, and Stop/Reset buttons are not for controller primary operation. The 22 mm operators located on the front of the controller door are used to command the AFC and Bypass modes of operation.

TYPE 3R OPERATION

To prevent condensation on the inside of the cabinet, leave the mains energized when the motor is not running.

¹ See the ATV61 Installation Manual and the ATV61 Programming Manual. These manuals are available from the Technical Library at www.Schneider-electric.us.

RESET AFTER CLEARING A FAULT

When a communication option is selected, the drive fault reset feature will be removed. Instead:

- LI4 is programmed for forced local

The user may choose to remove the forced local function if start/stop commands are not commanded over the communication system network. To activate the fault reset function:

- Assign fault reset to LI4

POWER CIRCUIT W (WITHOUT BYPASS)

This power circuit consists of a fused control transformer, circuit breaker disconnect with means for locking in the open position, power converter, and optional equipment as specified.

OPERATOR CONTROLS—GENERAL ARRANGEMENT AND OPERATION

The operator controls are located on the front door of the drive unless no control options are specified. The drive is factory configured to operate in terminal command mode.

MOD D09 omits the graphic display terminal. If D09 is selected, a separate graphic display terminal or PowerSuite software must be ordered to program the power converter.

CONTROLLER OPERATION

To operate the controller, the circuit breaker disconnect located on the front of the drive must be in the closed position. There are several modes of operation depending upon the control method used.

- Two-wire control functionality: Hand-Off-Auto or Hand-Off-Comm selector switch. The controller will automatically restart when power is restored after a power loss or upon clearing a fault condition, if the Auto contact is closed.
- Three-wire control functionality: Start/Stop push buttons. The controller will not restart when power is restored after a power loss or upon clearing a fault. The start push button must be pressed to restart the controller.

FIRE/FREEZESTAT INTERLOCKS

Table 33 describes the dedicated terminals for accepting a normally-closed user-supplied fire/freezestat interlock, for the controller configurations shown. The controller will stop operation if the connection between these terminals is opened.

Table 33: Fire/Freezestat Interlock Terminals

Terminals	Product Configuration	Control Circuit Voltage
1 and 2	Controllers (Power Circuit W or Y) without a communication card. The Run Command Relay is dropped out if the connection between terminals 1 and 2 is opened, stopping the motor.	120 VAC
A and D	Controllers without Bypass (Power Circuit W) with a communication card. The signal to LI2 (Freewheel Stop) is removed if the connection between terminals A and D is opened, stopping the motor.	24 VDC
3 and 3A	Controllers with Bypass (Power Circuit Y) with a communication card. The drive output contactor and bypass contactor open if the connection between terminals 3 and 3A is opened, stopping the motor.	120 VAC

Always remove the factory-installed jumper from these terminals before installing the interlock.

MOD A07 HAND-OFF-AUTO SELECTOR AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Auto (H-O-A) selector switch and manual speed potentiometer to operate the power converter.

Hand mode is for local control. As soon as Hand mode is selected, the power converter starts the motor. In Hand mode, the speed potentiometer is used to control the speed of the drive.¹

Off mode commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

Set the H-O-A switch to Off for fault reset.

Auto mode is for remote control. In Auto mode, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7. Motor speed is varied by adjusting the user-supplied auto speed reference signal (4–20 mA or 0–10 Vdc if J09 is selected) supplied to terminals G1/S2+ and J1/S3 in the drive.

When using a communication card in the Auto mode, forced local is inactive, therefore the communications network can change the power converter programming.

When MOD J09 is selected, the motor speed is varied by adjusting the user-supplied auto speed reference signal (0–10 V) supplied to terminals G1/S2+ and J1/S3. The converter is programmed to allow 0–10 V on AI2 input.

MOD B07 HAND-OFF-AUTO SELECTOR, START/STOP PUSH BUTTONS, AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Auto (H-O-A) selector switch, a Start push button, a Stop push button, and a manual speed potentiometer to operate the power converter.

Hand mode is for local control. The power converter will not start the motor until the Start push button is pushed. In Hand mode, the manual speed potentiometer (graphic keypad knob or remotely mounted potentiometer) is used to control the speed of the controller.¹

Off mode commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

Set the H-O-A switch to Off for fault reset.

WARNING

INABILITY TO INITIATE A STOP

The Stop push button is only active in the Hand mode.

- To stop the drive, open the disconnect switch or set the Hand-Off-Auto switch to Off.
- Use appropriate guarding or interlocking.

Failure to follow these instructions can result in death or serious injury.

Auto mode is for remote control. In Auto mode, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7. Motor speed is varied by adjusting the user supplied auto speed reference signal (4–20 mA or 0–10 Vdc if J09 is selected) supplied to terminals G1/S2+ and J1/S3. in the drive.

¹ The graphic keypad serves as the manual speed potentiometer function unless mod D09 or Type 3R configurations are used.

When using a communication card in the Auto mode, forced local is inactive, therefore the communications network can change the power converter programming.

When MOD J09 is selected, the motor speed is varied by adjusting the user-supplied auto speed reference signal (0–10 V) supplied to terminals G1/S2+ and J1/S3. The converter is programmed to allow 0–10 V on AI2 input.

The **Start** push button commands the power converter to start the motor for local control. The manual speed potentiometer is used to control the speed of the controller.

The **Stop** push button commands the power converter to stop the motor for local control by either following the programmed deceleration ramp (factory setting) or by freewheel stopping. If the Hand-Off-Auto switch is in the Auto mode, the switch must be set to Off to stop the power converter. The Stop push button is only active for local control (Hand), not for remote control (Auto).

MOD C07 START/STOP PUSH BUTTONS AND MANUAL SPEED POTENTIOMETER

This control option provides door-mounted Start and Stop push buttons and a manual speed potentiometer to operate the power converter locally.

The **Start** push button commands the power converter to start the motor. The manual speed potentiometer mounted on the drive is used to control the speed of the controller.

The **Stop** push button commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

MOD D07 HAND-OFF-COMM SELECTOR AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Comm (H-O-C) selector switch and manual speed potentiometer (graphic keypad knob or remotely mounted potentiometer) to operate the power converter.

Hand mode is for local control. As soon as Hand mode is selected, the power converter starts the motor. In Hand mode, the speed potentiometer is used to control the speed of the drive.¹

Off mode commands the power converter to stop the motor either by following the programmed deceleration ramp (factory setting) or by a freewheel stop.

Comm mode is for communication card control. In Communication mode, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7 and a control signal from a communication card is sent to the converter.

MOD E07 HAND-OFF-COMM SELECTOR, START/STOP PUSH BUTTONS, AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Comm (H-O-C) selector switch, a Start push button, a Stop push button, and a manual speed potentiometer (graphic keypad knob or remotely mounted potentiometer) to operate the power converter.

Hand mode is for local control. The power converter will not start the motor until the Start push button is pushed. In Hand mode, the manual speed potentiometer is used to control the speed of the controller.¹

Off mode commands the power converter to stop the motor either by following the programmed deceleration ramp (factory setting) or by a freewheel stop.

¹ The graphic keypad serves as the manual speed potentiometer function unless mod D09 or Type 3R configurations are used.

⚠ WARNING

INABILITY TO INITIATE A STOP

The Stop push button is only active in the Hand mode.

- To stop the drive, open the disconnect switch or set the Hand-Off-Comm switch to Off.
- Use appropriate guarding or interlocking.

Failure to follow these instructions can result in death or serious injury.

Comm mode is for communication card control. In Communication mode, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7, and a control signal from a communication card is sent to the converter.

The **Start** push button commands the power converter to start the motor in local control. The manual speed potentiometer is used to control the speed of the controller.

The **Stop** push button commands the power converter to stop the motor in local control by either following the programmed deceleration ramp (factory setting) or by freewheel stopping. If the Hand-Off-Comm switch is in Communication mode, the switch must be set to Off to stop the power converter. The Stop push button is only active for local control (Hand), not for communication control (Comm).

MOD N07

NO OPERATORS; WIRED FOR REMOTE OPERATION

Control option N07 omits control operator functions. It is for use with customer-supplied external control devices.

MOD A08

PILOT LIGHT OPTION #1 CLUSTER

This pilot light option provides visual indication of protective functions and circuit status.

Power On (red): illuminates when mains power is applied to the controller. The pilot light device is rated 120 Vac.

AFC Run (green): illuminates to annunciate an AFC run condition. The pilot light device is rated 120 Vac.

Auto (yellow): illuminates when the Hand-Off-Auto or Hand-Off-Comm selector switch is set to Auto or Comm. The pilot light device is rated 120 Vac.

Fault (yellow): illuminates to annunciate an AFC fault (trip) condition. The pilot light device is rated 120 Vac.

MOD C08

PILOT LIGHT OPTION #3 CLUSTER

This pilot light option provides visual indication of protective functions and circuit status.

Power On (red): illuminates when mains power is applied to the controller. The pilot light device is rated 120 Vac.

AFC (green): illuminates to annunciate an AFC run condition. The pilot light device is rated 120 Vac.

Fault (yellow): illuminates to annunciate an AFC fault (trip) condition. The pilot light device is rated 120 Vac.

MOD A09

5% LINE REACTOR

This option includes an integrally-mounted 5% AC line reactor factory-installed and wired between the circuit breaker disconnect means and the power converter for harmonic mitigation. It replaces the standard 3% DC choke.

MOD C09

3–15 PSI TRANSDUCER WITH DIGITAL DISPLAY OPTION

This option provides the controller with the capability to follow a user-supplied 3–15 PSI follower signal with digital display. The module is calibrated to operate as a 4–20 mA DC follower for the power converter.

MOD D09

OMIT GRAPHIC DISPLAY TERMINAL

This option omits the graphic display terminal. If MOD D09 is selected, a separate graphic display must be ordered to program the drive.

**MOD E09
SMOKE PURGE OPTION (FIREMAN'S
OVERRIDE)**

This option provides a smoke purge operating mode controlled by a user-supplied 120 Vac signal applied between terminals 22 and 23. When 120 Vac power is supplied to 22 and 23, the drive runs the motor at 60 Hz.

When using End damper control (MOD S09) with the Smoke purge option, there will be a delay on initiation of the drive.

NOTE: Delayed Start:

- End damper control is installed.
- Motor start will be delayed until the damper is fully open.
- Wait a sufficient time for the damper to open after start-up.

A supplied Delayed Operation Notice should be placed by the Fireman's Override Key Switch.

**MOD F09
PROFIBUS**

This option provides a factory-installed Profibus Communication card, VW3A3307.

**MOD H09
I/O EXTENSION CARD**

This option provides an additional 0–20 mA analog output for customer use. It includes a plug-in analog card, VW3A3202, with AO2, AO3, and COM. The output is factory-programmed for motor frequency. Selectable x–y range with graphic display.

**MOD J09
0–10 V AUTO SPEED REFERENCE**

This option provides for a 0–10 V user-supplied auto speed reference signal into the AI2 input, terminals G1/S2+ and J/S3 on terminal block 2. Not available with MOD C07 (page 66) or with MOD C09 (page 67).

**MOD K09
cUL Listing**

This option provides Canadian cUL certification when required by local code requirements.

**MOD L09
LONWORKS®**

This option provides a factory-installed LonWorks card, VW3A3312.

**MOD M09
MODBUS®**

This option provides, in addition to a standard Modbus port, a factory-installed plug-in Modbus card, VW3A3303.

**MOD O09
APOGEE™ P1**

This option provides a factory-installed PI card, VW3A3314.

**MOD P09
METASYS® N2**

This option provides a factory-installed plug-in Metasys® N2 card, VW3A3313.

MOD Q09 ETHERNET

This option provides a factory-installed Ethernet card, VW3A3310D.

MOD R09 BACNET

This option provides a factory-installed BACnet card, VW3A3315.

**MOD S09
END DAMPER CONTROL**

This option provides a factory-installed circuit to inhibit converter operation until the damper is fully open.

**MOD T09
SERVICE ENTRANCE RATING**

This option provides a UL869A approved insulated ground neutral lug assembly and mounting bracket with bonded enclosure ground wire suitable for use as service entrance rated equipment.

**MOD U09
SEISMIC QUALIFIED**

This option supplies a certification label and hardware qualified to seismic rating AC156 acceptance criteria test protocol with an importance factor of 1.5. Refer to "Seismic Qualification Mounting Criteria" on page 37.

MOD X09 3% LINE REACTOR

This option includes an integrally-mounted 3% AC line reactor factory installed and wired between the circuit breaker disconnect means and the power converter for harmonic mitigation. It replaces the standard 3% DC choke.

POWER CIRCUIT Y (BYPASS)

This power circuit operates the motor from the power converter or from full voltage line power (bypass mode). The motor can be run in the bypass mode in the unlikely event that the power converter becomes inoperative. The Bypass Package consists of:

- Drive output and bypass contactors (electrically interlocked) with Class 20 overloads (Class 10 for 1 hp @ 460 V)
- Control transformer
- Circuit breaker disconnect with means for locking in the open position
- AFC-Off-Bypass switch
- Test-Normal switch
- Power converter
- Optional equipment as specified

OPERATOR CONTROLS—GENERAL ARRANGEMENT AND OPERATION

CAUTION

RISK OF CONTROLLER DAMAGE

- Move the Hand-Off-Auto switch to the Off position before moving the AFC-Off-Bypass switch from AFC to the Off position.
- Avoid repeated opening of the drive output contactor while under load.

Failure to follow these instructions can result in equipment damage.

Drive output contactors are rated to carry full load motor current; however, these contactors are not intended to break motor current except in the event of an emergency. Always ensure that the motor has come to a complete stop and that the drive is stopped and its output frequency is zero before switching the drive off. Failure to follow these guidelines can reduce the life of the device.

Operator controls are located on the front door of the drive unless no control options are specified. The drive is factory configured to operate in terminal command mode. MOD D09 omits the graphic display terminal. If D09 is selected, a separate graphic display or PowerSuite software must be ordered to program the power converter.

The AFC-Off-Bypass switch allows selection of either adjustable speed operation of the motor through the power converter (AFC position) or line power operation of the motor (Bypass position). Both AFC and Bypass operation can be started in the Hand mode for immediate start, or in the Auto or Communication mode for remote contactor start.

TEST-NORMAL OPERATION (BYPASS ONLY)

The Test-Normal switch is used to test the power converter while the drive is operating the motor in bypass. To use this function and maintain motor operation, place the following switches in these positions:

- AFC-Off-Bypass: Set the switch to bypass to run the motor at full speed across the line.
- Test-Normal: Set the switch to Test.

- Hand-Off-Auto or Hand-Off-Comm: Set the switch to Hand. Use the manual speed potentiometer to change the speed reference and observe power converter operation.

BYPASS OPERATION

To control the operation of the motor with line power, the circuit breaker disconnect located on the front of the drive must be in the closed position and the AFC-Off-Bypass switch must be in the Bypass position. When the AFC-Off-Bypass selector switch is set to Bypass, motor operation is transferred to line power. In Hand mode the motor will immediately start. In Hand mode with a start/stop push button, the motor will start when the start push button is pressed. In Auto mode, the motor will start when the user-supplied contact is closed. In Communication mode, the motor will start when the Comm board Comm signal commands a run. When the selector switch is moved to the Off position, the bypass contactor opens and the motor stops. When in Bypass and Communication modes, the Comm board has no control over when the motor runs. If terminals 6 and 7 are connected, then the motor will run immediately.

FIRE/FREEZE STAT INTERLOCKS

Table 34 describes the dedicated terminals for accepting a normally-closed user-supplied fire/freezestat interlock, for the controller configurations shown. The controller will stop operation if the connection between these terminals is opened.

Table 34: Fire/Freezestat Interlock Terminals

Terminals	Product Configuration	Control Circuit Voltage
1 and 2	Controllers (Power Circuit W or Y) without a communication card. The Run Command Relay drops out if the connection between terminals 1 and 2 is opened, stopping the motor.	120 Vac
A and D	Controllers without Bypass (Power Circuit W) with a communication card. The signal to LI2 (Freewheel Stop) is removed if the connection between terminals A and D is opened, stopping the motor.	24 Vdc
3 and 3A	Controllers with Bypass (Power Circuit Y) with a communication card. The drive output contactor and bypass contactor open if the connection between terminals 3 and 3A is opened, stopping the motor.	120 Vac

Always remove the factory-installed jumper from these terminals before installing the interlock.

**MOD A07
HAND-OFF-AUTO SELECTOR AND
MANUAL SPEED POTENTIOMETER**

This control option provides a door-mounted Hand-Off-Auto (H-O-A) selector switch and manual speed potentiometer to operate the power converter.

Hand mode is for local control. In Bypass operation, as soon as Hand mode is selected, a full-voltage across-the-line start will occur. In AFC operation, as soon as Hand mode is selected, the power converter starts the motor. The manual speed potentiometer is used to control the speed of the controller.¹

Off mode commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

Set the H-O-A switch to Off for fault reset.

Auto mode is for remote control. In Bypass operation, a full-voltage across-the-line start will occur when the user-supplied run contact is closed between controller terminals 6 and 7. In AFC operation, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7. Motor speed is varied by adjusting the user-supplied auto speed reference signal (4-20 mA or 0–10 Vdc if J09 is selected) supplied to terminals G1/S2+ and J1/S3 in the drive.

When using a communication card in the Auto mode, forced local is inactive, therefore the communications network can change the power converter programming.

When MOD J09 is selected, the motor speed is varied by adjusting the user-supplied auto speed reference signal (0–10 V) supplied to terminals G1/S2+ and J1/S3. The converter is programmed to allow 0–10 V on AI2 input.

¹ The graphic keypad serves as the manual speed potentiometer function unless mod D09 or Type 3R configurations are used.

MOD B07 HAND-OFF-AUTO SELECTOR, START/STOP PUSH BUTTONS, AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Auto (H-O-A) selector switch, a Start push button, a Stop push button, and a manual speed potentiometer to operate the power converter.

WARNING

INABILITY TO INITIATE A STOP

The Stop push button is only active in the Hand mode.

- To stop the drive, open the disconnect switch or set the Hand-Off-Auto switch to Off.
- Use appropriate guarding or interlocking.

Failure to follow these instructions can result in death or serious injury.

Hand mode is for local control. In Bypass operation, when Hand mode is selected, a full-voltage across-the-line start will occur when the start push button is pushed. In AFC operation, the power converter will not start the motor until the Start push button is pressed. The manual speed potentiometer is used to control the speed of the controller.¹

Off mode commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

Set the H-O-A switch to Off for fault reset.

Auto mode is for remote control. In Bypass operation, a full-voltage across-the-line start will occur when the user-supplied run contact is closed between controller terminals 6 and 7. In AFC operation, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7. Motor speed is varied by adjusting the user-supplied auto speed reference signal (4–20 mA or 0–10 Vdc if J09 is selected) supplied to terminals G1/S2+ and J1/S3 in the drive.

When using a communication card in the Auto mode, forced local is inactive, therefore the communications network can change the power converter programming.

When MOD J09 is selected, the motor speed is varied by adjusting the user-supplied auto speed reference signal (0–10 V) supplied to terminals G1/S2+ and J1/S3. The converter is programmed to allow 0–10 V on AI2 input.

The **Start** push button commands the power converter to start the motor in Hand mode for local control. The manual speed potentiometer is used to control the speed of the controller.

The **Stop** push button commands the power converter to stop the motor for local control by either following the programmed deceleration ramp (factory setting) or by a freewheel stop. If the Hand-Off-Auto Switch is in Auto mode, it must be set to Off to stop the power converter. The Stop push button is only active for local control (Hand), not for remote control (Auto).

¹ The graphic keypad serves as the manual speed potentiometer function unless mod D09 or Type 3R configurations are used.

MOD D07 HAND-OFF-COMM SELECTOR AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Comm (H-O-C) selector switch and manual speed potentiometer to operate the power converter.

Hand mode is for local control. As soon as Hand mode is selected, the power converter starts the motor. In Hand mode, the speed potentiometer is used to control the speed of the drive.

Off mode commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

Comm mode is for communication card control. In Communication mode, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7 and a control signal from a communication card is sent to the converter.

MOD E07 HAND-OFF-COMM SELECTOR, START/STOP PUSH BUTTONS, AND MANUAL SPEED POTENTIOMETER

This control option provides a door-mounted Hand-Off-Comm (H-O-C) selector switch, a Start push button, a Stop push button, and a manual speed potentiometer to operate the power converter.

Hand mode is for local control. The power converter will not start the motor until the Start push button is pushed. In Hand mode, the manual speed potentiometer is used to control the speed of the controller. When using the knob on the graphic display to change the speed in hand mode, go to Menu 1.2, Monitoring, and select HMI Frequency Ref.

Off mode commands the power converter to stop the motor by either following the programmed deceleration ramp (factory setting) or by a freewheel stop.

WARNING

INABILITY TO INITIATE A STOP

The Stop push button is only active in the Hand mode.

- To stop the drive, open the disconnect switch or set the Hand-Off-Comm switch to Off.
- Use appropriate guarding or interlocking.

Failure to follow these instructions can result in death or serious injury.

Comm mode is for communication card control. In Communication mode, the power converter starts the motor when the user-supplied run contact is closed between controller terminals 6 and 7 and a control signal from a communication card is sent to the converter.

The **Start** push button commands the power converter to start the motor for local control. The manual speed potentiometer is used to control the speed of the controller.

The **Stop** push button commands the power converter to stop the motor for local control by either following the programmed deceleration ramp (factory setting) or by freewheel stopping. If the Hand-Off-Comm switch is in Communication mode, the switch must be set to Off to stop the power converter. The Stop push button is only active for local control (Hand), not for communication control (Comm).

MOD N07
NO OPERATORS; WIRED FOR REMOTE
OPERATION

Control option N07 omits control operator functions. It is for use with customer-supplied external control devices.

MOD A08
PILOT LIGHT OPTION #1 CLUSTER

This pilot light option provides visual indication of protective functions and circuit status.

Power On (red): illuminates when mains power is applied to the controller. The pilot light device is rated 120 Vac.

AFC (green): illuminates to annunciate an AFC run condition. The pilot light device is rated 120 Vac.

Fault (yellow): illuminates to annunciate an AFC fault (trip) condition. When MOD B09 (line contactor) is selected, the light illuminates when the AFC-Off-Bypass selector switch is in the Off or Bypass position to indicate that the power converter is not running. The pilot light device is rated 120 Vac.

Auto (yellow): illuminates when the Hand-Off-Auto or Hand-Off-Comm selector switch is set to Auto or Comm. The pilot light device is rated 120 Vac.

MOD B08
PILOT LIGHT OPTION #2 CLUSTER

This pilot light option provides visual indication of protective functions and circuit status.

Power On (red): illuminates when mains power is applied to the controller. The pilot light device is rated 120 Vac.

AFC (green): illuminates to annunciate an AFC run condition. The pilot light device is rated 120 Vac.

Fault (yellow): illuminates to annunciate an AFC fault (trip) condition. When MOD B09 (line contactor) is selected, the light illuminates when the AFC-Off-Bypass selector switch is in the Off or Bypass position to indicate that the power converter is not running. The pilot light device is rated 120 Vac.

Bypass (yellow): illuminates when the motor is started across the line. The pilot light device is sequenced by the Hand-Off-Auto selector switch and is rated 120 Vac.

MOD A09
LINE REACTOR

This option includes an integrally-mounted 5% AC line reactor, factory-installed and wired between the circuit breaker disconnect means and the power converter, for harmonic mitigation. It replaces the standard 3% DC choke.

MOD B09
LINE CONTACTOR

This option provides a line contactor factory-wired between the circuit breaker disconnect (or line reactor when provided) and the power converter. Not available with Type 3R.

NOTE: With line contactor MOD B09, the AFC Fault light will illuminate when the AFC-Off-Bypass selector switch is in the Off or Bypass position to indicate that the power converter is not running.

MOD C09
3–15 PSI TRANSDUCER WITH DIGITAL
DISPLAY OPTION

This option provides the controller with the capability to follow a user-supplied 3–15 PSI follower signal with digital display. The module is calibrated to operate as a 4–20 mA DC follower for the power converter.

MOD D09
OMIT GRAPHIC DISPLAY TERMINAL

This option omits the graphic display terminal. If MOD D09 is selected, a separate graphic display must be ordered to program the drive.

**MOD E09
SMOKE PURGE OPTION (FIREMAN'S
OVERRIDE)**

This option provides a smoke purge operating mode controlled by a user-supplied 120 Vac signal applied between terminals 22 and 23. When 120 Vac power is supplied to 22 and 23, motor operation is transferred to bypass (if not operating in this mode already).

The jumper between terminals 2 and 3 must be removed before using this mode.

When using End damper control (MOD S09) with the Smoke purge option, there will be a delay on initiation of the drive.

NOTE: Delayed Start:

- End damper control is installed.
- Motor start will be delayed until the damper is fully open.
- Wait a sufficient time for the damper to open after start-up.

A supplied Delayed Operation Notice should be placed by the Fireman's Override Key Switch.

**MOD F09
PROFIBUS**

This option provides a factory-installed Profibus Communication card, VW3A3307.

**MOD H09
I/O EXTENSION CARD**

This option provides a 0–20 mA analog output for customer use. It includes a plug-in analog card, VW3A3202, with AO and COM. The output is factory-programmed for motor frequency. Selectable x–y range with graphic display¹.

**MOD J09
0–10 V AUTO SPEED REFERENCE**

This option provides for a 0–10 V user-supplied auto speed reference signal into the AI2 input, terminals G1/S2+ and S3 (J) on terminal block 2. Not available with MOD C09 (page 74).

**MOD K09
cUL Listing**

This option provides Canadian cUL certification when required by local code requirements.

**MOD L09
LONWORKS®**

This option provides a factory-installed LonWorks card, VW3A3312.

**MOD M09
MODBUS®**

This option provides a factory-installed plug-in Modbus card, VW3A3303.

**MOD O09
APOGEE™ P1**

This option provides a factory-installed Apogee P1 card, VW3A3314.

**MOD P09
METASYS® N2**

This option provides a factory-installed plug-in Metasys N2 card, VW3A3313.

**MOD Q09
ETHERNET**

This option provides a factory-installed Ethernet card, VW3A3310D.

**MOD R09
BACNET**

This option provides a factory-installed BACnet card, VW3A3315.

**MOD S09
END DAMPER CONTROL**

This option provides a factory-installed circuit to inhibit converter operation until the damper is fully open.

¹ See the ATV61 Installation Manual and the ATV61 Programming Manual. These manuals are available from the Technical Library at www.us.SquareD.com.

MOD T09
SERVICE ENTRANCE RATING

This option provides a UL869A approved insulated ground neutral lug assembly and mounting bracket with bonded enclosure ground wire suitable for use as service entrance rated equipment.

MOD U09
SEISMIC QUALIFIED

This option supplies a certification label and hardware qualified to seismic rating AC156 acceptance criteria test protocol with an importance factor of 1.5. Refer to “Seismic Qualification Mounting Criteria” on page 37.

MOD X09
3% LINE REACTOR

This option includes an integrally-mounted 3% AC line reactor factory installed and wired between the circuit breaker disconnect means and the power converter for harmonic mitigation. It replaces the standard 3% DC choke.

SECTION 4— PROPORTIONAL–INTEGRAL–DERIVATIVE CONTROL

DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand “Before You Begin” on page 12 before installing or operating the E-Flex drive.
- Properly ground the controller panel before applying power.
- Close and secure the enclosure door before applying power.
- Certain adjustments and test procedures require that power be applied to this controller. Extreme caution must be exercised as hazardous voltages exist. The enclosure door must be closed and secured while turning on power or starting and stopping this controller.

Failure to follow these instructions will result in death or serious injury.

DANGER

UNINTENDED EQUIPMENT OPERATION

Test and ensure that any changes made to the parameter settings do not present any danger to personnel and equipment during the drive operation.

Each control scheme must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions will result in death or serious injury.

INTRODUCTION

This section provides programming instructions for using Proportional-Integral-Derivative (PID) control on the E-Flex adjustable speed drive.

PID control provides a method for controlling a process variable using a closed loop feedback system. The error between the desired setpoint and feedback process variable provides continuous corrective action to control the process output. From an application standpoint, the drive output adjusts the speed of the motor to reduce the error to zero. Closed loop control eliminates the cycling normally associated with open loop on-off control methods. PID control aims to regulate the process consistently under changing conditions at a maximum rate with minimum waste and minimum cost of operation.

Process variables such as temperature, pressure and level can be monitored by the drive as a current or voltage analog feedback signal. The PID regulator calculates the error between the setpoint and feedback for a closed loop, then applies an appropriate reference to adjust the motor speed.

There are three functions for control:

1. Proportional (P): The Proportional function determines the responsiveness of control or how quickly the output reacts to the error.
2. Integral (I): The Integral function determines the reaction based on the sum of recent errors and its absence may prevent the system from reaching its target value.
3. Derivative (D): The Derivative function determines the reaction to the rate at which the error has been changing and is very sensitive to measurement noise.

The weighted sum of P, I, and D functions is used to correct the process variable.

By tuning these three functions, the system performance including responsiveness (time to correct the error), overshoot (overage from the reference setpoint) and oscillations (cycling between the highest and lowest point until signal stabilization) can be controlled.

With PID control the relationship between speed and process variable (pressure, level, or temperature) is often misunderstood. For example, users may expect a certain motor speed at a given system variable. This is not correct because the speed is not directly related to the system variable. Instead the PID calculations adjust the speed as needed to maintain the setpoint. As system dynamics change (valves, dampers, ambient temperature, flow rate, and other processes), the speed required to maintain the setpoint will differ. Base PID performance on its ability to maintain the setpoint, not on motor speed.

Figure 18: PID Control Concept

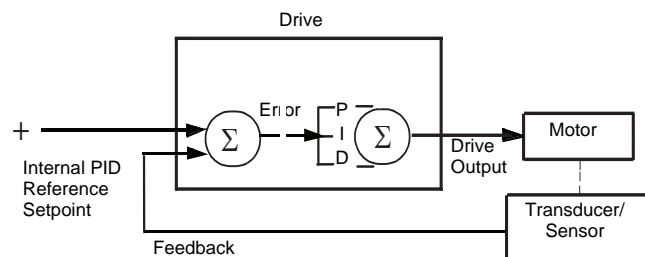
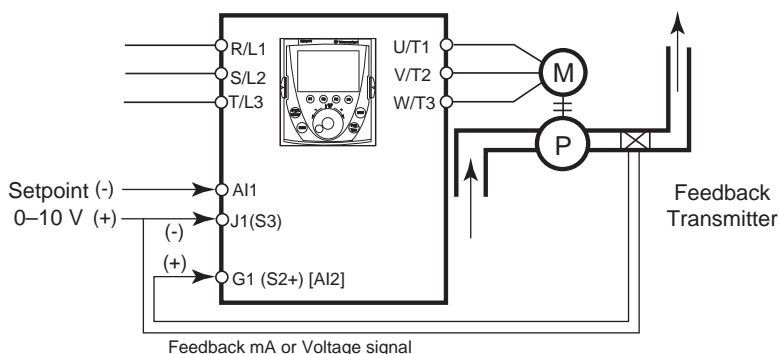


Figure 19: PID Setup for Drive



SCALING OF PID PARAMETERS

Scaling of PID parameters is required to suit a customer's application or range of the sensor input device providing the feedback signal or both. Some examples of PID parameters and their ranges are pressure (0 to 20 psi), flow (0 to 500 gpm), and temperature (–100 °F to 300 °F).

PID REFERENCE (Min., Max.) parameters must be within the sensor range, for example, PID FEEDBACK (Min., Max.) parameters. Parameter INTERNAL PID REF Setpoint is entered as a percentage of the PID FEEDBACK range demonstrated in the following examples. The scaling parameters cannot exceed a value of 32767. To simplify the setup, use the values as close as possible to this maximum limit, but remain within powers of 10 with respect to the actual values.

For example:

- To maintain a pressure of 40 psi for a pressure transducer with 0-100 psi range with an input signal of 4 to 20 mA, enter the MIN PID FEEDBACK as 0 (corresponding to 0 psi) and the MAX PID FEEDBACK as 1000 (corresponding to 100PSI). As 40 psi equals 40% of the sensor range with 0-100 psi, therefore set the INTERNAL PID REF Setpoint to 400.
- If a temperature device is scaled at -100 to +300 °F, enter the Minimum PID Feedback as 0 (corresponding to -100 °F) and the Maximum PID Feedback as 1000 (corresponding to +300 °F). An 80 °F setpoint is 45% of the range from -100 to 300°F; therefore set the INTERNAL PID REF Setpoint to 450.

PID TUNING

Tuning of the P, I, and D control functions is required to optimize the process performance based on application needs. There are several methods for tuning including manual, Ziegler-Nichols, and by using several software tools available in the market. The PID proportional gain (rPG), Integral gain (rIG) and derivative gain (rdG) parameters can be adjusted to allow the PID regulator to be tuned for a specific application.

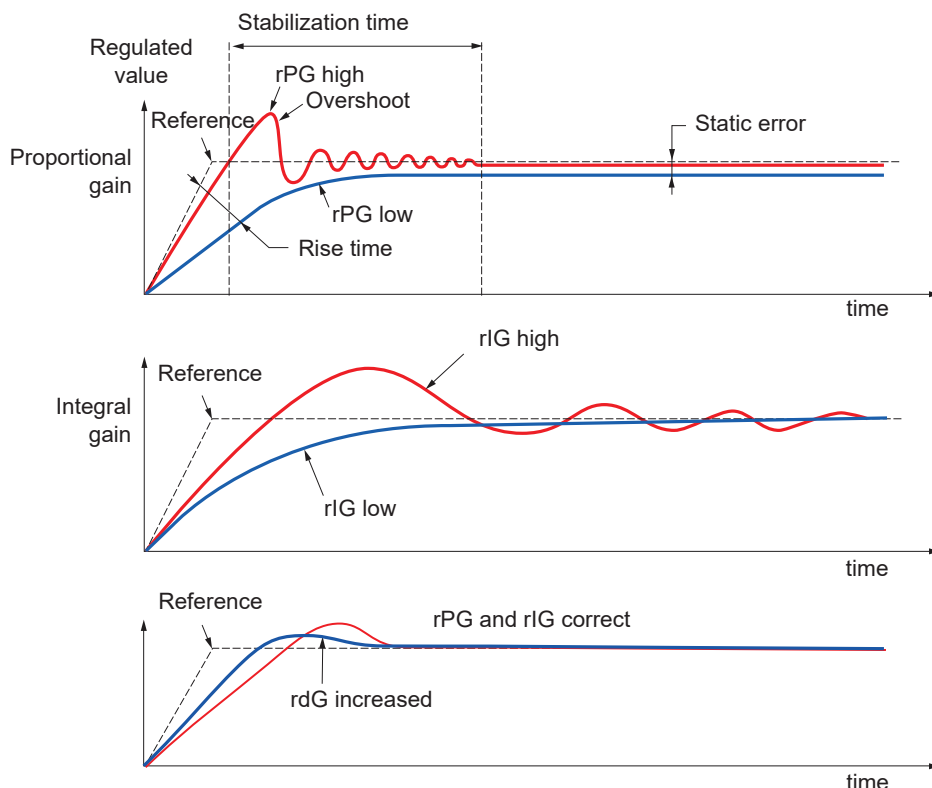
NOTE: Follow the instructions in the "Drive Configuration" on page 82 to set-up the P, I, and D control functions and access the parameters for gains adjustment.

In many cases the factory settings for these parameters will be sufficient. However, if necessary, adjustments should be gradual and independent. If the system is unstable with the factory settings or the PID reference (setpoint) is not achieved, use the manual method described below:

- Set the integral gain (rlG) to minimum.
- Leave the derivative gain (rdG) at 0.
- Vary the load or PID reference setpoint a number of times and observe the PID regulator response.
- Set the proportional gain (rPG) in order to obtain the best compromise between response time and stability.
- Once stable if the steady state response varies from the preset value (setpoint), gradually increase the integral gain (rlG), reduce the proportional gain (rPG) in the event of instability (pump applications) and find a compromise between response time and precision.
- Typically, the derivative gain (rdG) is not required, but may permit the reduction of overshoot and the improvement of response time. This can make it more difficult to obtain a compromise in terms of stability since this depends on 3 gains. If rdG is adjusted then the rPg and rlG may require re-adjustment.

Figure 20 on page 81 illustrates the system performance with adjustments in P, I, and D gains.

Figure 20: System Performance With Adjustments in P, I, and D Gains



The oscillation frequency depends on the system kinematics.

Parameter	Rise time	Overshoot	Stabilization time	Static error
rPG ↗	↘ ↘	↗	=	↘
rIG ↗	↘	↗ ↗	↗	↘ ↘
rdG ↗	=	↘	↘	=

SETTING PID CONTROL

The PID control with a Hand-Off-Auto selector switch can be set using the following positions:

- In the Auto position the drive speed reference follows the PID regulator
- In the Hand position the drive speed reference follows the graphic display terminal (HMI)

PID control for analog inputs with voltage (0–10 V) or current (4–20 mA) signal is possible.

If the E-Flex is a Type 3R Enclosure or has option D09 to omit the HMI, in the Hand position the drive speed reference is a door mounted speed potentiometer in place of the HMI.

Drive Configuration

Ensure that the Factory settings for the enclosed drive and motor parameters are set. For more information, refer to the Altivar 61 programming manual shipped with the drive.

NOTE: When making programming changes, if a warning message appears indicating that an input is already assigned to another function, press Enter to acknowledge this warning and continue programming the drive.

Use the graphic display terminal (HMI) attached to the E-Flex drive to change the following settings:

Table 35: Programmable Settings

Parameters	Description
SET ACCESS LEVEL	From the MAIN menu, select ACCESS LEVEL > ADVANCED.
SET THE ANALOG FEEDBACK SIGNAL	Configure the customer supplied analog feedback signal using the following rules: AI1 is a voltage only input (integral to the power converter ATV-61) AI2 is configured for voltage or current [AI2 is wired to GI (S2+) on the E-Flex terminal block]
DRIVE CONFIGURATION	From the MAIN menu, select DRIVE > INPUTS/OUTPUTS CFG > AI1 OR AI2 CONFIGURATION.
SET TYPE OF SIGNAL	Set AI1 or AI2 used to supply the analog feedback signal: From MAIN menu select DRIVE > 1.5 Inputs/ Outputs > AI2 Type as voltage or current.
SET THE MIN-MAX VALUES	Continue with the AI1 OR AI2 CONFIGURATION described above and configure the drive based on the type of feedback transducer used. Set AI2 min. value and AI2 max. value. For example, if the device has a 4–20 mA input, set AI2 Min. Value to 4 and AI2 Max. Value to 20. Also, if the device has a 0–10 Vdc input, set AI1 OR AI2 Min. Value to 0 and AI1 OR AI2 Max. Value to 10.
SET REFERENCE CHANNEL	From the MAIN menu select DRIVE > 1.6 COMMAND and assign REF. 2 CHANNEL to HMI. <i>NOTE:</i> If the E-Flex drive is a Type 3R Enclosure or has option D09 to omit the HMI, program the Ref. 2 channel to AI1 instead of HMI. From the MAIN menu select DRIVE > 1.6 COMMAND, then assign the REF. 2 channel to AI1. Additional programming for logic inputs (LI3/LI4) is described in "Hand-Off-Auto SELECTOR SWITCH WIRING" on page 84.
SET PID REGULATOR PARAMETERS	From the MAIN menu select DRIVE > 1.7 APPLICATION FUNCT > PID REGULATOR.
1.7 APPLICATION FUNCT> PID FEEDBACK ASS.	Specify the analog input to which the customer feedback signal is applied: AI1 OR AI2
1.7 APPLICATION FUNCT> ACT. INTERNAL PID REF.	Enables customers to enter a desired setpoint/reference value in the INTERNAL PID REF parameter.
MIN PID FEEDBACK	For more information about PID scaling parameters, see page 79.
MAX PID FEEDBACK	
MIN PID REFERENCE	
MAX PID REFERENCE	
INTERNAL PID REF	
PID PROPORTIONAL GAIN	For more information about PID tuning and adjusting gains, see page 79.
PID INTEGRAL GAIN	
PID DERIVATIVE GAIN	
PID RAMP	PID acceleration/deceleration ramp time can be adjusted from 0–99.95 s.
MIN PID OUTPUT	Min value of regulator output in Hz. Factory setting is 0 Hz.
MAX PID OUTPUT	Max value of regulator output in Hz. Factory setting is 60 Hz.
PID CORRECT REVERSE	Setting this value to No, increases the motor speed when the error is positive (for example, pressure control with a pump). Setting this value to Yes, decreases the motor speed when the error is positive (for example, temperature controls using a cooling tower fan). Error = Setpoint (PID Reference)–Process Variable (PID Feedback). A positive error occurs when the process variable is below the setpoint. <i>NOTE: Most applications work best with this value set to No.</i>

CONTROL WIRING MODIFICATIONS

⚠ CAUTION

UNINTENDED MOTOR SPEED

Ensure adequate current for the transducer. The 24 Vdc power supply is current limited to 200 mA for all components powered.

A load greater than the limit will cause the control voltage to dip and may result in erroneous behavior of the drive or components powered by 24 Vdc power supply. See Figure 22 for recommended wiring.

Failure to follow these instructions can result in injury or equipment damage.

In Figure 21, the analog PID feedback signal is wired to the control rail terminals G1(S2+), A, and COM. Connect the transducer based on the type of feedback signal (see Figure 21 for a 2-wire loop powered transducer and Figure 22 for a separately powered transducer). In Figure 23 on page 84, the setpoint can be applied externally using the wiring to the terminals on the power converter ATV61.

As an optional means for setpoint and wiring modifications, use a speed potentiometer (see Figure 24 on page 84). Programming changes for this option include:

MAIN > DRIVE > 1.6 COMMAND > Ref. 1 Channel to AI1.

Another option is to use the keypad to program the Internal setpoint. Activate the Internal PID ref. using the Menu option:

From the MAIN menu select DRIVE > 1.7 APPLICATION FUNCT > PID REGULATOR > ACT. INT PID REF., then select Yes.

Figure 21: 2-Wire Loop Powered 24 Vdc Transducer

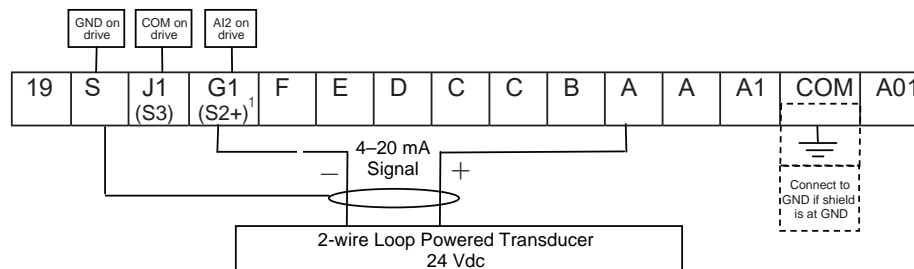
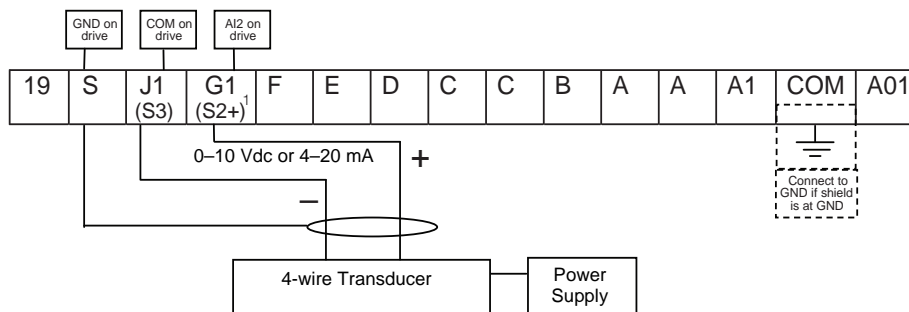


Figure 22: Separately Powered Transducer



¹ Terminal S2+ is not always wired to the drive and may need to be wired directly to the drive or as illustrated, a wire must be added from the drive to the terminal block.

Figure 23: Optional Setpoint Wiring (Using an External Source)

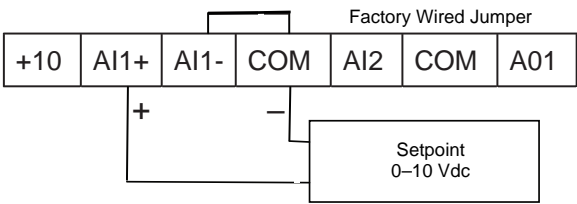
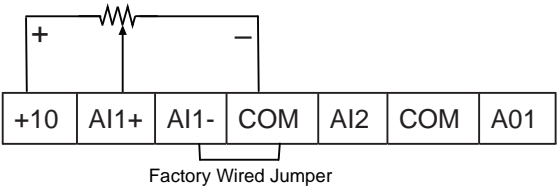


Figure 24: Optional Setpoint Wiring (Using a Speed Potentiometer)



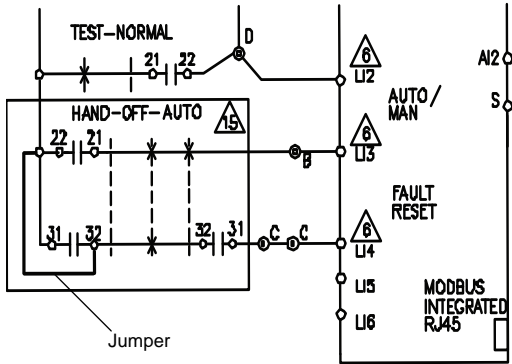
NOTE: Ground the shield at one end only to prevent large currents from flowing through the shield. The shield on the ungrounded end may be tied to ground through a capacitor (for example, 10 nF, 100 V or higher) in order to provide a path for the higher frequency noise.

**HAND-OFF-AUTO SELECTOR SWITCH
WIRING**

The E-Flex standard Hand-Off-Auto (HOA) switch contact wired to LI3 is opened when in Hand mode and closed when in Auto mode. To allow PI control in Auto mode and HMI control in Hand mode, the logic for this circuit must be reversed so that the contact is closed in Hand mode and opened in Auto mode. Use one of the following methods to wire the HOA selector switch wiring:

Method 1

Figure 25: Wiring Change Using a Jumper



CAUTION

UNINTENDED MOTOR SPEED

Ensure adequate current for the auxiliary relay. The 24 Vdc power supply is current limited to 200 mA for all components powered. A load greater than the limit will cause the control voltage to dip and may result in erroneous behavior of the drive or components powered by 24 Vdc power supply.

Failure to follow these instructions can result in injury or equipment damage.

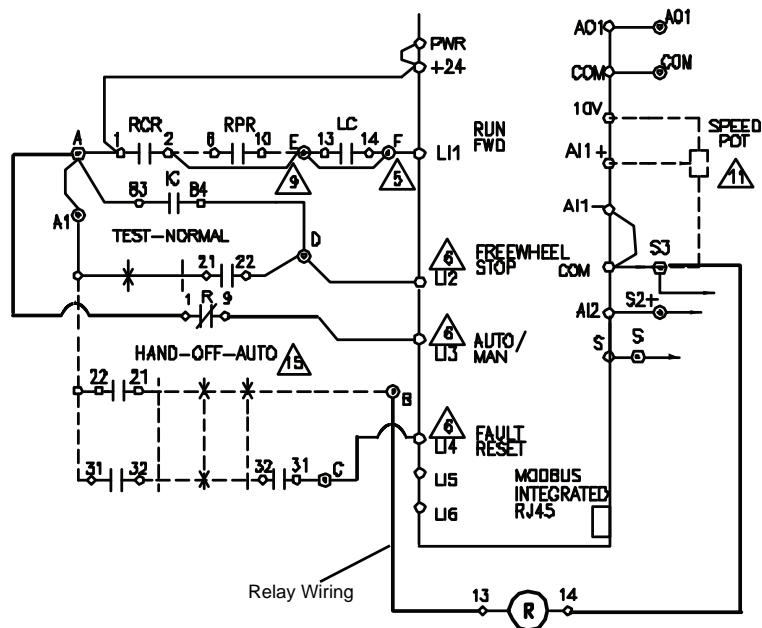
1. Using the HMI, select LI4 as Auto Manual:
MAIN > DRIVE > 1.6 COMMAND MENU> REF. 2 SWITCHING, then select LI4.
2. Ensure that REF. 2 CHANNEL is set to HMI or AI1 as described in "Drive Configuration" on page 82.
3. Connect a jumper wire across H22 and H32 to change. See Figure 25.
Access these wires from the contact block located at the back side of the door mounted HOA switch. The wires are labeled at the terminations.

NOTE: When making this modification, reset the drive in Hand mode by turning the HOA switch from Hand to Auto and then Off.

See Section 6, “Power and Control Circuit Elementary Diagrams” on page 99 for complete wiring diagrams.

Method 2

Figure 26: Wiring Change Using an Auxiliary Relay



This method uses an auxiliary relay (+24 Vdc) energized by the HOA switch (if a spare relay is available at the installation site). Figure 26 illustrates the wiring changes described in this method. For example, a combination 8501NR45 (14-pin relay socket din rail mountable) and 8501RS14V20 (4-pole relay) may be used. See Section 6, “Power and Control Circuit Elementary Diagrams” on page 99 for complete wiring diagrams.

1. Using the HMI, select LI3:
MAIN > DRIVE > 1.6 COMMAND > REF. 2 SWITCHING, then select LI3.
2. Ensure REF. 2 CHANNEL is set to HMI or AI1 as described in “Drive Configuration” on page 82.
3. Change the wiring:
 - a. Connect terminal LI3 through the N.C. relay contact to terminal A.
 - b. Connect the relay coil to terminal B and to terminal S3.
 - c. Disconnect the wire from terminal B to LI3.

SECTION 5— TROUBLESHOOTING AND MAINTENANCE

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

For 460 V units:

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.
- Do not use renewable link fuses in fused switches.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

For 208 and 230 V units:

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this bulletin in its entirety before installing or operating E-Flex drives. Installation, adjustment, repair, and maintenance of the drives must be performed by qualified personnel.
- Disconnect all power including external control power that may be present before servicing the drive. WAIT 15 MINUTES for the DC bus capacitors to discharge. Then follow the DC bus voltage measurement procedure on page 42 to verify that the DC voltage is less than 42 V. The drive LEDs are not accurate indicators of the absence of DC bus voltage.
- DO NOT short across DC bus capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install and close all covers before applying power or starting and stopping the drive.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in this drive, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.

Before servicing the drive:

- Disconnect all power.
- Place a "DO NOT TURN ON" label on the drive disconnect.
- Lock disconnect in open position.

Failure to follow these instructions will result in death or serious injury.

INTRODUCTION

A number of diagnostic and status codes are included on the power converter. The graphic display terminal provides visual indication of controller operating and protective circuit functions and indicator lights to assist in maintenance and troubleshooting. If the controller trips while operating, the codes must be viewed before power is removed because removing power resets the fault code.

NOTE: For controllers equipped with optional line contactor (MOD B09) the power is removed via the line contactor upon power converter trips.

EXTERNAL SIGNS OF DAMAGE

The following are examples of external signs of damage:

- Cracked, charred, or damaged covers or enclosure parts
- Damage to the graphic display terminal such as scratches, punctures, burn marks, chemical burns, or moisture in the screen
- Oil or electrolyte on the bottom of the drive which might have leaked from the capacitors inside
- Excessive surface temperatures of enclosures and conduits
- Damage to power or control conductors
- Unusual noise or odors from any of the equipment
- Abnormal temperature, humidity, or vibration

If any of the above signs are found while the equipment is powered up, immediately inform operating personnel and assess the risk of leaving the drive system powered up. Before removing power from the equipment, always consult with the operating personnel responsible for the machinery and process.

If troubleshooting indicates the need for component replacement, refer to "Field Replacement of the Power Converter" on page 92.

PREVENTIVE MAINTENANCE

All Type 1 controllers use convection cooling. All Type 12K controllers for 10 hp and above at 460 V and 7.5 hp and above at 208/230 V use forced air cooling. All Type 3R controllers use ventilation cooling. Inspect the interior fans (if used) and exterior fans of the controller for blockage and impeded rotation. To prevent overheating and to allow proper air flow, maintain the clearances shown on the enclosure outline drawings in this instruction bulletin.

To maintain the environmental rating of Type 12K or 3R enclosures, periodically inspect the enclosure gaskets for damage.

The graphic display terminal is an integral part of the enclosure and must be installed on the door to maintain the environmental integrity of a Type 12K enclosure. It can be omitted when MOD D09 is selected and in that case a closing plate must be installed to maintain the Type 12K environmental rating.

PRODUCT SUPPORT

When troubleshooting the E-Flex™ drive, discuss with operating personnel the symptoms of the reported problems. Ask them to describe the problem, when they first observed the problem, and where the problem was seen. Observe directly the drive system and process.

For more information, call, fax, or write:

Drives Product Support Group
P.O. Box 27446
Raleigh, NC 27611-7446

The Product 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 (888-Square D)
E-mail	drive.products.support@us.schneider-electric.com
Fax	919-217-6508

SERVICE (ON-SITE)

The Services division is committed to providing quality on-site service that consistently meets customer expectations. Services responds to your requests, seven days a week, 24 hours a day.

Toll Free	1-888-778-2733 (888-Square D)
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CUSTOMER TRAINING

Schneider Electric offers a variety of instructor-led, skill enhancing and technical product training programs for customers. For a complete list of drives/soft start training with dates, locations, and pricing, please call:

Phone	978-975-9306
Fax	978-975-2821

E-FLEX TROUBLESHOOTING SHEET

When requesting after-sales service, it is important to disclose all conditions under which the Square D equipment currently operates. This will help in diagnosing the system quickly.

Call the Product Support Group at 888-SQUARED (778-2733)

DATE: _____
CONTACT NAME: _____
COMPANY: _____
ADDRESS: _____
CITY: _____
STATE: _____
PHONE: _____
FAX: _____

DRIVE CONFIGURATION

CATALOG NUMBER: CLASS **8839** TYPE **EFD**: _____

APPLICATION/EQUIPMENT DESIGNATION: _____

MOTOR NAMEPLATE DATA

HORSEPOWER: _____ VOLTAGE (3 PHASE): _____ FREQUENCY: _____ POLES: _____ FLA: _____
SERVICE FACTOR: _____ MOTOR INSULATION: ☐ NEW OR ☐ EXISTING
MOTOR CABLE TYPE: _____ LENGTH IN FEET: _____
IS MOTOR DESIGNED TO COMPLY WITH NEMA MG-1 PART 31 GUIDELINES? ☐ YES ☐ NO

POWER SOURCE AND ENVIRONMENT

VOLTAGE BETWEEN: L1 AND L2: _____ L2 AND L3: _____ L3 AND L1: _____
SERVICE TRANSFORMER RATING: _____ KVA _____ % Z FREQUENCY: ☐ 60 HZ OR ☐ 50 HZ
AMBIENT TEMPERATURES: MIN °C (°F) _____ MAX °C (°F) _____ HUMIDITY: _____
ALTITUDE IF GREATER THAN 3300 FEET ABOVE SEA LEVEL, SPECIFY: _____ FT

DRIVE DETECTED FAULT CODES

Refer to ATV61 Programming Manual for possible causes and corrective action

- | | | | | |
|---|---|--|---|--|
| <input type="checkbox"/> Ai2F AI2 input | <input type="checkbox"/> FCF1 Output contactor stuck | <input type="checkbox"/> InFb Internal-thermal sensor | <input type="checkbox"/> OPF2 3 motor phase loss | <input type="checkbox"/> SCF4 IGBT short circuit |
| <input type="checkbox"/> APF Application fault | <input type="checkbox"/> FCF2 Output contactor open | <input type="checkbox"/> InFC Internal-time measurement | <input type="checkbox"/> OSF Mains overvoltage | <input type="checkbox"/> SCF5 Motor short circuit |
| <input type="checkbox"/> bOF DB resistor overload | <input type="checkbox"/> HCF Cards pairing | <input type="checkbox"/> InFE Internal-CPU | <input type="checkbox"/> OtF1 PTC1 overheat | <input type="checkbox"/> SLF1 Modbus comm. |
| <input type="checkbox"/> bUF DB unit short circuit | <input type="checkbox"/> HdF IGBT desaturation | <input type="checkbox"/> LCF Input contactor | <input type="checkbox"/> OtF2 PTC2 overheat | <input type="checkbox"/> SLF2 Powersuite comm. |
| <input type="checkbox"/> CFF Incorrect config. | <input type="checkbox"/> ILF Internal comm. link | <input type="checkbox"/> LFF2 AI2 4-20mA loss | <input type="checkbox"/> OtFL LI6 = PTC overheat | <input type="checkbox"/> SLF3 HMI communication |
| <input type="checkbox"/> CFI Invalid configuration | <input type="checkbox"/> InF1 Rating error | <input type="checkbox"/> LFF3 AI3 4-20mA loss | <input type="checkbox"/> PHF Input phase loss | <input type="checkbox"/> SOF Overspeed |
| <input type="checkbox"/> CnF Comm. network | <input type="checkbox"/> InF2 Incompatible power board | <input type="checkbox"/> LFF4 AI4 4-20mA loss | <input type="checkbox"/> PrF Phase removal | <input type="checkbox"/> SPIF PI Feedback |
| <input type="checkbox"/> COF CAN comm. | <input type="checkbox"/> InF3 Internal serial link | <input type="checkbox"/> nFF External flow sensor | <input type="checkbox"/> PrtF Power identification | <input type="checkbox"/> SSF Torque/current limit |
| <input type="checkbox"/> CrF1 Precharge | <input type="checkbox"/> InF4 Internal MFG area | <input type="checkbox"/> ObF Overbraking | <input type="checkbox"/> PtF1 PTC1 probe | <input type="checkbox"/> tJF IGBT overheat |
| <input type="checkbox"/> CrF2 Thyristor soft charge | <input type="checkbox"/> InF6 Internal-option | <input type="checkbox"/> OCF Overcurrent | <input type="checkbox"/> PtF2 PTC2 probe | <input type="checkbox"/> tnF Auto tuning |
| <input type="checkbox"/> EEF1 Control Eeprom | <input type="checkbox"/> InF7 Internal-hard initialization | <input type="checkbox"/> OHF Drive overheat | <input type="checkbox"/> PtFL LI6 = PTC probe | <input type="checkbox"/> ULF Process underload |
| <input type="checkbox"/> EEF2 Power Eeprom | <input type="checkbox"/> InF8 Internal-control supply | <input type="checkbox"/> OLC Process overload | <input type="checkbox"/> SCF1 Motor short circuit | <input type="checkbox"/> USF Undervoltage |
| <input type="checkbox"/> EPF1 External fault via logic input | <input type="checkbox"/> InF9 Internal-current measure | <input type="checkbox"/> OLF Motor overload | <input type="checkbox"/> SCF2 Impedant short circuit | |
| <input type="checkbox"/> EPF2 External fault via comm. link | <input type="checkbox"/> InFA Internal-mains circuit | <input type="checkbox"/> OPF1 1 motor phase loss | <input type="checkbox"/> SCF3 Ground short circuit | |

DETAILED DESCRIPTION OF PROBLEM

FIELD REPLACEMENT PROCEDURES

FIELD REPLACEMENT OF THE POWER CONVERTER

Refer to Appendix A beginning on page 103 for the part numbers of the equipment required for the following field replacement procedures. For component locations, refer to Figures 2–4 on pages 16–18.

If the power converter becomes inoperable in the E-Flex controllers, it must be replaced. Refer to Table 36 for power converter weights.

Table 36: Power Converter Weights

460 V	230/208 V	Converter		Converter w/ Flange	
VT		lb	kg	lb	kg
1–5	1–3	6.6	3	12.54	5.7
7.5	5–7.5	8.8	4	15.62	7.1
10–15	10	12.1	5.5	20.24	9.2
20	15	15.4	7	25.52	11.6
25–30	20–25	19.8	9	30.58	13.9
40	30–40	41.8	19	50.38	22.9
	50	85.8	39	96.58	43.9
50–60		57.2	26	66.44	30.2
75–100		96.8	44	108.24	49.2

Observe the lockout/tagout procedures as identified in OSHA Standard 29 CFR, Subpart J covering:

- 1910.147: The control of hazardous energy (lockout/tagout).
- 1910.147: App A, Typical minimal lockout procedures.

Removing the Power Converter Assembly

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power.
- Place a “Do Not Turn On” label on the drive disconnect.
- Lock the disconnect in the open position.
- Read and understand the bus voltage measurement procedure on page 42 before performing the procedure. Measurement of bus capacitor voltage must be performed by qualified personnel.
- DO NOT short across DC bus capacitors or touch unshielded components or terminal strip screw connectors with voltage present.
- Many parts in the drive, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

ELECTROSTATIC DISCHARGE

Do not subject this device to electrostatic discharge. This controller contains electronic components that are very susceptible to damage from electrostatic discharge.

Failure to follow these instructions can result in injury or equipment damage.

Observe the following precautions when handling static sensitive components:

- Keep static producing material (plastic, upholstery, carpeting) out of the immediate work area.
- Store the power converter assembly in its protective packaging when it is not installed in the drive.
- When handling the power converter assembly, wear a conductive wrist strap connected to the power converter assembly through a minimum of one megaohm resistance.
- Avoid touching exposed conductors and component leads with skin or clothing.

To replace the power converter, follow these steps:

1. Open the door of the drive. To open the door, turn the circuit breaker and handle assembly to the Off position.
2. Measure the DC bus voltage as described on page 42 of this instruction bulletin.
3. Disconnect all power and control wiring from the power converter assembly. Identify each wire for ease of re-assembling the new power converter.
4. Remove the heatsink fan assembly before removing the power converter. Refer to the "Field Replacement of Heatsink Fan Assembly" on page 95 for directions.
5. Remove the outside flange screws that secure the power converter to the enclosure back pan. Refer to Figures 12–16 starting on page 46 for screw locations. Refer to Table 37 for the number of screws on your controller. Keep the screws for the new power converter.

Table 37: Number of Flange Screws

460 V	No. of Screws	208/230 V	No. of Screws
1–7.5	10	1–5	10
10–25	10	7.5–10	10
30 40 50	10 12 14	15–25	10
60 75–100	14 16	30–40 50	12 14

6. Remove the power converter assembly from the enclosure.

Installing the Power Converter Assembly

Before installing, remove the side panels from the new drive.

To install the new power converter, follow these steps:

1. Install the new power converter assembly in the enclosure.
2. Secure the power converter picture frame to the enclosure back pan using the picture frame screws from the removed power converter. Torque the screws to 15 ± 2 lb-in. (1.7 ± 0.2 N·m).
3. Install all power and control wiring to the power converter assembly terminal blocks. Install all other removed equipment. Tighten the hardware to the torque values given in Table 38. Check all wiring connections for correct terminations and check the power wiring for grounds with an ohmmeter.

Table 38: Terminal Torques

Terminal		Torque	
		lb-in	N·m
Power Terminal Strip:			
460 V	EFDC•4V_ to EFDG•4V_ (1–7.5 hp)	12.3	1.4
	EFDH•4V_ to EFDK•4V_ (10–20 hp)	26.5	3
	EFDL•4V_ to EFDN•4V_ (25–30 hp)	47.7	5.4
	EFDN•4V_ to EFDQ•4V_ (40–60 hp)	106.2	12
	EFDR•4V_ to EFDS•4V_ (75–100 hp)	360	41
230 V	EFDC•3V_ to EFDG•3V_ (1–7.5 hp)	12.3	1.4
	EFDH•3V_ to EFDJ•3V_ (10–15 hp)	26.5	3
	EFDK•3V_ to EFDL•3V_ (20–25 hp)	47.7	5.4
	EFDN•3V_ to EFDN•3V_ (30–40 hp)	106.2	12
	EFDP•3V_ (50 hp)	360	41
208 V	EFDC•2V_ to EFDG•2V_ (1–7.5 hp)	12.3	1.4
	EFDH•2V_ to EFDJ•2V_ (10–15 hp)	26.5	3
	EFDK•2V_ to EFDL•2V_ (20–25 hp)	47.7	5.4
	EFDN•2V_ to EFDN•2V_ (30–40 hp)	106.2	12
	EFDP•2V_ (50 hp)	360	41
S Shield Connection (power converter)		3.5	0.34

4. Shut the enclosure door, secure the door with door fasteners, and close the circuit breaker disconnect.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified personnel.
- Qualified personnel performing diagnostics or troubleshooting requiring electrical conductors to be energized must comply with NFPA 70 E - Standard for Electrical Safety Requirements for Employee Workplaces and OSHA Standards – 29 CFR Part 1910 Subpart S Electrical.

Failure to follow these instructions will result in death or serious injury.

- To set the drive to allow increase in horsepower, do the following:
 - Make sure the Hand off Auto selector switch is in the Off position, and the Test Normal switch (if present) is in the Test position, then apply power to the drive.
 - Go to menu 2 (Access Level) and select Expert.
 - Go to Menu 1.4 (Motor Control) and change the Power Ident (Prt) from IP20 to IP00.
- Program the drive according to the control circuit elementary diagrams in Section 5 beginning on page 99. Follow the initial start-up procedure on page 56.

The drive is now ready to operate.

Refer to Appendix A beginning on page 103 for the part numbers of the equipment required for the following field replacement procedures. For component locations, refer to Figures 2–4 on pages 16–18.

FIELD REPLACEMENT OF HEATSINK FAN ASSEMBLY

If a heatsink fan becomes inoperable the fan assembly must be replaced. Observe the lockout / tagout procedures as identified in OSHA Standard 29 CFR, Subpart J covering:

- 1910.147: The control of hazardous energy (lockout/tagout).
- 1910.147: App A, Typical minimal lockout procedures.

Removing the Heatsink Fan Assembly

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power.
- Place a “Do Not Turn On” label on the drive disconnect.
- Lock the disconnect in the open position.
- Read and understand the bus voltage measurement procedure on page 42 before performing procedure. Measurement of bus capacitor voltage must be performed by qualified personnel.
- DO NOT short across DC bus capacitors or touch unshielded components or terminal strip screw connectors with voltage present.
- Many parts in the drive, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

ELECTROSTATIC DISCHARGE

Do not subject this device to electrostatic discharge. This controller contains electronic components that are very susceptible to damage from electrostatic discharge.

Failure to follow these instructions can result in injury or equipment damage.

Observe the following precautions when handling static sensitive components:

- Keep static producing material (plastic, upholstery, carpeting) out of the immediate work area.
- Store the heatsink fan assembly in its protective packaging when it is not installed in the drive.
- When handling the heatsink fan assembly, wear a conductive wrist strap connected to the heatsink fan assembly through a minimum of one megaohm resistance.
- Avoid touching exposed conductors and component leads with skin or clothing.

To replace the heatsink fan assembly, follow these steps:

1. Open the door of the drive. To open the door, turn the circuit breaker and handle assembly to the Off position.
2. Measure the DC bus voltage as described on page 42.
3. Locate the heatsink fan assembly below the power converter.
4. Remove the four screws securing the heatsink fan assembly. Keep the four screws.
5. Lift the fan assembly above the flange opening.
6. Disconnect the fan cable from the converter.
7. Remove the fan assembly from the enclosure.

Installing the Heatsink Fan Assembly

To install the new heatsink fan assembly, follow these steps:

1. Place the fan assembly near the flange opening.
2. Connect the fan assembly wiring plug to the converter cable, below the flange.
3. Install the heatsink fan assembly. Secure the assembly with the four screws saved from step 4 above. Torque the screws to 15 lb-in (1.7 N•m).
4. Shut the enclosure door and secure it with door fasteners. Then close the circuit breaker disconnect.
5. Fully test the drive before placing into service.

FIELD REPLACEMENT OF THE STIRRING FANS

If a stirring fan inside the enclosure becomes inoperable, the fan must be replaced.

Before removing the inoperable stirring fan, mark and note airflow direction to ensure proper installation of the replacement fan.

FIELD REPLACEMENT OF THE VENTILATION FAN ON TYPE 3R

Figure 27: Removing Mounting Screws

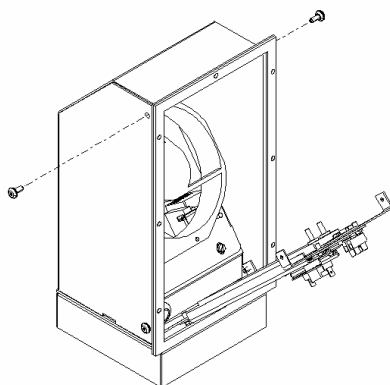
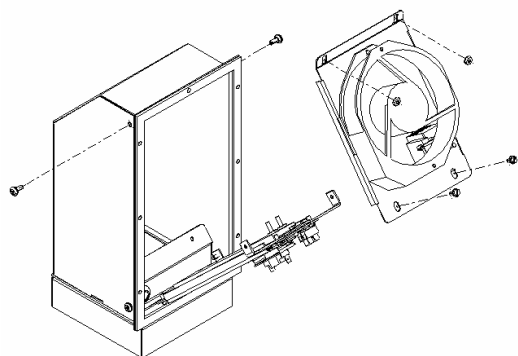


Figure 28: Removing Bracket Mounting Screws



FIELD REPLACEMENT OF THE SPACE HEATER ON TYPE 3R

FIELD MAINTENANCE AND REPLACEMENT OF HOOD FILTERS ON TYPE 3R

If a Type 3R ventilation fan becomes inoperable, the fan must be replaced. Before removing the inoperable ventilation fan, mark and note airflow direction to ensure proper installation of the replacement fan.

To replace the enclosure ventilation fan:

1. Observe the lockout/tagout procedures as identified in OSHA Standard 29 CFR, Subpart J covering:
 - 1910.147: The control of hazardous energy (lockout/tagout)
 - 1910.147: App A, Typical minimal lockout procedures
2. Open the disconnect between the input line and the drive, then lock and tag the disconnect between the input line and the drive in the Off position.
3. Remove all external control power that may be present.
4. Wait 15 minutes before opening the door of the drive.
5. Using a T20 Torx driver, remove the 7 screws used to hold the enclosure ventilation hood to the side of the enclosure.
6. Remove the control power wires and ground bonding jumper, then mark the location of these terminals.
7. Remove the bracket mounting screws and rotate the bracket forward. See Figure 27.
8. Using a 3/8 in. hex-head socket, remove the screws holding the fan bracket to the ventilation hood. See Figure 28.
9. Remove and replace the two screws that attaches the fan to the fan bracket.
10. Reassemble the ventilation hood. Make sure not to pinch the wires or allow the wires to come into contact with the heater surface.

CAUTION

EQUIPMENT DAMAGE

The surface of the heater is potentially hot.

- Prevent contact with the wires and the heater guard.
- Ensure that the wires do not contact the heater surface.

Failure to follow these instructions can result in equipment damage.

11. Reattach the control wires and the ground bonding jumper.
12. Mount the ventilation hood back to the side of the enclosure and secure with the 7 screws that were removed in step 4.

NOTE: To prevent displacement of the rubber washers, do not over tighten the screws.
13. After servicing the drive, close and secure the door.
14. Fully test the drive before placing into service.

If a Type 3R strip heater becomes inoperable, the strip heater must be replaced. The thermostat is factory set at 60 °F (15 °C).

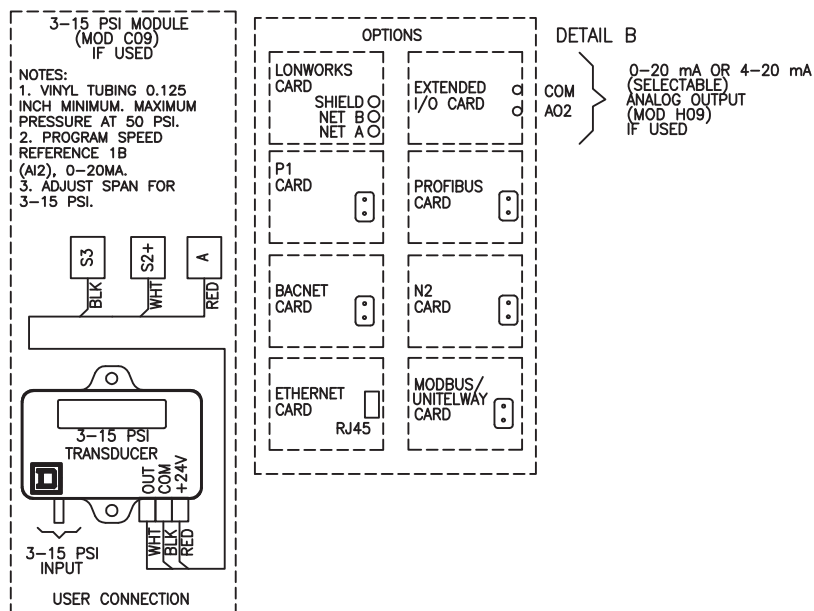
The Type 3R E-Flex filter material located on the bottom of the side hoods is washable. Remove, wash, and install it as required to maintain airflow.

SECTION 6— POWER AND CONTROL CIRCUIT ELEMENTARY DIAGRAMS

Figure 29: Power Circuit Y (With Bypass): Hand-Off-Auto, Speed Potentiometer and Start-Stop
(Drawing No. 80461-071-01) (continued)

ATV61 FACTORY CONFIGURATION						
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.	
SIM	1.1	-----	2/3 WIRE CONTROL	tCC	2C	
SIM	1.1	-----	PUMPS/FANS	CFG	PnF	
SIM	1.1	-----	STANDARD MOT. FREQ (HZ)	bFr	60	
SIM	1.1	-----	ACCELERATION (SEC)	ACC	10	
SIM	1.1	-----	DECELERATION (SEC)	dEC	10	
SIM	1.1	-----	LOW SPEED (HZ)	LSP	3	
SEt	1.3	-----	SWITCHING FREQ. (HZ)	SFr	8	
I-O	1.5	-----	2 WIRE TYPE	tCt	LEL	
I-O	1.5	AI2 CONFIG.	AI2 MIN. VALUE (mA)(W/O MOD J09)	CrL2	4	
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn	
Δ1	CTL	1.6	-----	REF. 1 CHAN	FR1	HMI
	CTL	1.6	-----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1	AI1
	CTL	1.6	-----	PROFILE(W/O MOD H03 OR D09 ONLY)	CHCF	SEP
	FUn	1.7	STOP CONFIG.	FREEWHEEL STOP ASSIGN	nST	LI2
	FUn	1.7	REFERENCE SWITCH.	REF. 1B SWITCHING	rCb	LI3
	FUn	1.7	REFERENCE SWITCH.	REF. 1B CHAN	Fr1b	AI2
	FLT	1.8	FAULT RESET	FAULT RESET	rSF	LI4
	FLT	1.8	CATCH ON THE FLY	CATCH ON THE FLY	FLR	YES
	FLT	1.8	OUTPUT PHASE LOSS	OUTPHASE LOSS	OPL	NO
Δ2	COM	1.9	FORCED LOCAL	FORCED LOCAL ASSIGN.	FLO	LI4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD						
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.	
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	OFr	
WHEN MOD J09 SELECTED - 0-10V DC SPEED REF.						
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.	
I-O	1.5	AI2 CONFIG.	AI2 TYPE	AI2t	10U	

DESCRIPTION	TYPE 1	TYPE 12K	TYPE 3R
± STIRRING FAN	NA	10-100HP 460V, 7.5-50HP 208/230V	NA
± VENTILATION FAN	NA	NA	ALL HP
± SPACE HEATER	NA	NA	ALL HP



[illegible]

Figure 30: Power Circuit Y (With Bypass): Hand-Off-Auto and Speed Potentiometer
(Drawing No. 80461-072-01) (continued)

ATV61 FACTORY CONFIGURATION					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
SIM	1.1	-----	2/3 WIRE CONTROL	tCC	2C
SIM	1.1	-----	PUMPS/FANS	CFG	PnF
SIM	1.1	-----	STANDARD MOT. FREQ (HZ)	bFr	60
SIM	1.1	-----	ACCELERATION (SEC)	ACC	10
SIM	1.1	-----	DECELERATION (SEC)	dEC	10
SIM	1.1	-----	LOW SPEED (HZ)	LSP	3
SEt	1.3	-----	SWITCHING FREQ. (HZ)	SFr	8
I-O	1.5	-----	2 WIRE TYPE	tCt	LEL
I-O	1.5	A12 CONFIG.	A12 MIN. VALUE (mA)(W/O MOD J09)	C12	4
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn
CHL	1.6	-----	REF. 1 CHAN	FR1	HMI
CHL	1.6	-----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1	A1
CHL	1.6	-----	PROFILE(W/O MOD H03 OR D09 ONLY)	CHCF	SEP
FUn	1.7	STOP CONFIG.	FREEWHEEL STOP ASSIGN	nST	U2
FUn	1.7	REFERENCE SWITCH.	REF. 1B SWITCHING	rCb	U3
FUn	1.7	REFERENCE SWITCH.	REF. 1B CHAN	Fr1b	A12
FLT	1.8	FAULT RESET	FAULT RESET	rSF	U4
FLT	1.8	CATCH ON THE FLY	CATCH ON THE FLY	FLR	YES
FLT	1.8	OUTPUT PHASE LOSS	OUTPHASE LOSS	OPL	NO
COM	1.9	FORCED LOCAL	FORCED LOCAL ASSIGN.	FLO	U4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	QFr
WHEN MOD J09 SELECTED - 0-10V DC SPEED REF.					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	A12 CONFIG.	A12 TYPE	A12t	10U

DESCRIPTION	TYPE 1	TYPE 12K	TYPE 3R
±STIRRING FANS	NA	10-100HP 460V, 7.5-50HP 208/230V	NA
±VENTILATION FAN	NA	NA	ALL HP
±SPACE HEATER	NA	NA	ALL HP

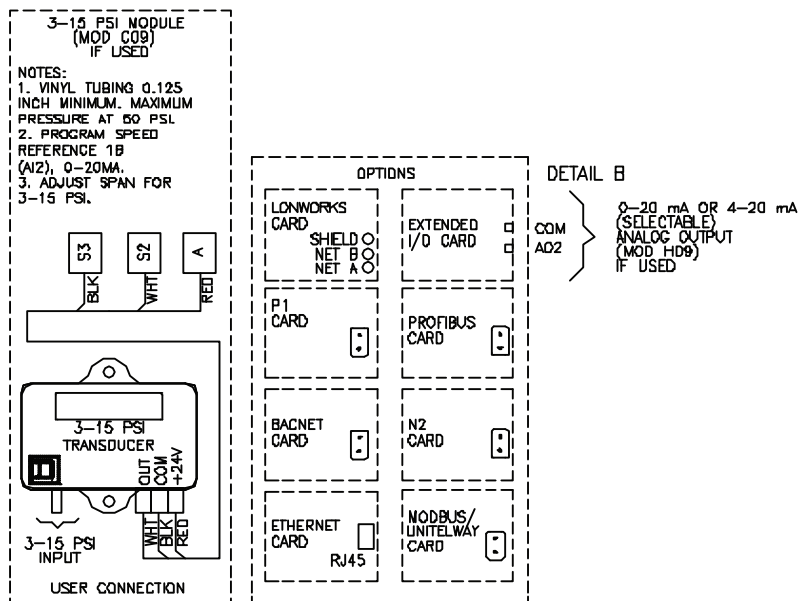


Figure 31: Power Circuit W (Without Bypass): Hand-Off-Auto, Start-Stop, and Speed Potentiometer
(Drawing No. 80461-073-01)

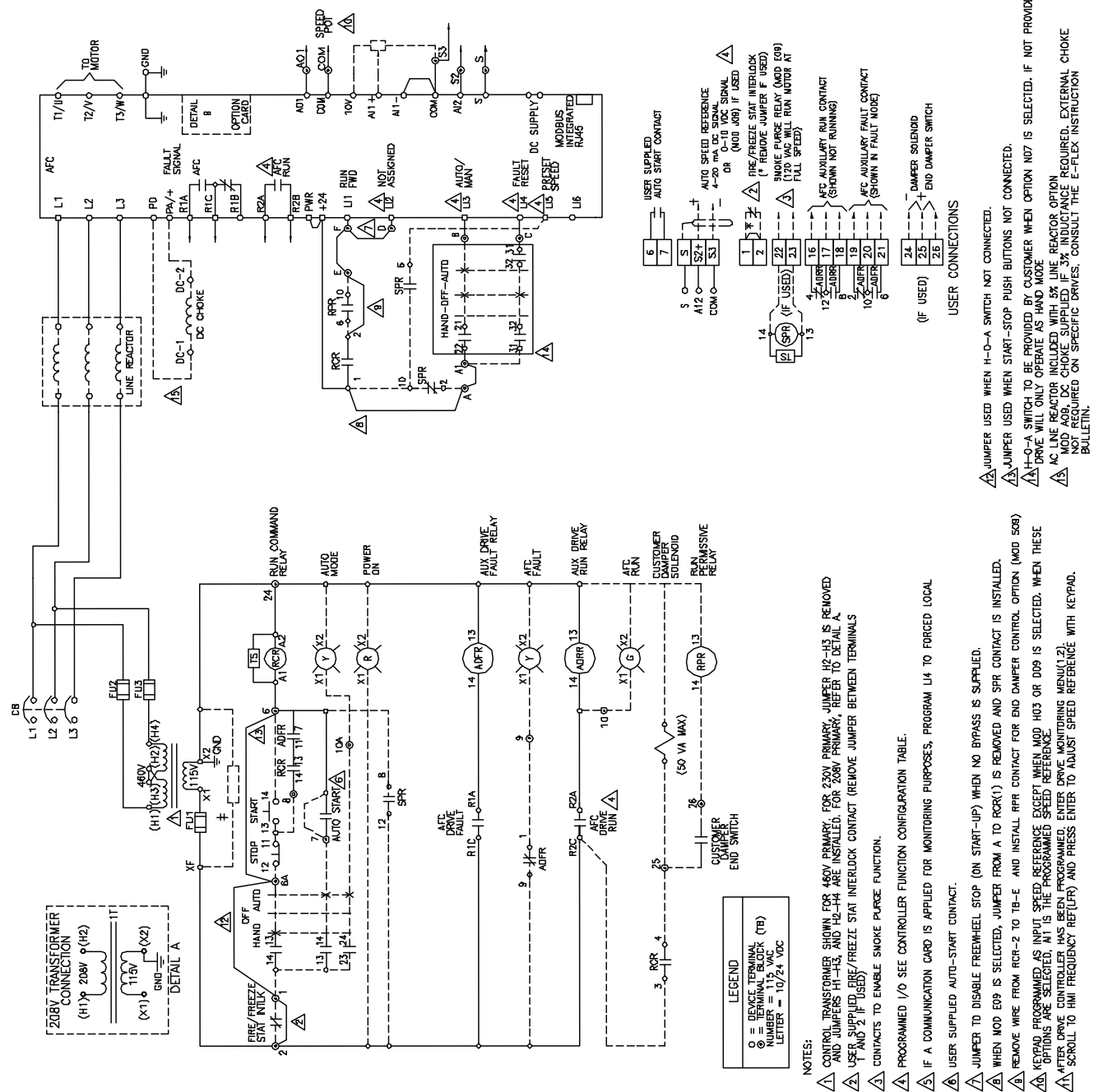


Figure 31: Power Circuit W (Without Bypass): Hand-Off-Auto, Start-Stop, and Speed Potentiometer
(Drawing No. 80461-073-01) (continued)

ATV61 FACTORY CONFIGURATION						
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.	
SIM	1.1	-----	2/3 WIRE CONTROL	tCC	2C	
SIM	1.1	-----	PUMPS/FANS	CFG	PnF	
SIM	1.1	-----	STANDARD MOT. FREQ (HZ)	bFr	60	
SIM	1.1	-----	ACCELERATION (SEC)	ACC	10	
SIM	1.1	-----	DECELERATION (SEC)	dEC	10	
SIM	1.1	-----	LOW SPEED (HZ)	LSP	3	
SEt	1.3	-----	SWITCHING FREQ. (HZ)	SFr	8	
I-O	1.5	-----	2 WIRE TYPE	tCt	LEL	
I-O	1.5	AI2 CONFIG.	AI2 MIN. VALUE (mA)(W/O MOD J09)	OrL2	4	
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn	
△	CtL	1.6	-----	REF. 1 CHAN	FR1	HMI
	CtL	1.6	-----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1	AI1
	CtL	1.6	-----	PROFILE(W/O MOD H03 OR D09 ONLY)	CHCF	SEP
	FUn	1.7	REFERENCE SWITCH.	REF. 1B SWITCHING	rCb	U3
	FUn	1.7	REFERENCE SWITCH.	REF. 1B CHAN	Fr1b	AI2
	FUn	1.7	PRESET SPEEDS	2 PRESET SPEEDS	PS2	U5
	FUn	1.7	PRESET SPEEDS	PRESET SPEED 2	SP2	60
	FLT	1.8	FAULT RESET	FAULT RESET	rSF	U4
△	FLT	1.8	CATCH ON THE FLY	CATCH ON THE FLY	FLR	YES
	COM	1.9	FORCED LOCAL	FORCED LOCAL ASSIGN.	FLO	U4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD						
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.	
I-O	1.5	AD2	AO2 ASSIGNMENT (MOTOR FREQ, mA)	AO2	OrFr	
WHEN MOD J09 SELECTED - 0-10V DC SPEED REF.						
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.	
I-O	1.5	AI2 CONFIG.	AI2 TYPE	AI2t	10U	
DESCRIPTION		TYPE 1	TYPE 12K	TYPE 3R		
±STIRRING FANS		NA	10-100HP 480V, 7.5-50HP 208/230V	NA		
±VENTILATION FAN		NA	NA	ALL HP		
±SPACE HEATER		NA	NA	ALL HP		

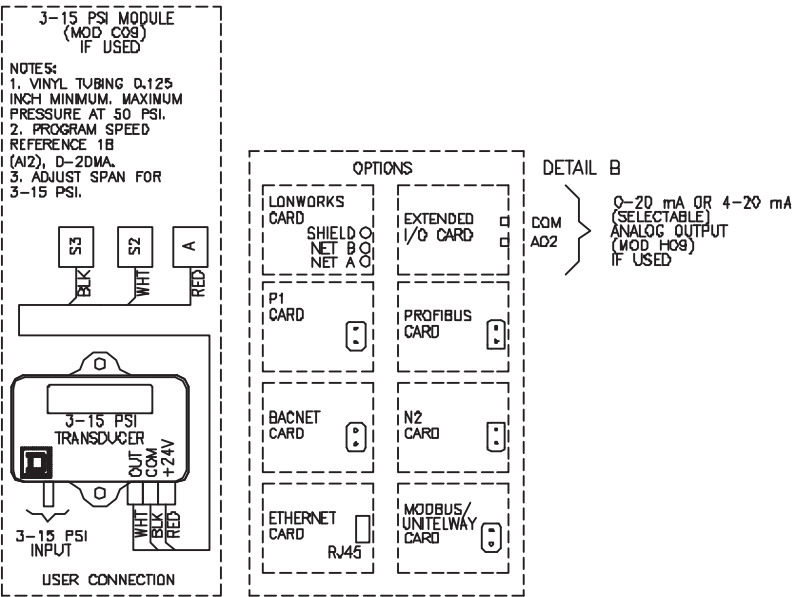


Figure 32: Power Circuit W (Without Bypass): Start-Stop and Speed Potentiometer
(Drawing No. 80461-074-01)

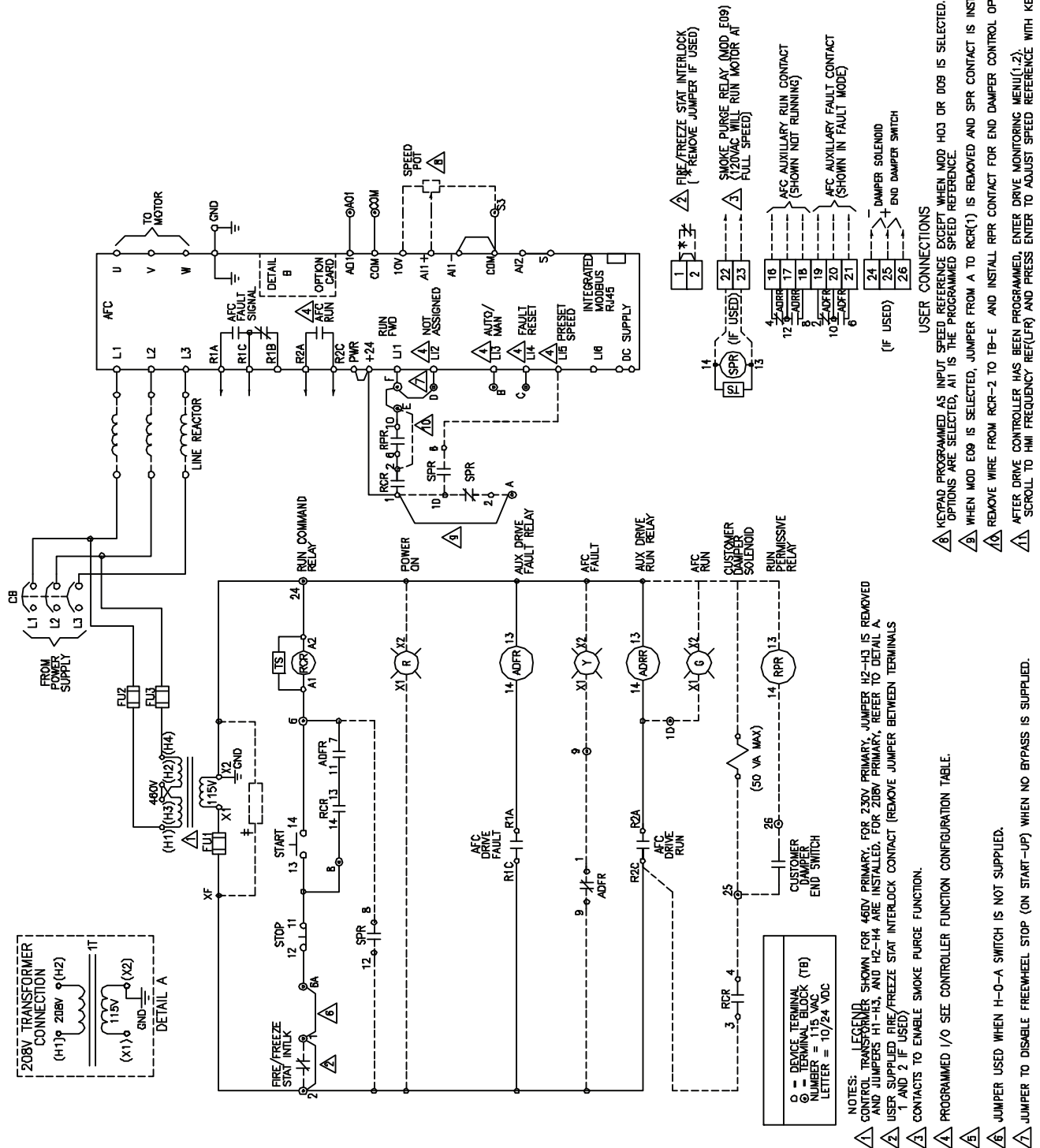


Figure 32: Power Circuit W (Without Bypass): Start-Stop and Speed Potentiometer
(Drawing No. 80461-074-01) (continued)

ATV61 FACTORY CONFIGURATION					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
SIM	1.1	----	2/3 WIRE CONTROL	tCC	2C
SIM	1.1	----	PUMPS/FANS	CFG	PnF
SIM	1.1	----	STANDARD MOT. FREQ (HZ)	bFr	60
SIM	1.1	----	ACCELERATION (SEC)	ACC	10
SIM	1.1	----	DECELERATION (SEC)	dEC	10
SIM	1.1	----	LOW SPEED (HZ)	LSP	3
SEt	1.3	----	SWITCHING FREQ. (HZ)	SFr	8
I-O	1.5	----	2 WIRE TYPE	tCt	LEL
I-O	1.5	AI2 CONFIG.	AI2 MIN. VALUE (mA)(W/O MOD J09)	CrL2	4
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn
△	CtL	1.6	----	REF. 1 CHAN	FR1 HMI
	CtL	1.6	----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1 AI1
	CtL	1.6	----	PROFILE(W/O MOD H03 OR D09 ONLY)	CHCF SEP
	FUn	1.7	REFERENCE SWITCH.	rCb	LI3
	FUn	1.7	REFERENCE SWITCH.	Fr1b	AI2
	FUn	1.7	PRESET SPEEDS	PS2	LI5
	FUn	1.7	PRESET SPEEDS	SP2	60
	FLT	1.8	FAULT RESET	rSF	LI4
	FLT	1.8	CATCH ON THE FLY	FLR	YES
WHEN MOD H09 SELECTED - EXTENDED I/O CARD					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	OFr
WHEN MOD J09 SELECTED - 0-10V DC SPEED REF.					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	AI2 CONFIG.	AI2 TYPE	AI2t	10U

DESCRIPTION	TYPE 1	TYPE 12K	TYPE 3R
‡STIRRING FANS	10-100HP 460V, 7.5-50HP 208/230V	10-100HP 460V, 7.5-50HP 208/230V	NA
‡VENTILATION FAN	NA	NA	ALL HP
‡SPACE HEATER	NA	NA	ALL HP

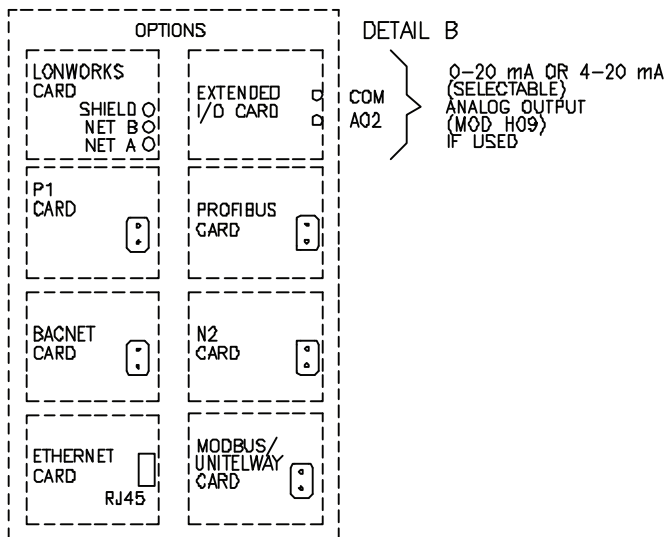


Figure 33: Power Circuit W (Without Bypass): Hand-Off-Auto and Speed Potentiometer
(Drawing No. 80461-075-01)

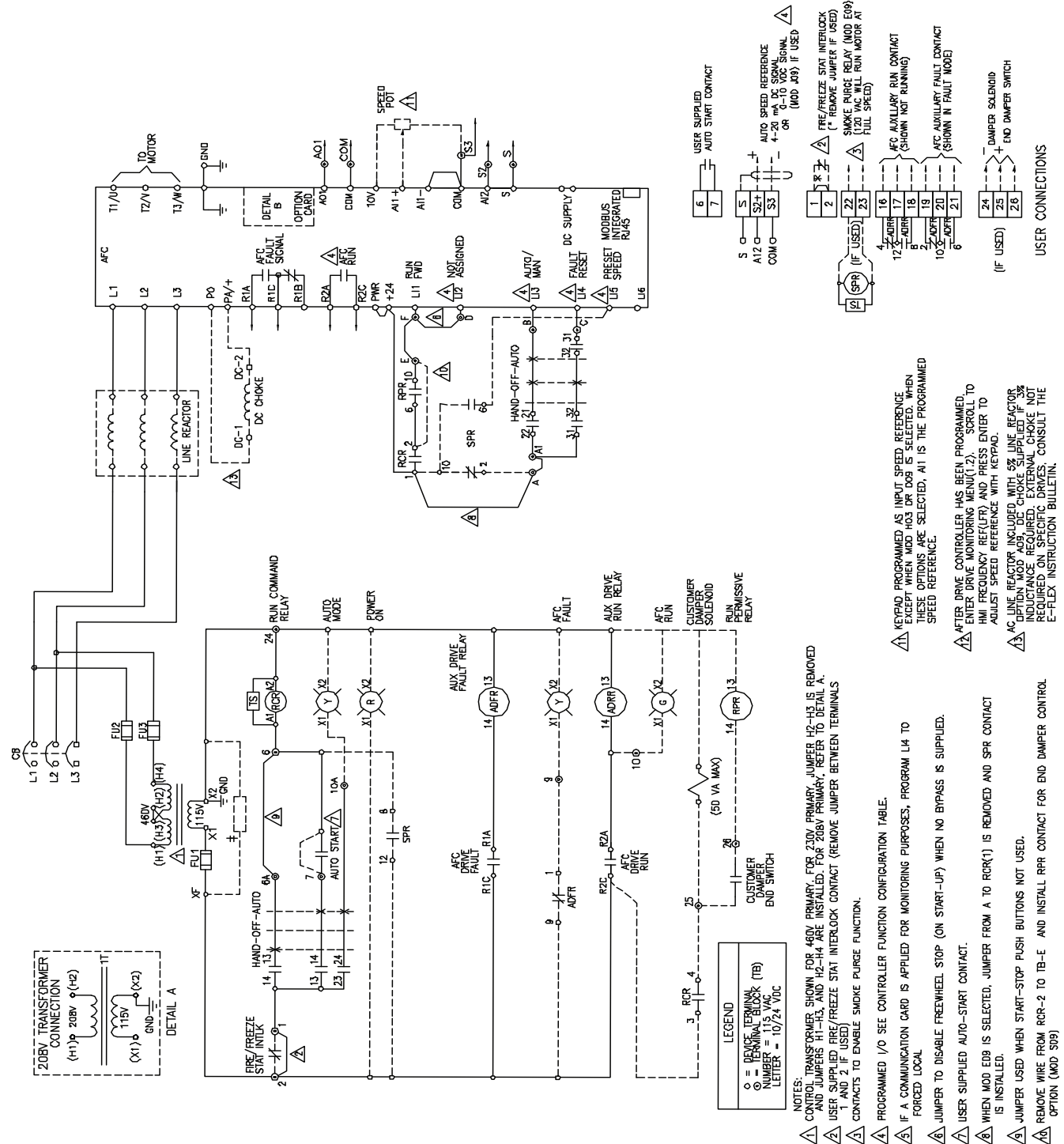
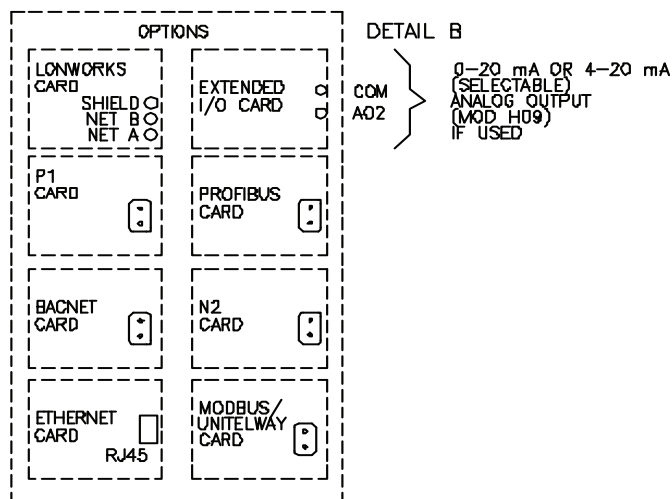
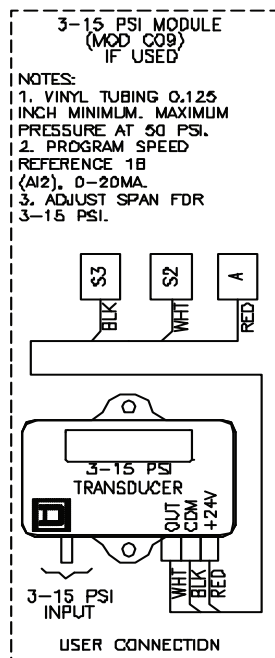


Figure 33: Power Circuit W (Without Bypass): Hand-Off-Auto and Speed Potentiometer
(Drawing No. 80461-075-01) (continued)

ATV61 FACTORY CONFIGURATION					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
SIM	1.1	----	2/3 WIRE CONTROL	tCC	2C
SIM	1.1	----	PUMPS/FANS	CFG	PnF
SIM	1.1	----	STANDARD MOT. FREQ (HZ)	bFr	60
SIM	1.1	----	ACCELERATION (SEC)	ACC	10
SIM	1.1	----	DECELERATION (SEC)	dEC	10
SIM	1.1	----	LOW SPEED (HZ)	LSP	3
SEt	1.3	----	SWITCHING FREQ. (HZ)	SFr	8
I-O	1.5	----	2 WIRE TYPE	tCt	LEL
I-O	1.5	AI2 CONFIG.	AI2 MIN. VALUE (mA)(W/O MOD J09)	CrL2	4
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn
△	CtL	1.6	----	REF. 1 CHAN	FR1 HMI
	CtL	1.6	----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1 AI1
	CtL	1.6	----	PROFILE(W/O MOD H03 OR D09 ONLY)	CHCF SEP
	FUn	1.7	REFERENCE SWITCH.	REF. 1B SWITCHING	rCb LI3
	FUn	1.7	REFERENCE SWITCH.	REF. 1B CHAN	Fr1b AI2
	FUn	1.7	PRESET SPEEDS	2 PRESET SPEEDS	PS2 LI5
	FUn	1.7	PRESET SPEEDS	PRESET SPEED 2	SP2 60
	FLT	1.8	FAULT RESET	FAULT RESET	rSF LI4
△	FLT	1.8	CATCH ON THE FLY	CATCH ON THE FLY	FLR YES
	COM	1.9	FORCED LOCAL	FORCED LOCAL ASSIGN.	FLO LI4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	OFr
WHEN MOD J09 SELECTED - 0-10V DC SPEED REF.					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	AI2 CONFIG.	AI2 TYPE	AI2t	10U

DESCRIPTION	TYPE 1	TYPE 12K	TYPE 3R
± STIRRING FANS	NA	10-100HP 460V, 7.5-50HP 208/230V	NA
± VENTILATION FAN	NA	NA	ALL HP
± SPACE HEATER	NA	NA	ALL HP



LEGEND	○ = DEVICE TERMINAL ⊙ = TERMINAL BLOCK (TB) NUMBER = 115 VAC LETTER = 10/24 VDC
--------	--

NOTES:

1. RCR TIMED CONTACT USED ONLY IF LINE CONTACTOR IS SUPPLIED.
 2. CONTROL TRANSFORMER SHOWN FOR 480V PRIMARY. JUMPER H2-H3 IS REMOVED AND JUMPERS H1-H3, AND H2-H4 ARE INSTALLED. FOR 208V PRIMARY, REFER TO DETAIL A.
 3. USER SUPPLIED FIRE/FREEZE STAT INTERLOCK CONTACT (REMOVE JUMPERS BETWEEN TERMINALS 3 AND 5A IF USED)
 4. USER SUPPLIED 115 VAC SIGNAL TO ENABLE SMOKE PURGE FUNCTION. (REMOVE JUMPERS BETWEEN TERMINALS 2 AND 3 IF USED)
 5. CIRCUIT SHOWN WITHOUT LINE CONTACTOR. (REMOVE JUMPER BETWEEN TERMINALS E AND F IF LINE CONTACTOR IS SUPPLIED)
 6. PROGRAMMED I/O SEE CONTROLLER FUNCTION CONFIGURATION TABLE.
 7. AC LINE REACTOR INCLUDED WITH 5% LINE REACTOR OPTION
 MOD A09, DC CHOKE SUPPLIED IF .3% INDUCTANCE REQUIRED. EXTERNAL CHOKE NOT REQUIRED ON SPECIFIC DRIVES, CONSULT THE E-FLEX INSTRUCTION BULLETIN.
 8. KEYPAD PROGRAMMED AS INPUT SPEED REFERENCE EXCEPT WHEN MOD H03 OR D09 IS SELECTED. WHEN THESE OPTIONS ARE SELECTED, A11 IS THE PROGRAMMED SPEED REFERENCE.
 AFTER DRIVE CONTROLLER HAS BEEN PROGRAMMED, ENTER DRIVE MONITORING MENU(1,2):
 9. SCROLL TO HMI FREQUENCY REF(UP) AND PRESS ENTER TO ADJUST SPEED REFERENCE WITH KEYPAD.

Figure 34: Power Circuit Y (With Bypass): Hand-Off-Comm, Start-Stop, and Speed Potentiometer
(Drawing No. 80461-078-01) (continued)

ATV61 FACTORY CONFIGURATION					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
SIM	1.1	----	2/3 WIRE CONTROL	tCC	2C
SIM	1.1	----	PUMPS/FANS	CFG	PnF
SIM	1.1	----	STANDARD MOT. FREQ (HZ)	bFr	60
SIM	1.1	----	ACCELERATION (SEC)	ACC	10
SIM	1.1	----	DECELERATION (SEC)	dEC	10
SIM	1.1	----	LOW SPEED (HZ)	LSP	3
SEt	1.3	----	SWITCHING FREQ. (HZ)	SFr	8
I-O	1.5	----	2 WIRE TYPE	tCt	LEL
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn
△ 8	CtL	1.6	REF. 1 CHAN(W/O H03 OR D09 ONLY)	FR1	HMI
	CtL	1.8	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1	AI1
	CtL	1.6	PROFILE	CHCF	SEP
	CtL	1.8	CMD SWITCHING	CCS	LI3
	CtL	1.6	CMD CHANNEL 2	Cd2	COM.CARD
	FUn	1.7	REFERENCE SWITCH. REF. 1B SWITCHING	rCb	LI3
	FUn	1.7	REFERENCE SWITCH. REF. 1B CHANNEL	Fr1b	COM.CARD
	FUn	1.7	STOP CONFIG. FREEWHEEL STOP ASSIGN.	nST	LI2
	FLT	1.8	FAULT RESET FAULT RESET	rSF	LI4
	FLT	1.8	CATCH ON THE FLY CATCH ON THE FLY	FLR	YES
	FLT	1.8	OUTPUT PHASE LOSS OUTPHASE LOSS	OPL	NO
	COM	1.9	FORCED LOCAL FORCED LOCAL ASSIGN.	FLO	LI4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	QFr

DESCRIPTION	TYPE 1	TYPE 12K	TYPE 3R
± STIRRING FANS	NA	10-100HP 460V, 7.5-50HP 208/230V	NA
± VENTILATION FAN	NA	NA	ALL HP
± SPACE HEATER	NA	NA	ALL HP

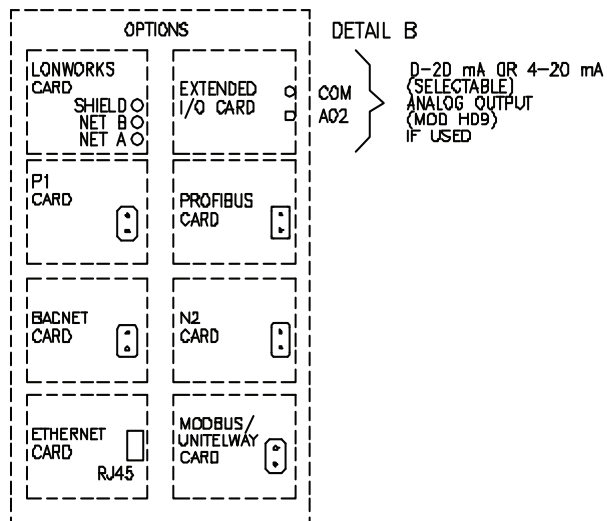


Figure 35: Power Circuit W (Without Bypass): Hand-Off-Comm, Start-Stop, and Speed Potentiometer
(Drawing No. 80461-079-01)

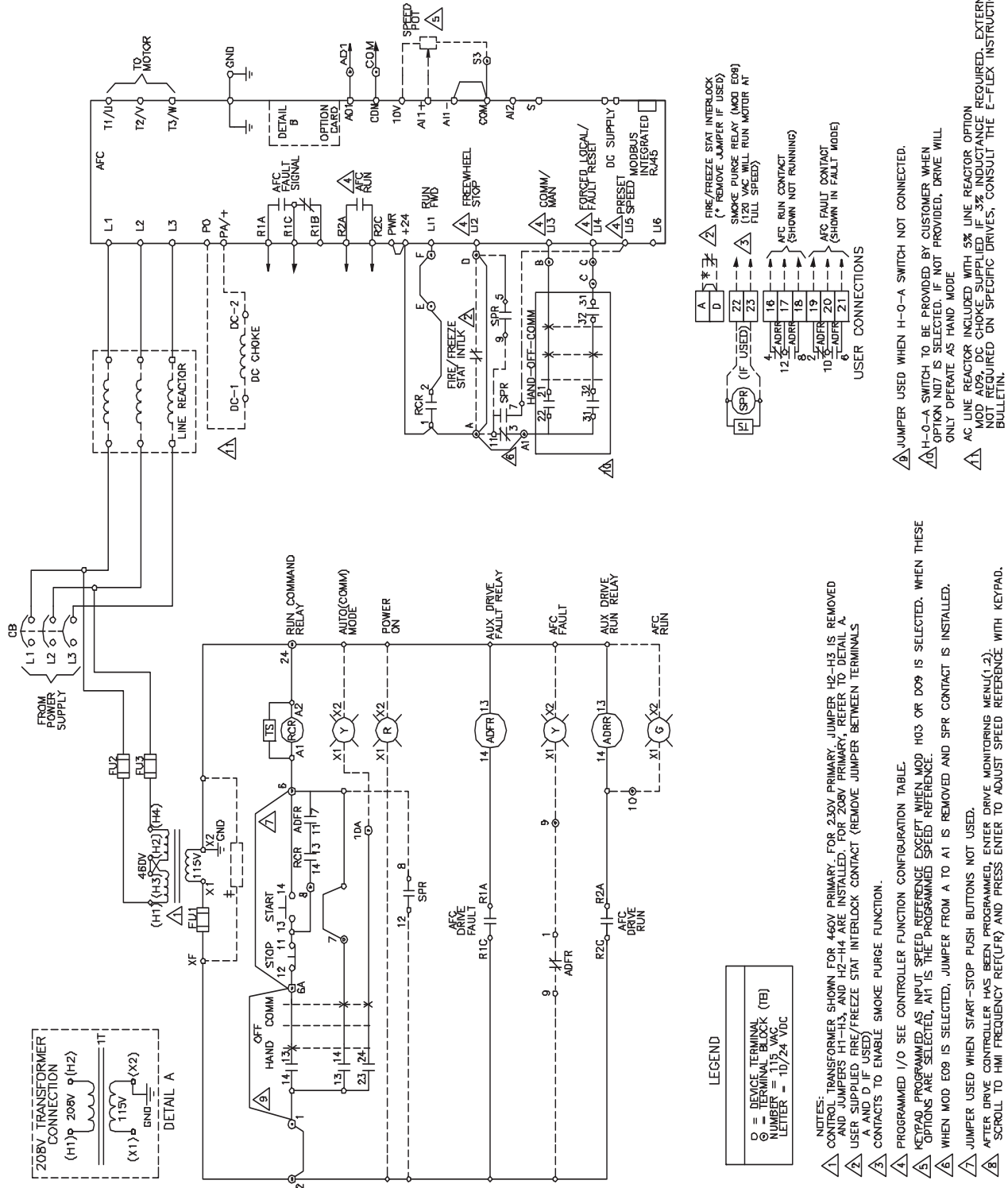


Figure 35: Power Circuit W (Without Bypass): Hand-Off-Comm, Start-Stop, and Speed Potentiometer
(Drawing No. 80461-079-01) (continued)

ATV61 FACTORY CONFIGURATION					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
SIM	1.1	----	2/3 WIRE CONTROL	tCC	2C
SIM	1.1	----	PUMPS/FANS	CFG	PnF
SIM	1.1	----	STANDARD MOT. FREQ (HZ)	bFr	60
SIM	1.1	----	ACCELERATION (SEC)	ACC	10
SIM	1.1	----	DECELERATION (SEC)	dEC	10
SIM	1.1	----	LOW SPEED (HZ)	LSP	3
SEt	1.3	----	SWITCHING FREQ. (HZ)	SFr	8
I-O	1.5	----	2 WIRE TYPE	tCt	LEL
I-O	1.5	R2 CONFIG.	R2 ASSIGN - DRIVE RUNNING	r2	rUn
CtL	1.6	----	REF. 1 CHAN(W/O H03 OR D09 ONLY)	FR1	HMI
CtL	1.6	----	REF. 1 CHAN(MOD H03 OR D09 ONLY)	FR1	AI1
CtL	1.6	----	PROFILE	CHCF	SEP
CtL	1.6	----	CMD SWITCHING	CCS	LI3
CtL	1.6	----	CMD CHANNEL 2	Cd2	COM.CARD
FUn	1.7	REFERENCE SWITCH.	REF. 1B SWITCHING	rCb	LI3
FUn	1.7	REFERENCE SWITCH	REF 1B CHANNEL	Fr1b	COM.CARD
FUn	1.7	STOP CONFIG.	FREEWHEEL STOP ASSIGN.	nST	LI2
FUn	1.7	PRESET SPEEDS	2 PRESET SPEEDS	PS2	LI5
FUn	1.7	PRESET SPEEDS	PRESET SPEED 2	SP2	60
FLT	1.8	FAULT RESET	FAULT RESET	rSF	LI4
FLT	1.8	CATCH ON THE FLY	CATCH ON THE FLY	FLR	YES
COM	1.9	FORCED LOCAL	FORCED LOCAL ASSIGN.	FLO	LI4
WHEN MOD H09 SELECTED - EXTENDED I/O CARD					
MENU	No	SUB-MENU	DESCRIPTION	CODE	ADJ.
I-O	1.5	A02	A02 ASSIGNMENT (MOTOR FREQ, mA)	A02	OFr

DESCRIPTION	TYPE 1	TYPE 12K	TYPE 3R
±STIRRING FANS	NA	10-100HP 460V, 7.5-50HP 208/230V	NA
±VENTILATION FAN	NA	NA	ALL HP
±SPACE HEATER	NA	NA	ALL HP

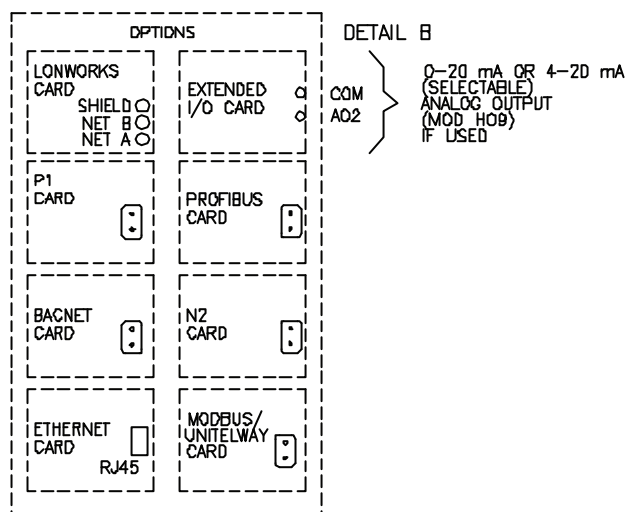
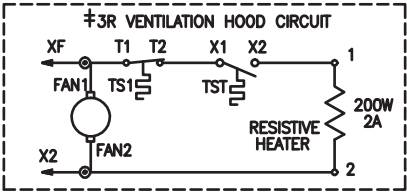


Figure 36: 3R Ventilation and Heater



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 - space heater 119–120
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APPENDIX A—RENEWABLE PARTS

Table 1: 460 V Renewable Parts

Description	Qty	1-7.5 hp	Qty	10-25 hp	Qty	30-50 hp	Qty	60-100 hp
Power Converter ¹	1	ATV61H075N4 (1 hp) ATV61H075N4 (2 hp) ATV61HU15N4 (3 hp) ATV61HU30N4 (5 hp) ATV61HU40N4 (7.5 hp)	1	ATV61HU55N4 (10 hp) ATV61HU75N4 (15 hp) ATV61HD11N4 (20 hp) ATV61HD15N4 (25 hp)	1	ATV61HD18N4 (30 hp) ATV61HD22N4 (40 hp) ATV61HD30N4 (50 hp)	1	ATV61HD37N4 (60 hp) ATV61HD45N4 (75 hp) ATV61HD55N4 (100 hp)
Graphic Display	1	VW3A1101	1	VW3A1101	1	VW3A1101	1	VW3A1101
Control Fuses Primary	2	25430–20100 (1A, 100 VA) 25430–20161 (1-6/10 A, 150 VA) 25430–20350 (3-1/2 A, 350 VA)	2	25430–20100 (1A, 100 VA) 25430–20161 (1-6/10 A, 150 VA) 25430–20350 (3-1/2 A, 350 VA)	2	25430–20100 (1A, 100 VA) 25430–20161 (1-6/10 A, 150 VA) 25430–20350 (3-1/2 A, 350 VA)	2	25430–20100 (1A, 100 VA) 25430–20161 (1-6/10 A, 150 VA) 25430–20350 (3-1/2 A, 350 VA)
Control Fuses Secondary	1	25430–20140 (1-4/10 A, 100 VA) 25430–20200 (2 A, 150 VA) 25430–20500 (5 A, 350 VA)	1	25430–20140 (1-4/10 A, 100 VA) 25430–20200 (2 A, 150 VA) 25430–20500 (5 A, 350 VA)	1	25430–20140 (1-4/10 A, 100 VA) 25430–20200 (2 A, 150 VA) 25430–20500 (5 A, 350 VA)	1	25430–20140 (1-4/10 A, 100 VA) 25430–20200 (2 A, 150 VA) 25430–20500 (5 A, 350 VA)
Pilot Light Red ²	1	LED 25501-00003 Head ZB5AV04	1	LED 25501-00003 Head ZB5AV04	1	LED 25501-00003 Head ZB5AV04	1	LED 25501-00003 Head ZB5AV04
Pilot Light Yellow ²	1	LED 25501-00004 Head ZB5AV05	1	LED 25501-00004 Head ZB5AV05	1	LED 25501-00004 Head ZB5AV05	1	LED 25501-00004 Head ZB5AV05
Pilot Light Green ²	1	LED 25501-00005 Head ZB5AV03	1	LED 25501-00005 Head ZB5AV03	1	LED 25501-00005 Head ZB5AV03	1	LED 25501-00005 Head ZB5AV03
Pilot Light Mounting Collar w/ Light Module	1	ZB5AV6	1	ZB5AV6	1	ZB5AV6	1	ZB5AV6
I/O Extension Card ³	1	VW3A3202	1	VW3A3202	1	VW3A3202	1	VW3A3202
LonWorks® Card ³	1	VW3A3312	1	VW3A3312	1	VW3A3312	1	VW3A3312
Modbus® ³	1	VW3A3303	1	VW3A3303	1	VW3A3303	1	VW3A3303
Metasys® N2 ³	1	VW3A3313	1	VW3A3313	1	VW3A3313	1	VW3A3313
24 Vdc supply	1	ABL7CEM24003	1	ABL7CEM24003	1	ABL7CEM24003	1	ABL7CEM24003
3R Hood Filter Material	2	31158-441-01	2	31158-441-01	2	31158-441-01	2	31158-441-01
3R Space Heater	1	29904-00027	1	29904-00027	1	29904-00027	1	29904-00027
3R Ventilation Fan	1	26016-00006 29904-09300	1	26016-00006	1	26016-00006	1	26016-00006
Stirring Fan Assembly	1	N/A	1 2	31158-065-50	1	31158-065-50	2	31158-065-50
Heatsink Fans	1	VZ3V1203 (1-3 hp) VZ3V1209 (5, 7.5 hp)	1	VZ3V1204 (10,15 hp) VZ3V1210 (20 hp) VZ3V1205 (25 hp)	1	VZ3V1205 (30 hp) VZ3V1211 (40 hp) VZ3V1206 (50 hp)	1	VZ3V1206 (60 hp) VZ3V1208 (70, 105 hp)
Profibus Card ³	1	VW3A3307	1	VW3A3307	1	VW3A3307	1	VW3A3307
Ethernet Card ³	1	VW3A3310D	1	VW3A3310D	1	VW3A3310D	1	VW3A3310D
Apogee™ P1 Card ³	1	VW3A3314	1	VW3A3314	1	VW3A3314	1	VW3A3314
BACnet Card ³	1	VW3A3315	1	VW3A3315	1	VW3A3315	1	VW3A3315

¹ The first five characters of the power converter part number may be "ATV61," indicating an IP20 device, or "HTV61," indicating an IP00 device.

² Long life 120 V LED type bulbs (100,000 hours) are provided as standard hardware from the factory. An alternative to the LEDs are incandescent bulbs (2,000 hours). Part number DL1CE130, Type BA9 rated 120–130 V, 2.4 W, is available as an interchangeable part.

³ Field replacement of the option board will reset the power converter to the factory default settings. The user must configure the controller per the elementary diagram with or without bypass starting on page 46.

Table 2: 208/230 V Renewable Parts

Description	Qty	1-3 hp	Qty	5-10 hp	Qty	15-25 hp	Qty	30-50 hp
Power Converter ¹	1	ATV61H075M3 (1 hp) ATV61HU15M3 (2 hp) ATV61HU15M3 (3 hp)	1	ATV61HU30M3 (5 hp) ATV61HU40M3 (7.5 hp) ATV61HU55M3 (10 hp)	1	ATV61HU75M3 (15 hp) ATV61HD11M3X (20 hp) ATV61HD15M3X (25 hp)	1	ATV61HD18M3X (30 hp) ATV61HD22M3X (40 hp) ATV61HD30M3X (50 hp)
Graphic Display	1	VW3A1101	1	VW3A1101	1	VW3A1101	1	VW3A1101
Control Fuses Primary 208 V	2	25430-20225 (100 VA, 2-1/4 A) 25430-20350 (150 VA, 3-1/2 A) 25430-20800 (350 VA, 8 A)	2	25430-20225 (100 VA, 2-1/4 A) 25430-20350 (150 VA, 3-1/2 A) 25430-20800 (350 VA, 8 A)	2	25430-20225 (100 VA, 2-1/4 A) 25430-20350 (150 VA, 3-1/2 A) 25430-20800 (350 VA, 8A)	2	25430-20225 (100 VA, 2-1/4 A) 25430-20350 (150 VA, 3-1/2 A) 25430-20800 (350 VA, 8 A)
230 V	2	25430-20200 (100 VA, 2 A) 25430-20321 (150 VA, 3-2/10 A) 25430-20750 (350 VA, 7-1/2 A)	2	25430-20200 (100 VA, 2 A) 25430-20321 (150 VA, 3-2/10 A) 25430-20750 (350 VA, 7-1/2 A)	2	25430-20200 (100 VA, 2 A) 25430-20321 (150 VA, 3-2/10 A) 25430-20750 (350 VA, 7-1/2 A)	2	25430-20200 (100 VA, 2 A) 25430-20321 (150 VA, 3-2/10 A) 25430-20750 (350 VA, 7-1/2 A)
Control Fuses Secondary 208 V	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5 A)	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5 A)	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5 A)	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5 A)
230 V	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5A)	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5A)	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5A)	1	25430-20140 (100 VA, 1-4/10 A) 25430-20200 (150 VA, 2 A) 25430-20500 (350 VA, 5A)
Pilot Light Red ²	1	LED 25501-00003 Head ZB5AV04	1	LED 25501-00003 Head ZB5AV04	1	LED 25501-00003 Head ZB5AV04	1	LED 25501-00003 Head ZB5AV04
Pilot Light Yellow ²	1	LED 25501-00004 Head ZB5AV05	1	LED 25501-00004 Head ZB5AV05	1	LED 25501-00004 Head ZB5AV05	1	LED 25501-00004 Head ZB5AV05
Pilot Light Green ²	1	LED 25501-00005 Head ZB5AV03	1	LED 25501-00005 Head ZB5AV03	1	LED 25501-00005 Head ZB5AV03	1	LED 25501-00005 Head ZB5AV03
Pilot Light Mounting Collar w/ Light Module	1	ZB5AV6	1	ZB5AV6	1	ZB5AV6	1	ZB5AV6
I/O Extension Board ³	1	VW3A3202	1	VW3A3202	1	VW3A3202	1	VW3A3202
LonWorks® Card ³	1	VW3A3312	1	VW3A3312	1	VW3A3312	1	VW3A3312
Modbus® ³	1	VW3A3303	1	VW3A3303	1	VW3A3303	1	VW3A3303
Metasys® N2 ³	1	VW3A3313	1	VW3A3313	1	VW3A3313	1	VW3A3313
24 Vdc supply	1	ABL7CEM24003	1	ABL7CEM24003	1	ABL7CEM24003	1	ABL7CEM24003
3R Hood Filter Material	2	31158-441-01	2	31158-441-01	2	31158-441-01	2	31158-441-01
3R Space Heater	1	29904-00027	1	29904-00027	1	29904-00027	1	29904-00027
3R Ventilation Fan	1	26016-00006	1	26016-00006	1	26016-00006	1	26016-00006
Stirring Fan Assembly	1	N/A	1	31158-065-50	1	31158-065-50 31158-295-50	2	31158-065-50
Heatsink Fans	1	VZ3V1203	1	VZ3V1209 (5, 7.5 hp) VZ3V1204 (10 hp)	1	VZ3V1210 (15 hp) VZ3V1205 (20, 25 hp)	1	VZ3V1211 (30, 40 hp) VZ3V1207 (50 hp)
Profibus Card ³	1	VW3A3307	1	VW3A3307	1	VW3A3307	1	VW3A3307
Ethernet Card ³	1	VW3A3310D	1	VW3A3310D	1	VW3A3310D	1	VW3A3310D
Apogee™ P1 Card ³	1	VW3A3314	1	VW3A3314	1	VW3A3314	1	VW3A3314
BACnet Card ³	1	VW3A3315	1	VW3A3315	1	VW3A3315	1	VW3A3315

¹ The first five characters of the power converter part number may be "ATV61," indicating an IP20 device, or "HTV61," indicating an IP00 device.

² Long life 120 V LED type bulbs (100,000 hours) are provided as standard hardware from the factory. An alternative to the LEDs are incandescent bulbs (2,000 hours). Part number DL1CE130, Type BA9 rated 120–130 V, 2.4 W, is available as an interchangeable part.

³ Field replacement of the option board will reset the power converter to the factory default settings. The user must configure the controller per the elementary diagram with or without bypass starting on page 46.

Table 3: Circuit Breaker OCPD—Fuse List

8839 Controller ¹	hp-VT	Circuit Breaker	Class J T-D Fuses ²		
			No Bypass	Bypass	
			150%	175%	225%
460 V					
EFDC•4V_	1	HLL36015	2-1/4	4	4-1/2
EFDD•4V_	2	HLL36015	5	6	7
EFDE•4V_	3	HLL36015	6	9	10
EFDF•4V_	5	HLL36015	12	15	15
EFDG•4V_	7.5	HLL36025	15	20	20
EFDH•4V_	10	HLL36035	20	25	30
EFDJ•4V_	15	HLL36050	30	40	45
EFDK•4V_	20	HLL36060	40	50	60
EFDL•4V_	25	HLL36080	45	60	70
EFDN•4V_	30	HLL36100	60	70	90
EFDN•4V_	40	HLL36125	70	100	110
EFDN•4V_	50	HLL36150	90	125	125
EFDQ•4V_	60	JLL36175	110	150	150
EFDN•4V_	75	JLL36225	125	175	200
EFDN•4V_	100	JLL36250	175	225	250
230 V					
EFDC•3V_	1	HLL36015	5	8	9
EFDD•3V_	2	HLL36015	9	12	15
EFDE•3V_	3	HLL36025	15	17 1/2	20
EFDF•3V_	5	HLL36040	25	30	30
EFDG•3V_	7.5	HLL36060	30	40	45
EFDH•3V_	10	HLL36070	40	50	60
EFDJ•3V_	15	HLL36110	60	80	90
EFDK•3V_	20	HLL36125	80	100	110
EFDL•3V_	25	JLL36175	90	125	150
EFDN•3V_	30	JLL36225	110	150	175
EFDN•3V_	40	JLL36250	150	200	225
EFDN•3V_	50	JLL36250	175	250	250
208 V					
EFDC•2V_	1	HLL36015	5-6/10	9	10
EFDD•2V_	2	HLL36015	10	15	15
EFDE•2V_	3	HLL36025	15	20	20
EFDF•2V_	5	HLL36040	25	30	35
EFDG•2V_	7.5	HLL36060	35	45	50
EFDH•2V_	10	HLL36070	45	60	60
EFDJ•2V_	15	HLL36110	60	90	100
EFDK•2V_	20	HLL36125	80	110	125
EFDL•2V_	25	JLL36175	100	150	150
EFDN•2V_	30	JLL36225	125	175	175
EFDN•2V_	40	JLL36250	175	200	250
EFDN•2V_	50	JLL36250	200	250	300

¹ "•" can be "A", "G" or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure. "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² Standard product is configured with circuit breakers. Fuse data is provided as an alternative to customized product from the factory.

Table 4: Replacement Power Converter Part Numbers

8839 Controller ¹	hp	Power Converter ²
460 V		
EFDC•4V_	1	ATV61K075N4U
EFDD•4V_	2	ATV61K075N4U
EFDE•4V_	3	ATV61KU15N4U
EFDF•4V_	5	ATV61KU30N4U
EFDG•4V_	7.5	ATV61KU40N4U
EFDH•4V_	10	ATV61KU55N4U
EFDJ•4V_	15	ATV61KU75N4U
EFDK•4V_	20	ATV61KD11N4U
EFDL•4V_	25	ATV61KD15N4U
EFDM•4V_	30	ATV61KD18N4U
EFDN•4V_	40	ATV61KD22N4U
EFDP•4V_	50	ATV61KD30N4U
EFDQ•4V_	60	ATV61KD37N4U
EFDR•4V_	75	ATV61KD45N4U
EFDS•4V_	100	ATV61KD55N4U
230 V		
EFDC•3V_	1	ATV61K075M3U
EFDD•3V_	2	ATV61KU15M3U
EFDE•3V_	3	ATV61KU15M3U
EFDF•3V_	5	ATV61KU30M3U
EFDG•3V_	7.5	ATV61KU40M3U
EFDH•3V_	10	ATV61KU55M3U
EFDJ•3V_	15	ATV61KU75M3U
EFDK•3V_	20	ATV61KD11M3U
EFDL•3V_	25	ATV61KD15M3U
EFDM•3V_	30	ATV61KD18M3U
EFDN•3V_	40	ATV61KD22M3U
EFDP•3V_	50	ATV61KD30M3U
208 V		
EFDC•2V_	1	ATV61KU15M3U
EFDD•2V_	2	ATV61KU30M3U
EFDE•2V_	3	ATV61KU30M3U
EFDF•2V_	5	ATV61KU40M3U
EFDG•2V_	7.5	ATV61KU55M3U
EFDH•2V_	10	ATV61KU75M3U
EFDJ•2V_	15	ATV61KD11M3U
EFDK•2V_	20	ATV61KD15M3U
EFDL•2V_	25	ATV61KD18M3U
EFDM•2V_	30	ATV61KD22M3U
EFDN•2V_	40	ATV61KD30M3U
EFDP•2V_	50	ATV61KD37M3U

¹ "•" can be "A", "G" or "H". "A" denotes a Type 12K enclosure; "G" denotes a Type 1 enclosure. "H" denotes a Type 3R enclosure. "_" indicates that the catalog number continues. See page 14 for a detailed description of catalog numbers.

² Standard product is configured with circuit breakers. Fuse data is provided as an alternative to customized product from the factory.

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Replaces 30072-451-51C dated 2/2008

New Faster Inputs

FL1E can support up to four 5KHz high-speed inputs. You have the option of configuring inputs I3, I4, I5 and I6 as fast counter inputs to give you even more flexibility.

Universal Voltages

Available in 12/24V DC for solar and vehicle applications, and 24V AC/DC for building automation, as well as 100-240V AC/DC, SmartRelay can be used for a wide variety of applications.

DIN Rail or Surface Mountable

New Controllable Backlit LCD Display

FL1E SmartRelays have a built-in LCD display with a brighter, higher contrast screen you can adjust to your own preference. System status — input, output, analog values, timers and counters — can be monitored through the 4x12 LCD screen or you can display a predefined message with up to 48 characters (chosen from 103 special character types). Non-LCD versions are also available.

EEPROM Memory

With IDEC SmartRelays, your program is stored in a non-volatile EEPROM Memory.

New Extended Retentive Data Memory

Extended memory gives you up to 250 bytes of retentive data memory. More than 4 times that of FL1D!

New Arithmetic Functions

Analog Math function blocks allow basic arithmetic operations such as addition, subtraction, multiplication, and division.

Password Protection

Concerned about your program being copied or altered? IDEC SmartRelays keep you safe with a unique password protection scheme allowing end users to access certain parameters without seeing or modifying the actual program.

New Built-in Analog Inputs

Each SmartRelay is equipped with 8 digital inputs that can be used for your applications. New in the FL1E 12/24VDC and 24VDC models are four built-in analog inputs. Inputs I1, I2, I7, and I8 can now be configured to accept 0-10V analog signals. Using expansion modules, you can utilize a maximum of 24 digital and 8 analog inputs.

New Memory Cartridges

Three memory cartridges are now available for FL1E: Violet, Green and Brown! Violet is a 32K high-capacity, removable program memory card. Green is a battery card that supports a Real Time Clock power supply for up to two years. Brown is a combined memory/battery card.



Operational Control Buttons

Program with just the push of a button! SmartRelay control buttons can be used to program, modify and change preset parameters. The four cursor keys can also be configured as inputs as needed.

Digital Outputs

IDEC SmartRelays are equipped with four relay outputs rated at 10A/pt. Using digital expansion modules; you can configure a maximum of sixteen outputs.

New 50% More Memory

FL1E SmartRelays offer an expanded program memory of 200 function blocks! This is a 50% increase compared to the existing FL1D series.

Additional text display

For the first time ever, you can connect an external text display to your SmartRelay, making it easy for you to monitor, view and troubleshoot from outside your panel. Turn to page 7 to learn more!


Quality

IDEC has built a reputation based on providing high-quality, dependable products you can trust, and our SmartRelays are no exception. Each model is cULus listed, CE certified, EMC compliant, FM approved for Class 1 Div 2 hazardous locations, C-tick compliant, Lloyds Registered and ABS approved.




Part Numbers


Base Modules – with LCD

Style	Part Number	Voltage	Input Signal	Input	Output	With Clock
	FL1E-H12RCE	12/24V DC	DC I1, I2, I7 and I8 are used for digital/analog	PNP	Relay	Yes
	FL1E-H12SND	24V DC			Transistor Source	
	FL1E-H12RCA	24V AC/DC	AC/DC	PNP/NPN	Relay	Yes
	FL1E-H12RCC	100-240V AC/DC		PNP		

Base Modules – without LCD


Style	Part Number	Voltage	Input Signal	Input	Output	With Clock
	FL1E-B12RCE	12/24V DC	DC I1, I2, I7 and I8 are used for digital/analog	PNP	Relay	Yes
	FL1E-B12RCA	24V AC/DC		PNP/NPN	Relay	Yes
	FL1E-B12RCC	100-240V AC/DC	AC/DC	PNP		

Text Message Display

Style	Part Number	Rated Voltage	Description
	FL1E-RD1	12 VDC, 24 VAC/DC	FL1E Text Display Panel

Digital I/O Expansion Modules

- 8-pt expansion module (4 in/4 out)
- Max. 4 digital expansion modules

Style	Part Number	Total I/O	Input Power	Input	Output
	FL1B-M08B2R2	8 (4 in/ 4 out)	12/24V DC	DC	Relay
	FL1B-M08B1S2		24V DC		Transistor Sink
	FL1B-M08C2R2		100-240V AC/DC	AC/DC	Relay
	FL1B-M08D2R2		24V AC/DC		

Specifications

Base Modules

Style	with LCD Display		FL1E-H12SND	FL1E-H12RCE	FL1E-H12RCA	FL1E-H12RCC
	without Display		—	FL1E-B12RCE	FL1E-B12RCA	FL1E-B12RCC
Power Supply	Rated Power Voltage		24V DC	12/24V DC	24V AC/DC	100 to 240V AC/DC
	Allowable Voltage Range		20.4 to 28.8V DC	10.8 to 28.8V DC	20.4 to 26.4V AC, 20.4 to 28.8V DC	85 to 265V AC, 100 to 253V DC
	Rated Frequency		—	—	47 to 63Hz	47 to 63Hz
	Current Draw		40 to 75mA (24V DC)	60 to 175mA (12V DC) 40 to 100mA (24V DC)	76 to 182mA (24V AC) 40 to 100mA (24V DC)	25 to 40mA (100V AC), 20 to 30mA (240V AC) 10 to 25mA (100V DC), 6 to 15mA (240V DC)
	Allowable Momentary Power Interruption		—	2ms (Typ.) (12V DC) 5ms (Typ.) (24V DC)	5ms (Typ.) (24V AC/DC)	10ms (Typ.) (100V AC/DC) 20ms (Typ.) (240V AC/DC)
	Power Consumption		0.7 to 1.3W (24V DC)	0.3 to 1.7W (12V DC) 0.4 to 1.8W (24V DC)	0.9 to 2.7VA (24V AC) 0.4 to 1.8W (24V DC)	1.1 to 4.6VA (100V AC), 2.4 to 6.0VA (240V AC) 0.5 to 2.9W (100V DC), 1.2 to 3.6W (240V DC)
	Reverse Polarity Protection		Yes	Yes	—	—
Clock	Backup Duration		—	80 hours (25°C) ¹	80 hours (25°C) ¹	80 hours (25°C) ¹
	Clock Accuracy		—	±2 sec/day maximum	±2 sec/day maximum	±2 sec/day maximum
Input	Input Signal		DC		AC/DC	AC/DC
	Input Points		8 (I1 to I8)		8 (I1 to I8)	8 (I1 to I8)
	Analog Input Points		4 (I1, I2, I7, I8)		—	—
	High-speed Input ²		4 (I3, I4, I5, I6), 5Khz maximum		—	—
	Analog	Input Range	0 to 10V DC (max. rated input: 28.8V DC)		—	—
		Input Error	±1.5 (of full scale)		—	—
		Input Resolution	10 bits (0 to 1000)		—	—
		Allowable Voltage Range	0 to 28.8V DC		—	—
	Input Impedance	Digital Input	3.5kΩ		4.8kΩ	840kΩ
		Analog Input	72kΩ		—	—
	Isolation		—	—	—	—
	Operating Range	OFF Voltage	< 5V DC		< 5V AC/DC	< 40V AC, < 30V DC
		ON Voltage	≥ 12V DC		≥ 12V AC/DC	≥ 79V AC, ≥ 79V DC
		OFF Current	< 0.85mA (I1 to I6), < 0.05mA (I1, I2, I7, I8)		< 1.0mA	< 0.03mA
		ON Current	≥ 2mA (I3 to I6) ≥ 0.15mA (I1, I2, I7, I8)	≥ 1.5mA (I3 to I6) ≥ 0.1mA (I1, I2, I7, I8)	≥ 2.5mA	≥ 0.08mA, 100V AC: 50ms (Typ.)
	Turn ON Time		1.5ms (Typ.) ≤ 1.0ms (I3, I6)		1.5ms (Typ.)	100V AC: 50ms (Typ.), 240V AC: 30ms (Typ.) 100V DC: 25ms (Typ.) 240V DC: 15ms (Typ.)
	Turn OFF Time		1.5ms (Typ.) ≤ 1.0ms (I3, I6)		15ms (Typ.)	100V AC: 65ms (Typ.), 240V AC: 105ms (Typ.) 100V DC: 95ms (Typ.), 240V DC: 125ms (Typ.)
	Wire Length		100m ³		100m ³	100m



- Two year backup duration (typ.) when battery cartridge or memory/battery cartridge used.
- When selecting frequency trigger function and up/down counter function.
- 10m when connected to analog input (twisted pair cable).

Specifications can't on next page.

Specifications con't

Style		with LCD Display	FL1E-H12SND	FL1E-H12RCE	FL1E-H12RCA	FL1E-H12RCC
		without Display	—	FL1E-B12RCE	FL1E-B12RCA	FL1E-B12RCC
Output	Output	Transistor source	Relay			
	Output Points/ Contact Configuration	4 points (separate)	4NO contacts			
	Isolation	—	Isolated			
	Dielectric Strength (between power/input terminals and output terminals)	—	2500V AC, 1 minute, 500V DC, 1 minute			
	Output Voltage	External power voltage	—			
	Maximum Load Current	0.3A	Resistive load: 10A at 12/24V AC/DC, 10A at 100/120V AC, 10A at 230/240V AC Inductive load: 2A at 12/24V AC/DC, 3A at 100/120V AC, 3A at 230/240V AC			
	Surge Current	—	30A maximum			
	Short-circuit Protection	Built-in current limiting resistor: Approx. 1A	External fuse required: 16A maximum			
	Minimum Switching Load	—	10mA, 2V DC	10mA, 12V DC		
	Initial Contact Resistance	—	100 mΩ maximum (at 1A, 24V DC)			
	Mechanical Life	—	10 million operations (no load, 10Hz)			
	Electrical Life	—	100,000 operations (rated resistive load) 1800 operations/hour			
Switching Rate	Mechanical Load	—	10Hz			
	Electrical Load	10Hz	—			
	Resistive Load/Lamp Load ¹	10Hz	2Hz			
	Inductive Load	0.5Hz	0.5Hz			



1. For fluorescent lamps, if the inrush current exceeds the allowable value, use an appropriate relay.

General

Style	Specification		Standard
Operating Temperature	Horizontal Mounting	0 to 55°C	Cold: IEC60068-2-1 Hot: IEC60068-2-2
	Vertical Mounting	0 to 55°C	
Storage/Transportation Temperature		−40 to +70°C (no freezing)	—
Relative Humidity		10 to 95% RH (no condensation)	IEC60068-2-30
Atmospheric Pressure		795 to 1080 hPa	—
Operating Condition		No corrosive gas	—
Degree of Protection		IP20	—
Vibration Resistance		5 to 8.4Hz, amplitude 3.5mm 8.4 to 150Hz, acceleration 9.8m/s ²	IEC60068-2-6
Shock Resistance		147m/s ²	IEC60068-2-27
Drop Test		0.3m	IEC60068-2-31
Drop Test (packaged)		1m	IEC60068-2-32
Emission		Class B Group ¹	EN55011
Electrostatic Discharge		8kV air discharge, 6kV contact discharge ²	IEC61000-4-2
Radiation Field Immunity		Field Strength: 1V/m and 10V/m	IEC61000-4-3
Burst Pulses		2kV (power line), 1kV (I/O signal line) ³	IEC61000-4-4
Energy Carriers Single Pulse (Surge) ⁴ (FL1E-H12RCC, FL1E-B12RCC only)		1kV (power line) normal 2kV (power line) common	IEC61000-4-5
Communication Cable		0.5 to 2.5mm ² (one wire), 0.5 to 1.5mm ² (two wires)	—
Terminal Style		Finger-safe type ⁵	—



- Class A for AS-Interface communication module.
- 8kV (air discharge), 4kV (contact discharge) for AS-Interface communication module.
- 1kV (criteria A), 2kV (criteria B) for AS-Interface communication module.

- For protection against surge noise on DC power supply types (FL1E-H12RCE/B12RCE, FL1E-H12SND, FL1E-H12RCA/B12RCA), use surge absorbers, noise cut transformers, or noise filters. Use of surge protection device (DEHN + SOHNE GmbH + Co. VWT AD 24 Part No. 918 402) is recommended.
- Tightening torque 0.4 to 0.5 N-m.

Text Display

Part Number	FL1E-RD1	
Keyboard Display		Membrane keypad with 10 keys, FSTN-Graphic Display with 128 x 64 (columns x rows), LED backlight
Power Supply	Input Voltage	24V AC/DC, 12V DC
	Allowable Voltage Range	20.4 to 26.4V AC, 10.2 to 28.8V DC
	Rated Frequency	47 to 63Hz
	Current Draw	30 to 55mA (24V DC)
	Power Consumption	12V DC 65mA 24V DC 40mA 24V AC 90mA
Data Transmission Rate		19200 baud
LCD Display	Backlight lifetime ¹	20,000 hours
	Display lifetime ²	50,000 hours
Weight		220g



Connect the text display and the base module using the text display cable (2.5m). The text display cable can be extended up to 10m using an extension cable (D-sub 9-pin).

- Backlight durability is the number of hours it takes for the light to become 50% of the original brightness.
- Display durability is calculated under ordinary operating and storage conditions: room temperature, normal humidity below 65% RH, and not subjected to direct sunlight.

Expansion I/O Module

Expansion I/O Module Model Number		FL1B-M08B1S2	FL1B-M08B2R2	FL1B-M08D2R2	FL1B-M08C2R2	FL1B-J2B2	FL1D-K2BM2
Power Supply	Rated Power Voltage	24V DC	12/24V DC	24V AC/DC	100 to 240V AC/DC	12/24V DC	24V DC
	Allowable Voltage Range	20.4 to 28.8V DC	10.8 to 28.8V DC	20.4 to 26.4V AC 20.4 to 28.8V DC	85 to 265V AC 100 to 253V DC	10.8 to 28.8V DC	20.4 to 28.8V DC
	Rated Frequency	—	—	50/60Hz (47 to 63Hz)	50/60Hz (47 to 63Hz)	—	—
	Current Draw	30 to 45mA	30 to 140mA (12V DC) 20 to 75mA (24V DC)	40 to 110mA (24V AC) 20 to 75mA (24V DC)	10 to 30mA (100V AC) 10 to 20mA (240V AC) 5 to 15mA (100V DC) 5 to 10mA (240V DC)	25 to 50mA	25 to 50mA
	Allowable Momentary Power Interruption	—	2ms (Typ.) (12V DC) 5ms (Typ.) (24V DC)	5ms (Typ.) (24V AC/DC)	10ms (Typ.) (100V AC/DC) 20ms (Typ.) (240V AC/DC)	2ms (Typ.) (12V AC/DC) 5ms (Typ.) (24V AC/DC)	5ms (Typ.)
	Power Consumption	0.8 to 1.1W	0.3 to 1.7W (12V DC) 0.4 to 1.8W (24V DC)	0.9 to 2.7VA (24V AC) 0.4 to 1.8W (24V DC)	1.1 to 3.5VA (100V AC) 2.4 to 4.8VA (240V AC) 0.5 to 1.8W (100V DC) 1.2 to 2.4W (240V DC)	0.3 to 0.6W (12V DC) 0.6 to 1.2W (24V DC)	0.6 to 1.2W (24V DC)
	Reverse Polarity Protection	Yes	Yes	—	—	Yes	Yes
Input	Input Signal	DC input	DC input	AC/DC input	AC/DC input	Analog input	—
	Input Points	4	4	4	4	—	—
	Isolation	—	—	—	—	—	—
	Allowable Voltage Range	0 to 28.8V DC	0 to 28.8V DC	0 to 26.4V AC 0 to 28.8V DC	0 to 265V AC 0 to 253V DC	—	—
	Operating Range	OFF Voltage	< 5V DC	< 5V AC/DC	< 40V AC < 30V DC	—	—
		ON Voltage	≥ 12V DC	≥ 8.5V DC	≥ 79V AC ≥ 79V DC	—	—
		OFF Current	< 0.85mA	< 0.85mA	< 1.0mA	< 0.03mA	—
		ON Current	≥ 2mA	≥ 1.5mA	≥ 2.5mA	≥ 0.08mA	—
	Turn ON Time	1.5ms (Typ.)	1.5ms (Typ.)	1.5ms (Typ.)	100V AC: 50ms (Typ.) 240V AC: 30ms (Typ.) 100V DC: 25ms (Typ.) 240V DC: 15ms (Typ.)	—	—
	Turn OFF Time	1.5ms (Typ.)	1.5ms (Typ.)	1.5ms (Typ.)	100V AC: 65ms (Typ.) 240V AC: 105ms (Typ.) 100V DC: 95ms (Typ.) 240V DC: 125ms (Typ.)	—	—
	Analog Input Points	—	—	—	—	2	—
	Analog Input Range	—	—	—	—	0 to 10V (max. rated input: 28.8V) 0 to 20mA (max. rated input: 40mA)	—
	Digital Resolution	—	—	—	—	10 bits (0 to 1000)	—
	Input Error	—	—	—	—	±1.5% (of full scale)	—
	Input Impedance	—	—	—	—	76kΩ (0 to 10V) 155 to 250Ω (0 to 20mA)	—
	Sampling Cycle	—	—	—	—	50ms	—

Expansion I/O Module Specifications con't on next page.

OT Touchscreens

PLCs

Automation Software

Power Supplies

Sensors

Communication

Barriers

Expansion I/O Module, con't

Expansion I/O Module Model Number		FL1B-M08B1S2	FL1B-M08B2R2	FL1B-M08D2R2	FL1B-M08C2R2	FL1B-J2B2	FL1D-K2BM2
OI Touchscreens PLCs Automation Software Power Supplies Sensors Communication Barriers	Wire Length	100 m	100 m	100 m	100 m	10 m (twisted-pair shielded cable)	—
	Output	Transistor source	Relay	Relay	Relay	—	Analog
	Output Points/ Contact Configuration	4 points (separate)	4NO contacts	4NO contacts	4NO contacts	—	—
	Isolation	—	Isolated	Isolated	Isolated	—	—
	Dielectric Strength (between power/input terminals and output terminals)	—	2500V AC, 1 minute 500V DC, 1 minute	2500V AC, 1 minute 500V DC, 1 minute	2500V AC, 1 minute 500V DC, 1 minute	—	—
	Output Voltage	External power voltage (20.4 to 28.8V DC)	—	—	—	—	—
	Maximum Load Current	0.3A	Resistive load 5A at 12/24V AC/DC 5A at 100/120V AC 5A at 230/240V AC Inductive load 2A at 12/24V AC/DC 3A at 100/120V AC 3A at 230/240V AC	Resistive load 5A at 12/24V AC/DC 5A at 100/120V AC 5A at 230/240V AC Inductive load 2A at 12/24V AC/DC 3A at 100/120V AC 3A at 230/240V AC	Resistive load 5A at 12/24V AC/DC 5A at 100/120V AC 5A at 230/240V AC Inductive load 2A at 12/24V AC/DC 3A at 100/120V AC 3A at 230/240V AC	—	—
	Short-circuit Protection	Built-in current limiting resistor: Approx. 1A	External fuse required: 16A maximum	External fuse required: 16A maximum	External fuse required: 16A maximum	—	Yes
	Minimum Switching Load	—	10mA, 12V DC	10mA, 12V DC	10mA, 12V DC	—	—
	Initial Contact Resistance	—	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)	—	—
	Mechanical Life	—	10 million operations (no load, 10Hz)	10 million operations (no load, 10Hz)	10 million operations (no load, 10Hz)	—	—
	Electrical Life	—	100,000 operations (rated resistive load) 1800 operations/hour	100,000 operations (rated resistive load) 1800 operations/hour	100,000 operations (rated resistive load) 1800 operations/hour	—	—
	Analog Output Points	—	—	—	—	—	2
	Analog Output Range	—	—	—	—	—	0 to 10V, 4-20mA
	Digital Resolution	—	—	—	—	—	10 bits (0 to 1000V)
	Output Error	—	—	—	—	—	±2.5% (of full scale)
	Output Impedance	—	—	—	—	—	5kΩ
	Analog Value Conversion Interval	—	—	—	—	—	50ms
	Wire Length	—	—	—	—	—	10 m (twisted-pair shielded cable)
	Mechanical Load	—	10Hz	10Hz	10Hz	—	—
	Electrical Load	10Hz	—	—	—	—	—
	Resistive Load/Lamp Load	10Hz	2Hz	2Hz	2Hz	—	—
	Inductive Load	0.5Hz	0.5Hz	0.5Hz	0.5Hz	—	—

General

Item		Specification	Standard
Operating Temperature	Horizontal Mounting	0 to 55°C	Cold: IEC60068-2-1 Hot: IEC60068-2-2
	Vertical Mounting	0 to 55°C	
Storage/Transportation Temperature		−40 to +70°C ¹	—
Relative Humidity		10 to 95% RH ²	IEC60068-2-30
Atmospheric Pressure		795 to 1080 hPa	—
Operating Condition		No corrosive gas	—
Degree of Protection		IP20	—
Vibration Resistance		5 to 9Hz, amplitude 3.5mm 9 to 150Hz, acceleration 9.8m/s ² (1G)	IEC60068-2-6
Shock Resistance		147m/s ² (15G)	IEC60068-2-27
Drop Test		50mm	IEC60068-2-31
Drop Test (packaged)		1m	IEC60068-2-32
Emission		Class B Group 1 ³	EN55011
Electrostatic Discharge		8kV air discharge 6kV contact discharge ⁴	IEC61000-4-2
Electromagnetic Fields		10V/m	IEC61000-4-3
Burst Pulses		2kV (power line) 1kV (I/O signal line) ⁵	IEC61000-4-4
Energy Carriers Single Pulse (Surge) ⁶ (FL1B-H12RCC, FL1B-B12RCC only)		1kV (power line) normal 2kV (power line) common	IEC61000-4-5
Communication Cable		0.5 to 2.5mm ² (one wire) 0.5 to 1.5mm ² (two wires)	—
Terminal Style		Finger-safe type ⁷	—



1. No freezing
2. No condensation
3. Class A for AS-Interface communication module
4. 8kV (air discharge), 4kV (contact discharge) for AS-Interface communication module
5. 1kV (criteria A), 2kV (criteria B) for AS-Interface communication module
6. For protection against surge noise on DC power supply types (FL1D-H12RCE/B12RCE, FL1D-H12SND, FL1D-H12RCA/B12RCA), use surge absorbers, noise cut transformers, or noise filters.
7. Tightening torque 0.4 to 0.5 N·m

AS-Interface Communication Module

Specifications

Module Type	AS-Interface slave module
Slave Type	Standard
	I/O code: 7
Profile	ID code: F
	ID2 code: F
Input/Output	Virtual input: 4
	Virtual output: 4
AS-Interface Voltage	30V DC (26.5 to 31.6V DC)
Current Draw	70 mA maximum (AS-Interface)

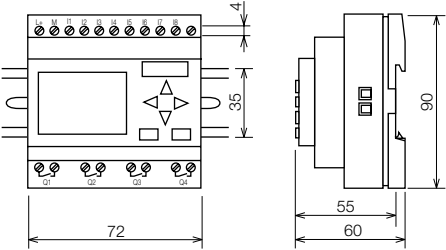
I/O Allocation

Input		Output	
AS-Interface	SmartRelay	SmartRelay	AS-Interface
Output Data Bit D0	Input In	Output Qm	Input Data Bit D0
Output Data Bit D1	Input In+1	Output Qm+1	Input Data Bit D1
Output Data Bit D2	Input In+2	Output Qm+2	Input Data Bit D2
Output Data Bit D3	Input In+3	Output Qm+3	Input Data Bit D3

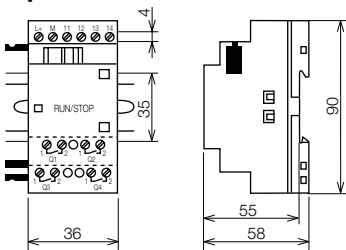


1. I/O point numbers “n” and “m” of the SmartRelay are automatically allocated by the base module according to the mounted position of the AS-Interface communication module.
2. AS-Interface communication module is IP20 terminal type.
3. AS-Interface cable is connected to the terminal block.

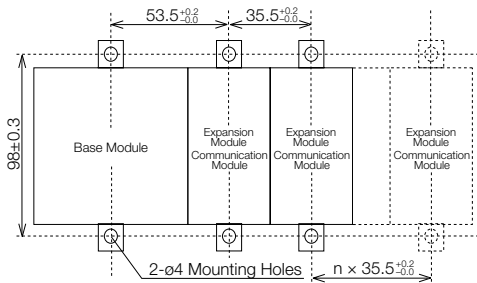
Base Module



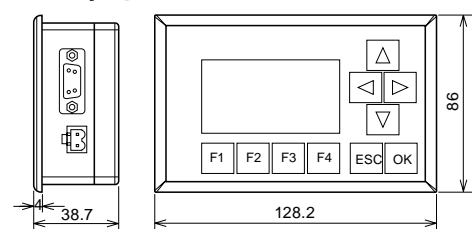
Expansion I/O Module, Communication Module



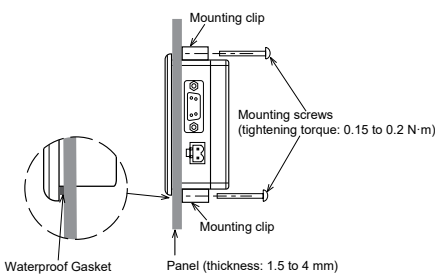
Mounting Hole Layout (Using Mounting Slides)



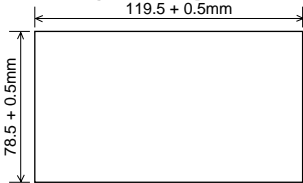
Text Display



Installation



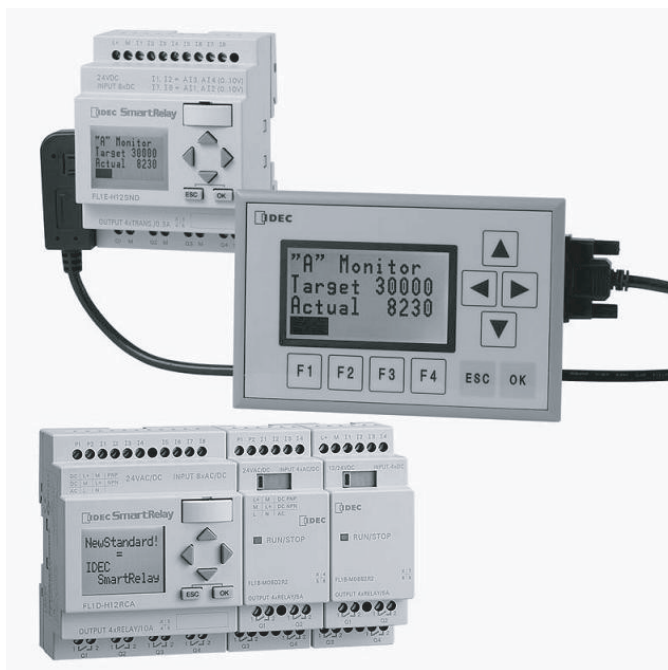
Mounting Hole Layout



FL1E series

IDEC SmartRelay

User's Manual



Revision History

Date	Manual No.	Description
November, 2008	B-1090(0)	First print
December, 2008	B-1090(1)	Sensor connections for IDEC SmartRelay: FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCE / FL1E-B12RCE / FL1E-H12SND
February, 2009	B-1090(2)	<ul style="list-style-type: none">• Compatibility (FL1C-PM3 memory cartridge in FL1E)• Compatibility (FL1E-PM4 memory cartridge in older IDEC SmartRelay modules)
July, 2009	B-1090(3)	Deleting the circuit program and password "Note"

Safety guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol. The notices shown below are graded according to the degree of danger.



Danger

indicates that death or severe personal injury will result if proper precautions are not taken.



Warning

indicates that death or severe personal injury may result if proper precautions are not taken.



Caution

with a safety alert symbol indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol indicates that property damage can result if proper precautions are not taken.

Note

indicates that an unintended result or situation can occur if the corresponding notice is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Within the context of the safety notices in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:



Warning

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by IDEC.

Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Disclaim of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Dear customer

We thank you for purchasing IDEC SmartRelay and congratulate you on your decision. With IDEC SmartRelay you have acquired a logic module that meets the stringent quality requirements of ISO 9001.

IDEC SmartRelay can be used in many fields of applications. Due to its high functionality and easy operation, IDEC SmartRelay offers you the utmost efficiency for almost any application.

Purpose of this manual

This IDEC SmartRelay manual provides you with information about the creation of circuit programs, about the installation and use of FL1E IDEC SmartRelay base modules, the Text Display and the IDEC SmartRelay expansion modules, and about their compatibility with the previous FL1A–FL1D versions (FL1x are the last four characters of the order number of the base modules and differentiate the device series).

IDEC SmartRelay's place in information technology

The wiring information in your IDEC SmartRelay manual is also found in the IDEC SmartRelay Product Info included with all devices. For further information on programming the IDEC SmartRelay on your PC, refer to the Online Help for WindLGC.

WindLGC is the programming software for PCs. It runs under Windows® (including Windows Vista®). It helps you to get started with IDEC SmartRelay and to write, test, print out and archive your programs, independent of the IDEC SmartRelay.

Guide

The manual is divided into 8 chapters:

- Getting started with IDEC SmartRelay
- IDEC SmartRelay installation and wiring
- Programming IDEC SmartRelay
- IDEC SmartRelay functions
- Configuring IDEC SmartRelay
- IDEC SmartRelay memory and battery cartridges
- IDEC SmartRelay software
- Applications

Valid range of this manual

The manual applies to devices of series FL1E.

New features of the FL1E IDEC SmartRelay device series

- The Text Display provides an additional display device for messages, and contains four cursor keys and four functions keys that can be used in the circuit program.
- The new IDEC SmartRelay Battery cartridge and the IDEC SmartRelay Combined Memory/Battery cartridge provide up to two years of backup time for the real-time clock. The new IDEC SmartRelay Memory cartridge and the Combined Memory/Battery cartridge provide 32 Kbytes memory space: four times the memory space of the old Memory cartridge (brown).
- Additional optional analog inputs and fast digital inputs are available on some of the FL1E IDEC SmartRelay base modules.
- FL1E IDEC SmartRelay menus can be displayed in ten supported languages. You have a configuration choice to specify the language for IDEC SmartRelay menus.
- New instruction blocks are available: Pulse Width Modulator (PWM), Analog Math, and Analog Math Error Detection.
- Message texts can tick on and off the display; can include bar graphs, can switch between two character sets, and can be displayed on either the IDEC SmartRelay Display, the Text Display, or both. Full editing capabilities are available from WindLGC; editing from the IDEC SmartRelay base module is limited to simple text. See section 2.1.3 for further details.
- USB PC cable between a PC and IDEC SmartRelay base module is provided.
- You can now have up to 200 program blocks in your circuit program.

Additional differences compared to previous devices (FL1A to FL1D)

- Extended set of reference parameters for function blocks.
- Enhancements to up/down counter, Operating hours counter, Twelve-month time switch and analog watchdog instruction blocks.
- You can find information on compatibility of IDEC Smart-Relay FL1E to previous devices at section 2.1.3.

Additional support

At our Internet address
<http://smart.idec.com/>
you can quickly and easily find answers to your queries
about IDEC SmartRelay.

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Getting started with IDEC SmartRelay

Here's IDEC SmartRelay

IDEC SmartRelay is a universal logic module made by IDEC that integrates:

- Controls
- Operator and display panel with background lighting
- Power supply
- Interface for expansion modules
- Interface for the memory cartridge, battery cartridge, combined memory/battery cartridge or a PC cable
- Interface for an optional text display (TD) module
- Pre-configured standard functions, for example, on-and off-delays, current impulse relay and softkey
- Timers
- Digital and analog memory markers
- Inputs and outputs, according to the device type

What IDEC SmartRelay can do for you

IDEC SmartRelay offers solutions for domestic and installation engineering applications such as stairway lighting, external lighting, sun blinds, shutters, shop window lighting and more; switch cabinet engineering, as well as for mechanical and apparatus engineering such as gate control systems, air-conditioning systems, and airwater pumps.

IDEC SmartRelay can also be implemented for special control systems in conservatories or greenhouses, for control signal processing and, by connecting a communication module such as an AS-i module, for distributed local controlling of machines and processes.

Special versions without operator panel and display unit are available for series production applications in small machine, apparatus, switching cabinet and installation engineering.

Which devices are available?

IDEC SmartRelay Base is available in two voltage classes:

- Class 1 ≤ 24 V, i.e. 12 V DC, 24 V DC, 24 V AC
- Class 2 > 24 V, i.e. 100...240 V AC/DC

IDEC SmartRelay Base is available in two versions:

- **With display:** 8 inputs and 4 outputs
- **Without display** ("IDEC SmartRelay Pure"): 8 inputs and 4 outputs

Each version is integrated into four subunits, is equipped with an expansion interface and Text Display interface and provides 39 pre-configured standard and special function blocks for the creation of your circuit program.

Which expansion modules are available?

- IDEC SmartRelay digital modules are available for operation with 12 V DC, 24 V AC/DC and 100...240 V AC/DC, and are equipped with four inputs and four outputs.
- IDEC SmartRelay analog modules are available for operation with 24 V DC and some with 12 V DC, depending on the specific module. Each is equipped with two analog inputs or two analog outputs.

The digital/analog modules are integrated in two or four subunits. Each one is equipped with two expansion interfaces for connecting additional modules.

Which display modules are available?

- IDEC SmartRelay Base with display
- Text Display

Features of the Text Display

The Text Display is available with the FL1E series. It provides an additional display that is wider than the Base module. It has four function keys that you can program in your circuit program as inputs. Like the IDEC SmartRelay Base module, it has four cursor keys, an ESC and OK key that you can also program in your circuit program and use for navigation on the Text Display.

You can create and download a power-up screen for the Text Display from WindLGC. This screen displays briefly when you initially power on the Text Display. You can also upload the power-up screen from the Text Display to WindLGC.

The menus for the Text Display are shown in Appendix section D.2. You configure the settings for the Text Display independently from the IDEC SmartRelay Base module. The settings can be different.

Which communication modules are available?

- IDEC SmartRelay communication module (CM) AS interface, which is described in more detail in a separate documentation.

The communication module has four virtual inputs and outputs, and acts as an interface between an AS-Interface system and an IDEC SmartRelay system. The module enables four data bits to be transferred from the IDEC SmartRelay base module to the AS-Interface system and vice versa.

It's your choice

The various IDEC SmartRelay Base versions, expansion modules, Text Display and communication modules offer you a highly flexible and adaptive system to suit your specific tasks.

The IDEC SmartRelay system offers you many solutions such as for small domestic installations, simple automation tasks, and even complex engineering tasks involving its integration into a bus system (e.g. communication module AS interface).

Note

IDEC SmartRelay base module may only be equipped with expansion modules of the same voltage class. Mechanical encoding pins in the housing prevent you from connecting devices of a different voltage class.

Exception: The left-hand interface of an analog module or communication module is galvanically isolated.

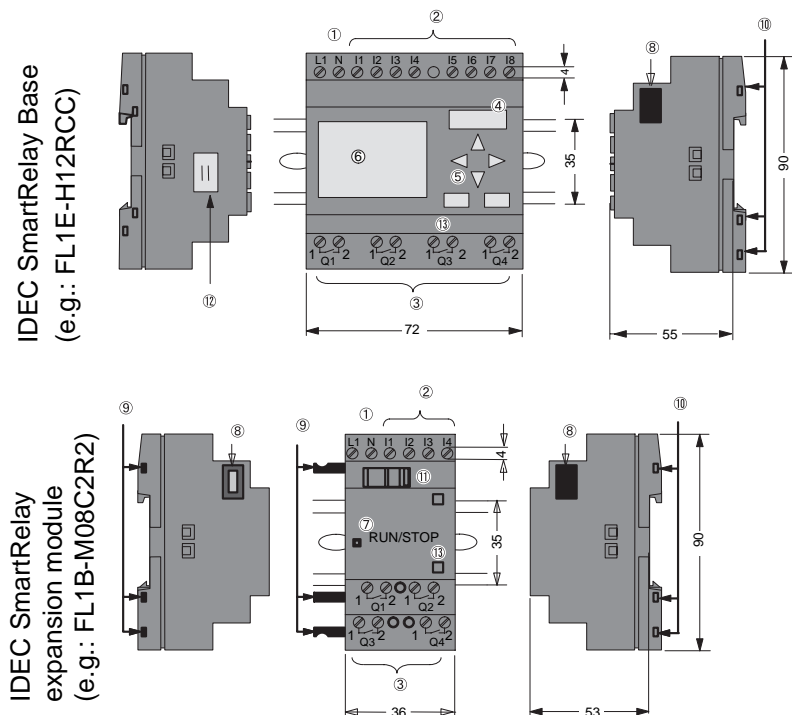
This type of expansion module can therefore be connected to devices of a different voltage class. See also Chapter 2.1.

A Text Display, if used, can be connected only to an FL1E IDEC SmartRelay base module.

Each IDEC SmartRelay base module supports the following connections for the creation of the circuit program, regardless of the number of connected modules:

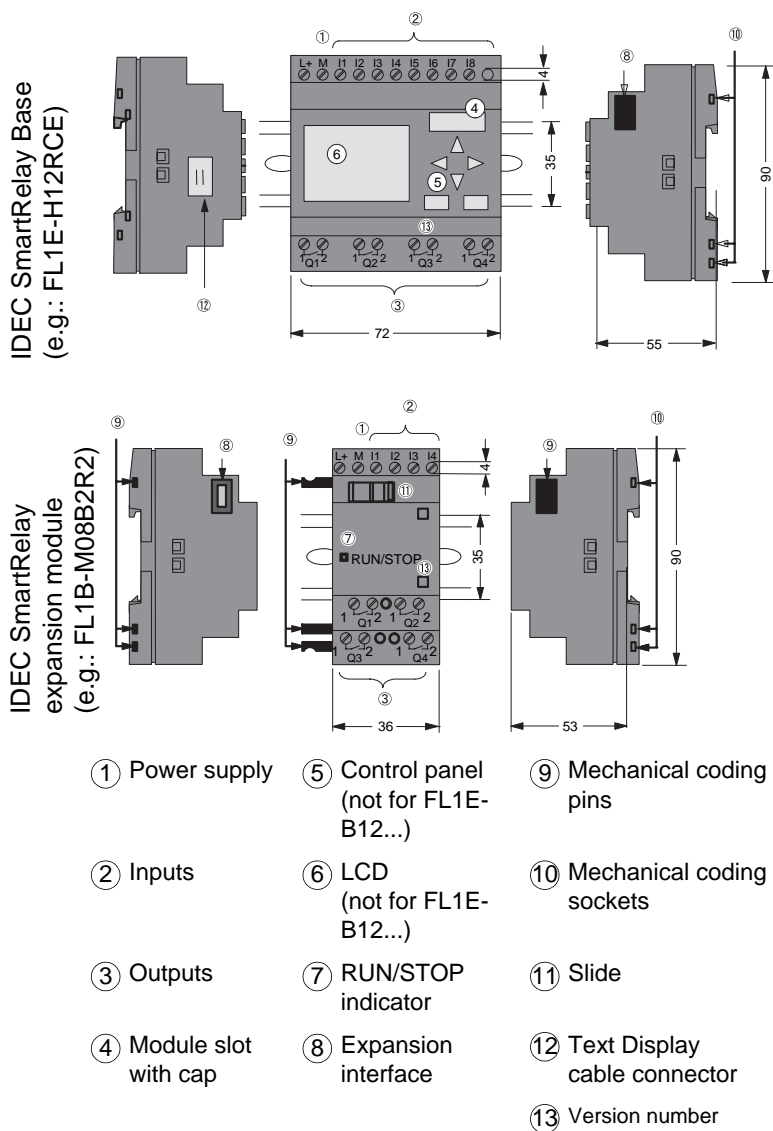
- Inputs I1 to I24
 - Analog inputs AI1 to AI8
 - Outputs Q1 to Q16
 - Analog outputs AQ1 and AQ2
 - Memory Markers M1 to M27:
 - M8: Startup marker
 - M25: Backlight flag: IDEC SmartRelay Display
 - M26: Backlight flag: Text Display
 - M27: Message text character set flag
 - Analog Memory Markers AM1 to AM6
 - Shift register bits S1 to S8
 - 4 cursor keys
 - 16 blank outputs X1 to X16
-

The IDEC SmartRelay structure

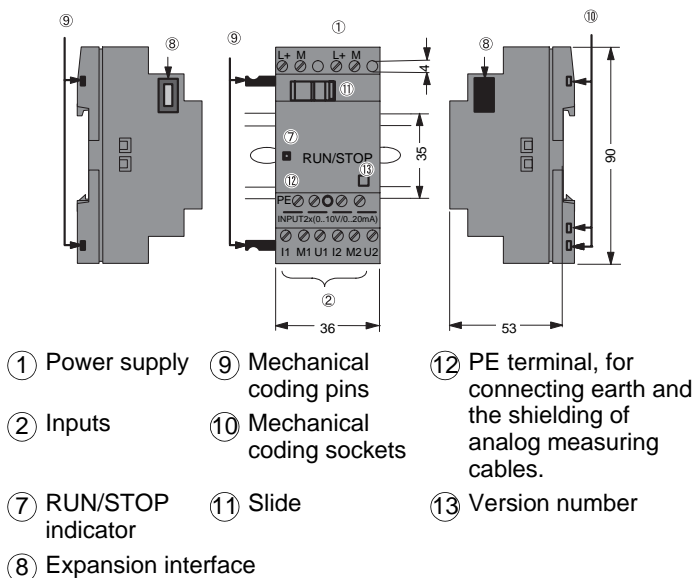


- ① Power supply
- ② Inputs
- ③ Outputs
- ④ Module slot with cap
- ⑤ Control panel (not for FL1E-B12...)
- ⑥ LCD (not for FL1E-B12...)
- ⑦ RUN/STOP indicator
- ⑧ Expansion interface
- ⑨ Mechanical coding pins
- ⑩ Mechanical coding sockets
- ⑪ Slide
- ⑫ Text Display cable connector
- ⑬ Version number

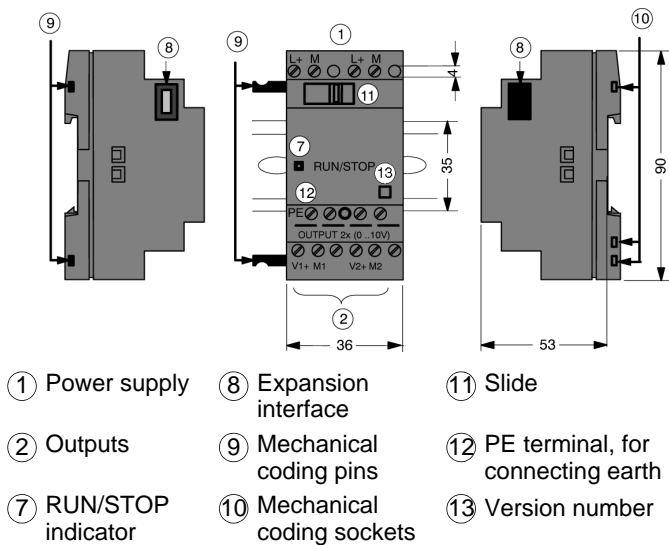
(example: $\frac{X}{3} \frac{2}{4}$
represents Version 1.)



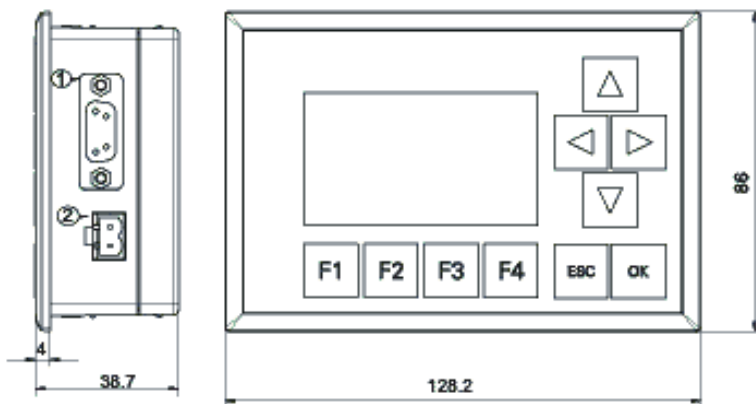
FL1B-J2B2



FL1D-K2B2



Text Display



- ① Communication interface
- ② Power supply

The Text Display includes a wider display area than the IDEC SmartRelay Display. It includes four programmable cursor keys, four programmable function keys, and an ESC and OK key. You use the included Text Display cable to connect from the communication interface on the right side of the Text Display to the corresponding interface on the left side of the IDEC SmartRelay base module.

How to identify the IDEC SmartRelay

The IDEC SmartRelay identifier informs you of various properties.

Base module

FL1E-①②③④⑤

- ① B: Base module without display
H: Base module with display
- ② Number of Inputs and Outputs
- ③ R: Relay output S: Tr. (source) output
- ④ C: With clock N: Without clock
- ⑤ D: 24V DC E: 12/24V DC A: 24V AC/DC
B: 100...240V AC C: 100...240V AC/DC

Expansion module

Digital module

FL1B-M①②③④

- ① Number of Inputs and Outputs
- ② B1: 24V DC B2: 12/24V DC
C2: 100...240V AC/DC D2: 24V AC/DC
- ③ S: Tr. (source) output R: Relay output
- ④ Terminal type 2: non-removable terminal

Analog input module

FL1B-J①②③

- ① Number of Inputs
- ② Resolution B: 10bit
- ③ Terminal type 2: non-removable terminal

Analog output module

FL1D-K①②③

- ① Number of Outputs
- ② Resolution B: 10bit
- ③ Terminal type 2: non-removable terminal

Communication module

FL1B-①②③④

- ① C: Communication module
- ② L1: LONWORKS AS: AS-Interface
- ③ blank: AS-Interface rated voltage (30V DC) C1: 24V AC/DC
- ④ Terminal type 2: non-removable terminal

Text Display

FL1E-①②

- ① RD: Remote Display
- ② Version type

Symbols



Version with display unit is equipped with 8 inputs and 4 outputs



Version without display unit is equipped with 8 inputs and 4 outputs



The digital module is equipped with 4 digital inputs and 4 digital outputs



The analog module is equipped with 2 analog inputs or two analog outputs, according to the device type





The communication module (CM); for example, AS Interface is equipped with 4 virtual inputs and 4 virtual outputs



The Text Display

Versions

The following IDEC SmartRelay versions are available:

Symbol	Designation	Supply voltage	Inputs	Outputs	Properties
	FL1E-H12RCE	12/24 V DC	8 digital ⁽¹⁾	4 relays (10 A)	
	FL1E-H12SND	24 V DC	8 digital ⁽¹⁾	4 solid state 24V / 0.3A	no clock
	FL1E-H12RCA ⁽³⁾	24 V AC / 24 V DC	8 digital	4 relays (10A)	
	FL1E-H12RCC ⁽²⁾	100...240 V AC/DC	8 digital	4 relays (10A)	
	FL1E-B12RCE	12/24 V DC	8 digital ⁽¹⁾	4 relays (10A)	no display unit no keyboard
	FL1E-B12RCA ⁽³⁾	24 V AC / 24 V DC	8 digital	4 relays (10A)	no display unit no keyboard
	FL1E-B12RCC ⁽²⁾	100...240 V AC/DC	8 digital	4 relays (10A)	no display unit no keyboard



(1): Of those can be used alternatively: 4 analog inputs (0 ... 10V) and 4 fast inputs.

(2): AC versions: Two groups consisting of 4 inputs each. Each input within a group must be connected to the same phase. It is possible to interconnect groups with a different phase.

(3): The digital inputs can be operated with P or N action.

Expansion modules

The following expansion modules can be connected to IDEC SmartRelay:

Symbol	Name	Power supply	Inputs	Outputs
	FL1B-M08B2R2	12/24 V DC	4 digital	4 relays (5A)
	FL1B-M08B1S2	24 V DC	4 digital	4 solid state 24V / 0.3A
	FL1B-M08D2R2 ⁽³⁾	24 V AC/DC	4 digital	4 relays (5A)
	FL1B-M08C2R2	100...240 V AC/DC	4 digital ⁽¹⁾	4 relays (5A)
	FL1B-J2B2	12/24 V DC	2 analog 0 ... 10V or 0 ... 20mA ⁽²⁾	none
	FL1D-K2B2	24 V DC	none	2 analog 0 ... 10 V DC


(1): Different phases are not allowed within the inputs.

(2): 0 ... 10 V, 0 ... 20 mA can be connected optionally.

(3): Digital inputs can be operated either with P or with N action.


Communication modules

The following communication modules can be connected to IDEC SmartRelay:

Symbol	Name	Power supply	Inputs	Outputs
	IDEC Smart-Relay CM AS Interface	30 V DC	the next four inputs after the physical inputs of IDEC SmartRelay ($I_n \dots I_{n+3}$)	the next four outputs after the physical outputs of IDEC SmartRelay ($Q_n \dots Q_{n+3}$)

Text Display Module

The following Text Display module is available:

Symbol	Name	Supply voltage	Display
	Text Display	24 V AC/DC 12 V DC	LCD (128 x 64) 4-row display

Certification and approvals

IDEC SmartRelay is certified to cULus and FM.

- cULus Haz. Loc.
Underwriters Laboratories Inc. (UL) to
 - UL 508 (Industrial Control Equipment)
 - CSA C22.2 No. 142 (Process Control Equipment)
 - UL 1604 (Hazardous Location)
 - CSA-213 (Hazardous Location)

APPROVED for use in

Class I, Division 2, Group A, B, C, D Tx

Class I, Zone 2, AEx, nC, IIC, Tx

Class I, Zone 2, Ex, nC, IIC, Tx

- FM Approval
Factory Mutual Research (FM) to
Approval Standard Class Number 3611, 3600, 3810
APPROVED for use in
Class I, Division 2, Group A, B, C, D Tx
Class I, Zone 2, Group IIC Tx
For further information, see our Internet address
(URL: <http://www.idec.com/usen>)

Note

You will find current approvals on the rating plate of the relevant module.

IDEC SmartRelay is issued with the CE Certificate of Conformity. It is compliant with IEC 60730-1 and IEC 61131-2 and interference-proof to EN 55011, Limit Class B.

Marine certification has been requested.

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

IDEC SmartRelay modules are therefore suitable for use in industrial and residential areas. Use in Class I, Division 2, Group A, B, C and D locations or in non-hazardous locations is supported.

Marine certification requires the surge protective device what manufactured by DEHN+SÖHNE GmbH+Co., in a case of 12/24V DC or 24V DC power line. The required Type No. and Part No.: BVT AD 24, 918 402. See Note on page 288.

For further information, see our Internet address (URL: <http://www.idec.com/usen>)

ID for Australia



Our products carrying the label shown at the side are compliant with AS/NZS 2064:1997 (Class A) standard.



Warning

Risk of death, personal injury or property damage can occur if you do not follow safety precautions for hazardous locations.

In potentially explosive atmospheres, do not disconnect connectors when the system is in RUN. Always switch off the power supply to IDEC SmartRelay and its components before you disconnect any connectors or components.

Substitution of components can impair suitability for Class I, Division 2 locations. Combinations of equipment are subject to investigation by the local authority having jurisdiction at the time of installation.

Recycling and Disposal

IDEC SmartRelay units can be fully recycled, due to their low-pollutant equipment. Contact a certified electronic waste disposal center for environmentally acceptable recycling and disposal of your old devices.

IDEC SmartRelay installation and wiring

General guidelines

Please note the following guidelines for installing and wiring your IDEC SmartRelay:

- Always ensure that the wiring of your IDEC SmartRelay is compliant with current rules and standards. Also, conform with all national and regional regulations when you install and operate the devices. For information on standards and regulations that apply to your specific case, contact your local authorities.
- Always switch off power before you wire or install/remove a module.
- Always use cables with appropriate conductor cross-sections for the relevant current. You can wire IDEC SmartRelay with cable conductor cross-sections from 1.5 mm² to 2.5 mm²; see Chapter 2.3.
- Do not exceed the screw torque of the terminals. The maximum torque is: 0.5 Nm, see Chapter 2.3.
- Keep the cabling as short as possible. If longer cables are necessary, you should use shielded versions. You should always route your cables in pairs: i.e. one neutral conductor plus one phase conductor or signal line.
- Always keep separate:
 - The AC wiring
 - High-voltage DC circuits with high-frequency switching cycles
 - Low-voltage signal wiring
- Ensure that the wires are installed with appropriate strain relief.
- Provide a suitable lightning surge arrester for cables installed in hazardous areas.
- Do not connect an external power supply in parallel to the output load of a DC output. This could develop a reverse current at the output if you have not installed a diode or similar barrier device.
- Reliable functioning of the equipment is only ensured with certified components!

Note

IDEC SmartRelay devices may only be installed and wired by skilled personnel who are familiar with and follow general engineering rules and relevant regulations and standards.

What you must note when installing

IDEC SmartRelay is designed for fixed and enclosed installation in the housing or the control cabinet.



Warning

Death, serious bodily injury or considerable damage to property can occur.

Modules of an IDEC SmartRelay are open facilities. This means that you must install IDEC SmartRelay only in a housing or cabinet.

Allow access to the housings or cabinets only with the use of a key or a tool and only allow access to authorized or approved personnel.

It is permissible to operate IDEC SmartRelay from the front at any time.

Safety of electronic control equipment

Introduction

The notes below apply regardless of the type or manufacturer of the electronic control.

Reliability

Maximum reliability of IDEC SmartRelay devices and components is achieved by implementing extensive and cost-effective measures during development and manufacture.

This includes the following:

- Use of high-quality components
- Worst-case design of all circuits
- Systematic and computer-aided testing of all components
- Burn-in of all large-scale integrated circuits (e.g. processors, memory, etc.)
- Measures preventing static charge when handling MOS ICs
- Visual checks at different stages of manufacture
- Continuous heat-run test at elevated ambient temperature over a period of several days
- Careful computer-controlled final testing
- Statistical evaluation of all returned systems and components to enable the immediate initiation of suitable corrective measures

- Monitoring of major control components, using online tests (cyclic interrupt for the CPU, etc.)

These measures are referred to as basic measures.

Carrying out tests

You must, however, ensure safety in your plant.

Before finally commissioning a system, carry out complete functional testing as well as all the necessary safety testing. In testing, also include any predictable faults that can occur. This means that you will avoid any danger to the plant or to people during operation.

Risks

In all cases where the occurrence of failures can result in material damage or injury to persons, special measures must be taken to enhance the safety of the installation – and therefore also of the situation. System-specific and special regulations exist for such applications. They must be observed on installing the control system (for example, VDE 0116 for burner control systems).

For electronic control equipment with a safety function, the measures that have to be taken to prevent or rectify faults are based on the risks involved in the installation. Beyond a certain degree of hazard the basic measures mentioned above are not sufficient. Additional measures must be implemented and approved for the controller.

Important information

The instructions in the operating manual must be followed exactly. Incorrect handling can render measures intended to prevent dangerous faults ineffective, or generate additional sources of danger.

2.1 Modular IEC SmartRelay setup

2.1.1 Maximum setup

As defined in Chapter 1, IEC SmartRelay supports a maximum of 24 digital inputs, 8 analog inputs, 16 digital outputs, and 2 analog outputs. You can achieve the maximum setup in different ways as shown below:

Maximum setup of an IEC SmartRelay *with* analog inputs - four in use

(FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND)

IEC SmartRelay base module, 4 digital modules, 2 analog modules and 1 analog output module (example)

I1,I2, I3...I6 AI3,AI4, AI1,AI2	I7, I8 AI1,AI2	I9...I12	I13...I16	I17...I20	I21...I24	AI5, AI6	AI7, AI8	
IEC SmartRelay base module	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- J2B2	FL1B- J2B2	FL1D- K2B2	
Q1...Q4	Q5...Q8	Q9...Q12	Q13...Q16				AQ1, AQ2	

Maximum setup of an IEC SmartRelay *with* analog inputs - two in use

(FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND)

IEC SmartRelay base module, 4 digital modules, 3 analog modules and 1 analog output module (example)

I1,I2, I3...I6 AI1,AI2	I7, I8 AI1,AI2	I9...I12	I13...I16	I17...I20	I21...I24	AI3, AI4	AI5, AI6	AI7, AI8	
IEC SmartRelay base module	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- J2B2	FL1B- J2B2	FL1B- J2B2	FL1D- K2B2	
Q1...Q4	Q5...Q8	Q9...Q12	Q13...Q16					AQ1, AQ2	

Maximum setup of an IEC SmartRelay *without* analog inputs

(FL1E-H12RCA/FL1E-B12RCA and FL1E-H12RCC/FL1E-B12RCC)

IEC SmartRelay base module, 4 digital modules, 4 analog modules and 1 analog output module (example)

I1 I8	I9...I12	I13...I16	I17...I20	I21...I24	AI1, AI2	AI3, AI4	AI5, AI6	AI7, AI8	
IEC SmartRelay base module	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- J2B2	FL1B- J2B2	FL1B- J2B2	FL1B- J2B2	FL1D- K2B2
Q1...Q4	Q5...Q8	Q9...Q12	Q13...Q16						AQ1, AQ2

With any setup, you can plug in an analog output module, which has the maximum of two analog outputs.

For FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND modules, you can configure whether the module uses two or four of the four possible analog inputs. AI inputs are numbered consecutively depending on how many you configure the base module to use. If you configure two inputs, they are numbered AI1 and AI2, and correspond to the I7 and I8 input terminals. Subsequent AI expansions modules would begin numbering at AI3. If you configure four inputs, they are numbered AI1, AI2, AI3, and AI4, and correspond to I7, I8, I1, and I2 in that order. Subsequent AI expansions modules would begin numbering at AI5. See sections 4.1 and 5.2.4.

High-speed/optimal communication performance

For optimal and high-speed communication performance between IDEC SmartRelay base module and the various modules, we recommend that you install the digital modules first, then the analog modules (examples above). (The special function PI controller is an exception: the AI used for the value PV should be on the IDEC SmartRelay base module or an analog input module adjacent to the IDEC SmartRelay base module).

We **recommend** that you position the CM AS Interface on the far right-hand side. (If the AS Interface voltage fails, communication between the IDEC SmartRelay system and expansion modules that are arranged to the right of the IDEC SmartRelay CM AS Interface expansion module is interrupted).

The Text Display module is installed separately. You connect it to the IDEC SmartRelay base module with the included Text Display cable.

2.1.2 Setup with different voltage classes

Rules

Digital modules can only be directly connected to devices of the same voltage class.

You can connect analog and communication modules to devices of any voltage class.

Overview: Connecting an expansion module to IDEC SmartRelay base module

In the following tables, "X" means that the connection is possible; "-" means that the connection is not possible.

IDEC SmartRelay base module	Expansion modules					
	FL1B-M08B2R2	FL1B-M08B1S2	FL1B-M08D2R2	FL1B-M08C2R2	FL1B-J2B2, FL1D-K2B2	CM
FL1E-H12RCE	x	x	x	-	x	x
FL1E-H12SND	x	x	x	-	x	x
FL1E-H12RCA	x	x	x	-	x	x
FL1E-H12RCC	-	-	-	x	x	x
FL1E-B12RCE	x	x	x	-	x	x
FL1E-B12RCA	x	x	x	-	x	x
FL1E-B12RCC	-	-	-	x	x	x

Overview: Connecting an additional expansion module to an expansion module

Expansion module	Additional expansion modules					
	FL1B-M08B2R2	FL1B-M08B1S2	FL1B-M08D2R2	FL1B-M08C2R2	FL1B-J2B2, FL1D-K2B2	CM
FL1B-M08B2R2	x	x	x	-	x	x
FL1B-M08B1S2	x	x	x	-	x	x
FL1B-M08D2R2	x	x	x	-	x	x
FL1B-M08C2R2	-	-	-	x	x	x
FL1B-J2B2, FL1D-K2B2	x	x	x	-	x	x
CM AS Interface	x	x	x	-	x	x

When setting up expansion modules of different power voltages, take the following restrictions into consideration.

Note

To power the CPU module and expansion I/O modules, use one power supply to supply the same power voltage.

When using different power supplies, supply power to the base module and expansion modules at the same time, or supply power to expansion modules before the base module. When supplying power to expansion modules after the base module, expansion modules may not be recognized by the base module.

When using different power supplies, the fast transient/burst immunity (IEC61000-4-4) will be 1 kV (power supply).

A 100 to 240V AC/DC module cannot be connected to the right side of a 12/24V DC, 24V DC, or 24V AC/DC module.

For analog input module and AS-Interface communication module, a module of any voltage can be connected to the left side. To the right side, however, a 100 to 240V AC/DC module cannot be connected.

2.1.3 Compatibility

The Text Display module can only be used with equipment series FL1E.

You cannot edit message texts from the IDEC SmartRelay base module that contain any of the following parameters:

- Par
- Time
- Date
- EnTime
- EnDate

You can only edit such message texts from WindLGC.

2.2 Installing/removing IEC SmartRelay

Dimensions

The IEC SmartRelay installation dimensions are compliant with DIN 43880.

IEC SmartRelay can be snap-mounted to 35 mm DIN rails to EN 50022 or on the wall.

IEC SmartRelay width:

- Text Display has a width of 128.2 mm, which corresponds to 8 subunits
- IEC SmartRelay base modules have a width of 72 mm, which corresponds to 4 subunits
- IEC SmartRelay expansion modules have a width of 36 mm, which corresponds to 2 or 4 subunits

Note

The figure below shows you an example of the installation and removal of a FL1E-H12RCC and a digital module. The measures shown apply to all other IEC SmartRelay Base versions and expansion modules



Warning

Always switch off power before you “remove” and “insert” an expansion module.

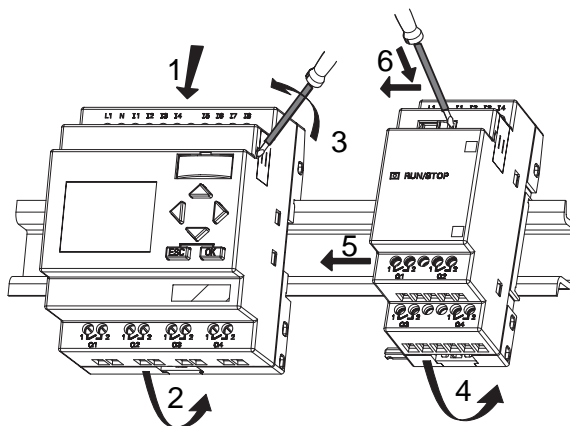
2.2.1 DIN rail mounting

Mounting

How to **mount** an IDEC SmartRelay base module **and** a digital module onto a DIN rail:

IDEC SmartRelay base module:

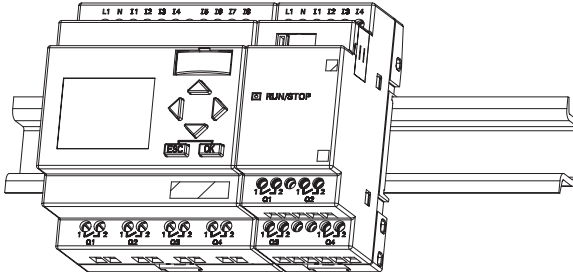
1. Hook the IDEC SmartRelay base module onto the rail.
2. Push down the lower end to snap it on. The mounting interlock at the rear must engage.



IDEC SmartRelay digital module:

3. On the right side of the IDEC SmartRelay base module/ IDEC SmartRelay expansion module, remove the connector cap.
4. Place the digital module onto the DIN rail on the right-hand side of the IDEC SmartRelay base module.
5. Slide the digital module towards the left until it contacts the IDEC SmartRelay base module.

6. Using a screwdriver, push the interlock to the left. In its end position the slide interlock engages in IDEC SmartRelay base module.



Repeat steps 3 through 6 to mount further expansion modules.

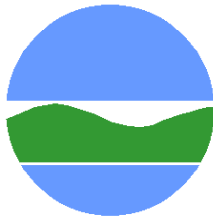
Note

The expansion interface on the last expansion module must be covered.

APPENDIX F

Quality Assurance Project Plan



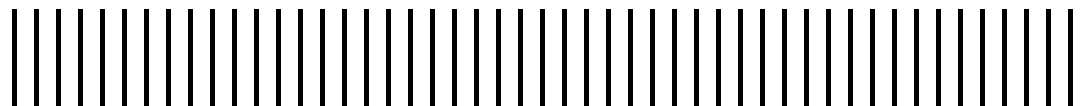


New York State Department of Environmental Conservation
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**Standby Contract for
Engineering Services (No. D007618)**

Generic Quality Assurance Project Plan for Work Assignments

May 2011



Plan Prepared By:

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**MALCOLM
PIRNIE**

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Acronyms Used in the Report

ASP	Analytical Services Protocol
CRQLs	Contract Required Quantitation Limits
DCA	Dichloroethane
DCE	Dichloroethene
FSP	Field Sampling Plan
GW	Groundwater
gpm	gallons per minute
HASP	Site Specific Health and Safety Plan
IDL	Instrument Detection Limit
MDL	Minimum Detection Limit
MPI	Malcolm Pirnie, Inc.
MS	Matrix spikes
MSD	Matrix spike duplicate
NBS	National Bureau of Standards
NYSDEC	New York State Department of Environmental Conservation
OSWER	Office of Solid Waste and Emergency Response
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCE	Perchloroethene (Tetrachloroethene)
RCRA	Resource Conservation and Recovery Act
PID	Photoionization Detector
PPE	Personal protective equipment
RFI	RCRA Facility Investigation
RPD	Relative percent difference
SCG	Standards, Criteria, and Guidance Values
SOPs	Standard Operating Procedures
SVOCs	Semi-volatile organic compounds
SWMU	Solid Waste Management Unit
TAGM	Technical and Administrative Guidance Memorandum
TCA	Trichloroethane
TCE	Trichloroethene
VC	Vinyl chloride
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
EPA	United States Environmental Protection Agency

1. Purpose and Objectives

1.1. Purpose

This Generic Quality Assurance Project Plan (QAPP) has been prepared as a generic appendix to site-specific documents developed for work assignments issued under the New York State Department of Environmental Conservation (NYSDEC) Standby Contract D007618 for engineering services. The purpose of this document is to provide quality assurance/ quality control (QA/QC) methods, procedures, and protocols for the collection, analysis, and evaluation of data collected during the work assignments.

This Generic QAPP is provided as a supplement to the site-specific documents for each work assignment under the NYSDEC Standby Contract. Any deviations from, or additions to, the procedures and protocols provided in this generic QAPP are detailed in a Supplemental QAPP, which would be provided as part of each work assignment.

1.2. QAPP Objectives

The objective of this Generic QAPP is to ensure that data collected during Work Assignments investigations are of suitable quality and quantity to meet the investigation objectives. To meet this objective, the following topics are presented and discussed in this QAPP:

- Project organization and responsibilities
- Data quality objectives
- Analytical method requirements
- Data validation requirements
- Preventative maintenance
- Quality assurance procedures
- Corrective actions

Field measurement collection procedures and sample collection procedures and sample integrity are discussed in the Generic Field Activities Plan. This QAPP has been prepared to address laboratory analysis of samples and data evaluation of the laboratory sample results. In addition, this QAPP addresses components that influence these processes and provides a detailed plan to ensure that decisions being made from the analytical data are valid, accurate, and defensible in support of subsequent recommendations.

2. Project Organization and Responsibilities

2.1. Project Organization

Malcolm Pirnie will provide oversight, coordination, health and safety, field support, and evaluation of analytical data. Malcolm Pirnie will also be responsible for evaluation of analytical test results, which will be submitted to NYSDEC. Malcolm Pirnie staff members involved in the overall management of the Standby Contract and associated work assignments will be identified in the site-specific documents developed for each site.

2.2. Analytical Laboratories

Analytical laboratories subcontracted with Malcolm Pirnie will perform analysis of samples collected during the work assignments. The laboratories under subcontract will be or were selected in accordance with the provisions of the NYSDEC *Draft Handbook for Standby Consultant Contracts* (NYSDEC, 2005). All laboratories subcontracted by Malcolm Pirnie under the NYSDEC Standby Contract are approved under applicable United States Environmental Protection Agency (USEPA) and New York State Department of Health (NYSDOH) protocols. These laboratories will maintain their certification by the NYSDOH Environmental Laboratory Approval Program (ELAP).

Each laboratory has their own provisions for performing internal QA/QC review of the data prior to transmittal to Malcolm Pirnie. In addition, Malcolm Pirnie will contract a data validation service to review the methods and protocols performed by the laboratory to validate the analytical results. A summary of the data validation results will be provided in a Data Usability Summary Report (DUSR) provided by the data validation service (Section 7.2.2).

3. Data Measurement QA/QC Objectives

This section defines the QA/QC objectives for environmental sampling and analysis, including the data quality objectives (DQOs) for measurement data and the criteria for measuring performance within these objectives. Data collected during the Work Assignments may include both field measurements and analytical samples. This Section discusses the various types of data anticipated and provides QA/QC objectives for data collected during the Work Assignments.

3.1. Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of the data to support decisions, and are developed to address specific procedures for collecting, analyzing, and evaluating results to meet overall project objectives. DQOs are developed and implemented to ensure that the quality of the data is such that the data is legally and scientifically defensible and is applicable for its anticipated use. DQOs developed for each specific site, measurement, and media assume project objectives, data objectives, and data collection methods.

Site-specific DQOs have been developed based on the factors presented above, and are presented below. These include the specific DQOs for each planned data collection task, which identifies the particular sampling protocols, analysis methods, and laboratory deliverables to be provided for each data type anticipated.

3.1.1. DQOs for Air and Soil Vapor

The objective of the soil vapor intrusion study is to evaluate the nature and extent of contamination at concentrations exceeding the NYSDOH CEH BEEI guidance levels in ambient and indoor air and sub-slab soil vapor. To be useful in meeting this objective, the data from the air and soil vapor samples must be of known quality. To support the DQOs for air and soil vapor, NYSDOH-approved analytical methodologies with NYSDEC ASP Category B deliverables have been chosen for air and soil vapor analyses. These procedures and deliverables are capable of producing high quality data characterized by rigorous QA/QC protocols and documentation. Site-specific air and soil vapor sample analyses are summarized in each work assignment. All air and soil vapor samples will be critical samples for the evaluation of potential risks to human health and the environment.

3.1.2. DQOs for Soil and Sediment

The objective of the soil sampling program is to evaluate the nature and extent of contamination at concentrations exceeding the 6 NYCRR Subpart 375-6 Remedial

Program cleanup objectives in surface and subsurface soil. Sediment samples will be collected to evaluate the nature and extent of contaminants at concentrations greater than 6 NYCRR Subpart 375-6 Remedial Program cleanup objectives, the NYSDEC Technical Guidance for Screening Contaminated Sediments criteria, or site-specific standards. To be useful in meeting this objective, the data from the soil and sediment samples must be of known quality. To support the DQOs for soil and sediment, USEPA SW-846 analytical methodologies with NYSDEC ASP Category B deliverables have been chosen for soil and sediment analyses. These procedures and deliverables are capable of producing high quality data characterized by rigorous QA/QC protocols and documentation. Site-specific soil and sediment sample analyses are summarized in each work assignment. All soil and sediment samples will be critical samples for the evaluation of potential risks to human health and the environment.

3.1.3. DQOs for Groundwater

Groundwater will be sampled and analyzed to evaluate the nature and extent of groundwater contamination at the site. Field instrumentation will be used during sampling activities to ensure the collection of representative samples. As such, data from the field instrumentation must be of sufficient quality to measure groundwater conditions prior to sampling. Analytical data will be used to identify the location of any groundwater contamination, to aid in evaluating contaminant source locations, and to assess if any standards, criteria, and guidance values (SCGs) have been exceeded. In order to meet these objectives, the data from the groundwater samples must be of known quality. Therefore, USEPA SW-846 analytical methodologies with NYSDEC ASP Category B deliverables have been selected for all groundwater analyses. These deliverables are characterized by rigorous QA/QC protocols and documentation, which historically have provided high quality data able to meet the DQOs for this media. Site-specific groundwater sample analyses are summarized in each work assignment. All groundwater samples will be critical samples for the evaluation of potential risks to human health and the environment.

3.1.4. DQOs for Surface Water

Surface water will be sampled and analyzed to evaluate the nature and extent of surface water contamination at the site. Field instrumentation will be used during sampling activities to ensure the collection of a representative sample. Analytical data will be used to evaluate the presence of contamination and to assess if any SCGs have been exceeded. To meet these objectives, the data from the surface water samples must be of known quality. Therefore, USEPA SW-846 analytical methodologies with NYSDEC ASP Category B deliverables have been chosen for all groundwater analyses. These deliverables are characterized by rigorous QA/QC protocols and documentation, which historically have provided high quality data able to meet the DQOs for this media. Site-specific surface water sample analyses are summarized in each work assignment. The

surface water sample will be a critical sample for the evaluation of potential risks to human health and the environment.

3.2. Field Measurement Quality Assurance Objective

Tasks requiring field measurements include field screening of samples, evaluating the progress of monitoring well development, monitoring well sample collection, collection of soil conductivity data, in-situ measurements, surveying sampling locations, and field analysis of samples using test kits. To ensure the accuracy and quality of the data provided by field measurements, the Generic Field Activities Plan (FAP) provides DQOs for recording field measurements during site investigations, including the following:

- Water Quality Parameters
- Field Screening of Soil Samples
- Field Test Kits
- Data Collection Using GPS and Data Point Surveys
- Membrane Interface Probe (MIP) and Soil Conductivity Sampling
- Radiological Screening

The DQOs developed for each method will ensure that the data is appropriate and reliable for the extent they will be used in the investigation. A summary of field measurement methods, documentation, DQOs, and QA/QC protocols is provided in the Generic FAP. Specific field measurements anticipated for each data collection task are detailed in each work assignment.

3.3. Laboratory Quality Assurance Objectives

Laboratory generated data are used to accurately identify and quantify hazardous substances, while the field generated data are used in conjunction with the laboratory data for further investigation of contamination at the site. Both laboratory and field internal QC programs include steps to assure the data are reliable for the extent they will be used in the investigation. In general, laboratory QC programs are more rigorous than field QC programs.

The scope and description of QC samples and QC methods are well detailed in the applicable USEPA methodologies for the particular analyses. The methodologies for organic and inorganic analyses describe the type of QC samples and required QC methods, and the required frequency of analysis. QC limits have been established for standards, blanks, duplicates, matrix spikes, and surrogates, and are contained in the methodologies.

Laboratory QC data will be reviewed by Malcolm Pirnie personnel and by a subcontracted third-party data validation service to assess the validity of the data and determine if the DQOs have been met. This objective will be met by implementing the following:

- *Evaluation of Laboratory Method Performance* – QC criteria for method performance will be reviewed and assessed for target analyses. Analysis methods will be performed based on documented procedures by certified laboratories.
- *Sample Matrix Effects* – QC samples will be collected and analyzed to determine measurement bias due to the sample matrix. If criteria are not met, matrix interferences will be confirmed by reanalysis or inspection of laboratory control samples to verify laboratory method performance is in control.
- *Planning and Management* – Laboratories will perform preventive maintenance and routine calibration of equipment. A managed program of internal and external QC checks will be followed to ensure data quality.
- *Corrective Actions* – If QC issues are detected during QA audits or QC checks, corrective actions will be taken to stop work and modify procedures to ensure data quality.

4. Field Investigation Procedures

Field investigation procedures are provided in the Generic Field Activities Plan.

5. Calibration Procedures

Calibration procedures are provided in the Generic Field Activities Plan.

6. Analytical Procedures

All groundwater, surface water, soil, sediment, and samples collected for laboratory analysis will be analyzed by a NYSDEC ASP-certified laboratory for various analytes, including VOCs, SVOCs, pesticides/PCBs, and metals, using USEPA SW-846 analytical methodologies accompanied by NYSDEC ASP Category B deliverables. Each work assignment summarizes the analytical procedures and methods that will be utilized for the site.

The analytical methods listed in each work assignment are sufficient to support the DQOs for each project. In particular, the detection limits of these methods are adequate to support the DQOs. The general SW-846 methods and procedures used for the analysis of VOCs (Method 8260B), SVOCs (Method 8270C), pesticides/PCBs (Methods 8081A and 8082), and metals (Methods 6010B, 7470A, and 7471A) are summarized as follows:

- All instruments will have the calibrations checked at a minimum at the start of each day before measurements are made.
- The calibration and calibration checks will indicate that the sensitivity of the instrument (practical detection limit) is adequate to meet project needs and that the instrument is accurate over the working range.
- All calibration information will be recorded in the laboratory log book. This includes date and time, technician signature, calibration procedure, calibration results, calibration problems, recalibration and maintenance, and instrument serial numbers.

All air and soil vapor samples collected for laboratory analysis will be analyzed by a NYSDOH-approved laboratory for VOCs (USEPA Method TO-15) that can meet the required method detection limits determined for each work assignment.

7. Data Reduction, Validation, and Reporting

The purpose of this section is to ensure that the large amounts of data produced by the laboratory are presented in a clear and useable format. In addition, data quality and technical validity must be verified prior to data use. The samples collected at the site will be analyzed according to USEPA SW-846 analytical methodologies, in which data reduction and reporting schemes are well developed and clearly defined. The employment of this method ensures comparability with other similarly analyzed environmental samples. Reduction, validation and reporting specifications for these analyses are detailed below.

7.1. Data Reduction

Data reduction is the process by which raw analytical data generated from the analytical instrument systems is converted into useable concentrations. The raw data, which takes the form of area counts or instrument responses, is processed by the laboratory and converted into concentrations expressed in terms of milligrams per kilogram (mg/kg), milligrams per liter (mg/L), micrograms per kilogram (ug/kg), micrograms per liter (ug/L), parts per million (ppm), parts per billion (ppb), or micrograms per cubic meter (ug/m³). These concentrations are the standard method for expressing the level of contamination present in environmental samples.

The process used to convert the instrument output into useable concentrations is clearly defined in the USEPA SW-846 methodologies. The resulting concentrations are comparable to other environmental samples in general and will be comparable to data previously collected for each site.

7.2. Data Validation

Data validation identifies invalid data and qualifies the usability of the remaining data. The output of data validation is qualitative or quantitative statements of data quality. Once the quality of individual measurements is known, a compilation of all data points into a cohesive statement can be made. The confidence associated with a statement incorporates both the confidence in individual measurements as well as in the decision.

Although rigorous validation of the data generated by the laboratory will be performed by a third party data validation subcontractor, the laboratory will be responsible for reviewing data to determine if any analytical problems exist. Specifically, the laboratory will develop a case narrative describing how closely the data meet the DQOs presented in this QAPP.

7.2.1. Data Review

The data review process shall consist of a contractual review that shall include an evaluation of the analysis and specific requirements of the published method in addition to the laboratory SOP. Data qualification shall be performed following the intent of the National Functional Guidelines in conjunction with the data validator's professional judgment, where applicable, since there are no formal validation guidelines written for this analysis.

Data will be declared invalid whenever documented evidence exists demonstrating that an sample was not collected under representative conditions, such as a air sampling canister leaking to ambient pressure during shipment.

The laboratory will provide a data reporting package. One copy of the ASP Category B data packages will be delivered to a third party data validation subcontractor for data assessment. The data packages will include the case narrative. A Data Usability Summary Report (DUSR) will be submitted to the NYSDEC. This package will include sampling analysis and summary forms.

Data validation will be performed using guidance from the following documents:

- USEPA Region 2 *Evaluation of Metals Data for the Contract Laboratory Program* (SOP# HW2 Rev. 13);
- USEPA Region 2 *Validating Semi-volatile Organic Compounds by SW-846 Method 8270* (SOP# HW22 Rev. 4);
- USEPA Region 2 *Validating Volatile Organic Compounds by SW-846 Method 8260B* (SOP# HW24 Rev. 2).
- USEPA Region 2 *Validating Polychlorinated Biphenyls by SW-846 Method 8082* (SOP# HW23B Rev. 1).
- USEPA Region 2 *Validating Volatile Organic Analysis of Ambient Air in canister by Method TO-15* (SOP# HW31 Rev. 4).

The QA/QC Task Leader will coordinate the validation of the data set based on information from the field team and information supplied from the laboratory on the analysis. The Validator shall review the submitted data package to determine compliance with those portions of the this QAPP and site documents that pertain to the production of laboratory data. Compliance is defined by the following criteria:

1. The data package is complete.
2. The data has been produced and reported in a manner consistent with the data requirements of the QAPP and the laboratory subcontract.
3. All protocol required QA/QC criteria have been met.

4. All instrument tune and calibration requirements have been met for the time frame during which the analyses were completed.
5. All protocol required initial and continuing calibration data is present and documented.
6. All data reporting forms are complete for all samples submitted. This will include all sample dilution/concentration factors and all pre-measurement sample cleanup procedures.
7. All problems encountered during the analytical process have been reported in the case narrative along with any and all actions taken by the laboratory to correct these problems.

The data validation task requires that the Data Validator conduct a detailed comparison of the reported data with the raw data submitted as part of the supporting documentation package.

Data are never declared invalid solely because they are unlikely to occur in nature, but may be flagged as suspect and be subjected to further review until the cause for the apparent anomaly is determined. The results from all QA/QC checks are evaluated to determine if the DQOs for each measurement are being met. Evidence of overwhelming measurement bias, external influences on the representativeness of the data, or lack of reproducibility of the measurement data may be cause for the data to be judged invalid.

7.2.2. Data Usability Summary Report (DUSR)

The Data Validator shall submit a DUSR covering the results of the data review process. This report shall include the following:

- A general assessment of the data package.
- Detailed descriptions of any and all deviations from the required protocols. (These descriptions must include references to the portions of the protocols involved in the alleged deviations).
- Any and all failures in the Validator's attempt to reconcile the reported data with the raw data from which it was derived. (Again, specific references must be included). Telephone logs should be included in the validation report.
- A detailed assessment by the Validator of the degree to which the data has been comprised by any deviations from protocol, QA/QC breakdowns, lack of analytical control, etc., that occurred during the analytical process.
- The report shall include, as an attachment, a copy of the laboratory's case narrative including the NYSDEC required sample and analysis summary sheets.
- The report shall include an overall appraisal of the data package.

The validation report shall include a chart presented in a spreadsheet format, consisting of site name, sample numbers, data submitted to laboratory, year of analytical protocol used,

matrix, fractions analyzed, e.g., volatiles, semi-volatiles, metals, cyanide, PCBs. Space should be provided for a reference to the NYSDEC ASP when non-compliance is involved and a column for an explanation of such violation.

7.3. Reconciliation with Data Quality Objectives

Calculations and determinations for data precision, accuracy and completeness will be performed in accordance with the procedures presented in Section 7.4 upon the receipt of the validated analytical data. Results will be compared to the project specifications discussed in the work assignment and site documents. If the results do not meet the project specifications, the data will be flagged as questionable and the cause of the failure (i.e., analytical methods, equipment failure, or sampling error) will be evaluated. The Project Manager and Quality Assurance Officer (QAO) will be responsible for decisions regarding use of questionable data. Potential outcomes of this evaluation will include limitations on the use of the data, rejection of the data, and/or re-sampling. Any limitations on the use of the data will be detailed in site reports. Corrective action procedures are discussed further in Section 10.

7.4. Data Reporting

The laboratory will report TCL and TAL data consistent with ASP reporting requirements. The QA reporting will include the following accuracy and precision protocols as performed on the appropriate QA samples.

If any of the data quality measures indicate performance outside the desired objective, the data associated with that result are not considered useless. The burden is on the project team to determine the extent to which a quality issue affects the related data, and ultimately how the issue impacts the fitness for use of the data.

Most often a single isolated incident in which the performance objective is not met does not automatically render the data useless, but rather slightly reduces the confidence that the measurement is reliable, and indicates that increased quality control measures are needed. Any potential limitations of the data set will be identified and communicated. The project team will present all known or potential limitations on the data in the final report.

Data quality is measured by how well the data meet the QA/QC goals for the project. QC elements include precision, accuracy, representativeness, completeness, comparability, and sensitivity:

- Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed conditions. Assessing precision measures the random error component of the data collection process. Precision is determined

by measuring the agreement among individual measurements of the same property, under similar conditions. The degree of agreement, expressed as the RPD, is calculated using the formula below.

$$RPD = \frac{V_1 - V_2}{\frac{V_1 + V_2}{2}} \times 100$$

where: V_1 = value 1
 V_2 = value 2

Analytical precision is assessed by analyzing MS/MSD pairs and laboratory duplicate samples. Field precision is assessed by measurement of field duplicate samples. The objective for precision is to equal or exceed the precision demonstrated for similar samples and should be with the established control limits for the methods. Precision control limits and QC RPD limits are noted within the laboratory SOP.

- Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Accuracy measures the bias or systematic error of the entire data collection process. Sources of these errors include the sampling process, field and laboratory contamination, sample preservation and handling, sample matrix interferences, sample preparation methods, and calibration and analytical procedures. To determine accuracy, a reference material of known concentration is analyzed or a sample which has been spiked with a known concentration is reanalyzed. Accuracy is expressed as a percent recovery and is calculated using the following formula:
- Completeness is calculated as follows:

$$\% \text{ Completeness} = 100 \times \frac{V}{n}$$

where: V = number of measurements judged valid
 n = total number of measurements

The objective is to generate a sufficient database with which to make informed decisions. To help meet the completeness objective, every effort must be made to avoid sample loss through accidents or inadvertence. The completeness goal for this project is 100%.

- Comparability expresses the confidence with which one data set can be compared to another. Comparability shall be performed as described in Section 1.5.2.
- Sensitivity is the capability of a method or instrument to discriminate between small differences in analyte concentration.

8. Preventative Maintenance

The purpose of the preventative maintenance program is to ensure that the sampling, field testing, and analytical equipment perform properly thereby avoiding erroneous results, and minimizing equipment downtime. The preventative maintenance program also provides for the documentation of all maintenance to be used as evidence of instrument maintenance and for scheduling of future maintenance. This section describes the equipment maintenance program for field instruments and those responsible for implementation of the program at the Site. The specific field equipment maintenance procedures are given in the manufacturer specifications and operating manuals provided in the Generic Field Activities Plan. The laboratory preventative maintenance program is the responsibility of the laboratory and only the minimum requirements are mentioned here.

8.1. Responsibilities

Responsibilities of key project personnel are described below:

Personnel	Responsibilities
Field Team Leader	<ul style="list-style-type: none">■ Keeping all maintenance records.■ Development and implementation of maintenance program.
Equipment Manager	<ul style="list-style-type: none">■ Maintaining storage of equipment within the Malcolm Pirnie equipment inventory.■ Carrying out all maintenance according to schedule. Informing field team members of specific maintenance requirements.■ Keeping records of all maintenance performed under his care. Sending out equipment for service/repair. Maintaining adequate supply of spare parts.
Field Personnel	<ul style="list-style-type: none">■ Maintenance of all equipment located on-site on a regular basis and after each use. Keeping supply of spare parts on-hand.

8.2. Preventative Maintenance Program

The preventative maintenance program consists of three parts, normal upkeep, service and repair, and formal recordkeeping. Normal upkeep consists of daily procedures that include cleaning, lubrication and checking the batteries of the equipment. The following is a partial list of normal upkeep procedures and a partial list of important spare parts:

- Normal upkeep for environmental monitoring equipment performed daily or after each use:
 - Cleaning.
 - Lubrication of moving parts.
 - Check/charge battery.
 - Inspect for damage.
 - Check for operation problems.
 - Inspect all hoses and lines.
- Partial list of important spare parts for environmental monitoring instruments frequently used:
 - Fuses.
 - Mini Rae-UV lamp.
 - Spare battery.

The normal upkeep is performed daily after each use and includes inspecting for damage, signs of problems, and charging the batteries if necessary. Specific equipment upkeep procedures are described in the manufacturer specifications and operation manuals for each instrument provided in the Generic Field Activities Plan.

Minor service and repair will be performed by the Equipment Manager who is experienced in the service and repair of field instruments. Equipment in need of major or more complex repair and service will be sent to the manufacturer.

All maintenance, servicing and repair of equipment shall be recorded and kept on file. Field personnel shall record maintenance and instrument problems in the field instrument log books. These will ultimately be kept on file by the Field Team Leader. The Equipment Manager shall keep a record of all equipment released to the field and a record of all maintenance and service on file.

8.3. Laboratory Instrument Maintenance

Preventative maintenance procedures will be clearly defined and written for each measurement system. Maintenance activity, preventative or repair, will be documented

on standard forms, which are maintained in log books. Written procedures will include maintenance schedules, problem identification procedures, space for describing problems and repair notes, and failure analysis protocols. Service contracts and regularly scheduled in-house maintenance will be included, along with a list of critical spare parts. Laboratory instrument maintenance and calibration and corrective action procedures are incorporated in the laboratory SOPs.

8.4. Rental Equipment

Rental equipment will be obtained only from known, reputable rental suppliers. The equipment will require a pre-receipt to verify accuracy, maintenance and upkeep of the equipment.

9. Quality Assurance Procedures

In order to monitor the quality of the analytical data generated for each work assignment, an appropriate number of QC methods will be employed for all field and laboratory measurement systems. The employment of QC methods permits the validation of the analytical methodology utilized and provides a measure of the suitability of the methodology to meet the DQOs prior to the beginning of measurement or analysis. Once the measurement and analysis has begun, the employment of QC methods permits the monitoring of the system output for quality. The QC results presented with the environmental sample data, allows the data to be assessed for quality, and a determination made on how well the data has met the DQOs.

Laboratory generated data is used to accurately identify and quantify hazardous substances, while the field generated data is used in conjunction with the laboratory data for further investigation of contamination at the site. Both laboratory and field internal QC programs include steps to assure the data are reliable for the extent they will be used in the focused investigation. In general, laboratory QC programs are more rigorous than field QC programs.

9.1. Field Quality Control

The intended data uses have been identified and the DQOs established for all field measurement activities in Sections 3 and 5 of this QAPP. Section 3 contains SOPs, which describe the use and calibration of field instruments. QC methods will be used to demonstrate that the instruments are capable of producing reliable data. The QC checks employed for field instruments are as follows:

QC METHOD	PURPOSE	FREQUENCY
Calibration Check Sample	<ul style="list-style-type: none">■ Insures proper working order of instrument.■ Measures instrument accuracy and sensitivity.	Daily
Background Sample	<ul style="list-style-type: none">■ Provides measure of instrument reliability.	Daily
Duplicate Sample	<ul style="list-style-type: none">■ Measures instrument precision	5 %

Trip Blanks	■ Measures potential contamination from sample transport, the environment and/or shipping.	Minimum of one per cooler of aqueous volatile samples.
Field Blanks	■ Measures potential contamination due to poor sampling device decontamination procedures	One per every 20 environmental samples per media.

The calibration check samples will be analyzed daily and duplicate samples will be analyzed at a minimum frequency of five percent. The calibration check verifies that the instrument is capable of accurately identifying and quantifying contaminants of concern. The duplicates provide a quantitative measurement of the precision of the instrument. Background samples are similar to blanks and provide information regarding instrument reliability. The information is recorded in field logbooks. The field technician uses the results from these QC methods to monitor the instrument at the time of the analysis. If QC results indicate a problem with the instrument, corrective action will be taken and, if necessary, the samples will be reanalyzed. Because field measurements are generally easy to repeat, measurements should be repeated as necessary so the data are as complete as possible. The QC results are used as an indication of data quality and reliability when the data are being reviewed.

9.2. Laboratory Quality Control

The scope and description of QC samples and QC methods are well detailed in the applicable USEPA SW-846 methodologies for the particular analysis. The methodologies for organic and inorganic analyses describe the type of QC samples and required QC methods, and the required frequency of analysis. QC limits have been established for standards, blanks, duplicates, matrix spikes, and surrogates, and are contained in the methodologies. QC data will be reviewed by Malcolm Pirnie personnel to assess the validity of the data and determine if the DQOs have been met.

10. Corrective Actions

10.1. Non-conformance Reports

Corrective action will be undertaken when a non-conforming condition is identified. A non-conforming condition occurs when QA objectives for precision, accuracy, completeness, representativeness or comparability are not met, or when procedural practices or other conditions are not acceptable.

A non-conformance report will be prepared by the site QAO, approved by the Project Officer, and issued to the Project Manager and other appropriate parties. The non-conformance report will describe the unacceptable condition and the nature of corrective measures recommended and will include a discussion of specific data involved, the impact to data quality, and ultimate data usability. A schedule for compliance will also be provided.

10.2. Corrective Actions

The non-conformance report will be transmitted to a responsible officer of the ASP laboratory, the NYSDEC, the Project Officer and the Project Manager. The non-conformance report will specify, in writing, the corrective action recommended including measures to prevent a recurrence of the original deficiency. Appropriate documentation of corrective action will also be prepared. The site QAO will monitor implementation of the corrective action, and provide written record as to whether the original problem has been resolved.

10.3. Stop Work Orders

A Stop-Work Order may be issued, upon authorization, by the site QAO, if corrective action does not adequately address a problem or if no resolution can be reached. To issue a Stop-Work Order, written authorization is required from the Project Manager and the NYSDEC Representative. If disagreement occurs among these individuals, it will be brought before successively higher levels of management until the issue is resolved.

10.3.1. Stop Work Order Documentation

The conditions and need for a Stop-Work Order will be documented in sufficient detail to permit evaluation of the deficiency and determination of proper corrective action. Pertinent communications will be attached to the Stop-Work Order and referenced in the appropriate spaces. Such communications include discussions, correspondences, or telephone conversations that pertain to evaluation of the problem and potential solutions, and implementation of the preferred solution.

10.3.2. Resumption of Work

In order for work to resume following a Stop-Work Order, the Project Manager and the NYSDEC Representative must rescind it in writing.

10.4. Course and Action to Prevent Recurrence

The site QAO is responsible for tracking non-conforming conditions, evaluating the effectiveness of corrective measures, and assuring that the necessary steps have been taken to prevent recurrence of the original problem.

10.5. Field Changes

The Project Manager is responsible for all site activities. In this capacity the Project Manager will at times be required to modify site programs in response to changing site conditions. At such times the responsible Field Team Leader will notify the Project Manager of the anticipated change, and obtain the approval of the Project Manager and implement the necessary changes. The Project Manager will notify in writing the site QAO, the Project Officer, and the NYSDEC Representative. A copy of the notification will be attached to the file copy of the affected document. If an unapproved action has been taken during a period of deviation, the action will be evaluated to determine the significance of any departure from established procedures.

11. Quality Assurance Reports

Malcolm Pirnie field staff will promptly report any difficulties to the Project Manager. The laboratory will provide a written description on any quality assurance, problems to Malcolm Pirnie with submission of the analytical data packages.

Following any quality assurance audits, the site QAO will submit a Quality Assurance report to the Project Manager describing the performance of the quality assurance program. Problems or issues that arise independent of audits, may be identified to project management at any time.

12. References

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- NYSDEC, 2002. "Draft DER-10 Technical Guidance for Site Investigation and Remediation." New York State Department of Environmental Conservation, Division of Environmental Remediation. December 2002.
- NYSDEC, 2005. "Draft Handbook for Standby Consultant Contracts". New York State Department of Environmental Conservation, Division of Environmental Remediation.
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- USEPA, 1987, Data Quality Objectives for Remedial Response Activities, CDM Federal Programs Corporation.
- USEPA, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, 540G89004.
- USEPA, 1989, Region II CERCLA Quality Assurance Manual, Final Copy, Revision 1.
- USEPA, 1989, Soil Sampling Quality Assurance User's Guide, Second Edition, EPA-600/8-89/046.
- USEPA, 1992, Region II Evaluation of Metals Data for the Contract Laboratory Program, SOP ID: HW-2, Revision 11, 3/90.
- USEPA, 1997, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), EPA 402-R-97-016, Revision 1.
- USEPA, 1998, Region II Low Stress (Low-Flow) Purging and Sampling Procedure for Collecting Ground Water Samples from Monitoring Wells, Final.

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USEPA, 1999, Region II Validating Volatile Organic Compounds by SW-846 Method 8260B, SOP ID: HW-24, Revision 1.

USEPA, 2000, Guidance for the Data Quality Objectives Process, EPA QA/G-4, August 2000.

USEPA, 2001, Region II Validating Semivolatile Organic Compounds by SW-846 Method 8270, SOP ID: HW-22, Revision 2.

USEPA, 2002, Region II Validating PCB Compounds by SW-846 Method 8082, SOP ID: HW-23B, Revision 1.

USEPA, 2005, Contract Laboratory Program Statement of Work for Inorganic Analysis Multi-Media, Multi-Concentration ILMO6.X, Draft.

APPENDIX G

Site Management Forms



Jimmy's Drycleaners
Roosevelt, New York
NYSDEC Site #130080

Date _____
Inspector _____
Time _____

Treatment System Operation		Alarms	
System On (Y/N)	_____	A/C Fail (Y/N)	_____
Blower On (Y/N)	_____	Blower Pressure (Y/N)	_____
Sump Pump On (Y/N)	_____	Sump Level (Y/N)	_____
Air Stripper			
Blower VFD Setting (Hertz)	_____	Intake/Exhaust Piping OK? (Y/N)	_____
System Pressure (inches water)	_____	Water Leaks (Y/N)	_____
Influent/Effluent Piping OK? (Y/N)	_____	Water Temperature (F°)	_____
Heat Exchanger			
Heat (On/Off)	_____	Building Temperature (F)	_____
Heat Exchanger Flow (GPM)	_____	Heat Exchanger Pressure (PSI)	_____
General Site			
Perimeter Fence OK? (Y/N)	_____	Circuit Breakers Checked (Y/N)	_____
Shed Fence OK? (Y/N)	_____	Outfall Condition OK? (Y/N)	_____
Monitoring Wells OK? (Y/N)	_____	Samples Collected (Y/N)	_____
Autodialer OK? (Y/N)	_____		
Notes:			

Operation & Maintenance Data Sheet
 NYSDEC-Jimmy's Dry Cleaners
 61 Nassau Road
 Roosevelt, NY

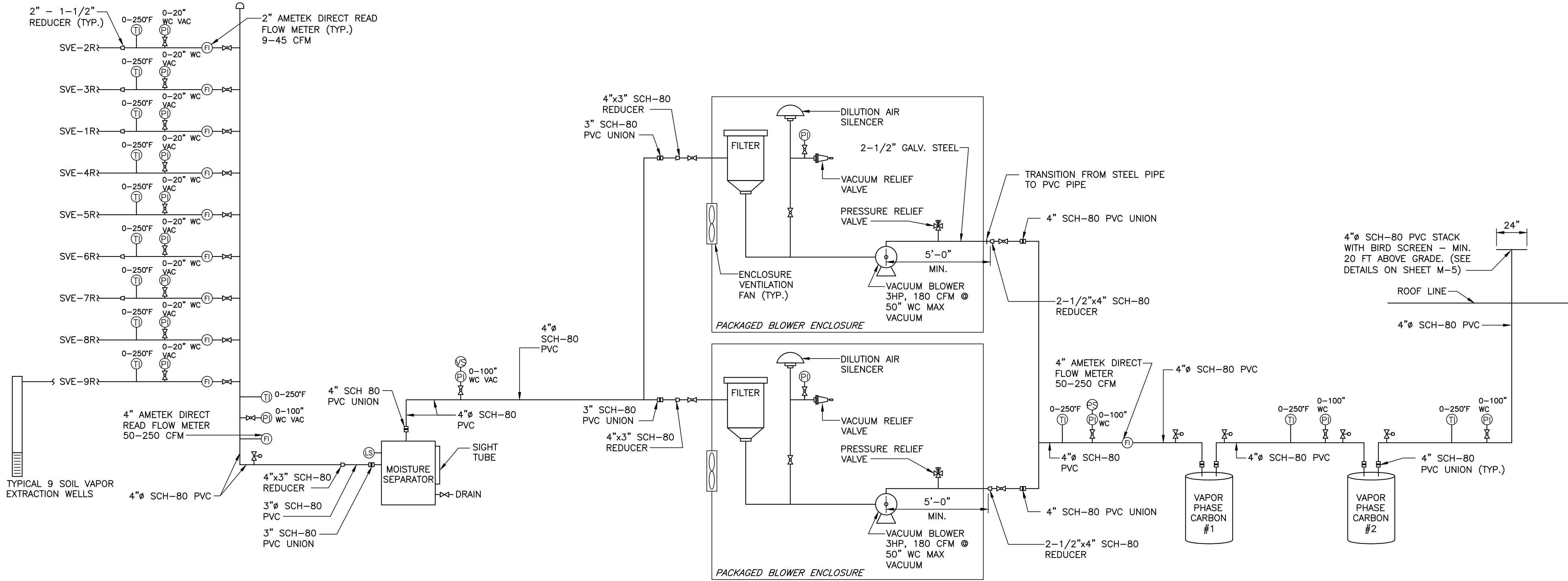
EnviroTrac Environmental Services
 5 Old Dock Road, Yaphank, NY 11980
 (631)924-3001, Fax (631)924-5001

Date:
 Weather / Temp:
 Technician / Operator:

Arrival Time:
 Departure Time:

System Status							
	Arrival	Departure	SVE Blower 1 Run Time (Hrs)				
SVE Blower 1 (ON/OFF)			SVE Blower 2 Run Time (Hrs)				
SVE Blower 2 (ON/OFF)			SVE Blower 1 VFD Frequency (Hz)				
Sensaphone (ON/OFF)			SVE Blower 2VFD Frequency (Hz)				
Soil Vapor Extraction System							
Total Influent Air Flow Rate (cfm)			Total Effluent Air Flow Rate (cfm)				
Blower 1 Inline Air Filter (F-1) Inlet Vacuum ("H2O)			Blower 2 Inline Air Filter (F-3) Inlet Vacuum ("H2O)				
Blower 1 Inlet Vacuum ("H2O)			Blower 2 Inlet Vacuum ("H2O)				
Blower 1 Fresh Air Valve Open (%)			Blower 2 Fresh Air Valve Open (%)				
Blower 1 Inlet Temperature (°F)			Blower 2 Inlet Temperature (°F)				
Blower 1 Outlet Temperature (°F)			Blower 2 Outlet Temperature (°F)				
Blower 1 Outlet Pressure ("H2O)			Blower 2 Outlet Pressure ("H2O)				
VGAC-1 Influent Pressure ("H2O)			VGAC-1 Influent PID (ppm)				
VGAC-2 Influent Pressure ("H2O)			VGAC-2 Influent PID (ppm)				
VGAC-2 Effluent Pressure ("H2O)			VGAC-2 Effluent PID (ppm)				
			Moisture Separator Tank Level (gal)				
SVE Manifold Legs - Vacuum/Flow Rate/PID							
SVE-1R ("H2O)/(cfm)/(ppm)				SVE-6R ("H2O)/(cfm)/(ppm)			
SVE-2R ("H2O)/(cfm)/(ppm)				SVE-7R ("H2O)/(cfm)/(ppm)			
SVE-3R ("H2O)/(cfm)/(ppm)				SVE-8R ("H2O)/(cfm)/(ppm)			
SVE-4R ("H2O)/(cfm)/(ppm)				SVE-9R ("H2O)/(cfm)/(ppm)			
SVE-5R ("H2O)/(cfm)/(ppm)							
Soil Vapor Monitoring Probes - Vacuum Influence/PID							
SVM-1 ("H2O)/(ppm)				SVM-4 ("H2O)/(ppm)			
SVM-2 ("H2O)/(ppm)				SVM-5 ("H2O)/(ppm)			
SVM-3 ("H2O)/(ppm)							

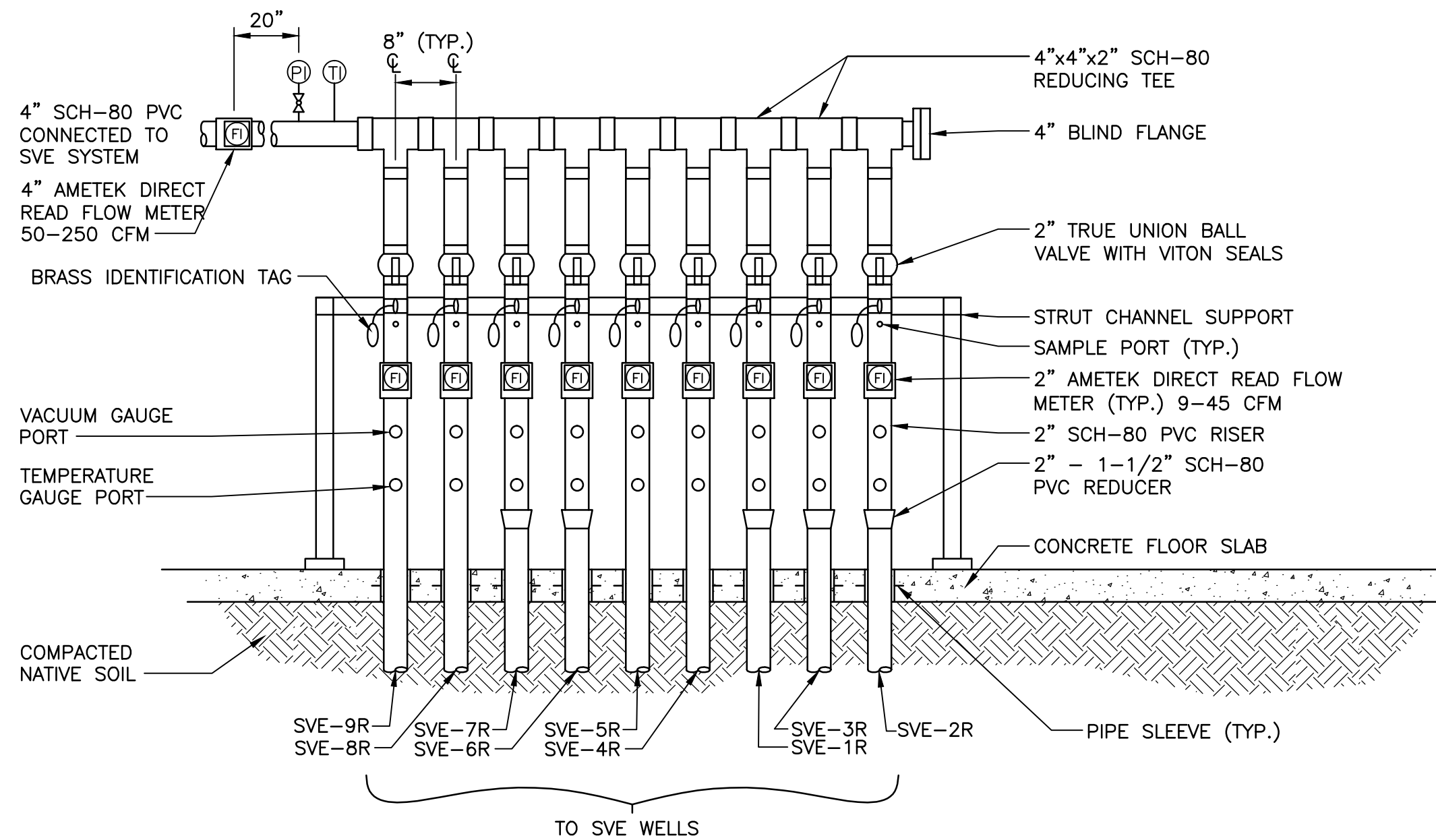
Notes, Comments & Observations:



- LEGEND:**
- ① FLOW INDICATOR
 - ② HIGH LEVEL SWITCH
 - ③ PRESSURE INDICATOR
 - ④ TEMPERATURE INDICATOR
 - ⑤ VACUUM SWITCH
 - ⑥ PRESSURE SWITCH
 - ⑦ GATE VALVE
 - ⑧ BALL VALVE
 - ⑨ BUTTERFLY VALVE
 - ⑩ PRESSURE REGULATOR
 - ⑪ PRESSURE/VACUUM RELIEF VALVE
 - ⑫ UNION
 - ⑬ REDUCER
 - ⑭ PIPE CAP
 - ⑮ SAMPLE PORT
 - ⑯ VACUUM BLOWER

- NOTES:**
- LAYOUT OF SVE SYSTEM FOR CONCEPT ONLY. CONTRACTOR MAY ALTER SYSTEM THAT MEETS THE MINIMUM SPECIFIED REQUIREMENTS AT NO ADDITIONAL COST TO THE DEPARTMENT.
 - FLOW INDICATOR TO READ IN DIRECT CFM.

PROCESS AND INSTRUMENTATION SCHEMATIC
NOT TO SCALE



- NOTES:**
- LAYOUT OF SVE SYSTEM FOR CONCEPT ONLY. CONTRACTOR MAY ALTER SYSTEM THAT MEETS THE MINIMUM SPECIFIED REQUIREMENTS AT NO ADDITIONAL COST TO THE DEPARTMENT.
 - CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING NECESSARY PIPE HANGARS AND SUPPORTS FOR PIPING SYSTEM SPECIFIED CONSISTENT WITH THE REQUIREMENTS SET FORTH IN THE SPECIFICATIONS AND AS DIRECTED BY THE OWNER.

SVE PIPE RISER/MANIFOLD SCHEMATIC
NOT TO SCALE

- NOTES:**
- CONTRACTOR SHALL PROVIDE AN ENCLOSURE OR STRUCTURE THAT MEETS THE FOLLOWING REQUIREMENTS AND PROVIDES AN INSULATED, WEATHER TIGHT ENCLOSURE THAT WILL REMAIN WEATHER TIGHT FOR THE DURATION OF THE ANTICIPATED OPERATIONAL PERIOD OF TWO YEARS.
 - FOLLOW BUILDING MANUFACTURERS INSTRUCTIONS TO INSTALL THE BUILDING STRUCTURE.
 - CONCRETE CONSTRUCTION SHALL CONFORM TO CODE ACI 318.
 - CONCRETE SHALL BE CONTROLLED AIR ENTRAINED, WITH A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS.
 - REINFORCING SHALL BE DEFORMED BARS NEW BILLET STEEL CONFORMING TO ASTM-A615, GRADE 60.
 - DRAIN FOUNDATION EXCAVATION DURING CONSTRUCTION AS REQUIRED.
 - CONSTRUCTION JOINTS NOT SHOWN MUST BE SUBMITTED BY THE CONTRACTOR FOR THE APPROVAL OF THE ENGINEER.
 - ALL EXPOSED EDGES OF CONCRETE TO HAVE A 3/4" CHAMFER.
 - CONTRACTOR SHALL NOT DISTURB/CUT REINFORCING STEEL WHEN INSTALLING CONDUITS THROUGH FOUNDATION WALL. CONTRACTOR SHALL BE REQUIRED INSTALL STEEL SLEEVES WITH SILICONE CAULKING AS DIRECTED.
 - COORDINATE LOCATION WITH MECHANICAL EQUIPMENT.
 - CONTRACTOR TO SLEEVE THE FOUNDATION SLAB FOR SVE PIPING PENETRATIONS.

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK LAW, SECTION 7209.2.



REVISIONS					REMARKS
NO.	BY	DATE			

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DWN SMH
CKD DJL

**NEW YORK STATE DEPT. OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION
JIMMY'S DRY CLEANERS SITE-OPERABLE UNITS 1&2
REMEDIAL CONSTRUCTION PROJECT**

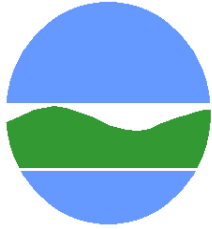
**CONTRACT D009345
SVE SYSTEM
SCHEMATICS AND NOTES
SCALE: AS SHOWN**

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APPENDIX H

Field Activities Plan



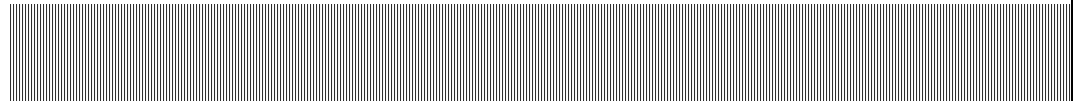


New York State Department of Environmental Conservation
625 Broadway • Albany, New York 12233

**Standby Contract for
Engineering Services (No. D007618)**

Generic Field Activities Plan for Work Assignments

May 2011



Report Prepared By:

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518-250-7300

0266 - NYSDEC

**MALCOLM
PIRNIÉ**

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Appendices

- A. Field Activities Generally Acceptable Procedures (GAPs)
- B. Operation and Calibration Procedures for Field Instruments
- C. Field Logs

Acronyms Used in the Report

ASP	Analytical Services Protocol
CRQLs	Contract Required Quantitation Limits
DCA	Dichloroethane
DCE	Dichloroethene
DNAPL	Dense Non-aqueous Phase Liquid
FSP	Field Sampling Plan
GPS	Global Positioning System
GW	Groundwater
gpm	gallons per minute
HASP	Site Specific Health and Safety Plan
IDL	Instrument Detection Limit
LNAPL	Light Non-aqueous Phase Liquid
MDL	Minimum Detection Limit
MPI	Malcolm Pirnie, Inc.
MS	Matrix spikes
MSD	Matrix spike duplicate
NBS	National Bureau of Standards
NYSDEC	New York State Department of Environmental Conservation
OSWER	Office of Solid Waste and Emergency Response
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCE	Perchloroethene (Tetrachloroethene)
RCRA	Resource Conservation and Recovery Act
PID	Photoionization Detector
PPE	Personal protective equipment
RFI	RCRA Facility Investigation
RPD	Relative percent difference
SOPs	Standard Operating Procedures
SVOCs	Semi-volatile organic compounds
SWMU	Solid Waste Management Unit
TAGM	Technical and Administrative Guidance Memorandum
TCA	Trichloroethane
TCE	Trichloroethene
VC	Vinyl chloride
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
EPA	United States Environmental Protection Agency

1. Objectives

1.1. Purpose

This generic Field Activities Plan (FAP) has been prepared as a generic appendix to site-specific documents developed for work assignments issued under the New York State Department of Environmental Conservation (NYSDEC) Standby Contract D007618 for engineering services. The purpose of this document is to provide field methods, procedures, and protocols for the collection of data during the work assignments.

This generic FAP is provided as a supplement to the site-specific documents for each Work Assignment under the NYSDEC Standby Contract. Any deviations from, or additions to, the procedures and protocols provided in this generic FAP will be detailed in a Supplemental FAP, which would be provided as part of each work assignment.

1.2. FAP Objectives

The objective of this generic FAP is to ensure that field data collected during work assignment investigations are of suitable quality and quantity to meet the investigation objectives. To meet this objective, the following topics are presented and discussed in this FAP:

- Description and objective of field investigation procedures
- Calibration procedures

This FAP has been prepared to address field methods and sample collection procedures. In addition, this FAP addresses components that influence these processes and provides a detailed plan to ensure that decisions being made based on the field data are valid, accurate, and defensible in support of subsequent recommendations.

The results of the field activities will be used to support project decisions and meet overall project objectives. The procedures summarized in Section 2 were developed to ensure that the quality of the field data is such that the data is legally and scientifically defensible and is applicable for its anticipated use. Media-specific data quality objectives, which are discussed in the generic Quality Assurance Project Plan (QAPP), have been developed based on the factors presented above. A summary of field activity methods, documentation, DQOs, and QA/QC protocols is provided in Section 2.

2. Field Investigation Procedures

A summary of objectives, equipment, and procedures for the following field activities is provided in this section:

- Field quality control samples
 - Trip blanks
 - Field blanks
 - Matrix spike/matrix spike duplicates
 - Field duplicates
- Field measurements
 - Water level measurements
 - Water quality parameters
 - Field screening of soil samples
 - Field PCB test kits
 - Data collection using GPS and data point surveys
 - Membrane interface probes
 - Radiological screening
- Sample equipment decontamination
- Monitoring wells installation and development
- Groundwater sampling
- Surface water sampling
- Sediment sampling
- Surface soil sampling
- Subsurface Soil sampling
 - Direct-push soil sampling
 - Split-barrel (split spoon) soil sampling
- Exploratory test pits and trenches
- Soil vapor and air sampling
- Community air monitoring program
- Storage and disposal of investigation derived waste
- Field documentation
- Sample handling

2.1. Field Quality Control Samples

Quality control procedures will be employed to ensure that sampling, transportation and laboratory activities do not bias sample analytical quality. Trip blanks, field blanks, duplicate samples, matrix spike samples and matrix spike duplicates will provide a quantitative basis for validating the analytical data. A summary of the anticipated QA/QC samples for each media is included in each work assignment.

2.1.1. Trip Blanks

The trip blanks will be prepared by the laboratory by filling 40 ml vials with a Teflon-lined septum with deionized, analyte-free water. The trip blank will accompany the day's sample containers at all times. One trip blank will be returned to the laboratory with each cooler containing aqueous samples for volatile organic compound (VOC) analysis. The trip blank will be analyzed for VOCs to detect possible contamination during shipment. Trip blanks will remain in the shipping cooler from the time of packing, in the laboratory, to arrival back at the laboratory.

2.1.2. Field Blanks

A field blank consists of an empty set of laboratory-cleaned sample containers. At the field location, deionized, analyte-free water is passed through decontaminated sampling equipment and placed in the empty set of sample containers for analysis of the same parameters as the samples collected with the sampling equipment. One field blank will be collected per every 20 environmental samples sent to the analytical laboratory, per media.

2.1.3. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample pairs are analyzed by the laboratory to provide a quantitative measure of the laboratory's precision and accuracy. When performing USEPA SW-846 volatile organic or organic extractable analysis with NYSDEC Category B deliverables, the laboratory must be supplied with triple sample volume for each Sample Delivery Group (SDG) in order to perform MS/MSD analyses. Blanks do not require separate matrix spike or duplicate analyses regardless of their matrix.

The limits on an SDG are:

- Each Case for field samples, or
- Each 20 field samples within a Case, or
- Each fourteen calendar day period during which field samples in a Case are received (said period beginning with receipt of the first sample in the SDG), whichever comes first.

Field personnel will specify samples for MS/MSD analysis. Extra volume is not required for aqueous samples for inorganic analysis. Non-aqueous samples (soils) do not require that any extra volume of sample be submitted to the laboratory for MS/MSD samples.

2.1.4. Field Duplicates

For each sample matrix, a field duplicate sample will be collected for the analytical laboratory at a rate of one sample per 20 environmental samples, per media. The duplicate sample is collected at the same location as the environmental sample. The field duplicate sample is identified using the sample designation system described in Section 4.12. The identity of the field duplicate is not revealed to the laboratory. The analytical results of the environmental sample will be compared to the field duplicate sample, to evaluate field sampling precision.

2.2. Field Measurements

Tasks requiring recording of field measurements include field screening of samples, evaluating the progress of monitoring well development, monitoring well sample collection, collection of soil conductivity data, in-situ measurements, surveying sampling locations, and field analysis of samples using test kits. A summary of field measurements is provided below. Specific procedures for inspection and calibration of the related field equipment are provided in Section 3.

2.2.1. Water Level Measurements

2.2.1.1. Measurement Objectives

Water levels in monitoring wells will be measured and used in conjunction with horizontal and vertical ground survey data to determine horizontal and vertical components of groundwater flow. Water level measurements will also be used to determine the volume of standing water in monitoring wells for development and purging activities. These measurements made during the initial site activities will be utilized to provide a baseline of groundwater elevations and flow at the site prior to subsequent activities.

2.2.1.2. Measurement Equipment

The following equipment will be used for the measurement of water levels:

- Electronic water level indicator and/or interface probe.
- Field logbook and pen.
- Photoionization Detector.
- Deionized Water.
- Low Phosphate Detergent.

2.2.1.3. Measurement Procedure

The first time we measure water levels at sites where VOCs are the contaminant of concern, at each monitoring well, the expansion cap will be removed and the head space and breathing zone's air quality will be monitored with a PID. This step may be omitted in subsequent rounds of water level measurements in those monitoring wells that yielded no detectable amounts of vapors or gases from prior sampling rounds. If air quality readings in the breathing space around the well exceed action levels set in the site-specific health and safety plan (HASP), appropriate measures will be taken as listed in the HASP.

The battery of the electric water level indicator will be checked by pushing the battery check button, and waiting for the audible signal to sound or the instrument light to come on. The water level indicator will be decontaminated before collecting a measurement in each monitoring well by using analconox wash and deionized water rinse. The instrument will then be turned on and the probe will be slowly lowered into the monitoring well, until the audible signal is heard or the instrument light goes on, indicating that the sensor in the probe has made contact with the water surface in the monitoring well.

In the presence of NAPL, an interface probe, which can indicate and differentiate between the contact surfaces of NAPL and water, will be used in the place of an electric water level indicator. The probe is checked, decontaminated, and used in the same manner as an electric water level indicator. When the sensor probe makes contact with the NAPL or water surfaces in a monitoring well, an audible signal will be heard. In order to distinguish between NAPL and water surfaces, a different audible signal is used for each medium (i.e., constant signal for NAPL, intermittent signal for water).

The depth to water will be recorded to the nearest one-hundredth of a foot, from the top of the measuring mark on the monitoring well riser. The date, time, monitoring well number, and depth to water will be recorded in the field book.

2.2.2. Water Quality Parameters

Water quality parameters, including pH, conductivity, dissolved oxygen, temperature, and turbidity are often measured during monitoring well development and groundwater and surface water sampling tasks. The parameters are typically measured using a multi-parameter water quality instrument equipped with a flow-through cell (e.g., Horiba U-22 or equivalent). A Generally Acceptable Procedure (GAP) for measuring water quality parameters is provided in the Low-flow Groundwater Sampling GAP presented in Appendix A.

At a minimum, the multi-parameter water quality instrument will measure the following field parameters:

- Temperature
- Conductivity
- Dissolved oxygen (DO)
- pH
- Turbidity
- Salinity

2.2.2.1. Instrument Operation

A thermistor is used by the instrument to measure temperature. The thermistor also measures the change in electrical resistance accompanying changes in temperature. The instrument uses the temperature data in conductivity temperature conversions, DO temperature compensation, and pH temperature compensation. The unit of measurement for temperature is °C (Celsius). The conductivity of water is determined by measuring the resistance of ion flow in between charged plates because conductivity is inversely proportional to resistance. The instrument reports conductivity as mS/cm (milli Siemen / centimeter). The instrument uses the membrane-electrode method for Dissolved Oxygen (DO). A reduction reaction in the cathode is caused by oxygen diffusing through the membrane of the sensor to create a current. This current is proportional to the concentration of oxygen dissolved in water. DO is reported as mg DO/L.

The instrument uses a glass-electrode method to determine pH. The known pH of a reference solution is determined by using two electrodes, a glass electrode and a reference electrode, and measuring the voltage (difference in potential) generated between the two electrodes. The difference in pH between solutions inside and outside the thin glass membrane creates electromotive force in proportion to this difference in pH. The reporting unit is the standard unit of pH (for example, 7.00 pH units). The instrument measures turbidity using the light-transmission scattering method. The unit for turbidity is NTU (Nephelometric Turbidity Unit).

2.2.2.2. Water Quality Measurement Procedures

The Horiba U-22 utilizes a water flow-through cell during groundwater sampling, or can be used without the cell for measuring surface water parameters. Field personnel will follow all procedures outlined for calibration and operation of the Horiba U-22 or equivalent instrument when collecting field parameter measurements. Specific procedures for operation and calibration of the multi-parameter water quality instrument are provided in Appendix B.

For measuring surface water DO, a YSI 550A Dissolved Oxygen Instrument (or equivalent) may be used in conjunction with the Horiba U-22. This instrument provides greater accuracy in surface water bodies due to better agitation of samples, and is easier to use in surface water applications. Field personnel will follow all procedures outlined

for calibration and operation of the YSI 550A or equivalent DO instrument when collecting field parameter measurements. Specific procedures for operation and calibration of the DO instrument are provided in Appendix B.

2.2.3. Field Screening of Soil Samples

Soil samples are screened using a photoionization detector (PID) to assess the presence of volatile organic vapors in soil samples from split-spoon samplers, direct-push core samples, and other soil sample types. The PID will be a MiniRAE 2000 or equivalent portable-type instrument that is programmable and contains the appropriate gas-discharge lamp (9.8, 10.6, or 11.7), measured in electron-volts (eV), based on the ionization potential of the target compound.

When field screening soil samples, field personnel will follow all procedures for calibration, operation, and preventive maintenance as specified in the operating manual provided by the manufacturer (Appendix B).

2.2.3.1. Field Screening Equipment

The following equipment may be used for field screening of soil samples:

- PID (MiniRAE 2000 or equivalent)
- Self-sealing quart-size polyethylene freezer bags, or 16 ounce glass jars. Jars must be decontaminated or certified as clean from a laboratory.

2.2.3.2. Field Screening Procedures

The polyethylene bag headspace method described below is one method to screen soil samples at the site. The collapse of the polyethylene bag during analysis allows uniform flow of contaminant vapors into the PID, giving accurate readings. However, a 16 ounce, decontaminated glass jar may be substituted or the soil in the split-spoon or macro-core may be screened directly.

1. Use a self-sealing quart-size polyethylene freezer bag. Half-fill the bag with sample (the volume ratio of soil to air is equal), then immediately seal it. Manually break up the soil clumps within the bag. Alternatively, soil in the split-spoon or direct-push macro-core may be screened directly immediately after opening the sampler.
2. When using glass jars:
 - Fill jars with a total capacity or 16 oz.
 - Seal each jar with one (1) or two (2) sheets of aluminum foil with the screw cap applied to secure the aluminum foil.

Note: Headspace development decreases with temperature. When temperatures are below the operating range of the instrument, perform headspace development and analysis in a

heated vehicle or building. Record the ambient temperature during headspace screening. Complete headspace analysis within approximately 20 minutes of sample collection.

3. After headspace development, introduce the instrument sampling probe through a small opening in the bag to a point about one-half of the headspace depth. Keep the probe free of water droplets and soil particles.
4. Record the highest meter response on a sampling form. Maximum response usually occurs within about two seconds. Erratic meter response may occur if high organic vapor concentrations or moisture is present.

Note: any erratic headspace data in the sampling form. Do not collect analytical samples from the polyethylene bag.

2.2.4. Field PCB Test Kits

PCB Test Kits (e.g., RaPID Assay[®]) will be used to provide quantitative, semi-quantitative or qualitative enzyme immunoassay (EIA) for the analysis of PCB (polychlorinated biphenyl) in water (groundwater, surface water, well water) or soil. The PCB Test Kit allows reliable and rapid screening for PCB (measured and reported as Aroclor 1254), with quantitation between 0.5 and 10 ppb (as Aroclor 1254), in water.

The PCB RaPID Assay[®] kit applies the principles of enzyme linked immunosorbent assay (ELISA) to the determination of PCB and related compounds. The sample to be tested is added, along with an enzyme conjugate, to a disposable test tube, followed by paramagnetic particles with antibodies specific to PCB attached. Both PCB (which may be in the sample) and the enzyme labeled PCB (the enzyme conjugate) compete for antibody binding sites on the magnetic particles. At the end of an incubation period, a magnetic field is applied to hold the paramagnetic particles in the tube and allow the unbound reagents to be decanted. After decanting, the particles are washed with Washing Solution. The presence of PCB is detected by adding the enzyme substrate (hydrogen peroxide) and the chromogen (3,3',5,5' – tetramethylbenzidine). The enzyme labeled PCB analog bound to the PCB antibody catalyzes the conversion of the substrate/chromogen mixture to a colored product. After an incubation period, the reaction is stopped and stabilized by the addition of acid.

Since the labeled PCB was in competition with the unlabeled PCB for the antibody sites, the color developed is inversely proportional to the concentration of PCB in the sample:

- Darker color = lower concentration
- Lighter color = higher concentration

The determination of the PCB level in an unknown sample is interpreted relative to the standard curve generated from kit standards after reading with a spectrophotometer.

2.2.4.1. Field PCB Test Kit Procedures

Field personnel will follow all procedures for use, calibration, and standard preparation for the RaPID Assay® Field PCB test kits provided by the manufacturer. Manufacturers' instructions for applicability, use, and QA/QC procedures for RaPID Assay® Field PCB test kits are provided in Appendix B.

2.2.5. Site and Data Point Surveys and Basemap Preparation

Sampling locations, temporary groundwater sampling points, and groundwater monitoring wells will be surveyed with accuracy and precision requirements discussed in each work assignment. Measurement of sampling points will be recorded using either a portable Global Positioning System (GPS) unit suitable for field surveys, or appropriate land surveying equipment operated by a competent land surveyor under the supervision of a New York State Licensed Land Surveyor. Survey data will be used to develop a site basemap. Basemaps will be prepared using geographic information system (GIS) software.

2.2.6. Membrane Interface Probes (MIP)

A Membrane Interface Probe with Soil Conductivity sensor (MIP-SC) will be used to provide real-time vertical characterization of subsurface soils and provide subsurface contaminant data as detailed in each work assignment. The MIP-SC system is a subsurface, continuous-logging instrument developed by Geoprobe Systems®, a division of Kejr, Inc. of Salina, Kansas, to screen for the presence of volatile contaminants in soil. The instrument is comprised of a permeable membrane and carrier gas system used to detect volatile organic compounds (VOCs) and a dipole soil conductivity measurement tip. The MIP- system will be used to qualitatively characterize shallow subsurface VOC contamination at the site, including fuel releases, chlorinated solvents, and non-aqueous phase liquid (NAPL). The MIP system also includes a soil conductivity tip to measure soil conductivity for subsurface correlation and soil characterization.

The MIP portion of the probe uses a heated permeable membrane advanced into the formation by direct-push methods. The membrane does not allow fluids to move across the membrane, allowing the instrument to function in the saturated zone. The probe is advanced into the subsurface at a speed of approximately one foot per minute. A heating element within the probe heats the membrane, which in turn heats the surrounding soil and/or groundwater in contact with the membrane, causing VOCs present in the media to volatilize and diffuse through the polymer membrane (Christy, 1996). The VOCs are collected by an inert carrier gas and carried to the surface detectors through a pressurized gas return tube within the MIP trunkline. The carrier gas is fed into an applicable detector, typically an ECD, PID or FID, which qualitatively measures the VOCs. The detector output (in millivolts) is recorded versus a corrected depth measurement based on the travel time of contaminants through the carrier gas return tube as determined by membrane response testing.

The SC tool uses a dipole arrangement at the tip of the probe, in which an alternating electrical current is passed from an insulated center electrode into the formation and returned to the probe body. The response of the formation to the current is measured as a voltage drop across the dipoles, which is then used to calculate formation resistance using Ohm's Law. The formation conductivity is determined as the inverse of the resistance ($1/R$), typically in units of milliSiemens per meter (mS/m).

2.2.6.1. Personnel

Generally, three personnel are required to operate the drilling and MIP equipment- two crew members under the direction of the field scientist overseeing field activities. One crew member operates the direct-push drilling equipment, and the other operates the MIP controller, logging equipment, and detectors as directed by the field scientist.

The field scientist overseeing SC-MIP operation and the assisting crew member will have a working knowledge of the principals of equipment operation and QA/QC procedures. The field scientist should also be familiar with the expected output of the detectors and how this output is affected by the SC-MIP system controls.

2.2.6.2. MPI-SC Detector Selection

Detector selection is based on the subsurface contaminants expected at the site. In general:

- The FID will be used for detection of unsaturated hydrocarbons, including methane;
- A PID will be used for general VOC screening including petroleum hydrocarbons; and,
- An ECD will be used primarily for detection of chlorinated VOCs (CVOCs).

Other detectors, including DSITMS and similar low-volume gas chromatography detectors, may be used to provide qualitative analysis and differentiation of VOC and CVOc compounds. More than one detector can be used simultaneously for initial investigations where subsurface contaminant characteristics are unknown.

Regardless of the detector used, each detector will be calibrated following the instructions provided by the manufacturer. All standards, methods, and operating procedures for the selected detector will be in accordance with manufacturer specifications. Detectors and associated equipment will be operated by a competent subcontractor trained in their operation and calibration.

2.2.6.3. MIP-SC Procedures

The general field procedures for MIP-SC sampling are outlined in the GAP provided in Appendix A. A subcontractor competent and trained in the operation and calibration of MIP equipment will provide MIP-SC services and equipment at the site. The contractor will follow all requirements of the Standard Operating Procedure (SOP) for MIP-SC logging provided by the manufacturer. Calibration and preparation of standards for the MIP will be performed in accordance with manufacturer specifications.

2.2.7. Radiological Screening

A radiological survey will be conducted to evaluate the presence of low level radioactive materials at levels two times greater than the background, which will be established based on non-impacted areas at the site or adjacent sites. Specific sampling objectives will be outlined in applicable work assignments. If radiological characterization of subsurface soil and groundwater is necessary based on survey results, levels of radioactive materials in soil will be compared to NYSDEC TAGM RAD-05-01 Cleanup Guidelines for Soils Contaminated with Radioactive Materials.

All radiological screening activities will generally follow the guidelines presented in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (USEPA, 1997). Procedures and methods incorporated in the MARRISM are consistent with practices accepted by the NYSDEC, USEPA, and the United States Army Corps of Engineers (ACOE).

Characterization of the extent of radiological contamination in the surface soils at the site will be conducted through a scoping survey. If radioactive contamination is discovered during the radiological screening, additional methods and protocols for subsurface sampling of soil and groundwater will be provided as an addendum to the FSP.

2.2.7.1. Radiological Screening Equipment

Radiological screening field equipment will consist of the following:

Ludlum Model 44-10 (or equivalent) sodium iodide (NaI) Gamma Scintillator coupled with a Ludlum Model 2221 (or equivalent) Scaler/Ratemeter.

- Global Positioning System (GPS) unit.
- Latex gloves (disposable).
- Neoprene gloves.
- Field logbook and pen.

2.2.7.2. Radiological Screening Procedures

A screening of the soils outside of site buildings will consist of a “walk-over” using a calibrated Ludlum Model 44-10 (or equivalent) 2-inch by 2-inch NaI Gamma Scintillator coupled with a Ludlum Model 2221 (or equivalent) Scaler/Ratemeter. This type of scan is used to detect radiological materials on the surface and in the top foot of the subsurface. Scanning will be carried out by walking over the outdoor area of the property at a speed of approximately 0.5 meters per second (about 1.5 feet per second), moving the detector in a serpentine fashion. Transects will be spaced to assure complete coverage of the area. A portable GPS unit will be used to map and record the results of the scan.

2.3. Sampling Equipment Decontamination

Cross contamination of samples from any source is to be avoided. All sampling equipment must be clean and free from the residue of any previous samples. All non-dedicated sampling equipment must be cleaned initially and prior to being re-used. The following is the procedure for decontamination and does not apply to heavy equipment or drilling equipment, with the exception of split spoons or equivalent samplers. All heavy equipment and drilling equipment will be steam cleaned in a predesignated location prior to use and between locations.

2.3.1. Equipment and Supplies

The following equipment may be needed to decontaminate equipment and tools used to collect soil, sediment and water samples:

1. Tap water for initial cleaning and rinsing of equipment.
2. Distilled water for final rinsing of equipment after tap water or solvent rinse.
3. Non-phosphate detergent (e.g., Alconox™) for cleaning equipment.
4. Dishwashing detergent to remove oily or organic residue.
5. Nitric acid as a 1% solution for removing metal contaminants from equipment
6. Isopropyl alcohol
7. Organic solvent for final cleaning of equipment (e.g., hexane or equivalent)
8. Personnel protective equipment (PPE) - including disposable gloves (Nitrile preferred), first aid kit, and waterproof outerwear (if necessary).
9. Re-sealable buckets approved for waste collection.
10. Squirt bottles for water, alcohol, and solvents.
11. Brushes for cleaning equipment.
12. Field notebooks, pens, pencils, and digital camera to document decontamination procedures.

2.3.2. Decontamination Guidelines

1. Non-dedicated soil and water sampling and processing equipment should be decontaminated between sampling intervals and between locations.
2. All solvents must be captured and disposed of in appropriate, labeled, soil or aqueous waste containers. All instruments that come into contact with the sample water must be cleaned in the same manner as the sampling device.
3. Liquids collected into the chemical waste container must be discarded in an appropriate waste stream.

4. Staff performing decontamination procedures are required to wear appropriate PPE, gloves (*e.g.*, Nitrile) and eye protection.
5. Care should be taken during cleaning to prevent cleaning solution contact with clothing. If circumstances dictate that contact will occur (*e.g.*, high wind), waterproof outer clothing (*e.g.*, foul weather gear or rain gear) and face shields must be worn.
6. The project work plan may designate collection of equipment rinse samples to document effectiveness of cleaning.
7. This Work Plan does not address radioactive waste decontamination, PPE for radioactive waste, or disposal of radioactive contaminated waste material.

2.3.3. Decontamination Procedure

The following procedures will be followed for decontamination:

1. Disassemble item(s) (if necessary).
2. Rinse each item with tap water.
3. Thoroughly scrub the item with a brush and soapy water, using non-phosphate detergent such as Alconox™ for non-oily residue, or a detergent for items with oily or other sticky organic residue.
4. During the scrubbing process, be sure to bleed Alconox™ solution or equivalent through small passageways/nozzles/vents, etc.
5. Rinse the item with tap water to remove all residual soap. Be sure to bleed tap water through small passageways/nozzles/vents, etc.
6. Rinse the item with 10% nitric acid to remove residual metals (if deemed necessary). Be sure to bleed 10% nitric acid through small passageways/nozzles/vents, etc.
7. Rinse the item with de-ionized water. Be sure to bleed de-ionized water through small passageways/nozzles/vents, etc.
8. Rinse the item with isopropyl alcohol. Be sure to bleed isopropyl alcohol through small passageways/nozzles/vents, etc.
9. Rinse the item with de-ionized water. Be sure to bleed de-ionized water through small passageways/nozzles/vents, etc.

10. Rinse the item with organic solvent (*e.g.*, hexane or equivalent) if deemed necessary. Be sure to bleed organic solvent through small passageways/nozzles/vents, etc.
11. Rinse the item with de-ionized or analyte-free water and allow to air dry. Be sure to bleed de-ionized or analyte-free water through small passageways, nozzles, vents, etc.
12. Re-assemble item(s) (if necessary).
13. Wrap the item(s) in aluminum foil or plastic bag to protect it until it is used.

Equipment used for sampling water from monitoring wells such as pneumatic bladder pumps will be decontaminated by thoroughly washing all internal and external surfaces with soapy water and rinsing with deionized water prior to use. All tubing must be dedicated to individual monitoring wells (*i.e.*, tubing cannot be reused). Field instrumentation will be cleaned per manufacturer's instructions (Appendix B). Probes, such as those used in pH and conductivity meters, and thermometers will be rinsed prior to and after each use with deionized water.

2.3.4. Reference

American Society for Testing and Materials (ASTM), 1994. Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites. Designation: D 5088 – 90.

2.4. Monitoring Well Installation and Development

2.4.1. Installation Objectives

Permanent monitoring wells will be installed to collect groundwater samples for chemical quality analysis. Groundwater levels in the wells will be measured to evaluate the horizontal component of groundwater flow.

2.4.2. Installation Equipment

A truck-mounted rotary drilling rig equipped with 4.25-inch (or 6.25-inch) hollow-stem augers will be used to create an eight-inch (or 10.5-inch) diameter borehole. For an overburden water table well, a two-inch diameter polyvinyl chloride (PVC) screen and riser pipe will be lowered through the borehole to five to seven feet below the water table by hand and with the use of the augers. Comparable methods may be used based on site conditions and project objectives. Probes and any other large pieces of equipment that come into contact with the soil must be steam cleaned before use and between boreholes. If visibly contaminated with free phase products or any other contaminants, probes and other equipment must be decontaminated by the following the procedures in Section 2.3

2.4.3. Installation Procedures (Rotary Drilling)

A minimum of six inches of clean filter pack sand will be emplaced into the bottom of the casing. The monitoring well assembly, consisting of two-inch inner diameter (I.D.) schedule-40 PVC casing with approximately five to 10 feet of continuous 0.01-inch slot schedule-40 PVC screen, will be inserted through the augers. For overburden water table wells, monitoring well screens will be placed so that a minimum of two feet of well screen is above the water table.

Clean filter pack sand will then be poured into the annular space between the augers and the monitoring well assembly as the augers are slowly removed. The filter pack sand will extend approximately two feet above the screened interval. A minimum one-foot thick layer of bentonite pellets will be placed above the filter pack by slowly dropping the pellets along the side of the monitoring well casing. If the bentonite pellets are emplaced above the water table, they will be hydrated with potable water. The augers will then be removed as the remainder of the annulus is tremie grouted to within two feet of the ground surface with a cement-bentonite grout. The cement-bentonite grout will consist of a mixture of portland cement and water in the proportion of five to six gallons of water per 94-pound bag of cement, with approximately three to five percent bentonite powder.

2.4.4. Monitoring Well Completion

Each well will be completed with a stick-up or flush-mount manhole cover set into a one square foot concrete pad as described in the monitoring well completion GAP document provided in Appendix A.

2.4.5. Monitoring Well Development

2.4.5.1. Development Objectives

Monitoring wells installed at the site will be developed to improve their hydraulic properties by removing sediment from the monitoring well and clearing the monitoring well screen of fine particles.

2.4.5.2. Development Equipment

The following equipment will be needed to develop the monitoring wells:

- Electric water level indicator;
- Polyethylene or nalgene tubing and foot-valve;
- Bottom-filling PVC bailer;
- Bailer cord;
- Temperature, pH, dissolved oxygen, oxidation-reduction potential (ORP), specific conductivity and turbidity meters;
- Photoionization Detector;

- Field logbook and field data sheets;
- Roll of polyethylene sheeting; and
- Decontamination equipment.

2.4.5.3. Development Procedures

Monitoring well development will be conducted using one or more of the following techniques:

- Bailing.
- Inertial Pumping.
- Surge Block.

Monitoring well development will be performed no sooner than 24 hours after well installation. Prior to developing each monitoring well, the initial water level and total depth will be measured. Following well development, the total depth will again be measured to evaluate the quantity of sediment removed (if any).

All equipment placed into the monitoring well will be either decontaminated prior to its introduction into the monitoring well, in accordance with Section 2.3, or it will be dedicated. Monitoring well development will proceed with repeated alternating sequences of surging and removal of water from the monitoring well, until the discharge water is relatively sediment free.

The effectiveness of the development procedure will be monitored after each well volume has been removed by measurements of field parameters, such as turbidity, pH, ORP, temperature, and conductivity, as described in Section 2.2.2. These field measurements and other observations will be recorded on a Well Development/Purging Log, an example of which is presented in Appendix C.

In general, monitoring well development will be discontinued after a minimum of 10 well volumes have been removed and stabilization of field parameter measurements has occurred, or when the turbidity of the discharge water reaches 50 nephelometric turbidity units (NTUs) or less. Specific procedures for monitoring well development are provided in the well development GAP document provided in Appendix A.

2.5. Groundwater Sampling

2.5.1. Sampling Objectives

Groundwater samples will be collected to evaluate the nature and extent of contaminants at concentrations greater than NYSDEC Class GA standards in groundwater. Specific sampling objectives are outlined in each work assignment. Samples will also be collected from temporary monitoring points utilizing a direct-push retractable screen sampler.

2.5.2. Sampling Equipment

The following equipment may be required for groundwater sampling:

- Electric water level indicator and/or interface probe
- Peristaltic pump.
- Polyethylene or Teflon®-lined polyethylene tubing.
- Silicone tubing.
- Direct-push retractable screen sampler or equivalent for soil boring groundwater grab samples.
- Temperature, pH, dissolved oxygen, ORP, specific conductivity, and turbidity meters.
- Photoionization detector.
- Field logbook and field data sheets.
- Laboratory prepared sample containers.
- Roll of polyethylene tubing.
- Decontamination equipment.
- Disposable latex or nitrile gloves.

2.5.3. Sampling Procedures (Permanent Monitoring Wells)

Groundwater sampling will typically be conducted in accordance with the USEPA Low-Flow Sampling Protocol (USEPA, 1998). Alternative methods, such as the collection of groundwater samples with passive diffusion bags or following purging of three well volumes, may be used at some sites based on project requirements and site conditions. Specific procedures are provided in the low-flow groundwater sampling and passive diffusion bag GAPs provided in Appendix A. General low-flow sampling procedures using a peristaltic pump are summarized below.

This step may be omitted in those monitoring wells which have already demonstrated in the previous rounds of water level measurement that they contain no or insignificant amounts of volatile organic vapors. The PID will be calibrated before the start of each sampling event.

Clean, new polyethylene or Teflon®-lined polyethylene tubing will be lowered into the water column to a maximum depth of two feet above the bottom of the monitoring well. The polyethylene tubing will be connected to a piece of silicone tubing that is inserted into the mechanical rollers of a peristaltic pump. By using the process of mechanical peristalsis, the peristaltic pump draws groundwater through the tubing to the surface, so that a sample can be collected. The well will be purged at a rate suitable to minimize drawdown. Field parameters, consisting of pH, specific conductance, temperature, dissolved oxygen, ORP, and turbidity will be measured in each sample collected from a

monitoring point through the use of individual meters. Both the pH and the specific conductivity meters will be calibrated for water temperature before each sampling event.

The volume of water removed from each monitoring well will be dependent upon the amount of time required for stabilization of the field parameters. In general, the well will be considered stabilized for sample collection when field parameters have stabilized for three consecutive readings as follows:

■ pH:	+/- 0.1 standard units
■ Specific Conductance:	+/- 3%
■ Oxidation-Reduction Potential:	+/- 10 millivolts
■ Dissolved Oxygen	+/- 10%
■ Turbidity	+/- 10%

When the field parameters have stabilized, the volume of water purged will be recorded, and the monitoring point will be sampled in the same manner as was used to purge the well. Once a groundwater sample is collected from the well, the polyethylene tubing will be disposed of as ordinary solid waste.

After recording field measurements, the analytical parameters and order of sample collection for groundwater samples will be:

1. TCL VOCs;
2. TCL SVOCs.
3. Other Parameters (TAL Metals, Pesticides, PCBs, etc.)

The sample bottles will be pre-preserved by the laboratory. The sample bottles will be immediately placed in a cooler held at 4°C. Disposable latex or nitrile gloves will be worn by the sampling personnel and changed between sampling points. Data to be recorded in the field logbook will include purging and sampling methods, depth to water, volume of water removed during purging, pH, temperature, ORP, dissolved oxygen, turbidity, and specific conductivity values, and PID readings.

Groundwater that is purged from monitoring wells will be discharged to the ground surface within 50 feet of each monitoring well location in accordance with the NYSDEC Proposed Technical and Administrative Guidance Memorandum (TAGM) - Disposal of contaminated groundwater generated during Site Investigations, if the following criteria are met:

1. There is a defined site which is the source of the groundwater contamination;
2. There is no free product observed such as DNAPLs or LNAPLs;

3. The infiltrating groundwater is being returned to the same water bearing zone from which it is being purged;
4. Prior approval has been granted by the NYSDEC project manager.

If there is no recharge surface (i.e., grass, uncovered soil, etc.) located within 50 feet of a well, then the purge water will be containerized and disposed of off-site. Purge water requiring off-site disposal will be handled in accordance with Section 2.13.

2.5.4. Sampling Procedures (Temporary Sampling Points)

A direct-push retractable screen sampler or equivalent will be utilized to collect discrete groundwater samples at various depths at each location. A 1 3/4-inch hollow push rod with a steel drop off tip will be advanced to a designated depth and then retracted. When the push rod is retracted a filter screen is exposed, allowing groundwater to hydrostatically enter the inlet screen from the formation. Clean, new Teflon®-lined polyethylene tubing will be lowered into the water column to a maximum depth of two feet above the bottom of the monitoring well. The polyethylene tubing will be connected to a piece of silicone tubing that is inserted into the mechanical rollers of a peristaltic pump. By using the process of mechanical peristalsis, the peristaltic pump draws groundwater through the tubing to the surface, so that a sample can be collected. Field parameters, consisting of pH, specific conductance, temperature, dissolved oxygen, ORP, and turbidity will be measured in each sample collected from a monitoring point through the use of individual meters. Both the pH and the specific conductivity meters will be calibrated for water temperature before each sampling event.

The volume of water removed from each sampling point will be dependent upon the amount of time required for stabilization of the field parameters. In general, the point will be considered stabilized for sample collection when field parameters have stabilized for three consecutive readings as follows:

- | | |
|----------------------------------|------------------------|
| ■ pH: | +/- 0.1 standard units |
| ■ Specific Conductance: | +/- 3% |
| ■ Oxidation-Reduction Potential: | +/- 10 millivolts |
| ■ Dissolved Oxygen | +/- 10% |
| ■ Turbidity | +/- 10% |

When the field parameters have stabilized, the volume of water purged will be recorded, and the sampling point will be sampled in the same manner as was used to purge the well. The purge water will be handled in accordance with Section 2.5.3.

After taking field measurements, the analytical parameters and order of sample collection for groundwater samples will be:

1. TCL VOCs;
2. TCL SVOCs.
3. Other Parameters (TAL Metals, Pesticides, PCBs, etc.)

The sample bottles will be pre-preserved by the laboratory. The sample bottles will be immediately placed in an insulated cooler maintained at 4°C. Disposable latex or nitrile gloves will be worn by the sampling personnel and changed between sampling points.

2.6. Surface Water Sampling

2.6.1. Sampling Objectives

Surface water samples are collected from lakes, streams, rivers, stormwater catch basins, etc. to evaluate the nature and extent of contaminants of concern at concentrations greater than NYSDEC surface water standards.

2.6.2. Sampling Equipment

The following equipment will be needed to collect groundwater samples for analysis:

- Glass beaker.
- Laboratory prepared sample containers.
- Temperature, pH, dissolved oxygen, ORP, specific conductivity and turbidity meters.
- Field logbook and field data sheets.
- Disposable latex or nitrile gloves.

2.6.3. Sampling Procedures

The surface water sample will be collected directly from the surface water body by partially submerging a pre-cleaned glass beaker or unpreserved sample container into the surface water. The glass beaker will be allowed to fill slowly and continuously. Once the glass beaker is completely filled, the surface water will be transferred directly into the laboratory-provided sample containers by slightly tilting the mouth of the sample bottle below the beaker edge. Surface water in the beaker will be emptied slowly into the sample bottle to minimize the disturbance created during transfer. If the surface water is not at the surface, a stainless steel dipper will be utilized to collect a sample. The dipper will be lowered into the water and brought to the surface with minimal disturbance. The transfer of surface water from the dipper to the sample bottles will be the same as the procedure described using a beaker described above.

Field parameters, consisting of pH, specific conductance, temperature, dissolved oxygen, ORP, and turbidity will be measured prior to the collection of the sample. Both the pH and the specific conductivity meters will be calibrated for water temperature before the sampling event.

After taking field measurements, the analytical parameters and order of sample collection for groundwater samples will be:

1. TCL VOCs;
2. TCL SVOCs.
3. Other Parameters (TAL Metals, Pesticides, PCBs, etc.)

The sample bottles will be pre-preserved by the laboratory. The sample bottles will be immediately placed in an insulated cooler maintained at 4°C. Disposable latex or nitrile gloves will be worn by the sampling personnel and changed between sampling points.

2.7. Sediment Sampling

2.7.1. Sampling Objectives

Sediment samples will be collected to evaluate the nature and extent of contaminants at concentrations greater than 6 NYCRR Subpart 375-6 Remedial Program cleanup objectives, the NYSDEC Technical Guidance for Screening Contaminated Sediments criteria, or site-specific standards. The objectives of a sediment sampling program are to assess the nature and extent of sediment contamination and evaluate the need for remediation. The location of each surface soil sample will be measured relative to permanent site features or recorded using a GPS device and marked on a site diagram in the field logbook. Additionally, all sediment sampling locations in shallow water will be marked in the field with a survey stake and labeled with the sample I.D. to facilitate subsequent surveying of the sampling location.

2.7.2. Sampling Equipment

The following equipment will be needed to collect sediment samples for analysis:

- Stainless steel trowel, shovel, or scoop
- Stainless steel bowl
- Appropriate sampling device and/or transfer device

2.7.3. Sampling Procedures

In general, the following considerations should be taken into account during sediment sampling activities:

- Collect the sediment sample after the surface water sample if both media are to be sampled at the same location.
- Collect downstream sediment samples before upstream samples.
- Do not stand in the sediment deposits being sampled.
- Twigs, leaves roots, grass, and rocks are not considered part of the sediment matrix and will be removed from the sample.

- If collected as a composite, collect at least three small, equal-sized sediment sample aliquots. Carefully composite the sample in a stainless steel mixing bowl prior to homogenization and filling of the sample containers.

The preferred order of sample collection is as follows:

- In-situ measurements (i.e., temperature, pH and specific conductance)
- Volatile Organics (VOA) – Do not use homogenization or composite sampling techniques when sampling volatile compounds – collect a grab sample.
- Semi-volatile Organics (SVOA)
- TAL Metals
- Radionuclides and other parameters

Collect the VOA fraction using the stainless steel trowel/scoop or other sampling device, avoiding the collection of rocks, twigs, leaves and other debris. Fill the VOA sample containers to zero headspace, directly from the sampling device.

For non-VOA sample fractions, remove the sample from the sampling device or stainless steel trowel/scoop, avoiding the collection of rocks, twigs, leaves and other debris, and place the sample into a stainless steel bowl, then follow the procedure for homogenization:

1. Thoroughly mix the sample, using the same stainless steel trowel or scoop, as used during the sample collection. The sediment in the bowl should be scraped from the sides, corner and bottom, rolled to the middle of the bowl and initially mixed.
2. The sample should be quartered and separated.
3. Each quarter should be mixed individually and then rolled to the center of the bowl.
4. Mix the entire sample again.
5. Fill sample containers in the order specified above or as described in the work assignment.
6. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

Decontaminate sampling equipment between each location following the procedures discussed in Section 2.3.

2.8. Surface Soil Sampling

2.8.1. Sampling Objectives

Surface soil samples will be collected to evaluate the nature and extent of contaminants at concentrations greater than 6 NYCRR Subpart 375-6 Remedial Program cleanup objectives. The objectives of a surface soil sampling program are to assess the nature and extent of soil contamination and evaluate the need for remediation. The location of each surface soil sample will be measured relative to permanent site features or recorded using a GPS device and marked on a site diagram in the field logbook. Additionally, all sampling locations will be marked in the field with a survey stake and labeled with the sample I.D. to facilitate subsequent surveying of the sampling location.

2.8.2. Sampling Equipment

The following equipment may be required for surface soil sampling:

- Hand Augers (multiple size stainless steel buckets)
- Labels
- Power Auger (if required for 2+ foot depth)
- Cooler
- Stainless steel trowels
- Field log book
- Shovels (to remove gravel and debris)
- Soils Data form, Daily QC form, etc.
- Plastic sheeting and/or aluminum foil
- Decontamination equipment as required
- Appropriate sample bottles
- Hand tools (for equipment or other needs)
- Plastic bags (sealable)
- Camera and film
- Compass
- 200 ft tape

2.8.3. Sampling Procedures

Surface soil samples may be collected at the same location as a soil boring, but is not required. In the event that the surface soil sample is in the same location as a soil boring, a surface soil sample will be collected prior to initiation of boring and sampling.

Vegetation at the sample location is removed by cutting or scraping away with a stainless steel trowel. Twigs, leaves roots, grass, and rocks are not considered part of the soil matrix and will be removed from the sample. Remove gravel or other debris from the surface before advancing the auger or trowel to a depth of approximately six inches. Using pre-cleaned stainless steel equipment, extrude the soil directly into the sampling containers. If dedicated sampling equipment is not used, sampling equipment must be decontaminated before collecting another sample.

Samples for VOC analysis must be collected first. Fill VOC sample containers as full as possible to minimize headspace losses. Fill separate containers with a sufficient quantity of soil for analyses of other required parameters. Samples will be immediately placed in an insulated cooler and maintained at a temperature of 4°C. Enter all data into a permanent field log book. VOC samples will be collected as grab samples.

Other samples may be collected as grab samples or composite samples. For composite samples, a volume of soil 6 inches by 6 inches by 2 inches deep (72 cubic inches) will be collected using a stainless steel trowel and transferred to a stainless steel mixing bowl. Upon collection, the sample will be homogenized in a stainless steel bowl and classified. Twigs, leaves roots, grass, and rocks are not considered part of the soil matrix and will be removed from the sample. After the soil is homogenized, a sample will be placed in laboratory-provided sample containers.

A qualified geologist will describe the soil samples, screen the soil samples for VOCs with a PID, and record any observations in the field log. The location(s) for collection of field duplicates, field blanks, and matrix spike/matrix spike duplicate samples shall be determined in the field.

Sampling equipment will be decontaminated as discussed in Section 2.3. Disposable gloves will be worn by the sampling personnel and changed between sampling points.

2.9. Subsurface Soil Sampling

2.9.1. Soil Sampling Objectives

Soil samples will be collected at discrete depth intervals to evaluate the nature and extent of contaminants at concentrations greater than 6 NYCRR Subpart 375-6 Remedial Program cleanup objectives in subsurface soil and to document the underlying stratigraphy. Analytical data will be used to evaluate the need for remediation.

2.9.2. Soil Sampling Equipment

The following equipment may be used to collect soil samples:

- Photoionization Detector.
- Roll of polyethylene sheeting.

- Stainless steel spatula or spoon.
- Stainless steel trowel.
- Stainless steel bowl.
- Disposable nitrile or latex gloves.
- Certified, pre-cleaned sample containers.
- Aluminum foil.
- Field logbook and pen.
- Decontamination equipment.

2.9.3. Soil Sampling Procedures

2.9.3.1. Direct-push Soil Sampling

A direct-push drill rig (e.g., Geoprobe® or equivalent) will drive a dual-tube sampler, blind probe, or similar direct push system into the subsurface to create a borehole approximately 1.5 to two inches in diameter. Subsurface soil samples will be removed from the borehole in four- or five-foot intervals in acrylic tubes. The total number of four- or five-foot tubes collected from each soil boring will be dependent on the final depth of the boring.

Before the soil is characterized and the boring is logged, the plastic tube will be cut along its length and the soil core will be screened for VOCs using a PID. A qualified geologist will characterize the soil samples and record observations in the field log. A standard boring log is provided in Appendix C.

Soil samples designated for VOC analysis shall be collected directly from the sampling device. Each grab sample will be placed in laboratory-provided sample containers. Samples will be immediately placed in a cooler and held at 4°C until the samples are sent to a NYSDOH ELAP and NYSDEC ASP-certified laboratory and analyzed for the applicable analyses. The location(s) for collection of field duplicates, field blanks, and matrix spike/matrix spike duplicate samples shall be determined in the field based on subsurface soil conditions.

Other samples may be collected as grab samples or composite samples, directly from the sampling device. For composite samples, soil will be directly from the sampling tube and transferred to a stainless steel mixing bowl, where it will be homogenized. After the soil is homogenized, a sample will be placed in laboratory-provided sample containers.

Sampling equipment will be decontaminated as discussed in Section 2.3. Disposable gloves will be worn by the sampling personnel and changed between sampling points.

2.9.3.2. Split-barrel (Split-spoon) Sampling

When direct-push sampling is not practical, a 24-inch long stainless steel split-barrel sampler can be driven a total of 24 inches into the undisturbed materials by typically dropping a 140-lb weight 30 inches. A 3-inch diameter split spoon may be used to increase the chances of sufficient volume recovery for sampling purposes. Split spoon samples will be collected in accordance with the American Society for Testing and Materials (ASTM) Method D 1586-99: Standard Test Method for Penetration Test and Split-barrel Sampling of Soils (ASTM, 1999).

Soil samples will be collected from the split-barrel sampler following the procedure described in Section 2.9.3.1.

2.10. Exploratory Test Pits and Trenches

Test pits and trenches will be excavated to determine stratigraphy to a maximum depth of approximately 15 feet. A contractor will be required to provide the backhoe or other equipment and an operator. Soil samples will be collected at various depths within the test pit as detailed below. A test pit excavation program will include recording of visual observations and information on the nature of the soil, including whether or not it is native soil or fill.

2.10.1. Test Pit Sampling Equipment

Materials useful for test pit excavations include the following:

- Test Pit Log
- Site Map
- Camera
- Measuring Tape
- Photoionization Detector (PID)
- Excavation Equipment
- Sheet polyethylene, hay bales, etc. for staging of excavated soil in compliance with appropriate erosion control/soil placement requirements.

2.10.2. Test Pit Sampling Procedures

A test pit log (Appendix C) should be provided for each test pit to record observations. The form will include information on the location of the test pit in relation to permanent site features, the excavated soil, and any other relevant observations, as listed below:

- Date test pit excavation was started/finished
- Test pit number
- Site/project/client name

- Project number
- Your name
- Surface conditions, such as asphalt, concrete, grass, mud, etc.
- Weather and temperature
- Excavation equipment make and model
- Contractor company name and personnel
- Site location

Prior to test pit excavation, site personnel will determine if there are any problems accessing the test pit location:

- Obtain underground utility clearance.
- Confirm that there are no overhead obstructions.
- Describe approximate location relative to landmarks and provide a sketch on test pit log.
- Create a contingency plan to enact if drums or other potentially hazardous materials are encountered during excavation.

Soil sampling procedures during test pit operations will be the same as those described for surface soil sampling (Section 2.8). In addition to documentation requirements for soil sampling, the following will also be noted during test pit sampling, and recorded on the test pit log (Appendix C):

- Describe the soil excavated, including color, texture, consistency, and moisture at a specific depth interval (e.g. every one or two feet)
- Record if there are any odors and, if so, describe.
- If appropriate, take and record a PID measurement at each depth interval.
- Collect soil samples at predetermined depths or as appropriate based on site conditions. Record sample number on test pit log.
- Sketch a cross section of the test pit showing any relevant observations.

2.11. Air and Soil Vapor Sampling

2.11.1. Air and Soil Vapor Sampling Objectives

Air and soil vapor sampling is intended to evaluate the potential for migration of VOCs from the subsurface into indoor air and the potential for current and future human exposures related to soil vapor intrusion. Indoor air, ambient air, soil vapor, and sub-slab vapor samples will be collected to evaluate the nature and extent of VOCs in these media. Ambient air samples will be collected from outside of the building to provide information

on background VOC concentrations. Sub-slab soil vapor samples will be collected from just below the concrete slab of a building to evaluate the potential for soil vapor intrusion.

2.11.2. Air Sampling Equipment

Air and sub-slab soil vapor samples will be collected using a Summa canister sampling train. The typical Summa canister sampling train consists of the following:

- Summa canister.
- Flow controller.
- Particulate filter.
- Pressure gage.
- Fittings and a sampling line.

The laboratory will evacuate the canister to a minimum vacuum of negative 28 inches (\pm 2 inches) of mercury (in. Hg) prior to sampling. After sampling, the final vacuum will be recorded on a chain of custody form to confirm sample integrity. A pressure gage will be used to monitor the vacuum before, during, and after sampling. A seven micron particulate filter will be used upstream of the flow controller to prevent blockage of the flow controller. The sampling line will consist of new, unused, 1/4-inch diameter flexible Teflon[®] tubing. All parts of the sampling train coming into direct contact with the sample will be made of stainless steel or Teflon[®]. The following general set-up procedure will be followed for each sampling location:

1. Place Summa canister at sampling location.
2. Note the environmental conditions in the sample area on the air sampling sheet.
3. Assemble the Summa canister sampling train. Follow the laboratory instructions for pressure measurement, particulate filter placement, and flow controller attachment.
4. Begin sampling following the procedures described below.

2.11.3. Indoor and Ambient Air Sampling Procedures

Indoor and ambient air samples will be collected in accordance with the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006) and the Generally Acceptable Procedure for Air Sampling with Summa Canisters (Appendix A). The procedures implemented for the collection of indoor and ambient air samples are summarized as follows:

1. Remove the brass plug fitting covering the 6-liter stainless steel Summa canister sampling port using a wrench.
2. Connect the pressure gage or flow controller with integral pressure gage to the Summa canister sampling port. Open the valve on the canister and quickly measure the vacuum within the canister. If the vacuum is greater than negative 25 inches of

mercury, then the canister is acceptable for sampling. Any canisters with a vacuum less than negative 25 inches of mercury should not be used for sampling. Close the valve and record the measurement on the sampling sheet.

3. Assemble the sampling train. Each fitting should be hand tightened and then tightened with a wrench approximately $\frac{1}{4}$ turn.
4. Confirm that the sampling train is air tight by conducting a vacuum test. Place the brass cap at the end of the sampling train (particulate filter), quickly open and close the sampling valve and monitor the vacuum on the pressure gage. If the vacuum decreases, there is a leak in the system. All of the fittings should be rechecked and the vacuum test redone.
5. Initiate sampling by opening the Summa canister valve. Record starting time on the sampling sheet.
6. During sampling, the pressure will be monitored periodically to ensure that the flow controller is operating properly.
7. When the time corresponding to the calibrated flow controller (for indoor air – 24 hours) has elapsed, close the canister valve. Disassemble the sampling train. Check the vacuum within the canister using the pressure gage and record the measurement on the sampling sheet.
8. Since the flow rate into the canister can fluctuate due to variations in atmospheric conditions, the measured final vacuum may range from 4 to 12 in. Hg. If the measured vacuum is greater than 12 in. Hg or less than 3 in. Hg, the sample may be flagged and re-sampling may be needed.
9. Place the brass cap on the sampling port of the canister and tighten. The air sampling is complete.
10. Place the air sample in the travel box and complete the chain-of-custody forms and identification tag on the canister.
11. Send the canister to the laboratory via next day airmail service for analysis of VOCs by Method TO-15.

2.11.4. Sub-slab and Soil Vapor Sampling Procedures

Sub-slab vapor and soil vapor sampling points will be constructed in the same manner at all sampling locations to minimize possible discrepancies. Sub-slab vapor and soil vapor sampling points will be constructed in compliance with the procedures outlined in the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006).

The building's heating system will be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor will be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) will

be noted and recorded. Probes will be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

Temporary sub-slab vapor sampling points will be constructed in accordance with the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006) and will include the following:

- Drill a 1-inch diameter hole approximately 1-inch into the concrete floor slab using an electric hammer drill.
- Drill a 1/4-inch diameter hole through the 1-inch hole completely through the concrete floor slab, but extending no further than 2 inches below the bottom of the floor slab.
- Insert inert tubing, such as Teflon or Teflon-lined polyethylene tubing (1/4-inch outside diameter [OD]), approximately 3 feet long; into the hole drilled in the floor, extending to the bottom of the floor slab.
- Seal the tubing at the floor penetration with bentonite, melted bees wax, or modeling clay ensuring that an effective seal has been established.
- Attach a syringe to the sampling tube and purge approximately 100 mL of air/vapor at a consistent flow rate that is less than or equal to 0.2 liters per minute. The syringe will be capped and the air released outside the building or into a Tedlar[®] bag using a three-way valve so as not to influence the indoor air quality.

Permanent sub-slab vapor sampling points will be constructed in accordance with the USEPA draft Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations and will include the following:

- 1.5-inch and 1/4-inch holes will be drilled using the same methods described above for temporary sub-slab vapor sampling points.
- Recessed probes will be constructed with brass or stainless steel fittings and inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon[®], etc.) of the appropriate size (approximately 1/8-inch to 1/4-inch diameter), and of laboratory or food grade quality;
- Tubing will not extend beyond the base of the concrete slab;
- Implants will be sealed to the slab with non-VOC-containing and non-shrinking cement grout.

Soil vapor probes will be semi-permanent and will be installed in accordance with the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006). The actual locations of the points will be dependent on the locations of subsurface utilities. In general, the target depth for each of the soil vapor points will be the basement floor level of the adjacent residential structures or just above the groundwater table, whichever is shallower. The soil vapor points will be installed using a

direct-push drilling rig to advance a borehole and collect soil samples continuously to the target depth. Upon reaching the target depth, a six-inch small-diameter stainless steel screen attached to Teflon or Teflon-lined tubing will be lowered to the bottom of the borehole. The bottom one-foot of the borehole will then be backfilled with clean silica sand. The remaining borehole annulus will be backfilled to the surface with hydrated bentonite. The point will be completed with a stick-up or flush mount casing.

To obtain representative samples that meet the data quality objectives, sub-slab and soil vapor samples will be collected in accordance with the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006) and summarized as follows:

- To ensure samples collected are representative, one to three volumes (i.e., the volume of the sample probe and tube) will be purged using disposable syringes after installation of the probes and prior to collecting the samples;
- A vacuum will not be used to clear the sample hole after boring through the sub slab;
- Sample flow rates for both purging and collecting must will not exceed 0.2 liters per minute to minimize ambient air infiltration during sampling;
- If requested by the NYSDEC project manager, a helium tracer gas will be used to verify the integrity of the sub-slab vapor point seal. Prior to sampling the sub-slab vapor, the atmosphere in the immediate vicinity of the area where the vapor point tubing intersects the ground will be enriched with the tracer gas. This will be accomplished by using an inverted plastic pail to keep the tracer gas in contact with the vapor point during testing. A portable monitoring device (specific to the tracer gas) will be used to analyze a sample of sub-slab vapor for the tracer gas prior to and after sampling for VOCs. If the tracer gas is detected at a concentration of less than 10 percent, it will be assumed that the probe is sealed and the vapor sample has not been diluted by surface air;
- Samples will be collected, using conventional sampling methods as described in Section 2.11.3, in a laboratory-certified Summa canister that is consistent with the sampling and analytical methods;
- Summa canisters will be either batch or individually certified as analyte free by the laboratory; and
- Samples will be collected over the same period of time as concurrent indoor and outdoor air samples.

2.12. Community Air Monitoring Program

To provide a measure of protection for any potential downwind receptors, and to confirm that work activities do not generate airborne contaminants, Malcolm Pirnie will conduct continuous monitoring for volatile organic compounds (VOCs) and particulate matter



(dust) during all ground intrusive activities. Monitoring will be conducted at the downwind perimeter of each work area.

2.12.1. VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) will be monitored on a continuous basis during all ground-intrusive activities. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. VOC monitoring will be conducted using a MiniRae 2000 photoionization detector (PID) or PPB Rae PID (or equivalent meter). The PID will be calibrated at least daily using the span calibration gas recommended by the manufacturer. The PID measurements will be compared to the action levels specified below.

Action Levels

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities 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 exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, all work activities will be stopped.

2.12.2. Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeter of the each work area during all ground-intrusive activities. Real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) will be used for the particulate monitoring. The equipment will be equipped with an audible alarm to indicate exceedance of the action levels summarized below. Any fugitive dust migration will also be visually assessed during all work activities.

Action Levels

- If the downwind PM-10 particulate level is 0.1 milligrams per cubic meter (mg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $0.15 \text{ mg}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $0.15 \text{ mg}/\text{m}^3$ above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $0.15 \text{ mg}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

All particulate monitoring measurements readings will be recorded and made available for NYSDEC and NYSDOH review.

2.13. Storage and Disposal of Investigation Derived Waste

Investigation derived wastes (IDW) will be handled in accordance with the NYSDEC Final TAGM for the Disposal of Drill Cuttings. Soil cuttings and purged water requiring off-site disposal will be containerized in UN-approved, 55-gallon steel drums. Some disposable personal protective equipment (PPE) and decontamination fluids will be generated. Attempts will be made to wash surface contamination off so that PPE (i.e., gloves and other disposable items) may be disposed of as ordinary solid waste. If contamination is suspected, these materials will be collected and containerized in UN-approved, 55-gallon steel drums (separately from contaminated soil and groundwater) and disposed of off-site.

Containerized materials will be labeled and staged at a location designated by the NYSDEC. Malcolm Pirnie will maintain a log of the containers and their contents. The contents will be evaluated upon receipt of analytical results from the field investigations. Containerized IDW will be transported by a licensed waste hauler and disposed of at an approved facility in accordance with applicable regulations.

2.14. Field Documentation

Documentation of an investigative team's field activities often provides the basis for technical site evaluations and other such related written reports. All records and notes generated in the field will be considered controlled evidentiary documents and may be subject to scrutiny in litigation.

Personnel designated as being responsible for documenting field activities must be aware that all notes may provide the basis for preparing responses for legal interrogatories. Field documentation must provide sufficient information and data to enable reconstruction of field activities. Numerically serialized field logbooks provide the basic means for documenting field activities. The following information must be provided on the inside front cover of each field logbook:

- Project Name (Site Name).
- Site Location.
- Site Manager.
- Date of Issue.

Control and maintenance of field logbooks is the responsibility of the Field Team Leader.

2.14.1. Sample Designation

A sample numbering system will be used to identify each sample. This system will provide a tracking procedure to allow retrieval of information about a particular sample, and will assure that each sample is uniquely numbered. The sample identification will consist of at least three components as described below. Identification numbers for soil boring samples will also have a fourth component.

Project Identification: The first component consists of a two- or three-letter designation, which identifies the project site.

- **Sample type:** The second component, which identifies the sample type, will consist of a two-letter code as follows:
 - IA - Indoor Air
 - AA - Ambient Air
 - MW - Monitoring Well (Groundwater Sample)
 - SB - Soil Boring
 - SS - Surface Soil
 - SV - Soil Vapor
 - SW - Surface Water
- **Sample Location:** The third component identifies the sample location using a two-digit number.
- **Sample Identification:** The fourth component will only be used for soil boring samples to indicate the vertical interval from which the sample was collected.
- **Quality Assurance/Quality Control Samples:** The samples will be labeled with the following suffixes:
 - FB - Field Blank

- MS - Matrix Spike
- MSD - Matrix Spike Duplicate
- TB - Trip Blank

Duplicate samples will be numbered uniquely as if they were samples. A record of identification for duplicate samples will be maintained.

Examples of identification numbers are given below:

- XX-SB-02-10: Soil boring, boring location number 2, 10 feet below ground surface.
- XX-MW-03-MSD: Monitoring well groundwater sample, monitoring well sample location 3, matrix spike duplicate.
- XX-SS-FB: Field blank for surface soil sample.

2.14.2. Documentation of Field Activities

Field logbook entries must be legibly written and provide an unbiased, concise, detailed picture of all field activities. Use of preformatted data reporting forms must be identifiable and referenced to field notebook entries.

Step-by-step instructions and procedures for documenting field activities are provided below and in following sub-sections. Instruction and procedures relating to the format and technique in which field logbook entries are made are as follows:

- Leave the first two pages blank. They will provide space for a table of contents to be added when the field logbook is complete.
- The first written page for each day identifies the date, time, site name, location, Malcolm Pirnie personnel and their responsibilities, other non-personnel and observed weather conditions. Additionally, during the course of site activities, deviations from the work plan must also be documented.
- All photos taken must be traceable to field logbook entries. It is recommended to reference photo locations on the site sketch or map.
- All entries must be made in ink. Waterproof ink is recommended.
- All entries must be accompanied by the appropriate military time (such as 1530 instead of 3:30).
- Errors must be lined through and initialed. No erroneous notes are to be made illegible.
- The person documenting must sign and date each page as it is completed.
- Isolated logbook entries made by a team member other than the team member designated responsible for field documentation, must be signed and dated by the person making the entry.

- Additions, clarifications, or corrections made after completion of field activities must be dated and signed.

2.14.3. General Site Information

General site characteristics must be recorded. Information may include:

- Type of access into facility (locked gates, etc.).
- Anything that is unexpected on-site (e.g., appearance of drums that have not been previously recorded).
- Information obtained from interview with access or responsible party personnel (if applicable), or other interested party contact on-site.
- Names of any community contacts on-site.
- A site map or sketch may be provided. It can be sketched into the logbook or attached to the book.

2.14.4. Sample Activities

A chronological record of each sampling activity must be kept that includes:

- Explanation of sampling at the location identified in the sampling plan (e.g., discolored soil, stressed vegetation).
- Exact sample location, using permanent recognizable landmarks and reproducible measurements.
- Sample matrix.
- Sample descriptions, i.e., color, texture, odor (e.g., soil type) and any other important distinguishing features.
- Decontamination procedures, if used.

As part of chain-of-custody procedures, recorded on-site sampling information must include sample number, date, time, sampling personnel, sample type, designation of sample as a grab or composite, and any preservative used. Sample locations should be referenced by sample number on the site sketch or map. The offer and/or act of providing sample splits to a third party (e.g., the responsible party representative; state, county, or municipal, environmental and/or health agency, etc.) must be documented.

2.14.4.1. Soil Vapor and Ambient Air Sampling Information

In addition to the above information, the following will be documented during sub-slab soil vapor sample collection:

- Historic and current storage and uses of volatile chemicals;
- Type and operation of heating or air conditioning systems during sampling;
- Floor plan sketches that document the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or

subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, footings that create separate foundation sections;

- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed); and,
- Any additional pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation.

The field sampling team will maintain a sample log sheet for each soil vapor sample location that includes the following:

- Sample identification;
- Date and time of sample collection;
- Sampling depth;
- Identity of samplers;
- Sampling methods and devices;
- Soil vapor purge volumes;
- Volume of soil vapor extracted;
- Vacuum of canisters before and after samples collected;
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and,
- Chain of custody protocols and records used to track samples from sampling point to analysis.

2.14.5. Sample Dispatch Information

When sampling is complete, all sample documentation such as chain-of-custody forms shall be copied and copies placed in the project files. A notation of numbers of coolers shipped, carrier and time delivered to pick-up point should be made in a field notebook.

2.15. Sample Handling

The analytical laboratory will provide the sample containers necessary for all soil, groundwater, surface water, air, and soil vapor samples. Container closures for all samples, except air and soil vapor, will be screw-on type and made of inert materials. Sample containers will be cleaned and prepared by the laboratory prior to being sent to the site. Trip blanks will be used to check for false positives due to laboratory cleaning procedures or cross contamination during sample shipment.

All samples collected will be identified with a sample label. A label will be attached to each bottle and each sample will be identified with a unique sample number.

Immediately following sample collection, each sample container will be marked with the following information:

- Sample Code.
- Project Number.
- Date/Time.
- Sample Type.
- Requested Analysis.
- Preservative, if used.
- Sampler's Initials.

The sample code will indicate the site location, media sampled, and the sample station.

After all sample identification information has been recorded, each sample label will be covered with waterproof clear plastic tape to preserve its integrity. All samples will be recorded and tracked under strict chain-of-custody protocols. In the field, each sample will be checked for proper labeling. The samples will then be packed into coolers with ice and shipped to the laboratory, if applicable. A chain-of-custody form will be completed for each cooler. The form will be signed and dated by the person who collected the samples, the person the samples were relinquished to for transport to the laboratory, and the laboratory sample controller/custodian who receives the samples.

2.15.1. Chain-of-Custody Record

A chain-of-custody record is a printed form that accompanies a sample or group of samples as custody is transferred from person to person. A sample chain-of-custody form is included in Appendix C. It documents custody transfer from person to person and sample information recorded on bottle labels. A chain-of-custody record is a controlled document.

As soon as practicable after sample collection, preferably after decontamination, the following information must be entered on the chain-of-custody form. All information is to be recorded in black ink:

- Malcolm Pirnie project number. Enter the seven-digit alphanumeric designation assigned by Malcolm Pirnie that uniquely identifies the project site.
- Project name. Enter site name.
- Samplers. Sign the name(s) of the sampler(s).
- Station number. Enter the sample number for each sample in the shipment. This number appears on the Malcolm Pirnie, Inc. sample identification label.

- **Date.** Enter a six-digit number, indicating the year, month, and day of sample collection (YYMMDD); for example, 051125.
- **Time.** Enter a four-digit number indicating the military time of collection; for example, 1354.
- **Composite or grab.** Indicate the type of sample.
- **Station location.** Describe the location where the sample was collected.
- **Number of containers.** For each sample number, enter the number of sample bottles that are contained in the shipment.
- **Remarks.** Enter any appropriate remarks.

2.15.2. Transferring to Common Carrier

Instructions for Malcolm Pirnie, Inc. shipper transferring custody of samples to a common carrier are as follows:

12. Sign, date, and enter time under "Relinquished by" entry.
13. Enter name of carrier (e.g., UPS, Federal Express) under "Received by."
14. Enter bill-of-lading of Federal Express airbill number under "Remarks."
15. Place the original of the chain-of-custody form in the appropriate sample shipping package. Retain a copy with field records.
16. Sign and date the custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field.
17. Wrap the seal across filament tape that has been wrapped around the package at least twice.
18. Fold the custody seal over on itself so that it sticks together.
19. Complete other carrier-required shipping papers.

Common carriers will usually not accept responsibility for handling chain-of-custody forms; this necessitates packing the record in the sample package.

2.15.3. Transferring Custody Directly to a Courier

To transfer custody of samples from the Malcolm Pirnie, Inc. sampler directly to a carrier, proceed as above, except eliminate the Malcolm Pirnie, Inc. shipper's signature.

3. Calibration Procedures

Instruments must be properly calibrated to produce technically valid data. Documented calibration and calibration check results verify that the instruments used for measurement are in proper working order and the data produced is reliable. The calibration requirements described or referenced in this section are necessary to support the data quality objectives for this project. When calibration requirements are met, the data will support the focused investigation decisions dealing with the nature and extent of contamination and safety concerns.

3.1. Calibration Procedures for Field Equipment

The manufacturer specifications for operation and maintenance procedures for the field equipment to be used during these tasks are provided in Appendix B. General calibration procedures and requirements include the following:

- All instruments will be calibrated at least once a month.
- All instruments will have the calibrations checked at a minimum at the start of each day before measurements are made.
- The calibration and calibration checks will indicate that the sensitivity of the instrument (practical detection limit) is adequate to meet project needs and that the instrument is accurate over the working range.
- All calibration information will be recorded in the field log book. This includes date and time, technician signature, calibration procedure, calibration results, calibration problems, recalibration and maintenance, and instrument serial numbers.

All calibration standards will be of National Bureau of Standards (NBS) quality and their sources listed and documented so that standards are traceable. In addition, only technicians trained in the use of the field instruments will operate them. If the instrument readings are incorrect at the time of the initial calibration, the instrument will either be calibrated by the technician or returned to the manufacturer for calibration. If the instrument readings are incorrect after a continuing calibration check, the preceding sample results will be reviewed for validity, and reanalyzed if necessary.

3.2. Laboratory Calibration Procedures

All samples analyzed according to the USEPA SW-846 analytical methodologies shall follow the procedures described in the applicable Statement of Work (SOW). The calibration procedures and frequency are specifically described for each analysis contained in the SOW. All calibration results shall be recorded and kept on file, and will

be reviewed and evaluated by the data validator as part of analytical data validation procedures.

Instrument calibration will be checked with a reference standard prior to the analysis of any sample. The standards used for calibrations will be traceable to the NBS, and each calibration will be recorded in the laboratory notebook for the particular analysis. Any printouts, chromatograms, etc., generated for the calibration will be kept on file.

4. References

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APPENDIX I

Summary of Green Remediation Metrics



Summary of Green Remediation Metrics for Site Management

Site Name: _____ Site Code: _____
 Address: _____ City: _____
 State: _____ Zip Code: _____ County: _____

Initial Report Period (Start Date of period covered by the Initial Report submittal)

Start Date: _____

Current Reporting Period

Reporting Period From: _____ To: _____

Contact Information

Preparer's Name: _____ Phone No.: _____

Preparer's Affiliation: _____

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	Total to Date
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	Total to Date (tons)
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	Total to Date (miles)
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	Total to Date (gallons)
Total quantity of water used on-site		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	Total to Date (acres)
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR
<p>I, _____ (Name) do hereby certify that I am _____ (Title) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application.</p>
<div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Date</div> <div>Contractor</div> </div>

APPENDIX J

Remedial System Optimization Table of Contents



REMEDIAL SYSTEM OPTIMIZATION FOR JIMMY'S DRYCLEANERS

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1.2 PROJECT OBJECTIVES AND SCOPE OF WORK

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2.3 CLEAN-UP GOALS AND SITE CLOSURE CRITERIA

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2.5.1 System Goals and Objectives

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4.1 RECOMMENDATIONS TO ACHIEVE OR ACCELERATE SITE CLOSURE

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4.2 RECOMMENDATIONS TO IMPROVE PERFORMANCE

4.2.1 Maintenance Improvements

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4.2.3 Process Modifications

4.3 RECOMMENDATIONS TO REDUCE COSTS

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4.3.3 Optimize Monitoring Program

4.3.4 Maintenance and Repairs

4.4 RECOMMENDATIONS FOR IMPLEMENTATION

APPENDIX K

Health and Safety Plan



Site Specific Health and Safety Plan

Revision 12e 6/25/2015

Project Name: Former Jimmy's Dry Cleaners
(NYSDEC Site No. 130080)
Hempstead, New York

Project Number: 00266415.0000
Client Name: New York State Department of Environmental Conservation
Date: 11/8/2018
HASP Expires 11/8/2019
Revision: 6

Approvals:

HASP Developer: _____
Emmanuel Sousa

Project Manager: _____
Andrew R. Vitolins, PG

HASP Reviewer: _____
Aaron Bobar, PG

Emergency Information

Site Address: 61 Nassau Road
Village of Roosevelt, Twp. of Hempstead
Nassau County, New York

Emergency Phone Numbers:

Emergency (fire, police, ambulance)	911
Emergency (facility specific, if applicable):	
Roosevelt VFD	516-378-3004
Nassau County Police Dept. (1st Prec.)	516-573-6100
Emergency Other (specify) N/A	N/A
Client Contact Heidi-Marie Dudek	518-402-9814
WorkCare (non-lifethreatening injury/illness)	1-800-455-6155
Project H&S Aaron Bobar	518-250-7300
Task Manager David Foster	914-641-2777
Project Manager Andrew Vitolins	518-461-3145
Corporate H&S Specialist Julie Santaniello	978-551-0033
Corporate H&S Director Denis Balcer	614-778-9171

Hospital Name and Address: South Nassau Communities Hospital
2277 Grand Avenue
Baldwin, NY 11510

Hospital Phone Number: 516-632-3900

Incident Notification Process

1 Dial 911/Facility Emergency Number/WorkCare as applicable	
2 Contact PM/Supervisor	Andrew Vitolins
3 Contact Corporate H&S	Denis Balcer
4 Contact Client	Heidi-Marie Dudek

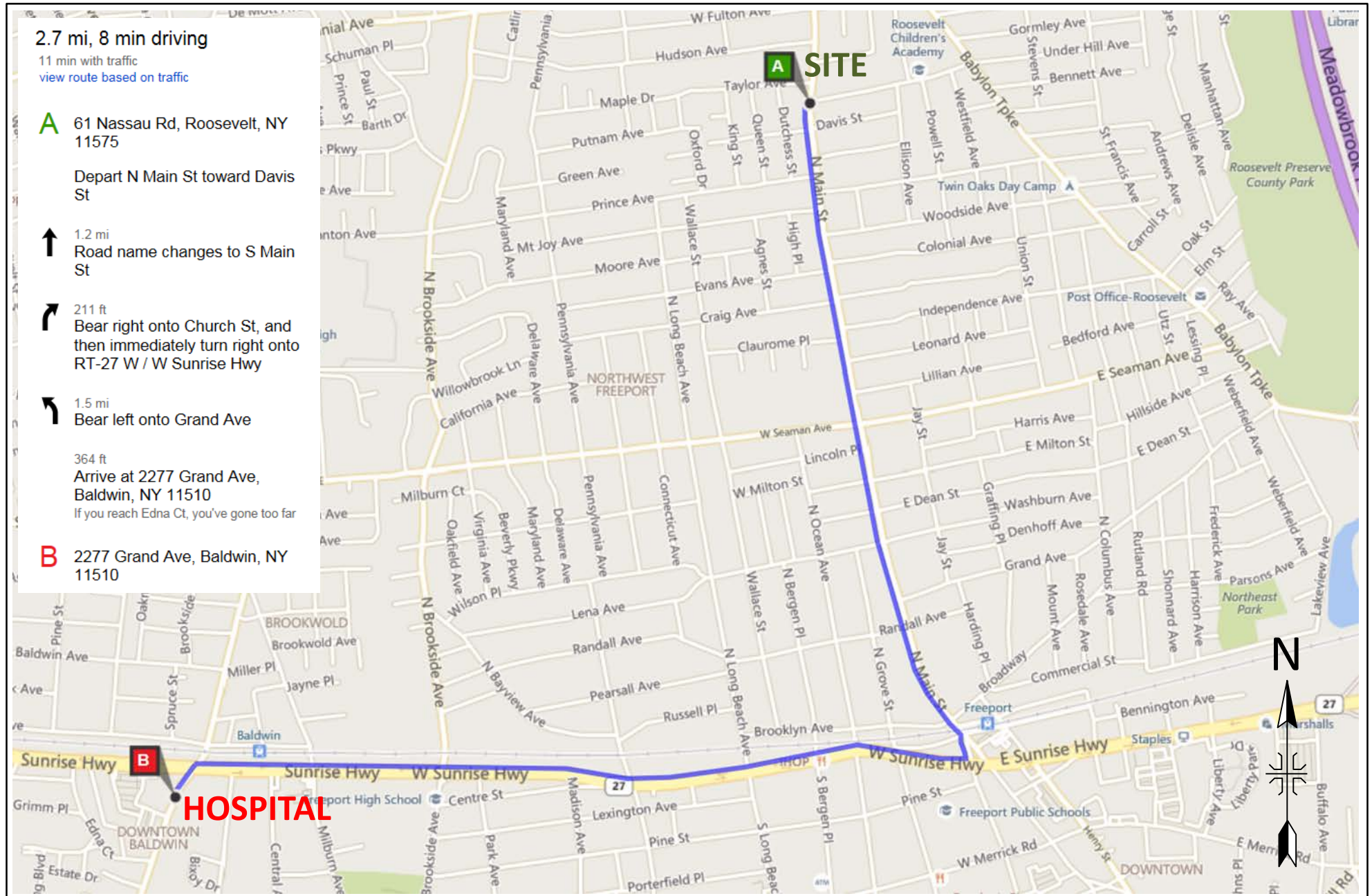
Complete below, as applicable, or clear cell contents:

Location of Assembly Area(s):

Nearest AED location: N/A
Nearest Storm Shelter: N/A

Figure 1
Hospital Route Map

Former Jimmy's Dry Cleaners (NYSDEC Site 130080)
Village of Roosevelt, Nassau County, New York



General Information

Site Type (select all applicable where work will be conducted):

- | | |
|--|---|
| <input type="checkbox"/> Active | <input type="checkbox"/> Railroad |
| <input type="checkbox"/> Bridge | <input type="checkbox"/> Remote Area |
| <input checked="" type="checkbox"/> Buildings | <input type="checkbox"/> Residential |
| <input checked="" type="checkbox"/> Commercial | <input type="checkbox"/> Retail |
| <input checked="" type="checkbox"/> Construction | <input type="checkbox"/> Roadway (public, including right-of-way) |
| <input type="checkbox"/> Military Installation | <input type="checkbox"/> Water Treatment Plant |
| <input type="checkbox"/> Inactive Industrial | <input type="checkbox"/> Unknown |
| <input type="checkbox"/> Active Industrial | <input type="checkbox"/> Security Risk Site/Location |
| <input type="checkbox"/> Landfill | <input type="checkbox"/> Utility |
| <input type="checkbox"/> Marine | <input type="checkbox"/> Other (specify): _____ |
| <input type="checkbox"/> Mining | |
| <input type="checkbox"/> Parking Lot/Private Roadway | |

Surrounding Area and Topography (select one):

- ☐ Surrounding area and topography are presented in the project work plan
- ☒ Surrounding area and topography (briefly describe):
The site is flat and generally rectangular in shape, consisting of approximately one acre. The site is a former commercial property in the vicinity of a residential area consisting of suburban dwellings and dense residential and light commercial areas typical of the southern portion of Long Island, NY.

Simultaneous Operations (SimOps)

- ☒ Not applicable
- ☐ SimOps will exist on this project

Site Background (select one):

- ☐ Site background is presented in the project work plan
- ☒ Site background (briefly describe):
The site was a former commercial dry cleaning facility, with impacts to soil and groundwater from PCE, TCE and other related chlorinated volatile organic compounds (CVOCs). The site has undergone extensive investigation and delineation, including interim remedial actions. This phase of project work consists of activities associated with final remedial implementation and monitoring. These include excavation, sodium permanganate injection, and SVE system construction.

The following tasks are identified for this project:

1	General Site Work
2	Sodium Permanganate Injections/ Oversight
3	Groundwater Sampling
4	Operation and Maintenance - Temporary, small or mobile system

- | | |
|---|--|
| <input checked="" type="checkbox"/> Subcontractor H&S information is attached | <input checked="" type="checkbox"/> The following H&S Standards are attached:
<i>Excavation and Trenching</i> |
| <input checked="" type="checkbox"/> Utility clearance required. | <i>Heavy Equipment HS Standard</i> |
| <input type="checkbox"/> Journey Management Plan attached | <i>Electrical Safety Standard</i> |
| <input type="checkbox"/> State specific H&S required: | LOTO Exchange of Information Form, LOTO Periodic Inspection Form |
| Comments: | |

Name	Role	Additional Responsibilities (Describe)
1 <u>Andrew Vitolins</u>	<u>PM</u>	
2 <u>David Foster</u>	<u>TM</u>	<u>Field Lead; SSO</u>
3 <u>Jasmine Mullins</u>	<u>FS</u>	<u>Field Sampler</u>
4 _____	_____	_____
5 _____	_____	_____
6 _____	_____	_____

[illegible]

Hazard Analysis

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low	4 - Medium	8 - High	12 - High

Business Line

Environment

Business Unit

All Categories

Task 1: General Site Work

Hazardous Activity #1

Field-Ambient environment - exposure heat, cold, sun, weather, etc

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-
Environmental	L	Gravity	H
Personal Safety	M	Pressure	-

Suggested FHSB Ref:

III I, III M

Driving	M	Electrical	L
Mechanical	-	Motion	L
Radiation	-	Sound	-

Overall Unmitigated Risk:

Medium

Mitigated Risk:

Medium

if utilizing:

Controls that should be Considered:

Primary: TRACK Field H&S Handbook (see ref. above) Secondary: H&S Standards Engineering Controls (specify below) Admin. Controls (specify below) Specialized Equipment (specify below) PPE (see HASP "PPE" section)

Enter Required Controls:

TRACK, appropriate clothing, sunscreen, hydration

Hazardous Activity #2

Field-Mobilization/Demobilization - from a site

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	L
Environmental	-	Gravity	M
Personal Safety	-	Pressure	-

Suggested FHSB Ref:

III V

Driving	M	Electrical	-
Mechanical	-	Motion	L
Radiation	-	Sound	-

Overall Unmitigated Risk:

Medium

Mitigated Risk:

Low

if utilizing:

Controls that should be Considered:

Primary: TRACK Field H&S Handbook (see ref. above) Engineering Controls (specify below) Secondary: JSAs Job Briefing/Site Awareness PPE (see HASP "PPE" section) Admin. Controls (specify below)

Enter Required Controls:

TRACK

Hazardous Activity #3

Field-Security - high profile projects with irritated or upset public

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-
Environmental	-	Gravity	-
Personal Safety	M	Pressure	-

Suggested FHSB Ref:

III H

Driving	-	Electrical	-
Mechanical	-	Motion	-
Radiation	-	Sound	-

Overall Unmitigated Risk:

Medium

Mitigated Risk:

Low

if utilizing:

Controls that should be Considered:

Primary: TRACK JSAs Site Awareness Cont/Emerg. Planning Secondary: Job Briefing/Site Awareness

Enter Required Controls:

TRACK, Site Awareness, Emergency Plan, Job Briefing, Site Awareness

Hazardous Activity #4

General-Vehicle -motor vehicle operation (all types on roadways)

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-
Environmental	-	Gravity	-
Personal Safety	-	Pressure	-

Suggested FHSB Ref:

III V

Driving	M	Electrical	-
Mechanical	-	Motion	-
Radiation	-	Sound	-

Overall Unmitigated Risk:

High

Mitigated Risk:

Low

if utilizing:

Controls that should be Considered:

Primary: TRACK Smith System (on line) Inspections Secondary: JSAs Admin. Controls (specify below)

Enter Required Controls:

TRACK, Seatbelt, Smith System, Vehicle Inspection

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
		0	1	2	3
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low	4 - Medium	8 - High	12 - High

Task 2: Sodium Permanganate Injections/ Oversight																									
Hazardous Activity #1																									
Field-Remediation - in-situ with injection chemicals (oxidizers, corrosives, etc.)																									
<div style="display: flex; justify-content: space-between;"> <div> <p>Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Biological</td><td>-</td> <td>Chemical</td><td>M</td> </tr> <tr> <td>Environmental</td><td>M</td> <td>Gravity</td><td>-</td> </tr> <tr> <td>Personal Safety</td><td>-</td> <td>Pressure</td><td>-</td> </tr> </table> </div> <div> <p>Suggested FHSB Ref: III E, III F, III AG</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Driving</td><td>-</td> <td>Electrical</td><td>-</td> </tr> <tr> <td>Mechanical</td><td>-</td> <td>Motion</td><td>-</td> </tr> <tr> <td>Radiation</td><td>-</td> <td>Sound</td><td>-</td> </tr> </table> </div> </div>		Biological	-	Chemical	M	Environmental	M	Gravity	-	Personal Safety	-	Pressure	-	Driving	-	Electrical	-	Mechanical	-	Motion	-	Radiation	-	Sound	-
Biological	-	Chemical	M																						
Environmental	M	Gravity	-																						
Personal Safety	-	Pressure	-																						
Driving	-	Electrical	-																						
Mechanical	-	Motion	-																						
Radiation	-	Sound	-																						
<p>Overall Unmitigated Risk: Medium</p> <p>Mitigated Risk: Low if utilizing:</p> <p>Controls that should be Considered: #N/A</p>																									
<p>Enter Required Controls: TRACK, Safety Glasses, Nitrile Gloves, High Vis Vest</p>																									
Hazardous Activity #2																									
Field-Equipment - work with small pressurized equipment (power washers, air compressors, etc.)																									
<div style="display: flex; justify-content: space-between;"> <div> <p>Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Biological</td><td>-</td> <td>Chemical</td><td>-</td> </tr> <tr> <td>Environmental</td><td>-</td> <td>Gravity</td><td>-</td> </tr> <tr> <td>Personal Safety</td><td>-</td> <td>Pressure</td><td>M</td> </tr> </table> </div> <div> <p>Suggested FHSB Ref: III AA</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Driving</td><td>-</td> <td>Electrical</td><td>-</td> </tr> <tr> <td>Mechanical</td><td>L</td> <td>Motion</td><td>L</td> </tr> <tr> <td>Radiation</td><td>-</td> <td>Sound</td><td>-</td> </tr> </table> </div> </div>		Biological	-	Chemical	-	Environmental	-	Gravity	-	Personal Safety	-	Pressure	M	Driving	-	Electrical	-	Mechanical	L	Motion	L	Radiation	-	Sound	-
Biological	-	Chemical	-																						
Environmental	-	Gravity	-																						
Personal Safety	-	Pressure	M																						
Driving	-	Electrical	-																						
Mechanical	L	Motion	L																						
Radiation	-	Sound	-																						
<p>Overall Unmitigated Risk: Low</p> <p>Mitigated Risk: Low if utilizing:</p> <p>Controls that should be Considered: #N/A</p>																									
<p>Enter Required Controls: TRACK, Safety Glasses, Cable Whip Protectors, Safe Distance from Operation</p>																									
Hazardous Activity #3																									
General-Lifting and movement of equipment of varying weights at varying frequencies by manual methods																									
<div style="display: flex; justify-content: space-between;"> <div> <p>Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Biological</td><td>-</td> <td>Chemical</td><td>-</td> </tr> <tr> <td>Environmental</td><td>-</td> <td>Gravity</td><td>-</td> </tr> <tr> <td>Personal Safety</td><td>M</td> <td>Pressure</td><td>-</td> </tr> </table> </div> <div> <p>Suggested FHSB Ref: III AF</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Driving</td><td>-</td> <td>Electrical</td><td>-</td> </tr> <tr> <td>Mechanical</td><td>-</td> <td>Motion</td><td>-</td> </tr> <tr> <td>Radiation</td><td>-</td> <td>Sound</td><td>-</td> </tr> </table> </div> </div>		Biological	-	Chemical	-	Environmental	-	Gravity	-	Personal Safety	M	Pressure	-	Driving	-	Electrical	-	Mechanical	-	Motion	-	Radiation	-	Sound	-
Biological	-	Chemical	-																						
Environmental	-	Gravity	-																						
Personal Safety	M	Pressure	-																						
Driving	-	Electrical	-																						
Mechanical	-	Motion	-																						
Radiation	-	Sound	-																						
<p>Overall Unmitigated Risk: High</p> <p>Mitigated Risk: Medium if utilizing:</p> <p>Controls that should be Considered: #N/A</p>																									
<p>Enter Required Controls: TRACK, Proper Lifting Technique</p>																									
Hazardous Activity #4																									
Field-Tools, hand - use of hammers, screwdrivers, wrenches, etc																									
<div style="display: flex; justify-content: space-between;"> <div> <p>Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Biological</td><td>-</td> <td>Chemical</td><td>-</td> </tr> <tr> <td>Environmental</td><td>-</td> <td>Gravity</td><td>L</td> </tr> <tr> <td>Personal Safety</td><td>-</td> <td>Pressure</td><td>-</td> </tr> </table> </div> <div> <p>Suggested FHSB Ref: III AD</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Driving</td><td>-</td> <td>Electrical</td><td>-</td> </tr> <tr> <td>Mechanical</td><td>-</td> <td>Motion</td><td>M</td> </tr> <tr> <td>Radiation</td><td>-</td> <td>Sound</td><td>-</td> </tr> </table> </div> </div>		Biological	-	Chemical	-	Environmental	-	Gravity	L	Personal Safety	-	Pressure	-	Driving	-	Electrical	-	Mechanical	-	Motion	M	Radiation	-	Sound	-
Biological	-	Chemical	-																						
Environmental	-	Gravity	L																						
Personal Safety	-	Pressure	-																						
Driving	-	Electrical	-																						
Mechanical	-	Motion	M																						
Radiation	-	Sound	-																						
<p>Overall Unmitigated Risk: Medium</p> <p>Mitigated Risk: Low if utilizing:</p> <p>Controls that should be Considered: Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: H&S Standards Job Briefing/Site Awareness Admin. Controls (specify below) Specialized Equipment (specify below) Site Awareness/PPE (see HASP "PPE" section)</p>																									
<p>Enter Required Controls: TRACK, Safety Glasses, Protective Gloves, Hard Hat</p>																									

Task 3: Groundwater Sampling									
Hazardous Activity #1									
Field-Sampling - sample cooler preparation									
Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):					Suggested FHSHB Ref: III AD, III AF				
Biological	-	Chemical	M	Driving	-	Electrical	-		
Environmental	-	Gravity	M	Mechanical	L	Motion	L		
Personal Safety	M	Pressure	-	Radiation	-	Sound	-		
Overall Unmitigated Risk: Medium					Mitigated Risk: Low if utilizing:				
Controls that should be Considered:					Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: H&S Standards Job Briefing/Site Awareness Admin. Controls (specify below) Specialized Equipment (specify below) Site AwarenessPPE (see HASP "PPE" section)				
Enter Required Controls:					TRACK, Safety Glasses, Proper Lifting Techniques, Nitrile Gloves, Secure in Transit, Proper Packing Techniques				
Hazardous Activity #2									
Field-Sampling - monitoring well sampling with electric, pneumatic or other non-manual pump									
Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):					Suggested FHSHB Ref: III F, III AB, III AF				
Biological	-	Chemical	L	Driving	-	Electrical	L		
Environmental	-	Gravity	L	Mechanical	-	Motion	M		
Personal Safety	-	Pressure	-	Radiation	-	Sound	-		
Overall Unmitigated Risk: Low					Mitigated Risk: Low if utilizing:				
Controls that should be Considered:					Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: Job Briefing/Site Awareness PPE (see HASP "PPE" section)				
Enter Required Controls:					TRACK; 3rd party field assistance; PPE; awareness/ Job Briefing				
Hazardous Activity #3									
Chemical-Reactive - working with or exposure to reactives during laboratory work, sample bottle preservatives, decon chemicals, etc									
Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):					Suggested FHSHB Ref: III K, III AG				
Biological	-	Chemical	M	Driving	-	Electrical	-		
Environmental	L	Gravity	-	Mechanical	-	Motion	-		
Personal Safety	-	Pressure	M	Radiation	-	Sound	-		
Overall Unmitigated Risk: Medium					Mitigated Risk: Low if utilizing:				
Controls that should be Considered:					Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: Job Briefing/Site Awareness PPE (see HASP "PPE" section)				
Enter Required Controls:					TRACK, Safety Glasses, Nitrile Gloves				
Hazardous Activity #4									
Field-Tools, hand - use of hammers, screwdrivers, wrenches, etc									
Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):					Suggested FHSHB Ref: III AD				
Biological	-	Chemical	-	Driving	-	Electrical	-		
Environmental	-	Gravity	L	Mechanical	-	Motion	M		
Personal Safety	-	Pressure	-	Radiation	-	Sound	-		
Overall Unmitigated Risk: Medium					Mitigated Risk: Low if utilizing:				
Controls that should be Considered:					Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: H&S Standards Job Briefing/Site Awareness Admin. Controls (specify below) Specialized Equipment (specify below) Site AwarenessPPE (see HASP "PPE" section)				
Enter Required Controls:					TRACK, Safety Glasses, Protective Gloves				

Task 4: Operation and Maintenance - Temporary, small or mobile system	
Hazardous Activity #1	
Chemical - solids/partiulates, skin or eye irritation/damage/allergy	
Overall Unmitigated Risk: Medium	Mitigated Risk: Low if utilizing:
Controls that should be Considered:	Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: H&S Standards Job Awareness PPE (see HASP "PPE" section)
Enter Required Controls:	TRACK, Safety Glasses, Proper Lifting Techniques, Nitrile Gloves, Secure in Transit, Proper Packing Techniques
Hazardous Activity #2	
Electrical - Process Failure - Injury or death from improper lockout/tagout	
Overall Unmitigated Risk: High	Mitigated Risk: Medium if utilizing:
Controls that should be Considered:	Primary: TRACK Lockout/Tagout Permits, PPE, HASP, Lockout/Tagout training. Secondary: Specialized equipment.
Enter Required Controls:	TRACK, PPE, LOTO Training, LOTO permits, site awareness, job briefing. Use the LOTO procedures before
Hazardous Activity #3	
Gravity - Struck by - Injury from falling object	
Overall Unmitigated Risk: Medium	Mitigated Risk: Low if utilizing:
Controls that should be Considered:	Primary: TRACK JSAs Engineering Controls (specify below) Inspections Secondary: Job Briefing/Site Awareness PPE (see HASP "PPE" section)
Enter Required Controls:	TRACK, Safety Glasses, Nitrile Gloves
Hazardous Activity #4	
Mechanical - Process failure - Injury from lockout/tagout noncompliance	
Overall Unmitigated Risk: HIGH	Mitigated Risk: LOW if utilizing:
Controls that should be Considered:	Primary: TRACK, Lockout/Tagout Permits, PPE, Lockout/Tagout Training
Enter Required Controls:	TRACK, LOTO permits/procedures, PPE, job briefing, site awareness.
Hazardous Activity #5	
Motion - Musculoskeletal - Injury from lifting, twisting, stooping or awkward body positions	
Overall Unmitigated Risk: Medium	Mitigated Risk: Low if utilizing:
Controls that should be Considered:	Primary: TRACK JSAs PPE (see HASP "PPE" section) Engineering Controls (specify below) Admin. Controls (specify below) Secondary: Field H&S Handbook (see ref. above) Housekeeping Medical SurveillanceWorkCare First Aid/CPR Training (designed person)
Enter Required Controls:	TRACK, JSAs, planning. Use a buddy for moving large or heavy objects.
Hazardous Activity #6	
Sound - Noise - Injury or illness due to noise exposure	
Overall Unmitigated Risk: Medium	Mitigated Risk: Low if utilizing:
Controls that should be Considered:	Primary: TRACK Engineering Controls (specify below) Admin. Controls (specify below) PPE (see HASP "PPE" section) Medical Surveillance Secondary: H&S Standards Field H&S Handbook (see ref. above) WorkCare
Enter Required Controls:	TRACK, PPE, JSAs, Job briefing. Use the required PPE when working around the SVE Systems or loud construction tasks.

☐ HAZCOM/GHS for this project is managed by the client or general contractor

List the chemicals anticipated to be used by **ARCADIS** on this project per HazCom/GHS requirements.
(Modify quantities as needed)

Preservatives		Qty	Decontamination		Qty	Calibration		Qty.
<input checked="" type="checkbox"/>	Not applicable		<input type="checkbox"/>	Not applicable		<input type="checkbox"/>	Not applicable	
<input type="checkbox"/>	Hydrochloric acid	<500 ml	<input checked="" type="checkbox"/>	Alconox	≤ 5 lbs	<input checked="" type="checkbox"/>	Isobutylene/air	1 cyl
<input type="checkbox"/>	Nitric acid	<500 ml	<input type="checkbox"/>	Liquinox	≤ 1 gal	<input type="checkbox"/>	Methane/air	1 cyl
<input type="checkbox"/>	Sulfuric acid	<500 ml	<input type="checkbox"/>	Acetone	≤ 1 gal	<input type="checkbox"/>	Pentane/air	1 cyl
<input type="checkbox"/>	Sodium hydroxide	<500 ml	<input type="checkbox"/>	Methanol	≤ 1 gal	<input type="checkbox"/>	Hydrogen/air	1 cyl
<input type="checkbox"/>	Zinc acetate	<500 ml	<input type="checkbox"/>	Hexane	≤ 1 gal	<input type="checkbox"/>	Propane/air	1 cyl
<input type="checkbox"/>	Ascorbic acid	<500 ml	<input type="checkbox"/>	Isopropyl alcohol	≤ 4 gal	<input type="checkbox"/>	Hydrogen sulfide/air	1 cyl
<input type="checkbox"/>	Acetic acid	<500 ml	<input type="checkbox"/>	Nitric acid	≤ 1 L	<input type="checkbox"/>	Carbon monoxide/air	1 cyl
<input type="checkbox"/>	Isopropyl alcohol	< 4 gal.	<input checked="" type="checkbox"/>	Other:		<input type="checkbox"/>	pH standards (4,7,10)	≤ 1 gal
<input type="checkbox"/>	Formalin (<10%)	< 4 gal.		<u>Sodium thiosulfate</u>		<input type="checkbox"/>	Conductivity standards	≤ 1 gal
<input type="checkbox"/>	Methanol	<500 ml				<input type="checkbox"/>	Other:	
<input type="checkbox"/>	Sodium bisulfate	<500 ml						
Fuels		Qty.	Kits					Qty.
<input type="checkbox"/>	Not applicable		<input checked="" type="checkbox"/>	Not applicable				
<input checked="" type="checkbox"/>	Gasoline	≤ 5 gal	<input type="checkbox"/>	Hach (specify):				1 kit
<input type="checkbox"/>	Diesel	≤ 5 gal	<input type="checkbox"/>	DTECH (specify):				1 kit
<input type="checkbox"/>	Kerosene	≤ 5 gal	<input type="checkbox"/>	Other:				1 kit
<input type="checkbox"/>	Propane	1 cyl						
<input type="checkbox"/>	Other:							
Remediation		Qty.	Other:		Qty.			Qty.
<input type="checkbox"/>	Not applicable		<input type="checkbox"/>	Not applicable		<input type="checkbox"/>		
<input checked="" type="checkbox"/>	<u>Sodium Permanganate</u>	100 gal.	<input type="checkbox"/>	Spray paint	≤ 6 cans	<input type="checkbox"/>		
<input type="checkbox"/>			<input type="checkbox"/>	WD-40	≤ 1 can	<input type="checkbox"/>		
<input type="checkbox"/>			<input type="checkbox"/>	Pipe cement	≤ 1 can	<input type="checkbox"/>		
<input type="checkbox"/>			<input type="checkbox"/>	Pipe primer	≤ 1 can	<input type="checkbox"/>		
<input type="checkbox"/>			<input type="checkbox"/>	Mineral spirits	≤ 1 gal	<input type="checkbox"/>		

Material safety data sheets (MSDSs)/Safety Data Sheets (SDSs) must be available to field staff. Indicate below how MSDS information will be provided:

☐ Not applicable
☐ Printed copy in company vehicle
☐ Printed copy in the project trailer/office
☒ Printed copy attached
☐ Electronic copy on field computer

☐ Contractor MSDSs/SDSs are not applicable
☐ Contractor MSDSs/SDSs are attached
☐ Contractor MSDSs/SDSs will be on site and located: _____

☒ Bulk quantities of the following materials will be stored: Sodium Permanganate 100 gallons
 Sodium thiosulfate

Contact the project H&S contact for information in determining code and regulatory requirements associated with bulk storage of materials.

Monitoring

☐ Chemical air monitoring is not required for this project or is the responsibility of contractor.

For projects requiring air monitoring, list the relevant constituents representing a hazard to site workers.

Constituent	Max. Conc.	TWA	STEL	IDLH	LEL/UEL	VD	VP	IP
	Units	Units	Units	Units	(%)	Air=1	(mm Hg)	(eV)
PCE	5 ppm	25 p	100 p	150 p,N	NA/NA	0 NA	14	9.32
Trichloroethylene	3 ppm	10 p	25 p	1000 p,N	8/10.5	0 NA	58	9.45
cis 1,2-Dichloroethene	10 ppm	200 p	NA -	1000 p,N	5.6/12.8	0 NA	180-265	9.65
None		9999 -	0 -	0 -	0	0 0	0	0
None		9999 -	0 -	0 -	0	0 0	0	0
None		9999 -	0 -	0 -	0	0 0	0	0

Notes: TWAs are ACGIH 8 hr-TLVs unless noted.

p-ppm m-mg/m³ c2- ceiling (2 hr) se-sensitizer "N/A" -Constituent is not in database, manually enter information
s- skin c-ceiling "9999" - NA O-OSHA PEL
r- respirable i-inhalable N-NIOSH 10 hr REL

Monitoring Equipment and General Protocols

Air monitoring is required for any task or activity where employees have potential exposure to vapors or particulates above the TWA. Action levels below are appropriate for most situations. Contact the project H&S contact for all stop work situations. Select monitoring frequency and instruments to be used.

Monitoring Frequency:

Continuously

Indicator Tube/Chip Frequency:

Indicator tube/chip monitoring not required

Instrument	Action Levels	Actions
<input checked="" type="checkbox"/> Photoionization Detector	< 24	Continue work
	24 - 49	Sustained >5 min. continuous monitor, review eng. controls and PPE, proceed with caution
Lamp (eV): 10.6	> 49	Sustained >5 min. stop work, contact SSO
<input type="checkbox"/> Flame Ionization Detector (FID)	< 0.0	Continue work
	0.0 - 0.0	Sustained >5 min. continuous monitor, review eng. controls and PPE, use caution
	> 0.0	Sustained >5 min. stop work, contact SSO
<input type="checkbox"/> LEL/O ₂ Meter	0-5% LEL	Continue work
	>5-10% LEL	Continuous monitor, review eng. controls, proceed with caution
	>10% LEL	Stop work, evacuate, contact SSO
	19.5%-23.5% O ₂	Normal, continue work
	<19.5% O ₂	O ₂ deficient, stop work, evacuate, cont. SSO
	>23.5% O ₂	O ₂ enriched, stop work, evacuate, contact SSO
<input type="checkbox"/> Indicator: <input type="checkbox"/> tube <input type="checkbox"/> chip	≤PEL/TLV	Continue work
	>PEL/TLV	Stop work, review eng. controls and PPE, contact SSO
Compound(s):		
<input type="checkbox"/> Particulate Monitor (mists, aerosols, dusts in mg/m ³)	< 2.5	Continue work
	2.5 - 5.000	Use engineering controls, monitor continuously
	> 5.000	Stop work, review controls, contact SSO
<input type="checkbox"/> Other:	Specify:	Specify:

Personal Protective Equipment (PPE)

See JSA or Permit for the task being performed for required PPE. If work is not conducted under a JSA or Permit, refer to the governing document for PPE requirements. At a minimum, the following checked PPE is required for all tasks during field work (outside of field office trailers and vehicles) not covered by a JSA or Permit on this project:

Minimum PPE required to be worn by all staff on project:			Specify Type:
<input checked="" type="checkbox"/> Hard hat	<input type="checkbox"/> Snake chaps/guards	<input type="checkbox"/> Coveralls:	_____
<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Briar chaps	<input type="checkbox"/> Apron:	_____
<input type="checkbox"/> Safety goggles	<input type="checkbox"/> Chainsaw chaps	<input checked="" type="checkbox"/> Chem. resistant gloves:	Nitriles
<input type="checkbox"/> Face shield	<input type="checkbox"/> Sturdy boot	<input type="checkbox"/> Gloves other:	_____
<input type="checkbox"/> Hearing protection	<input checked="" type="checkbox"/> Steel or comp. toe boot	<input type="checkbox"/> Chemical boot:	_____
<input type="checkbox"/> Rain suit	<input type="checkbox"/> Metatarsal boot	<input type="checkbox"/> Boot other:	_____
<input type="checkbox"/> Other:	_____	<input checked="" type="checkbox"/> Traffic vest, shirt or coat:	Class II
_____	_____	<input type="checkbox"/> Life vest:	_____

Task specific PPE: See appropriate JSA documents

Comments:

Primary ARCADIS role is field oversight of remedial measures/ construction activities - therefore, OSHA Level D will be the primary level of protection during field activities for ARCADIS personnel.

Medical Surveillance (check all that apply)

- ☐ Medical Surveillance is not required for this project.
- ☒ HAZWOPER medical surveillance applies to all ARCADIS site workers on the project.
- ☒ HAZWOPER medical surveillance applies to all subcontractors on the project.
- ☐ HAZWOPER medical surveillance applies to all site workers on the project except:

☐ Other medical surveillance required (describe type and who is required to participate):

☐ Client drug and/or alcohol testing required.

Hazardous Materials Shipping and Transportation (check all that apply)

- ☒ Not applicable, no materials requiring a Shipping Determination (SD) will be transported or shipped
- ☐ A SD has been reviewed and provided to field staff
- ☐ A SD is attached
- ☐ All HazMat will be transported under Materials of Trade by ARCADIS (see generic MOT SD Form)
- ☐ Other (specify):

Roadway Work Zone Safety (check all that apply)

- ☒ Not applicable for this project
- ☐ All or portions of the work conducted under a TCP
- ☐ All or portions of the work conducted under a STAR Plan
- ☐ TCP or STAR Plan provided to field staff
- ☐ TCP or STAR Plan attached
- ☐ Other (specify):

ARCADIS Commercial Motor Vehicles (CMVs)

This section is applicable to ARCADIS operated vehicles only

- ☒ This project will **not** utilize CMV drivers
- ☐ This project will utilize CMV drivers

Site Control (check all that apply)

- ☐ Not applicable for this project.
- ☐ Site control protocols are addressed in JSA or other supporting document (attach)
- ☒ Maintain an exclusion zone of 25 ft. around the active work area
- ☐ Site control is integrated into the STAR Plan or TCP for the project
- ☐ Level C site control - refer to Level C Supplement attached
- ☒ Other (specify):
The entire site area will be controlled using construction fencing, and site access will be controlled by the construction subcontractor.

Decontamination (check all that apply)

- ☐ Not applicable for this project.
- ☐ Decontamination protocols are addressed in JSA or other governing document (attach)
- ☒ Wash hands and face prior to consuming food, drink or tobacco.
- ☐ Remove gloves and coveralls and contain, wash hands and face prior to consuming food, drink or tobacco. Ensure footwear is clean of site contaminants
- ☐ Respiratory protection- refer to the Level C supplement attached.
- ☒ Other (specify):
Sodium thiosulfate will be used as a decontamination agent for the sodium permanganate during injections.

Sanitation (check all that apply)

- ☐ Mobile operation with access to off-site restrooms and potable water
- ☒ Restroom facilities on site provided by client or other contractor
- ☐ Project to provide portable toilets (1 per 20 workers)
- ☒ Potable water available on site
- ☐ Project to provide potable water (assume 1 gal./person/day)
- ☐ Project requires running water (hot and cold, or tepid) with soap and paper towels

Safety Briefings (check all that apply)

- ☒ Safety briefing required daily
- ☐ Safety briefing required twice a day
- ☐ Safety briefings required at the following frequency: _____
- ☒ Subcontractors to participate in ARCADIS safety briefings
- ☐ ARCADIS to participate in client/contractor safety briefings
- ☐ Other (specify): _____

Safety Equipment and Supplies

Safety equipment/supply requirements are addressed in the JSA or Permit for the task being performed. If work is not performed under a JSA or Permit, the following safety equipment is required to be present on site in good condition (Check all that apply):

- | | |
|--|---|
| <input checked="" type="checkbox"/> First aid kit | <input type="checkbox"/> Insect repellent |
| <input checked="" type="checkbox"/> Bloodborne pathogens kit | <input checked="" type="checkbox"/> Sunscreen |
| <input checked="" type="checkbox"/> Fire extinguisher | <input type="checkbox"/> Air horn |
| <input type="checkbox"/> Eyewash (ANSI compliant) | <input checked="" type="checkbox"/> Traffic cones |
| <input checked="" type="checkbox"/> Eyewash (bottle) | <input type="checkbox"/> 2-way radios |
| <input checked="" type="checkbox"/> Drinking water | <input type="checkbox"/> Heat stress monitor |
| <input type="checkbox"/> Other: _____ | _____ |
| _____ | _____ |

International Travel

☒ This project does not involve international travel

☐ This project involves international travel to: Type in a city name or select country from menu

Contact WorkCare for travel to this country (M=Mandatory, R=Recommended):	NA
iJet Security Rating (1=minimum threat, 5=very high threat):	NA
U.S. State Department Travel Alert (A) or Warning (W) Issued:	NA
ARCADIS Grey (G) or Black (B) listed:	NA

Behavior Based Safety Program (*check all that apply*)

☒ TIP required at the following frequency on this project:

Select One: 80 mhrs time(s) Define:

☒ H&S Field Assessment required at the following frequency on this project:

Select One: mhrs 1 time(s) Define:

☐ Other (specify):

Signatures

I have read, understand and agree to abide by the requirements presented in this health and safety plan.
I understand that I have the absolute right to stop work if I recognize an unsafe condition affecting my work until corrected.

Printed Name	Signature	Date
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>

Add additional sheets if necessary

You have an absolute right to STOP WORK if unsafe conditions exist!

Attachments
FORMS

Real Time Exposure Monitoring Data Collection Form

Document all air monitoring conducted on the Site below. Keep this form with the project file.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

Calibration Method: (Material used settings, etc.)	
Calibration Results:	
Calibrated By:	

Activity Being Monitored	Compounds/Hazards Monitored	Time	Reading	Action Required? Y/N

Describe Any Actions Taken as a Result of this Air Monitoring and Why (does it match Table 5-1):

Employee Signature Form

I certify that I have read, understand, and will abide by the safety requirements outlined in this HASP.

[illegible]

Subcontractor Acknowledgement: Receipt of HASP Signature Form

ARCADIS claims no responsibility for the use of this HASP by others although subcontractors working at the site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this site. To this end, health and safety becomes the inherent responsibility of personnel working at the site.

[illegible]

Visitor Acknowledgement and Acceptance of HASP Signature Form

By signing below, I waive, release and discharge the owner of the site and ARCADIS and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the site and in any way arising from or related to any and all known and unknown conditions on the site.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site

AUS Personal Protective Equipment List by Business Line

This matrix outlines **basic** PPE requirements for each Business Line. **Specific client, task, or regulatory requirements may dictate the type of PPE beyond what is listed in this matrix.** Additionally, task specific requirements may also be included in the HASP or JSA. Hazard/task specific PPE or emergency supply recommendations are outlined by hazard/task in the Field H&S Handbook. PPE and equipment should be charged to the project. For any supplies that the PM determines cannot be billed, the equipment should be charged to the employee's overhead charge number. PPE associated with specialized training such as NFPA 70E Arc Flash is included in this matrix. Refer to the specific training program for a description of the necessary PPE for tasks in such requirements.

Listed "General PPE" is required for field staff, the last column specifies PPE for ARCADIS staff visiting project sites.					
	Environment ¹	Infrastructure ¹	Buildings ¹	Water ¹	Staff Visiting Project Sites
Minimum PPE Required to Be Worn					
Hard Hat	R	R	R	R	R
Reflective Traffic Vest (Minimum Class 2)	R	R	R	R	R
Safety Glasses - Clear and Tinted	R	R	R	R	R
ANSI Compliant Safety -Toe Boots	R	R	R	R	R
Minimum PPE Required to Have On Hand					
Hearing Protection - Ear plugs (Need for ear muffs TBD)	R	R	R	R	R
Leather gloves and glove clip	R	R	R	R	R
First Aid Supplies ²					
Small first aid kit	R	R	R	R	O
16 oz. Bottle of Eye Wash	R	R	R	R	O
Tick Remover (fine tip tweezers) (See THA for high risk locations)	O	O	O	O	O
PPE Supplies Required As Appropriate					
PPE duffel bag with logo, or equivalent	O	O	O	O	O
Half Face or Full-Face Respirator ³ (See THA)	O ³	O ³	O ³	O ³	O ³
Insect Repellent (See THA.) (Recommended 20-30% DEET)	O	O	O	O	O
Sunscreen	O	O	O	O	O
Hand sanitizer	O	O	O	O	O
Cut Resistant or Chemical Resistant Gloves ⁴	O	O	O	O	O
Poison Ivy pre-exposure wipes or post exposure cleanser (i.e. Tecnu or Zanol) (See THA for high risk locations)	O	O	O	O	O
Other specialized protective equipment (See THA for Work Tasks)	O	O	O	O	O
Outdoor wilderness survival kit ⁵	O	O	O	O	O

Notes:

R - Required

O - Optional. Based on HASP Task Hazard Analysis (THA) or geographic location of work.

THA - Task Hazard Analysis.

Review the HASP Task Hazard Analysis (THA) in making this determination. Certain specific factors can influence the determination for requiring this PPE for the site or task. For example, certain geographic regions may have a higher incidence of the hazard or associated risk, the proximity of the site relative to emergency services may require such, previous observations of the hazard at the site, or where unknown hazard conditions apply. Modifications to the minimum required PPE are required to be communicated via the HASP and/or JSA.

¹ The Business Line Director, Operations Manager, Project Manager or Employee Supervisor is responsible for making the decision to provide ARCADIS branded shirts to employees. Billing of such shirts is related to the authority level of the decision maker.

² For project sites with an office/trailer, First Aid/emergency response supplies can be kept in a central location, and may not be required to be carried by each ARCADIS employee.

³ Staff must comply with the ARCADIS **Respiratory Protection H&S Standard** before a respirator can be worn. The H&S Standard is available on the H&S Team webpage via the H&S Standards Library link.

[Link to ANA H&S Standard Library](#)

⁴ Determination for use of cut resistant, chemical resistant gloves or other specialized hand protection are to be based on THA in the project HASP.

⁵ Outdoor survival kits are generally required when working in remote wilderness locations. See the HASP THA and the Field H&S Handbook for requirements and supply list.

Task Improvement Process

General

Observed Company: _____

Observation Type: _____

TIP Form: H&S Field Multi-Task (General)

Task Observed: _____

Observee Name: _____

Observer Name: _____

Observation Date: _____

Project Number: 00266415.0000

Project Name: Former Jimmy's Dry Cleaners(NYSDEC Site No. 130080)Hempstead, New York

Supervisor: _____

Equipment On Site: _____

Pertinent Information: _____

Observation

Task	Correct	Questionable	Comments
General			
PPE worn according to HASP/JLA specifications and inspected before use?			
STOP work authority used where appropriate?			
Body Use/Positioning			
Proper lifting/pushing / pulling techniques used (no awkward positions/posture; no twisting or excessive reaching; no straining; no excessive weight; load under control/stable; etc.)?			
Body parts away from pinch points (clear or protected from being caught between objects/equipment or from contacting sharp objects/edges, etc.)?			
Body parts not in the Line of Fire (protected from being struck by traffic, equipment, falling/flying objects, etc.)?			
Work Procedures/Environment			
Correct type and number of barricades/warning devices/cones?			

Communication with others when necessary (hand signals, flags, etc.)?			
Right tools and equipment selected for the job and inspected before use?			
Tools and equipment used properly?			
Housekeeping performed (work areas and pathways clear of hazards, uneven surfaces addressed, etc.)?			
Slip/trip/fall hazards addressed (path selected and cleared, eyes on path, speed footing, etc.)?			
Proper energy control (electrical systems grounded, lock out/tag out performed, isolated, cords/fixtures in good condition, GFCI inspected and utilized when appropriate and used properly, etc.)?			
Protected from overhead/underground utilities (proper clearance, properly marked, spotters as necessary, etc.)?			
Safe work on/near water (appropriate flotation device, appropriate boat for body of water and operation of boat, etc.)?			
Chemical/Radiation protection (decontamination zones set up properly, air monitoring, completed, and logged, etc.)?			
Fall from elevated height prevention (maintains 3-points of contact, appropriate ladder, mounting/dismounting vehicle/equipment, fall arrest system, etc.)?			
Any additional safety issues identified:			

Tip Summary Enter details of the TIP and follow up discussion provide details on how any questionable items were resolved.

Discussion following the TIP led by: _____

Date of follow-up discussion: _____

Positive Comments:

--

Discussion Summary Completed:

<input type="checkbox"/>	Supervisor Led
<input type="checkbox"/>	Peer to Peer
<input type="checkbox"/>	ARCADIS Employee to Subcontractor

Summary of Questionable Items

--

Action Items (Optional) Assign appropriate action items based on the observations made. You can add more than one action item if needed.

Item #	Action Item	Responsible Person	Due Date	Comp. Date
1				
2				
3				

Standard Review

Reviews to be performed after entry of this TIP into 4-Sight.

Quality Review

Quality Reviews to be performed after entry of this TIP into 4-Sight.

Field Validation and Verification

Use the 4-Sight generated copy of this TIP to perform field V&V activities.

[illegible]



Control Number: TSM- 00266415.0000

TSM + project number plus date as follows: xxxxxxxx.xxxx.xxxx - dd/mm/year

TAILGATE HEALTH & SAFETY MEETING FORM

Project Name: Former Jimmy's Dry Cleaners (NYSDEC Site No. 130080)		Project Location:
Date:	Time:	Conducted by:
		Signature/Title:

Issues or concerns from previous day's activities:

Task anticipated to be performed today:

The following was used to to communicate H&S information in this briefing (check all that apply):

- ☐ HASP (including THA)
- ☐ JSAs (specify JSA #s): _____
- ☐ Permits (specify type or #): _____
- ☐ TCP or STAR Plan
- ☐ FHSB (specify sections): _____
- ☐ H&S Standard (specify number): _____
- ☐ H&S checklist (specify type): _____
- ☐ Activity specific hazard analysis:

Activity: _____

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	<input type="checkbox"/>	Chemical	<input type="checkbox"/>	Driving	<input type="checkbox"/>	Electrical	<input type="checkbox"/>
Environmental	<input type="checkbox"/>	Gravity	<input type="checkbox"/>	Mechanical	<input type="checkbox"/>	Motion	<input type="checkbox"/>
Personal Safety	<input type="checkbox"/>	Pressure	<input type="checkbox"/>	Radiation	<input type="checkbox"/>	Sound	<input type="checkbox"/>

Controls required to be used:

PPE Required (If not using JSA or Permit with PPE requirements):

- ☐ Hard hat
- ☐ Safety glasses
- ☐ Face shield
- ☐ Safety goggles
- ☐ Steel/composite toe boots
- ☐ Traffic vest (specify II or III): _____
- ☐ Life Vest (specify type): _____
- ☐ Protective Suit (specify type): _____

☐ Protective gloves (specify type): _____☐ Other (specify): _____**Signature and Certification: I have read and understand the project specific HASP for this project.**

Printed Name/Signature/Company	Sign In Time	Sign Out Time	
			I will STOP the job any time anyone is concerned or uncertain about health & safety or if anyone identifies a hazard or additional mitigation not recorded in the site, project, job or task hazard assessment.
			I will be alert to any changes in personnel, conditions at the work site or hazards not covered by the original hazard assessments.
			If it is necessary to STOP THE JOB , I will perform TRACK ; and then amend the hazard assessments or the HASP as needed.
			I will not assist a subcontractor or other party with their work unless it is absolutely necessary and then only after I have done TRACK and I have thoroughly controlled the hazard.
			All site staff should arrive fit for work. If not, they should report to the supervisor any restrictions or concerns.
			In the event of an injury, employees will call WorkCare at 1.800.455.6155 and then notify the field supervisor.
			Utility strike, motor vehicle accident or 3rd party property damage - field supervisor will immediately notify the Project or Task Manager

What You Need to Know

Emergency Phone: 911

WorkCare Phone: 1-800-455-6155

Your nearest hospital:

South Nassau Communities Hospital 2277 Grand Avenue Baldwin, NY 11510 0 0 0 0 51

H&S Specialist for this project:

Julie Santaniello

Cell Phone:

978-551-0033

Project Site Safety Officer:

0

Nearest assembly area(s):

0

Nearest storm shelter(s):

N/A

Simultaneous operations (SimOps):

You must review address SimOps activities in your tailgate safety briefing.
Review of THA may be required.

Site Security: A Site Security Plan does not apply to this project.

Utility Clearance: Review of utility clearance checklist and daily site walkover for utility identification is required.

State Specific Requirements: State specific H&S requirements do not apply this project.

You are required to have current training in the following:

H&S Program Orientation , HAZCOM GHS/EAP, Defensive Driving - Smith On-Line, DOT HazMat #1 , Excavation

General Awareness , Hazwoper 40 Hour, Hazwoper 8-Hour Annual Refresher , 0, 0, 0, 0, 0, 0,

SDSs for this project are located: Printed copy attached

Primary chemical constituents of concern for this project:

PCE, Trichloroethylene, cis 1,2-Dichloroethene,

PID action levels for this project:

<	24.4			Continue work
	24.4	-	48.8	Sustained >5 min. continuous monitor, review eng. controls and PPE, proceed with caution
>	48.8			Sustained >5 min. stop work, contact SSO

0

For work not conducted under a JSA or permit, you must wear the following PPE:

Hard hat, Safety glasses, Steel or comp. toe boot, Traffic vest, shirt or coat: Class II, Gloves other: 0,

Primary ARCADIS role is field oversight of remedial measures/ construction activities - therefore, OSHA Level D will be the primary level of protection during field activities for ARCADIS personnel.

You are required to be current on your medical surveillance.

Shipping determinations are not required for your work.

TCP/STAR Plans are not required for your work.

The following safety equipment and supplies are required to be on site for this project:

First aid kit, Bloodborne pathogens kit, Fire extinguisher, Eyewash (bottle), Drinking water, Sunscreen, Traffic cones,

Site Control:

Maintain an exclusion zone of 25 ft. around the active work area

Decontamination:

Wash hands and face prior to consuming food, drink or tobacco.

Sanitation:

Restroom facilities on site provided by client or other contractor

Potable water available on site

Safety Briefings:

Safety briefing required daily

This project has the following TIP goals:

1 per 80 mhrs

Job Safety Analysis

General

JSA ID	14280	Status	(3) Completed
Job Name	Environment-Drum sampling/handling	Created Date	8/11/2016
Task Description	Drum Handling	Completed Date	07/18/2017
Template	False	Auto Closed	False

Client / Project

Client	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Project Number	00266416.0000
Project Name	Former Jimmy's Cleaners
PIC	LOEWENSTEIN, DANIEL
Project Manager	VITOLINS, ANDY

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Williamson, James	9/1/2016	7/18/2017	Rigg, David	<input checked="" type="checkbox"/>
HASP Reviewer	Bobar, Aaron	8/25/2016	8/17/2016	Lang, Daniel C	<input checked="" type="checkbox"/>

Job Steps

Job Step No.	Job Step Description	Potential Hazard	Critical Action	H&S Reference
1	Inspect Drums for signs of Bulging, Leaking, Crystals, Temperature, and Odor	1 Exposure to chemicals stored in drum or container.	Read drum labels for information about contents. Review all relevant MSDSs about chemical contents. If labels are not attached, call PM or Local H&S Representative.	None
		2 Contents of the drum can cause fire/explosion hazard.	Use air monitoring meters to screen drums. % LEL and VOCs (PPM). If either of the values are above the action levels described in the HASP or MSDS then Stop Work, move away from the area, and reassess the situation. Call PM and H&S staff for support.	
2	Remove lids or bungs from Drums	1 Hand Injuries can occur from sharp edges, pinch points, and from use of hand tools.	Wear appropriate work gloves. When removing ring from drum, fingers can get pinched between ring and drum. Keep fingers clear of this space. Select proper tool for task. If large amount of drums will be encountered, use a speed or drum wrench.	Employee H&S Field book, Section III Subpart II, page 104. Also Section III Subpart L, page 38.
		2 Rapid depressurization from empty or partially full drums can cause flying parts or volatile COCs releasing on staff.	Do not handle or open bulging drums (contact Corp H&S for assistance). Bleed any built up pressure by carefully loosening bung prior to removing ring. Keep face and arms away from bung opening when loosening. Slightly lift lid, insert end of air monitoring device to monitor air inside drum.	
		3 Use of mechanical tools to remove bolts from drum lids causes excessive noise.	Wear hearing protection.	
		4 Splashing can occur if filling drum, or collecting samples.	Wear eye and face protection. Pour liquids into drum slowly to minimize splashing.	
		5 When working with COCs that have fire/explosive properties, sparking or heat could cause fire/explosion.	Use brass or non Spark Hand Tools if such a hazard exists or is suspected.	
3	Replace drum lids	1 Hand Injuries can occur from sharp edges, pinch points, and from use of hand tools.	see step 2 above	
4	Moving and Storing Drums	1 Drum storage areas can be accessed by the general public, or may not be secure.	Calculate how many drums will be stored in new location. Ensure that drums are not easily accessed by the general public. Do not store such that drums impede pedestrian or vehicular traffic.	

4	Moving and Storing Drums	2	Muscle strain can occur when lifting/pulling/pushing drums.	Drums that are full can weigh as much as 800 lbs. Use a lift assist device whenever possible, and use a team lift approach. When moving soil drum generated by drilling, have drillers use their equipment to move the drums. Using dolly, slightly lift drum away from dolly to install forks under drum. Slowly let drum come back down and rest on dolly. Using hook on top of dolly, ensure it latches on top of drum bung.	
		3	Body parts can be pinched between lift device, or drum and the ground.	Be aware of hand and foot placement during drum staging. Do not hurry through task.	
		4	When moving, the drum can tip or the dolly could become unstable from uneven ground surface.	Plan travel route with drum prior to moving. With drum secure on dolly, have one employee pull back on dolly, and other employee slowly push back on drum toward dolly. Have second worker act as spotter for traffic, pedestrians, and any trip hazards along the way.	

PPE Personal Protective Equipment			
Type	Personal Protective Equipment	Description	Required
Dermal Protection	chemical protective suit (specify type)		Required
Eye Protection	faceshield		Required
	safety glasses		Required
	safety goggles		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
	work gloves (specify type)		Required
Hearing Protection	ear plugs		Required

Supplies			
Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	Other	dolly	Required

Review Comments		
Reviewer	Comments	
Employee: Role Review Type Completed Date	Bobar, Aaron HASP Reviewer Approve 8/17/2016	Seems consistent with approved template...

Job Safety Analysis

General

JSA ID	14278	Status	(3) Completed
Job Name	Environment-Groundwater Sampling and free product recovery	Created Date	8/11/2016
Task Description	Groundwater Sampling	Completed Date	07/18/2017
Template	False	Auto Closed	False

Client / Project

Client	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Project Number	00266415.0000
Project Name	Former Jimmy's Cleaners
PIC	LOEWENSTEIN, DANIEL
Project Manager	Vitolins, Andy

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Williamson, James	9/1/2016	7/18/2017	Rigg, David	<input checked="" type="checkbox"/>
HASP Reviewer	Bobar, Aaron	8/25/2016	7/18/2017	Royer, Richard	<input checked="" type="checkbox"/>

Job Steps

Job Step No.	Job Step Description	Potential Hazard	Critical Action	H&S Reference
1	Stage at pre-determined sampling location and set up work zone and sampling equipment	1 Personnel could be hit by vehicular traffic	Set up cones and establish work area. Position vehicle so that field crew is protected from site traffic. Unload as close to work area as safely possible.	
		2 Sampling equipment, tools and monitoring well covers can cause tripping hazard	Keep equipment picked up and use TRACK to assess changes.	
2	Open wells to equilibrate and gauge wells	1 When squatting, personnel can be difficult to see by vehicular traffic.	Wear class II traffic vest if wells are located proximal to vehicular traffic. Use tall cones and the buddy system if practicable.	
		2 Pinchpoints on well vault can pinch or lacerate fingers	Use correct tools to open well vault/cap. Wear leather gloves when removing well vault lids, and chemical protective gloves while gauging. Wear proper PPE including safety boots, knee pads and safety glasses.	
		3 Lifting sampling equipment can cause muscle strain	Unload as close to work area as safely possible; use proper lifting and reaching techniques and body positioning; don't carry more than you can handle, and get help moving heavy or awkward objects.	
		4 Pressure can build up inside well causing cap to release under pressure	Keep head away from well cap when removing. If pressure relief valves are on well use prior to opening well	
3	Begin Purging Well and Collecting Parameter Measurements	1 Electrical shock can occur when connecting/disconnecting pump from the battery.	Make sure equipment is turned off when connecting/disconnecting. Wear leather gloves. Use GFCIs when using powered tools and pumps. Do not use in the rain or run electrical cords through wet areas.	
		2 Purge water can spill or leak from equipment	Stop purging activities immediately, stop leakage and block any drainage grate with absorbent pads. Call PM to notify them of any reportable spill.	
		3 Water spilling on the ground can cause muddy/slippery conditions	Be careful walking in work area when using plastic around well to protect from spillage	
		4 Lacerations can occur when cutting materials such as plastic tubing	When cutting tubing, use tubing cutter. No open fixed blades should ever be used. When possible wear work gloves, leather type.	
		5 Purge water can splash into eyes	Pour water slowly into buckets/drums to minimize splashing. Wear safety glasses.	

4	Collect GW or Free Product Sample	1	Working with bailer rope can cause rope burns on hands.	Slowly raise and lower the rope or string for the bailer. Wear appropriate gloves for the task.	
		2	Sample containers could break or leak preservative	Discard any broken sampleware or glass properly. Do not overtighten sample containers. Wear chemical protective gloves.	
5	Recovery of Free Product from well	1	Exposure to free product	Additional chemical protection may be necessary based on the type of product. Additionally, safety goggles, a faceshield, or respiratory protection may be required. Verify in the HASP.	
6	Staging of Well Purge water and/or Free Product	1	Muscle strains can occur when moving purge water or drums	If using buckets, do not fill buckets up to the top. Always keep lid on buckets when traveling or moving them to another location. Only half fill buckets so when dumping the buckets weigh less. See drum handling JSA for movement of drums.	Drum handling JSA

PPE Personal Protective Equipment			
Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Recommended
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Recommended
Miscellaneous PPE	other	Knee pads	Required

Supplies			
Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)	alconox, DI water, spray bottle	Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	flashlight		Required
Personal	eye wash (specify type)	bottle	Required
	insect repellent		Recommended
	sunscreen		Recommended
Traffic Control	barricades		Recommended
	traffic cones		Required

Review Comments		
Reviewer	Comments	
Employee: Role Review Type Completed Date	Bobar, Aaron HASP Reviewer Approve 8/17/2016	Seems consistent with approved template...

Job Safety Analysis			
General			
JSA ID	00266415-2015-01	Status	(3) Completed
Job Name	Environmental- Chemical Injection	Created Date	7/17/2015
Task Description	Chemical Injection	Completed Date	7/17/2015
Template	False	Auto Closed	False

Client / Project	
Client	NYSDEC
Project Number	00266415.0000
Project Name	Jimmy's Dry Cleaners
PIC	
Project Manager	Andrew R. Vitolins

User Roles					
Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Kathryn Farris	7/17/2015	7/17/2015	Dan Lang	<input checked="" type="checkbox"/>
Quality Reviewer	Aaron Bobar	7/17/2015	7/17/2015	Dan Lang	<input checked="" type="checkbox"/>

Job Steps					
Job Step No.	Job Step Description	Potential Hazard	Critical Action	H&S Reference	
1	Traveling to Site	1 Fatigue from long driving hours, driving early in the morning, or late at night, driving U-haul track/ trailer.	Take breaks during driving if necessary. Use defensive driving techniques. Follow traffic regulation.		
2	Site reconnaissance and walk-around	1 Slips/trips/falls can occur from uneven ground surface, slippery walkways or from tripping over equipment.	Survey the site upon arrival. Note any site conditions that may pose a potential hazard, and make note of any changes since the last injection event.		
		2 Site workers or equipment can be struck by site vehicular traffic	Wear Class II traffic vest and cone off the work area. Follow the JSA and Field H&S Handbook for roadway work. Plan the location where the injection trailer will be set up making sure to not block any ingress/egress to the site.		
3	Make arrangements for chemicals to be shipped safely to site, and stored in secure location	1 Secure storage area	Store on-site supplies in a safe place out of way of normal site operations. Lock the storage container.		
4	Load, unload and set up of required equipment including waterline hoses, injection hoses, flow meters, required PPE and supplies in/out of vehicle or storage area	1 Lifting equipment can cause back/shoulder/arm strains	Use proper lifting techniques. Request assistance when lifting heavy equipment.		
		2 Trip hazards over dragging and unsecured hoses	Keep coiled hose ends secured to coil when loading and unloading, stop and pick up dangling hoses that could be a trip hazard when carrying.		
5	Opening the injection/monitoring wells	1 Biological hazard	Be watchful for biological hazard and practice good housekeeping		
		2 Excessive bending	Wear knee pads to keep proper body position		
		3 Volatile vapor escape from wells	Ventilate the area before commencing the work if necessary		

6	Chemical mixing	1	Contact with chemicals (irritation, burning), exothermic reaction, gas generation during mixing	Read MSDS of the chemicals to be mixed. Wear modified level C PPE (tyvec/tychem cover all, chemical resistance gloves, full face respirator. No food, drink, or ignition source near mixing area. Perform all mixing in secondary containment area.	
		2	Heavy lifting	Use proper lifting technique and use buddy for items over 50 pounds or awkward size or awkward position lifting	
		3	Splash during air mixing	Maintain low pressure and low flow of air during mixing	
7	Injection of mixed solution	1	Contact with solution and spill	Maintain good housekeeping. Wear proper PPE, inspect injection lines prior to and during injection. Use bucket to capture solution during venting the lines and wells.	
8	Pump solution into wells and read pressure and flow gauges.	1	Pressure can build up resulting in hose or flow meter failure leading to possible injury.	Start injections at low flow rate and adjust as needed. Secure cam locks to hoses or flow meters with counter pins. Never place any body part directly over well head.	
		2	Pressure can build up resulting in hose or flow meter failure leading to possible injury.	Monitor pressures and stress points of the system during injection (connections, valves, threaded fittings, etc.). When injection is complete, ensure there is no pressure prior to disassembly. If injecting into bedrock, utilize fittings at the well head that will allow you to seal off residual pressure in the well before disconnecting hoses.	
		3	Slips/trips/falls can occur due to hoses laying on the ground resulting in injury.	Practice good housekeeping techniques. For hoses used during introductions, avoid walking over hoses as much as practicable. Use high visibility marking and warning devices and secure hose if travelling across a designated facility walking area.	
9	Equipment cleaning	1	Slips/trips/falls can occur from water causing slippery surfaces. Tripping can occur from equipment being laid out for cleaning.	Be aware of surroundings when cleaning equipment. Maintain good footing and walk slowly on wet/slippery surfaces. Wear proper PPE.	
		2	Heavy lifting of equipment can cause muscle strain.	Use proper lifting techniques. Request assistance when lifting heavy equipment.	
10	Demobilization of equipment	1	Tripping on equipment laying on the ground	Secure all equipment after use. Leave the site clean and free from any trash or debris. Secure all wells, gates and entrances to the site.	
		2	Heavy lifting can cause muscle strain.	Use proper lifting techniques when loading equipment.	
		3	Contact with chemicals	Wear proper PPE	
		4	Unsecured Loading of equipment	Fasten the loose equipment inside the vehicle or in the truck	
11	Traveling back from site	1	Improperly loading the trailer can cause flying debris on the roadway. Improper trailer connections can cause the trailer to detach during the demob.	Follow JSA for Driving-Commercial Motor Vehicle. Be sure all line items on the checklist are satisfactory before departing from the site.	JSA for Driving-Commercial Motor Vehicles

Job Safety Analysis			
General			
JSA ID	Crusher Road JSA 6	Status	(3) Completed
Job Name	Environmental- Chemical Injection	Created Date	
Task Description	Chemical Injection	Completed Date	
Template	False	Auto Closed	False

PPE Personal Protective Equipment			
Type	Personal Protective Equipment	Description	Required
Dermal Protection	chemical protective suit (specify type)	Level C	Required
	long sleeve shirt/pants		Required
	splash apron		Required
Eye Protection	faceshield		Required
	safety glasses	Goggle type for splash protection	Required
Foot Protection	outer boot covers		Required
	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	PVC or equivalent	Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies			
Type	Supply	Description	Required
Communication Devices	mobile phone		Required
	walkie talkie		Recommended
Decontamination	Decon supplies (specify type)	Neutralization solution	Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	Sterile rinsing eye wash for chemical injections	Required
Traffic Control	traffic cones		Required

Job Safety Analysis

General

JSA ID	00266415-2015-02	Status	(3) Completed
Job Name	Jimmy's Dry Cleaners Construction OS	Created Date	7/17/2015
Task Description	Excavation/Trenching Oversight (Outdoors)	Completed Date	7/17/2015
Template	True	Auto Closed	False

Client / Project

Client	NYSDEC
Project Number	00266415.0000
Project Name	Jimmy's Dry Cleaners
PIC	
Project Manager	Andrew R. Vitolins

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Stewart, Ian D	5/21/2012	6/14/2010	Baxter, Jonathan P.	<input checked="" type="checkbox"/>
HASP Reviewer	Tremblay, Tony	6/28/2010	6/17/2010	Lenz, Mark R	<input checked="" type="checkbox"/>
Quality Reviewer	Crandall, James M.	6/25/2010	6/25/2010	Johnson, Gary W	<input type="checkbox"/>

Job Steps

Job Step No.	Job Step Description	Potential Hazard	Critical Action	H&S Reference
1	Utility Clearance	1 Contact with utilities can cause injury, property damage, and cause releases of hazardous substances to the environment.	Establish a minimum of three lines of evidence, and obtain additional lines of evidence as needed for site specific conditions. Maintain utility markings, perform detailed site inspections, and keep open and constant communication between operators, onsite staff, and project management. Always Use Stop Work Authority if there is a question or concern about the location of a utility.	ARCHSFS019 - Utility Clearance HS Standard
		2 Slip trip and falls while performing site clearance activities	Focus on task at hand and do not hurry through task. Avoid reading maps/drawings while walking, stop walking when looking up for overhead utilities.	
2	Excavation/Trenching and Backfilling Oversight	1 Slips trips and falls from poor housekeeping around trench or excavation.	Maintain work area and minimize clutter near excavation. Place excavated material properly and at least 2 feet away from the edge of excavation. Remove potential hazards when possible. Mark hazards when it cannot be removed. Create and maintain awareness of hazard. Maintain barriers, fall hazard warning signage and traffic controls properly. Do not cross over caution tape, safety fencing etc. Follow Project specific STAR Plan	FHSHB IV(D)
		2 Excavation or trench collapse trapping workers or creating falls.	Excavation/Trench greater than five (5) feet deep in which subcontractor, employees or others will be entering must be properly sloped, benched, shored or have a trench box in place. Sloping, benching, shoring or use of trench box is not required IF an excavation is less than five (5) feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in. Ensure a Competent Person is on site to inspect and oversee excavation/ trenching activities. Where feasible, stay six (6) feet from edge of excavation/trench. A safe means of egress, such as a stairway, ladder, or ramp, shall be located so that no more than twenty-five (25)	

				feet of lateral travel is necessary for site workers conducting activities in trenches exceeding four (4) feet in depth.	
		3	Potential high level of dust, fumes, vapors or particulates creating visibility or inhalation/contact hazards could result in exposure above occupational exposure limit or create an IDLH atmosphere.	Visually monitor air for dust, and wet excavated soil as needed to control dust. Monitor for chemical vapors if hazard exists. The atmosphere must be tested in excavations greater than four (4) feet in depth where oxygen deficiency or toxic or flammable gases are likely to be present, before workers will be permitted to enter. Ensure downwind and perimeter monitoring also performed, if atmospheric hazards exists.	
		4	Excessive noise from excavating equipment or pumps.	Make sure all authorized personnel including subcontractors are wearing hearing protection (ear plugs/muffs) when working around noisy equipment. Increase distance from noise hazard when practical.	
		5	Potential Leaks of Petroleum Fluids and Lubricants from excavating equipment and support equipment.	Make sure all authorized personnel including subcontractors perform equipment inspections looking for leaks, cracked hoses, and loose fittings. Promptly and properly repair all leaks.	
		6	Open Excavation, Unauthorized Entry, or Property Damage	Make sure all authorized personnel including subcontractors mark open excavation with demarcation tape, orange fencing, orange cones, etc. to prevent unauthorized / accidental entry. Make sure controls are adequate for traffic protection after dark or when the site is unstaffed. Backfill excavation area as soon as possible and fence off any excavation not backfilled at the end of the work day.	
		7	Contact with potentially impacted groundwater and soil.	Conduct task in a calm, cautious manner. Wear appropriate PPE. Ensure equipment is in working conditions before start of work every day. Stop work immediately and report to the site manager, if any life threatening conditions exist.	
		8	Working Around Heavy Machinery	Where feasible, maintain distance from excavation equipment in excess of the swing radius. Maintain eye contact with operators at all time. Ensure equipment is in good working condition before work begins. Wear appropriate PPE, including safety vest. Do not wear loose clothing and pull back long hair. Be aware of and avoid standing in red zones (equipment operator "blind-spots"). No personnel are permitted to stand underneath suspended loads.	
3	Stockpile Maintenance and Sampling	1	Falls climbing on or during covering of stockpile.	Avoid climbing on stockpiles when possible, keep hands free, do not hurry trough tasks such as pulling plastic sheeting up onto or over piles.	
		2	Overexertion placing plastic sheeting, weight, and straw bales.	Use proper lifting techniques, avoid twisting of body, and forceful pulling/pushing. Do not hurry through task.	
		3	Cuts, scrapes, impalement from debris in stockpiles.	Have excavation contractor remove/isolate large chunks of concrete, exposed rebar etc. from stockpile to extent practical. Inspect areas prior to kneeling or placing hands when sampling upon stockpile.	

PPE Personal Protective Equipment			
Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	When sampling groundwater	Required
	work gloves (specify type)	Leather when hand hazard exists; nitrile for soil/	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	When working near heavy equipment	Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies			
Type	Supply	Description	Required
Communication Devices	mobile phone	Remote area, check reception	Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	flashlight		Required
Personal	eye wash (specify type)		Required
	insect repellent		Recommended
Traffic Control	Other	Cones/tape to delineate trenches prior to backfill	Required

Review Comments		
Reviewer		Comments
Employee: Role Review Type Completed Date	Tremblay, Tony HASP Reviewer Approve 6/17/2010	
Employee: Role Review Type Completed Date	Crandall, James M. Quality Reviewer NA 6/25/2010	No additional comments. Very well done.

Job Safety Analysis

General

JSA ID	00266415-2015-03	Status	(3) Completed
Job Name	Jimmy's Dry Cleaners Construction OS	Created Date	7/17/2015
Task Description	Construction Inspection/ Oversight	Completed Date	7/17/2015
Template	True	Auto Closed	False

Client / Project

Client	NYSDEC
Project Number	00266415.0000
Project Name	Jimmy's Dry Cleaners
PIC	
Project Manager	Andrew R. Vitolins

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Moyers, Samuel H	12/27/2011	7/15/2011	Lenz, Mark R	<input checked="" type="checkbox"/>
HASP Reviewer	Casaletta, Robert J.	7/29/2011	7/15/2011	Kundert, Brian J	<input type="checkbox"/>
Quality Reviewer	Palmer, Peter	8/4/2011	8/4/2011	Suarez, Gustavo	<input type="checkbox"/>

Job Steps

Job Step No.	Job Step Description	Potential Hazard	Critical Action	H&S Reference
1	Accessing/egressing work location	1 Slips, trips and falls on boats, barges, construction lay down areas and steel fabrication areas	Do not hurry through task, plan routes and focus on walking task. Keep hands free.	ARC HSGE001 Tailgate Meeting
		2 Falls from ladders, scaffolds, or on stairs	Maintain 3 points of contact climbing/descending ladders, Expect boat movement when accessing barge ladders and plan movement when crossing to ladder. Use handrails on stairs, or scaffold stairs, inspect route and plan route on scaffolds.	
		3 Impacts to head, arms, legs and body from suspended or protruding construction equipment, pitching boat.	Plan route and select routes along aisle ways with adequate width. No shortcutting over or under equipment. Always maintain awareness of crane blocking and low overhangs. Stay seated during boat operations. Wear hard hat at all times, even on or in boat.	
		4 Struck by construction equipment	For vehicle and exposed worker, follow STAR Plan for project. For worker, plan routes and communicate with equipment operators.	
		5 Lack of safety briefing may result in injury	Participate in contractor safety briefings to ensure H&S requirements are met during inspection activities and awareness of planned work activities. Use TRACK for all inspection activities.	
2	Performing inspections and observations	1 Cuts and scrapes to hands while inspecting steel and concrete.	Wear protective leather gloves or equivalent gloves. Do not place hands in areas of impaired visibility.	
		2 Falls from height while inspecting steel.	100 percent tie off fall protection is required (double legged lanyard). Plan routes prior to climbing and do not hurry through task. No shortcutting or over reaching when moving at height.	
		3 Impalement or cuts, scrapes from sitting on improvised or non standard seating.	Inspect area prior to sitting for splinters, protruding nails, or similar hazard. Seating should be prefabricated and designed for that purpose or craft made by carpenter.	

		4	Struck by equipment and suspended loads	Maintain awareness of surroundings during inspections, and look up frequently for crane activity overhead. Avoid distractions such as talking on cell phones or radios during inspection work.	
3	Escorting visitors and visitor safety	1	Visitor not knowledgeable of site hazards	Escorts to provide all visitors with safety briefing even if briefing is provided by contractor or USACE. Emphasize the need to wear required PPE at all times.	ARC HSGE001 Tailgate Meeting
		2	Visitor slip trip and fall by not focusing on walking task or unfamiliarity with boat characteristics.	TRACK visitor behaviors and coach/mentor visitors if questionable behaviors are observed. Verify visitor has correct footwear for site.	

PPE Personal Protective Equipment			
Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots	with ankle support and good tread	Required
Hand Protection	work gloves (specify type)	leather or other suitable material	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	NR 30 or better	Required
Miscellaneous PPE	personal flotation device	Type III or V per SSO	Required
	traffic vest--Class II or III	II or III per SSO, see also STAR Plan	Required

Supplies			
Type	Supply	Description	Required
Communication Devices	mobile phone		Required
	walkie talkie	per SSO or contractor requirement	Required
Miscellaneous	fall protection (specify type)	requires double legged lanyard for harnesses	Required
	fire extinguisher	ABC in vehicle	Required
	first aid kit	in vehicle	Required
Personal	insect repellant		Recommended
	sunscreen		Recommended

Review Comments		
Reviewer	Comments	
Employee: Role Review Type Completed Date	Casaletta, Robert J. HASP Reviewer Revise 4/14/2010	Add to Job Step 1 : Potential hazard- Personal injury Critical Action- Conduct a Tailgate meeting to review planned work activities for the work period. Cpmplete Tailgate meeting form to document the meeting. HSP Reference ARC HSGE001 Tailgate Meeting.
Employee: Role Review Type Completed Date	Casaletta, Robert J. HASP Reviewer Approve 7/15/2011	
Employee: Role Review Type Completed Date	Palmer, Peter Quality Reviewer NA 8/4/2011	Good point on the potential hazard associated with distractions due to talking on cell phone or radios during inspections.

Job Safety Analysis

General

JSA ID	14281	Status	(2) Review
Job Name	Environment-Sample cooler handling	Created Date	8/11/2016
Task Description	Sample Cooler Handling	Completed Date	
Template	False	Auto Closed	False

Client / Project

Client	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Project Number	00266416.0000
Project Name	Former Jimmy's Cleaners
PIC	LOEWENSTEIN, DANIEL
Project Manager	VITOLINS, ANDY

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Williamson, James	8/31/2016	7/18/2017	Rigg, David	<input checked="" type="checkbox"/>
HASP Reviewer	Bobar, Aaron	9/5/2016		Royer, Richard	<input checked="" type="checkbox"/>

Job Steps


Job Step No.	Job Step Description	Potential Hazard	Critical Action	H&S Reference
1	Transfer field samples to sample packing area	1 Lifting heavy coolers may result in muscle strain especially to lower back.	Use proper lifting techniques and keep back straight. Use buddy system for large coolers, Use mechanical aids like hand trucks if readily available to move coolers. Do not over fill coolers with full sample containers for temporary movement to the sample prep area. Ensure an adequate supply of sample coolers are in field.	
		2 Hazards to hands from broken glass caused by over tightening lids or improper placement in cooler	Inspect all bottles and bottle caps for cracks/leaks before and after filling container. Do not over tighten sample lids. Clean up any broken bottles immediately, avoid contact with sample preservatives. Wear leather gloves when handling broken glass.	
		3 Exposure to chemicals (acid preservatives or site contaminants) on the exterior of sample bottles after filling.	Wear protective gloves for acid preservatives and safety glasses with side shields during all sample container handling activities (before and after filling), Once filled follow project specific HASP PPE requirements for skin and eye protection.	
		4 Samples containing hazardous materials may violate DOT/IATA HazMat shipping regulations	All persons filling a sample bottle or preparing a cooler for shipment must have complete ARCADIS DOT HazMat shipping training. Compare the samples collected to the materials described in the Shipping Determination for the Project and ensure consistent. Re-perform all Shipping determinations if free product is collected and not anticipated during planning.	
2	Sample cooler selection	1 Sample coolers with defective handles, lid hinges, lid hasps cracked or otherwise damaged may result in injury (cuts to hands, crushing of feet if handle breaks etc)	Only use coolers that are new or in like new condition, No rope handled coolers unless part of the manufacturer's handle design.	ARCADIS Shipping Guide US-001
		2 Selection of excessively large coolers introduces lifting hazards once the cooler is filled.	Select coolers and instruct lab to only provide coolers of a size appropriate for the material being shipped. For ordinary sample shipping sample coolers should be 48 quart capacity or smaller to reduce lifting hazards.	
3	Pack Samples	1 Pinch points and abrasions to hands from cooler lid closing unexpectedly	Beware that lid could slam shut; block/brace if needed; be wary of packing in strong winds. New coolers may be more prone to self closing, tilt cooler back slightly to facilitate keeping lid open.	

3	Pack Samples	2	Awkward body positions and contact stress to legs and knees when preparing coolers on irregular or hard ground surfaces.	Plan cooler prep activities. Situate cooler where neutral body positions can be maintained if practical, like truck tailgate. Avoid cooler prep on rough gravel surfaces unless knees and legs protected during kneeling.	
		3	Frostbite or potential for oxygen deficiency when packing with dry ice. Contact cold stress to fingers handling blue ice or wet ice	Dry ice temperature is -109.30F. Wear thermal protective gloves. DO NOT TOUCH with bare skin! Dry ice sublimates at room temp and could create oxygen deficiency in closed environment. Maintain adequate ventilation! Do not keep dry ice in cab of truck. Wear gloves when handling blue ice or gaging wet ice. Dry Ice is DOT regulated for air shipping, follow procedures in Shipping Determination.	
4	Sealing, labeling and Marking Cooler	1	Cuts to hands and forearms from strapping tape placement or removing old tape and labels	Do not use a fixed, open-blade knife to remove old tags/labels, USE SCISSORS or other safety style cutting device. Only use devices designed for cutting. Do not hurry through task.	
		2	Lifting and awkward body position hazards from taping heavy coolers, dropping coolers on feet during taping.	Do not hurry through the taping tasks, ensure samples in cooler are evenly distributed in cooler to reduce potential for overhanging cooler falling off edge of tailgate/table when taping.	
		3	Improper labeling and marking may result in violation of DOT/IATA HazMat shipping regulations delaying shipment or resulting in regulatory penalty	Do not deviate from ARCADIS Shipping Guide or Shipping Determination marking or labeling requirements.	
5	Offering sample cooler to a carrier or lab courier for shipment.	1	Lifting heavy coolers may result in muscle strain especially to lower back.	See lifting hazard controls above.	
		2	Carrier refusal to accept cooler may cause shipping delay and/or result in violation of DOT HazMat shipping regulations.	Promptly report all rejected and refused shipments to the ARCADIS DOT Program Manager. Do Not re-offer shipment if carrier requires additional labels markings or paperwork inconsistent with your training or Shipping Determination without contacting the ARCADIS DOT Compliance Manager.	

PPE Personal Protective Equipment			
Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies			
Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	Other	Scissors	Required

Review Comments		
Reviewer	Comments	
Employee: Role Review Type Completed Date	Bobar, Aaron HASP Reviewer Revise 8/17/2016	Will discuss externally...

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EXECUTIVE SUMMARY

This Standard sets forth the accepted practice for and establishes the requirements for workplace safety near excavations and trenches and employee and subcontractor entry into such.

It is ARCADIS' policy that ARCADIS staff will not enter excavations and trenches unless it is absolutely necessary and that an OSHA-defined Excavation Competent Person is on-site for all excavation work under ARCADIS contractual control. The competent person will be provided by the entity on site responsible for performing the excavation work unless otherwise required by the client. Thus, if an ARCADIS subcontractor is conducting the excavation work, that subcontractor will provide the competent person. If ARCADIS is self-performing the excavation services, then ARCADIS will provide a competent person whether a specialized subcontractor or authorized employee.

An excavation Competent Person must be involved in the excavation/trenching hazard assessment process. This will assist in determining the need for an engineering opinion when excavating near or adjacent to structures and determining the need and timing of inspections.

Prior to excavation, all underground installations (water, electric, telephone, gas, etc.) must be located and documented in accordance with ARCADIS Utility Clearance Policy and Standard ARC HSFS019.

All excavations over four feet in depth (or less than 4 feet in depth if deemed necessary by the Competent Person) shall be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel.

Water must not be allowed to accumulate in open excavations where employees are working. When necessary, means such as diverting natural drainage around the excavation or actively pumping water must be used to prevent or control water accumulation.


Excavated materials (spoil) must be placed no closer than 2 feet from the edge of an open excavation, and otherwise retained to prevent loose material from falling into the excavation.

Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades *when the excavations are not readily seen because of plant growth or other visual barrier*.

Any excavation over 5 feet in depth into which employees will enter that is not entirely in stable rock as defined in this Standard requires use of a protective system.

All excavations over 20 feet in depth must be designed by a registered professional engineer regardless of whether personnel will enter it or not.

All excavations over 4 feet in depth must be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency. Excavations less than 4 feet in depth must be evaluated by the competent person and at the competent person's discretion be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency.

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1. POLICY

It is ARCADIS US policy to be proactive in the identification, assessment and control of health and safety hazards and associated risks. To those means, any work involving trenching and excavation that is under the control or direction of ARCADIS or an ARCADIS subcontractor will be accomplished following, at a minimum, this Standard.

It is ARCADIS' policy that ARCADIS staff will not enter excavations and trenches unless it is absolutely necessary. If there are no suitable alternatives and it becomes necessary to enter excavations or trenches, this standard, at a minimum will be strictly followed.

It is also the policy of ARCADIS to ensure an OSHA-defined Excavation Competent Person is on-site for all excavation work under ARCADIS contractual control. The competent person will be provided by the entity on site responsible for performing the excavation work unless otherwise required by the client. Thus, if an ARCADIS subcontractor is conducting the excavation work, that subcontractor will provide the competent person. If ARCADIS is self-performing the excavation services, then ARCADIS will provide a competent person whether a specialized subcontractor or authorized employee.

2. PURPOSE AND SCOPE

2.1 Purpose

To effectively control or eliminate the hazards presented by working near or entry into excavations or trenches, this Standard sets forth the accepted practice for and establishes the requirements for workplace safety near excavations and trenches and employee and subcontractor entry into such.

2.2 Scope

This standard along with associated checklists and the Utility Location Standard (ARC HSFS019) apply to all employees of ARCADIS-US. Only trained and authorized personnel are permitted to work near or enter excavations and trenches, perform rescue services, or act as the excavation competent person.


3. DEFINITIONS

Exhibit 1 includes relevant definitions to this Standard including that for competent person qualifications.

4. RESPONSIBILITIES

4.1 Corporate H&S with Division and Practice Experts

- On a routine basis, review and update, as necessary, this standard.
- As requested by Operations Leadership, review cancelled checklists periodically to ensure conformance to this standard.
- Coordinate with the Training Group to ensure that the excavation competent person qualifications and training/retraining requirements are met.

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- Conduct excavation competent person evaluations for nominated individuals as necessary, in order to approve and designate them as competent.
- Recommend qualified training provider for excavation awareness training for employees working in or around excavation/trenching operations.
- Provide technical assistance regarding excavation and trench protocol, atmospheric testing equipment, PPE, hazard assessment and research information on unusual hazards.
- Audit project-specific excavation sites for compliance with this standard.

4.2 Principal in Charge (PIC), Project Manager (PM), and/or Task Manager (TM)

- Verify that excavation and trench protocols are properly identified and addressed within the project work plan, project health & safety plan, and/or other project-related documents.
- Verify that their divisional or project team employees have received the proper training provided by Corporate Health & Safety or qualified training source prior to conducting excavation/trenching entry activities.
- Verify that any ARCADIS employee acting as the Excavation Competent person has been designated and authorized to do so per the requirements specified in section 4.4 of this standard.
- Verify that the proper entry equipment, including personal protective equipment (PPE), atmospheric testing equipment and safety equipment, is available for use by their divisional employees.
- Verify that copies of the completed checklists are available for Corporate Health and Safety review and retained with the project files.
- Request that Corporate Health and Safety review cancelled checklists as necessary and appropriate

4.3 Health and Safety Plan Writers and Reviewers


Use this standard as guidance to ensure the appropriate identification, assessment and control of excavation and trenching hazards for documentation in project HASPs and development of task specific Job Safety Analysis (JSA).

4.4 Competent Person

Competent Person responsibilities include:


- Anticipation, identification and control of excavation and trenching hazards, as well as the signs and symptoms of exposure to the hazard(s), and the Authority to implement all corrective actions including Stopping Work.

Note: An excavation Competent Person must be involved in the excavation/trenching hazard assessment process. This will assist in

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determining the need for an engineering opinion when excavating near or adjacent to structures and determining the need and timing of inspections.

- Review existing soil sampling data (if any) or other pertinent hazard characterization information recorded by the client.
- Investigate the client's excavation/trenching protocol, to verify that any identified hazards and previous experience with earthwork at the site is properly communicated.
- Coordinate entry operations with the client's employees when both client and ARCADIS employees will be working in or near an excavation/trench.
- Offer all entrants an opportunity to review the applicable control measures and testing results and an opportunity to request a reevaluation as necessary.
- Design of structural ramps that are used solely by employees as a means of access or egress from excavations.
- Monitoring of water removal equipment and operations, if water is controlled or prevented from accumulating by the use of water removal equipment,
- Inspection of excavations subject to runoff from heavy rains.
- Daily inspections of excavations, the adjacent areas, and protective systems when required.
- If evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions are present, the Competent Person is responsible for ensuring that exposed employees are removed from the hazardous area until the necessary precautions have been taken to ensure their safety.
- Examining material or equipment used for protective systems that is damaged to evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.
- For excavations less than 5 feet (1.52 m) in depth, in which employees will be entering, a Competent Person must examine the ground to determine if there are indications of a potential cave-in hazard. If there are potential indicators of a cave-in


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hazard, the Competent Person will require some form of cave-in protection be implemented before employees can enter.

- Classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits.
- Soil and rock deposits shall be classified by a Competent Person as Stable Rock, Type A, Type B, or Type C based on the results of at least one visual and at least one manual analysis.
- If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a Competent Person. The deposit shall be reclassified as necessary to reflect the changed circumstances.
- When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved.
- Order evacuation of the excavation/trench if an uncontrolled hazard develops, either within or outside the space, or upon observing a behavioral effect of hazard exposure among excavation/trench entrants.
- Verify that all tests and precautionary measures identified on the Daily/Periodic Inspection Checklist located in Exhibit 2 and the ARCADIS Utility Location Policy and Standard ARC HSFS019 has been performed prior to authorizing subsurface work or entry into an excavation or trench.

ARCADIS employees must meet the following requirements to be a designated and approved Competent Person:

- Attend an Excavation Competent Person training course approved by Corporate Health and Safety or have equivalent training; and
- Approval by Corporate Health and Safety through demonstration of practical field experience and/or knowledge of the subject matter.
 - Documentation of the evaluation and approval of each excavation competent person will be completed using the form provided in Exhibit 3.
 - This documentation and a listing of the approved ARCADIS excavation competent person will be maintained by the Training Group; and
- If on an Environmental project where HAZWOPER training is required by ARCADIS, the Competent Person must also have completed the 40 Hour HAZWOPER training, be current on their annual 8 Hour HAZWOPER refresher and it is recommended, but

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not required, that the Competent Person completed the HAZWOPER Supervisor training course.


4.5 Site Safety Officer (SSO)

When ARCADIS and/or our subcontractor is in control of an excavation project, the SSO will be responsible for the following:

- Interface with the client representative and Competent Person to identify and understand hazards associated with the client's excavation and trenching and/or work permit programs.
- Implement the ARCADIS Utility Clearance Policy and Procedure and complete the Daily/Periodic Excavation Inspection Checklist, when the excavation project is under the control of ARCADIS.
- Verify adequate training and experience of those ARCADIS employees working in and around excavations.
- Verify that the safety procedures identified in this Standard, the site specific HASP, and applicable regulatory requirements are used when required to protect employees during excavation activities.
- Verify that the client takes the necessary precautions in notifying their employees that our employees will be installing an excavation or trench.
- Review the lockout/tagout and isolation measures implemented by ARCADIS, our subcontractor and/or the client as necessary based on proximity of utilities or other energy sources in the area of the excavation/trench.
- Immediately report any unusual or unplanned excavation or trenching hazards to both the Competent Person and the Project Manager or Task Manager.
- Keep unauthorized persons away from the excavation area.
- Confirm that the ARCADIS Utility Location Policy and Standard ARC HSFS019 has been performed prior to authorizing subsurface work or entry into an excavation or trench.
- Issue, authorize, and have the Utility Clearance and Daily/Periodic Inspection forms readily available for review
- Verify that copies of the completed clearance forms and checklists are properly disseminated to Corporate Health and Safety and retained with the project files, as specified in Section 8.0 – Records.

4.6 Employees

- Notify the PIC, PM, TM or SSO if they have not received appropriate training.
- Review the site specific HASP, task specific JSAs, and other written plans that are associated with their work.


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- Use the TRACK process regularly and frequently to recognize the hazards which may be faced during work around or in excavation/trenches, as well as to understand the signs and symptoms of exposure to airborne hazard(s).
- Never enter an excavation/trench without verifying that the required Utility Location Procedure, Daily/Periodic Inspection Checklist and required air monitoring is conducted.
- Use Stop Work Authority if excavation/trenching hazard(s) have not been appropriately addressed. Immediately consult with SSO, Competent Person and ARCADIS Project/Task Manager.
- Use the PPE, air monitoring and testing equipment that has been provided or have access to the information documenting that results are within the defined Action Levels established within the HASP.
- Maintain an awareness of all required hazard controls and consult with the Competent Person as necessary.
- If unexpected conditions arise during entry, immediately notify other entrants, evacuate the space and inform the designated Competent Person
- Obey evacuation orders given by the Competent Person, SSO, automatic alarm activation, or when self-perceived.
- At least one person on site must maintain current certification in basic first aid and cardiopulmonary resuscitation (CPR).


5. PROCEDURE

5.1 General Safety Requirements for all Excavations

- If excavation work encounters unanticipated groundwater contamination, soil contamination or other unanticipated contaminants, ARCADIS staff will Stop Work and notify the Project Manager. An appropriate work plan to sample the suspected contaminants shall be developed, samples collected by HAZWOPER trained personnel, the HASP modified and a contaminant management plan developed, as necessary.
- All surface obstructions must be moved or supported so as to protect employees and equipment.
- Prior to excavation, all underground installations (water, electric, telephone, gas, etc.) must be located and documented in accordance with ARCADIS Utility Clearance Policy and Standard ARC HSFS019.
- When excavating in areas near underground installations, proper precautions must be taken to determine the exact location of the installations and to adequately protect and support them. While an excavation is open, underground installations shall be protected, supported or removed as necessary to protect employees.

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- Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person.
- Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.
- Ladders must extend at least 36" (3 feet) above the landing surface.
- All excavations over four feet in depth shall be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel. As deemed necessary by the competent person, excavations less than 4 feet in depth will be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel.
- If personnel are working in a location exposed to vehicular traffic they must be provided with and be required to wear reflective safety vests. Adequate, signs, barriers or other equivalent traffic controls must be used to protect employees.
- Personnel are not permitted to be beneath elevated loads handled by equipment or be in excavations when heavy equipment is digging in or near the excavation.
- Mobile equipment located near open excavations must be adequately protected from falling or rolling into excavations by the use of barricades or warning devices.
- Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.
- Water must not be allowed to accumulate in open excavations where employees are working. When necessary, means such as diverting natural drainage around the excavation or actively pumping water must be used to prevent or control water accumulation.
- Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.
- All structures adjacent to an open excavation must be supported, or a registered professional engineer (PE) must determine that the structure will not be affected by the excavation activities.
- Excavated materials (spoil) must be placed no closer than 2 feet from the edge of an open excavation, and otherwise retained to prevent loose material from falling into the excavation.

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- Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier.
- Employees at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8m) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.
- Work tasks will be designed to limit the number of personnel required to enter any excavation. All tasks that can be completed remotely from outside the excavation (such as soil sampling) will be conducted in such a manner.
- Personnel will not be allowed to enter any excavation unless required protective systems and procedures are used to prevent accidents and injury.

Best Management Practice: In some instances, an excavation will not have any protective systems in place when employees will not be entering into the excavation. Even if employees are not entering into this type of excavation, a competent person should be consulted to establish a safe zone distance away from the edge of any open excavation to minimize the hazard of falling into this type of excavation. Standing at the edge of an excavation places an employee at risk of falling into the excavation, thereby subjecting themselves to the hazard of excavation/trench collapse, which then triggers the requirement for protective system use as defined in this standard. General guidance would be for employees to remain 6 feet or more away from the edge of any excavation.

- Dust control measures will be implemented during excavation and soil-moving activities as required by the Health and Safety Plan (HASP). As necessary, dust control measures will also be used to manage soil located in temporary storage areas or stockpile areas. Specific dust control measures will be detailed in the HASP. The Competent Person must be consulted prior to initiating “wet” dust control measures to discuss limits/impact to protective systems.
- Excavations cut through a firewall or containment berm/bund shall provide alternate means of containment while the job is progressing. A specific containment procedure or diversion procedure will be included as a supplement to the HASP or defined in the Remedial Work Plan.
- Excavating in archeological sites requires special consideration and compliance with local legal requirements and shall be avoided wherever possible. Archaeological investigations on federal and state lands have additional requirements. For example, permit provisions are established in federal (specifically the federal Archaeological Resources Protection Act) and some state statutes. If an artifact or archeological feature is unearthed during excavation, ARCADIS shall stop work and consult with client, regulatory agencies and professional archaeologist, as necessary.

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5.2 Excavations Requiring Protective Systems

This section defines excavations that require protective systems.

- All excavations into which employees will enter, regardless of depth, where the potential for cave-in exists.
- Any excavation over 5 feet in depth into which employees will enter that is not entirely in stable rock as defined in this Standard.
- Any excavation near a structure, (e.g. foundations, piers, footers, walls, sidewalks, tanks, roadways, etc.), as required by the registered professional engineer reviewing the stability of the excavation and the structure.
- All excavations over 20 feet in depth must be designed by a registered professional engineer regardless of whether personnel will enter it or not.
- All excavations that could potentially impact adjacent structures shall be reviewed by a registered professional engineer to determine if the stability of the structure will be affected by the excavation.
- Support systems for an adjacent structure must be designed by a registered professional engineer.

5.3 Selection and Use of Protective Systems

5.3.1 Shoring or Shielding


If shoring or shielding is selected as the protective system for an excavation, soil classification in accordance with 1926 Subpart P Appendix A is required.

One of the following options must be used for excavations which will be shored or shielded.

- Timber shoring as specified in 1926 Subpart P Appendix C must be utilized
- Hydraulic shoring, trench jacks, air shores, or shields as required in 1926.652 (c)(2) must be utilized following the system manufacturer's data
- A system which follows other tabulated data (approved by a registered professional engineer) must be utilized
- The excavation must be designed by a registered professional engineer

5.3.2 Sloping

If sloping is selected as the protective system for an excavation, the excavation sides must be sloped at a maximum of 34 degrees (1.5 Horizontal: 1 Vertical), unless the procedure listed above is followed.

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Soil classification is required for all excavations with sides which will be sloped greater than 34° (1.5 Horizontal: 1 Vertical). If it will be sloped greater than 34°, the one of the following options must be utilized:

- Option 1 - assume Type C and slope 1.5/1 - default sloping classification
- Option 2 - classify soil according to the standard and use Type A/B sloping requirements
- Option 3 – use other tabulated data with PE approval
- Option 4 – PE approval of sloping/benching design


5.4 Atmospheric Testing for Entry

All excavations over 4 feet in depth must be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency. Excavations less than 4 feet in depth must be evaluated by the competent person and at the competent person's discretion be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency.

Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

The site designated "Competent Person" and/or SSO will document initial and periodic air monitoring results for all activities requiring entry into the excavation. All atmospheric testing of excavations must be conducted in the following sequence and meet the following air quality criteria.

- Oxygen content must be between 19.5% to 23.5%
- Combustible gas or vapor less than (<) or equal to 5% of its lower explosive limit (LEL): Level D. Continue to monitor atmospheric conditions as detailed in project specific Health and Safety Plan.
- Combustible gas or vapor levels greater than (>) 5%, but < 10% of its LEL: Continuous atmospheric monitoring required; review use/implementation of engineering controls (ventilation, etc.) and PPE; evaluate potential source(s) of ignition and where feasible, remove from the area; fire extinguisher must be available; and use TRACK to assess condition/controls and proceed with caution.
- Combustible gas or vapor levels > or equal to 10% of its LEL: Stop Work; evacuate the excavation/trench; contact the Competent Person and SSO; and re-evaluate source/controls of combustible gas,
- Carbon monoxide levels must not exceed 25 ppm as an 8-hour Time Weighted Average (TWA).

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- Hydrogen sulfide must not exceed 5 ppm as a Short-Term Exposure Limit (STEL) value or 1 ppm as an 8-hour TWA.
- Toxic air contaminant levels must not exceed 50% of the PEL or the TLV for the specific contaminant (whichever is lower).

5.5 Location of Underground/Overhead Utilities

- The competent person and the project manager shall both verify that local underground facilities location/protection agencies are notified within the required time frame prior to the initiation of excavation activities and meet all requirements in the ARCADIS Utility Location Policy and Standard ARC HSFS019.
- Prior to initiation of excavation or trenching operations the competent person shall verify that all utilities have been located.

5.6 Daily/Periodic Inspections

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a Competent Person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the Competent Person:

- Prior to initiation of daily excavation or trenching operations the competent person shall complete a daily inspection of the excavation.
- During excavation or trenching operations the competent person shall complete a periodic inspection after any event (e.g., thunderstorm, vibration, excessive drying) that may affect excavation stability.

Note: In order to correctly ascertain the soil types, the competent person must identify the locations and the limits of each type of soil, and must conduct visual and all appropriate manual tests to classify the initial (opening) soil types observed.


Note: These inspections are only required when employee exposure can be reasonably anticipated. Not just in-trench exposure, but also ANY hazardous condition in the area that an employee could be exposed to.

The competent person shall complete the daily/periodic inspection checklist (A copy of the checklist is attached to this Policy as Exhibit A) – Subcontractors must complete the ARCADIS checklist or an equivalent inspection form for each inspection of excavation and trenching activities.

5.7 Soil Classification for Selection of Protective Systems

5.7.1 Soil Classification

This section describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. This

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section contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

This section applies when a sloping, benching or shoring system is utilized as a method of protection for employees from cave-ins.

5.7.2 Soil Classification Definitions

5.7.2.1 Types/Classes of Soil

5.7.2.1.1 Type Class A Soils

Type/Class A Soils are cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater. Examples of cohesive soils are: Clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if the following apply.

- The soil is fissured;
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects;
- The soil has been previously disturbed;
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4 Horizontal:1 Vertical) or greater;
- The material is subject to other factors that would require it to be classified as a less stable material

5.7.2.1.2 Type Class B Soils


Type/Class B Soils are:

- Cohesive soils with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa)
- Granular cohesion-less soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam
- Previously disturbed soils except those which would otherwise be classed as Type C soil
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration
- Dry rock that is not stable
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4 Horizontal:1 Vertical), but only if the material would otherwise be classified as Type B

5.7.2.1.3 Type/Class C Soils

Type/Class C Soils are:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less

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- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4 Horizontal:1 Vertical) or steeper


5.7.2.2 *Methods for Classifying Soils*

Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in this section. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis conducted by a competent person using tests described below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

The visual and manual analyses, such as those noted as being acceptable in this section, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

Observe the following:

- Samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine grained material is cohesive material. Soil composed primarily of coarse grained sand or gravel is granular material.
- Soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.
- The side of the open excavation and the surface area adjacent to the excavation. Crack like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.
- The area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.
- The open side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.
- The area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.


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- The area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

5.7.2.3 Classifications

- *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8 inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8 inch thread can be held on one end without tearing, the soil is cohesive.
- *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.
- *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.
- *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand operated sheervane.
- *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:
 1. If the sample develops cracks as it dries, significant fissures are indicated.
 2. Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined by using the thumb penetration or other test.

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5.7.2.4 Cohesive with Fissures vs Granular

If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

5.7.2.5 Layered system

A layered system shall be classified in accordance with its weakest layer. Each layer may be classified individually where a more stable layer lies under a less stable layer.

5.7.2.6 Reclassifying Soils

A layered system shall be classified in accordance with its weakest layer. Each layer may be classified individually where a more stable layer lies under a less stable layer.


In most instances the ARCADIS designated Excavation/Trenching Competent person will assume Type C soil, unless they have conclusive data to validate Type A or B.

5.7.2.7 Excavation Construction Based on Soil Type


The maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V). Short-term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of Part 1926. The maximum allowable slope for a soil or rock deposit must be determined from the table provided below. The actual slope must not be steeper than the maximum allowable slope. The actual slope must be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope which is at least horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P, Appendix B.

EXCAVATION SLOPE INFORMATION FROM 29 CFR 1926 SUBPART P APPENDIX B MAXIMUM ALLOWABLE SLOPES	
Soil or Rock Type	Maximum Allowable Slopes (H:V)¹ for Excavations Less Than 20 Feet Deep²
Stable Rock	Vertical (90 degrees)
Type A ³	¾:1 (53 degrees)
Type B	1:1 (45 degrees)
Type C	1½:1 (34 degrees)

- Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal (H). Angles have been rounded off.

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2. Sloping or benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.
3. A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth must be 3/4H:1V (53 degrees).

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6. TRAINING

6.1 Project - Specific Orientation

All staff working on a site where trenching and excavation activities are being conducted by ARCADIS or its subcontractors will be provided with site orientation on excavation projects and participate in daily safety meetings that include a discussion of the following:

- Site excavation hazards and procedures;
- Requirements for conducting activities remotely whenever possible;
- Client requirements and procedures for excavation activities;
- Review of applicable federal, state and/or local excavation requirements; and
- This Excavation and Trenching Standard, as appropriate

6.2 Employee Training

Besides site orientation training, additional training will be provided as follows based on the employee's activities:


- All employees who work in the area of potential excavation/trenching sites will receive awareness level training as provided and/or approved by ARCADIS Corporate H&S in order to recognize and to understand the hazards associated with trenching/excavation work.
- On an as needed basis, employees will receive site specific instruction regarding the excavation/trenching operation from the Competent Person and/or the SSO.

6.3 Competent Person Training

Competent Persons will be provided training as follows:

In order for ARCADIS employees to be assigned duties as a competent person, with respect to excavation and trenching, in addition to the criteria noted in section 4.4, personnel must attend an Excavation Competent Person training course approved by Corporate Health and Safety or have equivalent training. The course shall include, but is not limited to the following:

- Introduction to and definition of trenches and excavations.
- General requirements of OSHA 29 CFR 1926 Subpart P.
- Responsibilities and requirements of a competent person.
- Hazards associated with trenches/excavations and Identification and Assessment of these hazards.
- Hazard controls

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- Soil analysis and testing (visual and manual;
- Protective systems;
- Personal protective equipment;
- Utility location;
- Atmospheric testing;
- Water drainage and pumping;
- Site housekeeping and management;
- Communications;
- Access and egress
- Emergency Procedures.
- Inspections.

All training provided must be reviewed and approved by Corporate Health & Safety and will be managed through the Training Team.

Documentation of training certification received by attendance at any training course including externally provided training courses will be kept by the employee with copies provided to the Training Team.

7. REFERENCES

ARCADIS Health and Safety Standard [ARC HSFS010– Health and Safety Planning](#)


ARCADIS Health and Safety Standard [ARC HSFS004 – Control of Hazardous Energy \(Lockout/Tagout\)](#)

ARCADIS Utility Clearance Policy and Standard [ARC HSF019](#)

OSHA [29 CFR Part 1926 Subpart P](#) - Excavations

8. RECORDS

- 8.1** Training records will be kept by the individual employee with copies of such certificates kept by the Training Team. Training dates and times will be kept by the Training Team.
- 8.2** Completed clearance forms and checklists will be kept in the project files with copies available for Corporate H&S review.
- 8.3** Copies of all HASPs that document excavation trenching procedures will be kept in the project files.

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9. APPROVALS AND HISTORY OF CHANGE

Approved By: Anthony Tremblay, CSP, CIAQP – Corporate H&S, Director of Technical Programs



History of Change

Revision Date	Revision Number	Standard Developed/Reviewed By or Revised By	Reason for change
12 May 2008	01	Greg Ertel	Original document
13 June 2008	02		Modified Section 5.1 – 4 th bullet related to structural ramps. Modified Section 5.2 to designate a 6x factor for structural integrity of structures near the excavation. Revised Exhibit 1 to modify the definition of a Competent person
9 January 2009	03		Cleaned up definitions, deleted training requirements from Section 5.0 and moved them to Section 6.0, modified purpose statement
31 March 2011	04		Updated Competent Person training and qualification requirements in section 4.6, section 6.2 and definition in Exhibit 1.
27 March 2012	05	Tremblay	Section 4 competent person, SSO and employee responsibilities revised; Confined Space references eliminated; Training requirements clarified; use of ladders detailed; Fall prevention requirements clarified in section 5.1; depth of protective system requirement corrected to 5 feet; spoils pile must be minimum 2 feet from edge of excavation; Atmospheric Monitoring Action Levels revised; Employee Awareness Training and Competent Person Training requirements clarified
4 June 2012	06	Tremblay	Section 4.4 typo corrected; 8-hour HAZWOPER Supervisor course for competent person was made a recommended practice instead of a requirement; Section 4.5 SSO responsibilities revised to eliminate those responsibilities that belong with the Competent Person; Section 5 Best Management Guidance to maintain safe distance from the edge of excavation; checklists hyperlinked

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Revision Date	Revision Number	Standard Developed/Reviewed By or Revised By	Reason for change
18 September 2013	07	Tremblay	Tracking table format updated; Section 5.1 revised to include information about encountering unanticipated contaminants, implementing dust control measures, instituting containment measures when breaching a containment berm and avoiding excavating in archeological sites
26 September 2013	08	Tremblay	Section 5.7.2.7 Maximum Allowable Slope Table had a typo in Type C soil line H:V ratio (corrected the ratio to read 1 ½ : 1). The value of 34 degrees is correct; Header format update and pages renumbered
23 February 2015	09	Tremblay	Page numbering correction; Exhibit 2 checklist and Exhibit 3 Competent Person Checklist inserted to supplement the existing hyperlink to documents


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Exhibit 1 – Definitions

Attendant is a trained qualified individual stationed outside the excavation whose duty is to monitor authorized entrants inside the excavation or trench and have a means of communication with the designated rescue services.

Benching/Benching system means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury or otherwise injure and immobilize a person.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sides, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Competent person means one who, through education, training, and/or experience, is capable of identifying existing and predictable hazards or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.

Dry soil means soil that does not exhibit visible signs of moisture content.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal into which a person can bodily enter.

Entry constitutes the act by which an employee proceeds into an excavation or trench. Consideration of hazards, especially cave-ins and fall protection must still be considered and accounted for when equipment or personnel are near an excavation or trench, even if personnel will not be entering.


Entrants are employee's who are trained and authorized to enter a trench or excavation. Entrants must have attended a Qualified Excavation Training course offered or approved by Corporate Health and Safety.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Hazardous Atmosphere is an atmosphere which exposes employees to a risk of death, incapacitation, injury, or acute illness from one or more of the following:

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- An atmospheric concentration of any substance in excess of 50% of its established permissible exposure limit (PEL); or its assigned threshold limit value (TLV) or other value listed on the Material Safety Data Sheet (MSDS) for the chemical constituent, whichever is lower.
- A flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL).
- An airborne combustible dust at a concentration that obscures vision at a distance of 5 feet or less.
- An atmospheric oxygen concentration below 19.5% (oxygen-deficient atmosphere) or above 23.5% (oxygen-enriched atmosphere).
- An atmosphere which is immediately dangerous to life and health.

Immediately Dangerous to Life and Health (IDLH) means any condition which poses an immediate threat to loss of life; may result in irreversible or immediate-severe health effects; may result in eye damage, irritation, or other conditions which could impair escape from the space.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems and other systems that provide protection.


Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce. To oversee an excavation/trench activity the PE must have experience with and expertise in excavation, soil and stability considerations.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or shear vane.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shield can be

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either pre-manufactured or job-built in accordance with 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields".

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Soil classification system means, for the purpose of this procedure, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Submerged soil means soil which is underwater or is free seeping.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench means a narrow excavation (in relation to its length) made below the surface of the ground to which a person can bodily enter. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 meters). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 meters) or less (measured at the bottom of the excavation), the excavation is considered to be a trench.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.



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Exhibit 2 – [Daily / Periodic Excavation Inspection Checklist](#)

Daily / Periodic Excavation Inspection Checklist

		Daily / Periodic Excavation Inspection Checklist			
Project Name:		Date / Time:			
Project Number:		Location:			
Prepared By:		Project Manager:			
This checklist must be completed for all excavations. It documents that daily and periodic inspections are conducted.					
Soil Classified As:		<input type="checkbox"/> Stable Rock	<input type="checkbox"/> Type A	<input type="checkbox"/> Type B	<input type="checkbox"/> Type C
Soil Classified On:		By:			
Type of Protective System in Use	<input type="checkbox"/> Sloping	<input type="checkbox"/> Shoring	<input type="checkbox"/> Shielding	<input type="checkbox"/> Benching	<input type="checkbox"/> Other
Description:					
Inspection Item		YES	NO	N/A	Comments
Has the ARCADIS Utility Clearance Procedure been completed?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are underground installations protected from damage?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has a Competent Person been identified?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are adequate means of entry / exit available in the excavation – at least every 25 feet?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If exposed to traffic, are personnel wearing reflective vests and adequate barriers/traffic controls installed?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do barriers exist to prevent equipment from rolling into the excavation?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was air monitoring conducted prior to and during excavation entry?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was the stability of adjacent structures reviewed by a registered P.E.?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are spoil piles at least 12 feet from the excavation edge?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the excavation(s) readily visible? If no, employees must be protected from falling by guardrail systems, fences, or barricades?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If the well, pit, shaft, or similar excavation is 6 feet (1.8m) or more in depth, are employees protected from falling by guardrail systems, fences, barricades?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are work tasks completed remotely if feasible?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is a protective system in place and in good repair?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is excavation isolated from the effects of vibration?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are employees protected from falling / elevated materials?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is soil classification adequate for current environmental / weather conditions?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do portable ladders extend at least 3 feet above the excavation?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are portable ladders or ramps secured in place?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Have all personnel attended safety meeting on excavation hazards?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are support systems for adjacent structures in place?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the excavation free from standing water?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is water control and diversion of surface runoff adequate?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are employees wearing required protective equipment?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Excavation Competent Person:					Date / Time:


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Exhibit 3 – Competent Person Evaluation Form for Excavation / Trenching

Exhibit 3 – Competent Person Evaluation Form for Excavation / Trenching

Name of Employee: _____ Job Title: _____

Department: _____ Office Location: _____

Experience with Excavations/ Trenching:

Relevant Training:


Other Relevant Qualifications:

**Include documentation from employee's Supervisor that acknowledges their capacity to work as a designated competent person.*

Based on the information listed above and an evaluation of this employee's knowledge and experience, I consider them to be a Competent Person for Excavation and Trenching.

Evaluation By: _____ Job Title: _____

Signature: _____ Date: _____

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EXECUTIVE SUMMARY


This Health and Safety Standard (HSS) sets forth minimum requirements for Arcadis personnel to conduct work that involves stored energy sources, and to prevent employees from injuries by controlling the associated hazardous energy and unexpected start-up of equipment by means of Lockout/Tagout (LO/TO) procedures.

This HSS applies:

- To hazardous energy including but not limited to kinetic, electrical, chemical, thermal, hydraulic, gravitational, and pneumatic.
- When servicing or performing maintenance on equipment.
- When required to remove or bypass a guard or other safety device.
- When required to place any part of their body in an area where a danger zone exists during a machine or equipment operating cycle.

Through this standard, Arcadis requires:

- Only Authorized Employees to initiate LO/TO isolation procedures.
- Development of a written LO/TO plan [Exhibit 2](#).
- Arcadis must use the Permit to Work process, as outlined in [Exhibit 3](#) prior to initiating the energy isolation process.
- Use of a lockout device and an attached tag on all isolating devices capable of being locked out or accepting lockout devices.
- At a minimum, the use of a tagout system designed to provide full employee protection against equipment start-up, if an energy isolating device is not capable of being locked out.
- Notification of all affected personnel prior to equipment deactivation and isolation, and also prior to equipment reactivation after isolation measures have been removed.
- Those authorized to perform energy isolation will use their own locking device.
- Authorized Employee(s) are to conduct a periodic inspection of their energy control procedure(s) **at least annually** to ensure that the requirements of the established energy control procedure and the LO/TO standard are being followed. The periodic inspection (LO/TO Task Improvement Process – TIP or Periodic Inspection Checklist) shall be performed by an authorized employee other than the ones(s) utilizing the energy control procedure being inspected.
- Awareness level training of all affected employees who work in areas or with equipment where LO/TO will be performed, in order to recognize the hazards of energized and locked or tagged out equipment, and to understand the basic requirements of LO/TO.

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1. POLICY

It is Arcadis policy to be proactive in the identification, assessment and control of health and safety hazards and associated risks. To those means, any equipment that utilizes or stores hazardous energy will be controlled following this Health & Safety Standard (HSS) at any time Arcadis staff or its subcontractors must perform maintenance on this equipment. Whenever possible, Arcadis will de-energize equipment before performing maintenance, troubleshooting, or other activities where hazardous energy is present. When controlling hazardous energy, this standard, at a minimum will be strictly followed.

When fulfilling the Authorized Employee role, Arcadis will provide the necessary equipment to isolate, secure or block unexpected energization of equipment. This equipment includes but is not limited to locks, tags, chains, wedges, key blocks, plug lockouts, adapter pins, self-locking fasteners or other hardware for isolating, securing or blocking of machines or equipment to prevent incidents involving hazardous energy.

2. PURPOSE AND SCOPE

2.1 Purpose

This HSS details the administration and necessary provisions for protecting employees from injuries associated with hazardous energy release, and unexpected start-up of equipment through the use of Lockout/Tagout (LO/TO) procedures.


2.2 Scope

This standard applies to all Arcadis employees and on all projects where equipment that utilizes hazardous energy is present and maintained by Arcadis staff. Arcadis subcontractors must have LO/TO programs that meet the minimum requirements of this standard.

Only trained and authorized personnel are permitted to use the procedures outlined in this HSS for locking or tagging out equipment to ensure it does not unexpectedly energize and/or start while an Authorized Employee is performing maintenance or service activities. This standard applies specifically to employees that operate, service or maintain equipment requiring the removal or by-passing of a machine guard or protective enclosure. In addition, it applies to personnel who must place any part of their body in a place where the accidental energization of equipment, release of stored energy, or release of stored hazardous materials may cause injury.

Arcadis staff who design and develop equipment and processes that require energization, must do so to allow for LO/TO and include information as to how to LO/TO such equipment or processes.

If any device must be worked on in an electrically energized capacity, the work will be done following the Arcadis Electrical Safety Standard (ARC HSFS006). If other energized equipment must be worked on in an energized state, contact Corporate Health & Safety or the client H&S resource for guidance.

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Note: Requirements of this HSS do not apply when work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energization or startup of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

3. DEFINITIONS

Definitions relating to LO/TO can be found in [Exhibit 1](#).

4. RESPONSIBILITIES

4.1 Corporate H&S with Business Line and Practice Experts

On an annual basis, review and update, as necessary, this standard. In addition, Corporate Health & Safety along with Business Line and practice expert staff shall:

- Review LO/TO procedures in the field periodically using the Task Improvement Process (TIP) to ensure conformance to this standard;
- Provide and/or coordinate the initial LO/TO training and retraining, and/or recommend qualified training provider, to staff based on needs;
- Provide technical assistance regarding LO/TO processes; and
- As requested, assess project-specific LO/TO programs for compliance with this HSS.

4.2 Project Manager and Task Manager

The Project Manager (PM) and Task Manager (TM) shall:


- Verify that LO/TO protocols are properly identified and addressed within the project work plan, project health & safety plan, and/or other project-related documents.
- Verify that their project team employees have received the proper LO/TO training provided by Corporate Health & Safety or qualified training source prior to conducting LO/TO activities.
- Verify that the proper LO/TO equipment, including PPE, electrical testing equipment and safety equipment, is available for use by their project employees.

4.3 Health and Safety Plan Writers and Reviewers

Reference this standard as guidance and regulatory requirements to ensure the appropriate identification, assessment and control of equipment with hazardous energy for documentation in project HASPs.

4.4 Authorized Employees

Authorized employees must have training and instruction in their duties and responsibilities regarding LO/TO. Authorized employees must:

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- Recognize the hazards which may be faced during LO/TO activities.
- Develop an equipment specific LO/TO procedure for the specific LO/TO work to be done.
- Conduct a periodic inspection of energy control procedure at least annually to ensure that the requirements of the established energy control procedure and the LO/TO standard are being followed.
- Follow the requirements of this HSS, the project HASP, JSAs and any other specific LO/TO procedures applicable to the work being done.
- Use the appropriate and applicable PPE and testing equipment that has been provided.
- Conduct periodic inspections using the TIP process.

Information about Arcadis Authorized LO/TO staff can be obtained from the Arcadis Training Team.

4.5 Affected Employees


Affected Employees are responsible to:

- Understand the hazards of energized and de-energized equipment.
- Follow the instructions provided by supervisors and authorized employees who are conducting LO/TO work.
- Acknowledge LO/TO hazardous energy control work by reviewing and signing the Permit to Work.
- Not tamper with or remove LO/TO devices.
- Not perform servicing or maintenance on a machine or piece of equipment which is locked or tagged out. Servicing or maintenance work on a piece of equipment that is locked out/tagged out can only be conducted by an Authorized Employee.

4.6 All Arcadis Employees

Use the TRACK process regularly and frequently. In addition, read and understand all hazard identification and risk assessments conducted using the HARC process as documented in HASPs, JSAs, and other written plans that are associated with their work. Arcadis employees will:

- Participate in entry operations only if trained and authorized to do so;
- Never tamper with equipment that is under LO/TO control; and
- Never attempt to work on energized or de-energized equipment without appropriate training and authorization.

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5. PROCEDURE

LO/TO procedures are used to control energy hazards associated with service and maintenance of equipment which uses hazardous energy to operate. This HSS applies to all types of energy including kinetic, potential, electrical, chemical, thermal, hydraulic, gravitational, and pneumatic. The HSS applies when servicing or performing maintenance on equipment and during normal production operations if personnel are:

- Required to remove or bypass a guard or other safety device, or
- Required to place any part of their body in an area where a danger zone exists during a machine or equipment operating cycle.

5.1 General Requirements

An Energy Control Program is developed to ensure that before service or maintenance of equipment is performed, the equipment is isolated from its energy source and made inoperable so that unexpected energizing, startup or release of stored energy during equipment service and maintenance is prevented. The written LO/TO procedure template in [Exhibit 2](#) can be used to develop specific LO/TO procedures as part of the project HASP, a JSA, or to include the requirements of this HSS and our clients.

Prior to initiating the LO/TO process, Arcadis employees will complete and use the Permit to Work ([Exhibit 3](#)). Completed Permit(s) to Work will be retained in project file for a minimum of 12 months.

5.2 Equipment List

5.2.1 Hardware


Arcadis will provide, as necessary to execute project work, locks, tags, chains, wedges, key blocks, plug lockouts, adapter pins, self-locking fasteners or other hardware for isolating, securing or blocking of machines or equipment to control energy sources.

5.2.2 Lockout/Tagout - Devices

Lockout devices and tags shall be issued by Arcadis, and are the only device(s) used for controlling energy. LO/TO locks and tags must not be used for other purposes. All locks and tags provided by Arcadis are capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected. Locks and tags are of substantial construction in order to prevent inadvertent or accidental removal. All tags are required to be marked to identify the employee applying the lock(s)/tag(s). All locks will be uniquely keyed and may be color coded.

5.2.3 Lockout/Tagout - Tags

Only standard "Danger – Do Not Operate" (black, red and white) tags will be used. Tags are constructed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible. Tags will warn against hazardous conditions if the machine or equipment is energized, and will include a legend such as the following: "Do Not Start," "Do Not Open," "Do Not Close," "Do Not

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Energize,” or “Do Not Operate,” depending on application. Used tags are to be destroyed and the tags will not be re-used unless designated for re-use.

5.2.4 Energy Isolating Devices

When replacement or major repair, renovation, or modification of a machine or equipment is performed, and when new machines or equipment are installed, energy-isolating devices designed to accept a lockout device for such machines or equipment will be installed. If equipment for de-energizing is in a confined space, the confined space will be cleared of all employees prior to testing the energy source for de-activation.

5.3 General Safety Procedures for Lockout/Tagout and Isolation

Lockout/tagout isolation procedures will be initiated only by an Authorized Employee. Personnel not trained in lockout/tagout procedures are not authorized to install, inspect, repair, adjust, remove, maintain or service equipment where the potential for injury due to accidental start-up, energization, or release of stored energy exists.

All affected employees must be notified prior to equipment deactivation and isolation and must be notified prior to equipment reactivation after isolation measures have been removed. Personnel involved with lockout/tagout isolation of equipment shall receive information concerning the specific type and magnitude of energy or hazardous material involved, the hazards involved, and the method of control to be utilized.

Authorized Employees shall de-energize equipment by following the written procedure developed specifically for the equipment involved and consistent with this HSS and or other applicable laws and client requirements.


Prior to performing any work on equipment, all isolation devices shall be in place. Locks and tags shall be affixed to each energy-isolating device by Authorized Employees. These must secure the isolated equipment in the “off” position. Each person involved with servicing the isolated equipment shall attach a lock to the isolating device. In situations involving two or more persons, multiple lock hasps shall be utilized. **Tags shall be attached with all locks and must identify the authorized individual responsible for each lock, must be signed, dated and must have the name of the contractor with which the employee is employed.**

Prior to work, Authorized Employees shall verify and document that the equipment has been disengaged, de-energized, and isolated. All potentially stored or residual energy must be released, relieved or disconnected. If there is a potential of accumulation, verification of isolation shall be conducted and documented throughout the project (see the next section).

If a machine must be re-energized after initial isolation (i.e., for testing or repositioning), then LO/TO procedures must be followed as outlined to re-isolate the equipment.

5.4 General Lockout/Tagout Procedures

Specific written LO/TO procedures will be developed for each piece of energized equipment requiring maintenance or service. These specific procedures can be developed using LO/TO Procedure Template ([Exhibit 2](#)). If a client has specific written


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LO/TO procedures for its facility equipment with which employees of Arcadis are working, the procedure will be reviewed and used or revised by Arcadis, as appropriate.

The following information provides general LO/TO procedures to be used for the development of equipment specific procedures. Prior to initiating the LO/TO process, Arcadis employees will complete and use the Permit to Work ([Exhibit 3](#)).

5.4.1 Lockout/Tagout Sequence

- The authorized employee(s) shall notify all affected employees prior to the shutdown and isolation of the equipment/machine. Affected employees should be informed of the reason for shutdown and approximate length of time required for servicing or maintenance.
- The authorized employee(s) shall review the type(s) and magnitude(s) of energy present and the hazards present.
- If the machine/equipment is operating, the authorized employee(s) shall have the machine/equipment operator explain the standard shutdown procedure and then shut it down according to the procedure.
- The energy isolating devices shall be deactivated so the machine/equipment is isolated from the energy source(s).
- Each isolating device shall be locked out and tagged out. If lockout is not feasible, only tagout of the isolating device will be conducted, and additional precautions will be required to provide employee protection equivalent to the protection provided when lockout procedures are utilized. Each Authorized Employee conducting activities on the equipment/machine shall attach a(n) individually assigned safety lock to each isolating device. A standard tag shall also be attached to each individual's lock that identifies, by name, the authorized employee responsible for each lock. Stored or residual energy must be released or dissipated from each system to reach a zero energy state. Visual inspection shall be made to confirm that all moving parts have stopped. Any stored or residual energy shall be drained, blocked, repositioned, restrained, or bled. Electrical circuits shall be grounded to discharge electricity stored in capacitors.
- To ensure that the equipment is completely isolated from the energy source(s), it is necessary to test the equipment to make certain that it will not operate. The following methods shall be used to test the equipment:
 - Check the area and equipment to assure that no personnel are exposed to the start-up of equipment
 - Activate all start-up devices and operating controls
 - Use tic-tracers or voltage indicators to test electrical circuits
 - Return all operating control(s) to the neutral or off position after verifying the isolation of the equipment

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5.4.2 Release of Lockout/Tagout and Return of Equipment to Service

When the equipment/machine is ready to be returned to service at the conclusion of work activities, the following steps shall be taken to safely return equipment to service:

- Check the machine/equipment and immediate area to ensure that non-essential items and tools have been removed
- Check to ensure that all guards and covers have been replaced
- Check to ensure that all employees are safely positioned or have left the area
- Check to ensure that all operating controls are in the neutral or off position
- All authorized employees shall personally remove their individual locks and tags from the isolation devices and destroy used danger tags unless tags are designed for reuse
- All affected employees must be notified that the work activities are completed and the equipment/machine is ready for use

If work activities are not completed prior to a shift ending (or other personnel change), then the procedures in [Section 5.4.3 Transfer of Lockout/Tagout During Shift and Personnel Changes](#) must be followed.

5.4.3 Transfer of Lockout/Tagout During Shift and Personnel Changes

The supervisor shall designate an authorized employee who shall control the lockout/tagout devices at the end of a shift and shall be responsible for transferring lockout/tagout authority to the next shift.


The designated authorized employee shall not remove his/her lock from any of the isolation devices until at least one of the arriving authorized employees has locked out and tagged out all of the isolation devices.

If the arriving authorized employees assuming responsibility for lockout/tagout do not attach locks prior to the previous shift employees removing all of their locks, then the employees assuming lockout/tagout authority shall repeat the entire lockout/tagout sequence.

5.5 Group Lockout/Tagout

Authorized employees shall obtain specific site lockout instructions from the project manager or designee and shall coordinate extended lockout requirements with the project manager or designee. When more than two employees are involved in work activities on the machine or equipment covered by this HSS, each authorized employee will attach a lock to a multi-lock hasp on each isolation device.

When group lockout/tagout is used, the last authorized employee with a lock attached to isolation devices will be responsible for removing the isolation devices and restoring equipment to use conditions according to the equipment-specific or general HSS.

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When more than one crew, trade, or contractor, etc., is used on a project that requires equipment lockout/tagout, one specific employee shall be designated to coordinate affected work forces and to ensure continuity of protection.

5.6 Tagout System

Arcadis requires the use of a lockout device and an attached tag on all isolating devices capable of being locked out or accepting lockout devices. If an energy isolating device is not capable of being locked out, Arcadis requires the use of a tagout system designed to provide full employee protection against equipment start-up. When a tagout device is used on an energy-isolating device, the tag shall be attached at the same location that the lockout device would have been attached. Additional precautions will be implemented to provide a level of safety equivalent to that obtained by using a lockout device. Additional safety measures may include such steps as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or removal of a valve handle to reduce the likelihood of inadvertent energization.


Use of tagout procedures without the use of locks can only be utilized if the equipment to be de-energized will not accept a lock and the following conditions are met:

- Tagout procedures will provide protection to personnel equivalent to the use of locks.
- Additional measures, sufficient to ensure protection of employees, are taken to prevent accidental start-up or energization.
- If equipment for de-energizing is in a confined space, the confined space will be cleared of all employees prior to testing the energy source for deactivation.

5.7 Employee Unavailable to Release Lockout/Tagout

If the employee who installed a locking device is not available, the following procedure shall be used to unlock the device(s):

- The individual requesting device removal will attempt to contact the authorized employee via cell phone, hotel phone or home phone and request the employee return to remove the device. If the authorized employee is contacted but cannot come in, the status of the locked equipment will be documented and the requesting entity notified of the equipment status. All of the above including unanswered attempts at contact will be documented. If contact is not made, a message will be left to indicate that the locking device will be removed. Upon removal a red warning tag will be left where the device was placed indicating to the authorized employee that the device was removed and the equipment is now energized.
- The Project Manager or designee will verify that the authorized employee is not at the facility and is not potentially in harms way relative to the affected equipment.
- The Project Manager or designee will notify the Business Line Director of H&S or the client H&S resource of the reason for device removal and the status of the affected employee.

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- The device shall be removed after verifying that no employees are in harms way.
- The entire sequence of events will be documented in the form of a memorandum addressed to the Business Line Director of H&S.

5.8 Written Lockout/Tagout Procedure Exception

If the following elements exist, a written LO/TO Procedure is not required for a particular machine or equipment:


- The machine or equipment has no potential for stored or residual energy or accumulation of stored energy after shut down which could endanger employees;
- The machine or equipment has a single energy source which can be readily identified and isolated;
- The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment;
- The machine or equipment is isolated from that energy source and locked out during servicing or maintenance
- A single lockout device will achieve a locked-out condition;
- The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance;
- The servicing or maintenance does not create hazards for other employees; and
- There have been no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.

The Authorized Employee is responsible for ensuring the elements listed above are met prior to proceeding with LO/TO operations without a specific written LO/TO procedure. In addition, the Authorized Employee must still complete and use the Permit to Work ([Exhibit 3](#)).

5.9 Periodic Inspections

Authorized Employee(s) are to conduct a periodic inspection of their energy control procedure(s) **at least annually** to ensure that the requirements of the established energy control procedure and the LO/TO standard are being followed:

- The periodic inspection shall be performed by an Authorized Employee other than the ones(s) utilizing the energy control procedure being inspected;
- The periodic inspection shall be conducted to correct any deviations or inadequacies identified;

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- Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each Authorized Employee, of that employee's responsibilities under the energy control procedure being inspected; and
- Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in the standard.

The periodic inspection maybe completed and documented in two ways.

- LO/TO Task Improvement Process (TIP) shall be performed by an Authorized Employee other than the ones(s) utilizing the energy control procedure being inspected. The completed TIP must be entered into 4-Sight. It is recommended that a copy of the TIP be printed and placed in the project file.
- LO/TO Periodic Inspection Checklist ([Exhibit 4](#)) shall be completed by an Authorized Employee other than the one(s) utilizing the energy control procedure being inspected. The completed Periodic Inspection Checklist will be attached to and documented on the LO/TO Periodic Inspection Log. All files will be retained in the project file.

Note: The Authorized Employee conducting the inspection must document that the periodic inspections have been performed. This certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, the employees included in the inspection, and the Authorized Employee performing the inspection.

5.10 Additional Precautions


Whenever outside servicing personnel, subcontractor, contractor, or client are to be engaged in the LO/TO process, Arcadis and the outside party shall inform each other of their respective LO/TO procedures. This process will be documented using [Exhibit 5](#), LO/TO Exchange of Information Documentation.

6. TRAINING

All affected employees who work in areas or with equipment where or on which LO/TO will be performed will complete awareness level training as provided by Arcadis in order to recognize the hazards of energized and locked or tagged out equipment and to understand the basic requirements of LO/TO.

Authorized Employees will receive Lockout/Tagout – Authorized Employee training, available through the Arcadis Learning Center. In addition, staff who wish to be considered as an Authorized Employee must obtain equipment specific hands-on instruction from an Authorized Employee for the equipment he or she will work on, and participate in a lockout/tagout TIP as the Observee to verify that they understand the concepts and requirements of lockout/tagout.

Documentation of training certification received by attendance at any training course including externally provided training courses will be kept by the employee with copies provided to HR Operations (HROperations.ANA@arcadis.com) for upload to the Arcadis Learning Center.

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6.1 Retraining

Retraining is required when there is a change in job assignments, machines, or the energy control procedures, or a new hazard is introduced. Documentation of this retraining is accomplished by working with the vendor or supplier to complete or revise [Exhibit 2](#) for the relevant piece of equipment. This revised form is then attached to the Lockout/Tagout Permit to Work and both are reviewed with applicable staff prior to LO/TO activity.

7. REFERENCES (regulation citation, technical links, publications, etc.)

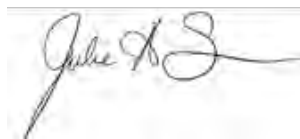
- Arcadis Health and Safety Standard [ARC HSFS010](#) – Health and Safety Plan
- Arcadis Health and Safety Standard [ARC HSFS003](#) – Confined Space Entry
- Arcadis Health and Safety Standard [ARC HSFS006](#) – Electrical Safety
- OSHA [29 CFR 1910.147](#), The Control of Hazardous Energy


8. RECORDS - DATA RECORDING AND MANAGEMENT

- Training records will be kept by the individual employee with copies of such certificates provided to HR Operations (HROperations.ANA@arcadis.com).
- Copies of all HASPs that document LO/TO procedures will be kept in the project files.
- Active specific written LO/TO procedures and JSAs will be kept with equipment or readily accessible on site.
- Historic equipment specific written LO/TO procedures and JSAs will be kept in the project file for the life of the equipment.
- Completed Permit(s) to Work shall be kept readily available for examination at the project location for a period of 12 months, and thereafter, equipment specific permits shall be kept on file for the life of the equipment.
- Lockout/Tagout Periodic Inspection Checklists will be kept with project files or 4-Sight database.

9. APPROVALS AND HISTORY OF CHANGE


Approved by: Julie Santaniello, CSP - Corporate H&S, Manager of Technical Programs



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History of Change

Revision Date	Revision Number	Standard Developed/Reviewed By or Revised By	Reason for change
1 October 2008	01	Mike Thomas / Michael Ramer	Original document
26 February 2009	02		Corrected title and document number in the Exhibit
6 October 2010	03		Addition to section 6.0
28 February 2011	04		Reviewed and Updated to new Standards Format. Added Executive Summary Section.
1 August 2011	05		Updated training section to reflect live offering
14 March 2012	06	Brent Oakeson/Tony Tremblay	Standard Reviewed; Section 5.6, bullet 3 reference changed to Authorized Employee; Definitions moved to Exhibit 1
13 April 2012	07	Tony Tremblay	Replaced terminology JLA to JSA
16 October 2012	08	Pat Vollertsen/Tony Tremblay	Section 5 - clarified that plug connected electric equipment may be exempt from this LO/TO HSS; Revision of section 6.0; LO/TO Permit to Work (refer to Exhibit 3) process instituted; Permit to Work record keeping detailed in Section 8; Exhibit 5 Exchange of Information form added
15 February 2013	09	Tremblay/Vollertsen	Inserted statement that Authorized Employee(s) to conduct a periodic inspection of their energy control procedure(s) at least annually into Executive Summary, Section 4.4 and Exhibit 2 – Equipment Specific LO/TO Procedure; Added reference to locating information about Authorized LO/TO staff from the Training Team into Section 4.4
20 February 2013	10	Pat Vollertsen/Tony Tremblay	Section 6 Retraining clarified

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<u>Revision Date</u> 29 September 2016	<u>Arcadis HS Standard No.</u> ARC HSFS004	<u>Revision Number</u> 13

Revision Date	Revision Number	Standard Developed/Reviewed By or Revised By	Reason for change
25 November 2013	11	Tony Tremblay	Section 1 Policy, Clarified that when fulfilling the Authorized Employee role, Arcadis will provide the necessary equipment to isolate, secure or block unexpected energization of equipment; Section 4.5 Affected Employee, now includes a note that Affected Employees CAN NOT service or maintain a piece of equipment that has been locked out/tagged out; Section 5.2 bullets renumbered; Section 7 OSHA Control of Hazardous Energy reference - hyperlink added; Exhibit 1: Clarified Affected Employee definition, so staff understand that they CAN NOT service or maintain a piece of equipment that has been locked out/tagged out; Authorized Employee definition includes more detail; Servicing or Maintenance definition added
13 August 2014	12	Tony Tremblay	Removed references to Qualified Employee and replaced with Authorized Employee to match terminology with OSHA standard. Exhibit 3 and 5 references to Qualified Employee changed to Authorized Employee; Authorized Employee definition had training requirements added
29 September 2016	13	Andrew McDonald/Julie Santaniello	Updated for branding and terminology consistency. Added Section 5.6 Tagout System, Section 5.8 Written Lockout/Tagout Procedure Exception, Section 5.9 Periodic Inspections and 5.10 Additional Precautions. Clarified recordkeeping requirements (Section 8). Updated Exhibits 2, 3, 4 and 5.


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Exhibit 1 – Definitions

Affected Employee operates or uses equipment that is subject to lockout/tagout procedures or works around or in the vicinity of equipment subject to lockout/tagout processes.

Note: An affected employee becomes an authorized employee when the affected employee's duties are expanded to include performing servicing or maintenance on a machine or piece of equipment which must be locked or tagged out. See the definition of an *Authorized Employee* below. Before performing service or maintenance on a piece of equipment that is locked or tagged, that employee must receive the training detailed in [Section 6](#) of this standard.

Authorized Employee is someone who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control. Arcadis HR Operations maintains a list of LO/TO Authorized Employees.

Energy Isolation Device is a mechanical device that physically prevents the transmission or release of energy. It does not include control circuit type devices, but rather physical devices that control circuit operation designed to accept a lockout device. They are installed when replacement or major repair, renovation, or modification of a machine or equipment is performed, and when new machines or equipment are installed.

Hazardous Energy covered by this standard includes, but is not limited to:

- Electrical
- Mechanical
- Hydraulic
- Pneumatic
- Chemical
- Thermal
- Gravitational (stored)
- Pressure (stored)
- Hazardous materials

Lockout Device is a device that utilizes a positive means, such as a lock, chain, block, etc. to hold an energy-isolating device in a safe position ensuring that the energy isolating device and equipment cannot be operated. All locks shall be uniquely keyed.

Servicing and/or maintenance are workplace activities such as constructing, installing, and setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the *unexpected* energization or startup of the equipment or release of hazardous energy.

Tagout Device is a prominent warning device, such as a tag, to indicate that the isolating energy device and equipment may not be operated.


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Exhibit 2 – [Template for Equipment Specific Lockout/Tagout Procedure](#)

Lockout Tagout (LOTO) Procedure



Project Name:		Project Location:	
Project Number:		Project Manager:	
Developed By:		Reviewed By:	
Origin Date:	Revision #:	Revision Date:	Revised By:
Equipment #:		Equipment Manufacture:	
Equipment Description:		Equipment Location:	
Warning: Only Authorized Employees who have been Trained and Authorized can perform the LOTO procedure below			
Equipment Diagram			
<p>Insert photos of equipment or schematic showing location of equipment to be locked out.</p> <p style="font-size: 4em; opacity: 0.3; transform: rotate(-30deg); position: absolute; top: 50%; left: 50%;">EXAMPLE</p>			
Adjacent & Associated Equipment			
Adjacent & Associated Equipment		Location of Adjacent & Associated Equipment and Action to be Taken	
Lockout Tagout (LOTO) Procedure			
Energy Source	Lockout Device	Isolation Location	Zero Energy Check, Verification & Testing

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Exhibit 3 – [Equipment Lockout/Tagout Permit to Work](#)



Equipment Lockout / Tagout (LO/TO) Permit to Work							
Equipment:		Project Number:					
Project Name:		Project Location:					
Name of Authorized Person in Control of LO/TO Process:		Name of Authorized Person applying Equip Isolation Device:					
Name of Authorized Person that verified Hazardous Energy Source is controlled:		Name of NFPA 70e Authorized Person (If Required):					
Start Date for LO/TO Procedure:		Estimated Date of Completion for LO/TO Procedure:					
Estimated Start Time for LO/TO Procedure:		Estimated Completion Time for LO/TO Procedure:					
TRACK ing the LO/TO Work Permit							
THINK THROUGH THE TASK							
Job Task: (Brief summary of what hazardous energy control work is proposed)							
WORKFORCE INVOLVED/AFFECTED BY LO/TO WORK Check all that apply							
Name	Company	Phone Number	Reviewed LO/TO Procedure	Authorized Person	70e Authorized Person	Affected Employee	Affected Employee Trained
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments/Additional Details							
RECOGNIZE THE HAZARDOUS ENERGY SOURCE (check all that apply) and ASSESS THE RISK (Low-Moderate-High)							
YES	NO	Type of Hazardous Energy	SELECT ↓	YES	NO	Type of Hazardous Energy	SELECT ↓
<input type="checkbox"/>	<input type="checkbox"/>	Electrical		<input type="checkbox"/>	<input type="checkbox"/>	Thermal	
<input type="checkbox"/>	<input type="checkbox"/>	Mechanical		<input type="checkbox"/>	<input type="checkbox"/>	Gravitational (Stored)	
<input type="checkbox"/>	<input type="checkbox"/>	Hydraulic		<input type="checkbox"/>	<input type="checkbox"/>	Pressure (Stored)	
<input type="checkbox"/>	<input type="checkbox"/>	Pneumatic		<input type="checkbox"/>	<input type="checkbox"/>	Hazardous Material	
<input type="checkbox"/>	<input type="checkbox"/>	Chemical		<input type="checkbox"/>	<input type="checkbox"/>	Other Hazard	

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Exhibit 4 – [Lockout/Tagout Periodic Inspection Checklist](#)

Lockout Tagout (LO/TO) Periodic Inspection Checklist



Periodic inspections of energy control procedure(s) are required at least annually to ensure that the requirements of the established energy control procedure and the LO/TO standard are being followed. This form must be attached to the Periodic Inspection Log. The Arcadis LO/TO TIP maybe used in place of this checklist.

All **No** responses require an update to the written LO/TO procedure.

		Yes/No	Details
1	Is all machinery or equipment capable of movement, required to be de-energized or disengaged and locked-out during cleaning, servicing, adjusting or setting up operations, whenever required?		
2	Where the power disconnecting means for equipment does not also disconnect the electrical control circuit:	--	--
2a	Are the appropriate electrical enclosures identified?		
2b	Is means provided to assure the control circuit can also be disconnected and locked-out?		
2c	Is the locking-out of control circuits in lieu of locking-out main power disconnects prohibited?		
3	Are all equipment control valve handles provided with a means for locking-out?		
4	Does the lock-out procedure require that stored energy (mechanical, hydraulic, air, etc.) be released or blocked before equipment is locked-out for repairs?		
5	Are appropriate employees provided with individual keys for personal safety locks?		
6	Are employees required to keep personal control of their key(s) while they have safety lock access?		
7	Is it required that only the employee exposed to the hazard, place or remove the safety lock?		
8	Is it required that employees check the safety of the lock-out by attempting startup after making sure no one is exposed?		
9	Are employees instructed to always push the control circuit stop button immediately after checking the safety of the lock-out?		
10	Is there a means provided to identify any or all employees who are working on locked-out equipment by their locks or accompanying tags?		
11	Are a sufficient number of accident preventive signs or tags and safety padlocks provided for any reasonably foreseeable repair emergency?		
12	When machine operations, configuration or size requires the operator to leave his or her control station to install tools or perform other operations, and that part of the machine could move if accidentally activated, is such element required to be separately locked or blocked out?		
13	In the event that equipment or lines cannot be shut down, locked-out and tagged, is a safe job procedure established and rigidly followed?		


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Exhibit 5 – [Lockout/Tagout Exchange of Information Documentation](#)



Lockout/Tagout Exchange of Information Documentation

The LO/TO standard requires that Arcadis exchange energy control procedures with outside employers who service and/or maintain equipment/machines owned by Arcadis that require LO/TO. Arcadis staff will use this form to notify all parties that they must comply with any identified restrictions and prohibitions, as outlined below. This form should be completed by an Arcadis Qualified LO/TO staff person in conjunction with the outside employer's LO/TO Authorized representative. This exchange of information must occur before service/maintenance activities begin on Arcadis-owned equipment. If Arcadis staff will also be working on this equipment or in surrounding areas, then attach this documentation form to the Equipment Specific LO/TO Procedure and the LO/TO Permit to Work.

1. Identification of Outside Employer(s):

Company: _____
 Name: _____
 Address: _____
 Telephone #: _____

2. Identify Location of Equipment:

Identify Equipment/Machine to be serviced: _____
 Hazardous energy control procedures for the equipment/machine have been exchanged with _____ (Name of Outside Employer) and _____ (New York Authority).

3. After comparing the Arcadis and Outside Employer LO/TO programs/procedures, identify any specific restrictions/prohibitions or procedural steps below:


4. _____ Persons (listed below) shall review, understand and comply with the above-identified specific restrictions/prohibitions or procedural steps.

(Printed Name)

(Signature)

5. Acknowledged acceptance of the provisions of this exchange of information form:

Outside Employer Representative _____
 (LO/TO Qualified) (Signature) (Date)
 Arcadis Authorized LO/TO Staff _____
 (Signature) (Date)


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EXECUTIVE SUMMARY

Damaging an underground or above ground utility can result in serious injury and loss of life, disrupt essential services, and create significant liability to ARCADIS, clients and subcontractors. Therefore, it is ARCADIS' policy that the following steps be completed prior to beginning any subsurface intrusive work:

- The presence of existing or known utilities will be investigated and cleared (to the extent feasible) by locating, marking, and, where appropriate, visually verifying (potholing) before the start of any subsurface intrusive work.
- A minimum of **three (3) reliable lines** of evidence are required for an acceptable utility clearance. Each location of subsurface intrusive work must have at least 3 reliable lines of evidence. All lines of evidence used during the utility clearance procedure will be recorded on the Utility and Structures Checklist of equivalent client provided checklist or permit. If a line of evidence is lost or not apparent, STOP WORK, and reestablish the line of evidence prior to resuming subsurface intrusive work. The Utility Structures and Checklist is valid for 15 business days from the date of completion.
- The lines of evidence used will be reasonable and appropriate for the conditions expected to be encountered (soil type, water table, etc.) and the type of utilities expected to be encountered (e.g., gas line versus an irrigation line).
- Contact the State One Call or equivalent service (Nationwide "811") as required by law. The State One Call or equivalent service (Nationwide "811") can only be used as a reliable line of evidence when working within the public right of way or easement.
- For point clearance (single intrusive point, used as 1 of the 3 required reliable lines of evidence) the borehole must be cleared to 110% of the diameter of the intrusive device (i.e. auger, drill head, etc.) or an additional 2 inches of overall diameter, whichever is greater.
- Utility clearance information will be documented on the ARCADIS [Utility and Structures Checklist](#) (USC) or equivalent client provided checklist or permit.
- Employees overseeing utility clearance activities will:
 - Be familiar with the contents of this standard & [ARC HSFS-019 Supplement 2](#);
 - Have one year field experience in the identification of utilities; and
 - Have training and six months experience in the proper operation and results interpretation of any clearance equipment used by ARCADIS employees, including without limitation, magnetometers and ground penetrating radar.
- All utility strikes must be reported to [Corporate Health and Safety and Legal](#) within 24 hours using the [Utility Line Strike Investigation Form](#). **Do not enter the incident into 4-Sight until approved to do so by Corporate Legal. Refer to [ARC HSFS-019 Supplement 5](#), Utility Strike Emergency Action Plan Guidelines.**

[Report Utility Incident Now](#)

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1. POLICY

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical standards within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and standards relating to work in the vicinity of subsurface, submarine or aboveground utilities.

2. PURPOSE AND SCOPE

2.1 Purpose

This standard directs general safety standards and best practices associated with the identification and management of subsurface, submarine and aboveground utilities on project sites. Utility location SOP for submarine utilities can found in [ARC HSFS-019 Supplement 6](#).

2.2 Scope

This standard assigns responsibilities and expectations for proper utility clearance by both ARCADIS employees and ARCADIS subcontractors at project sites.

3. DEFINITIONS


Definitions relating to Utility Clearance can be found in [Exhibit 1](#).

4. RESPONSIBILITIES

4.1 Project Manager Responsibilities

For every project site having the potential to come into contact with utilities, Project Managers must ensure that:

- The requirements of this standard are followed.
- Local regulations governing utility clearance are followed. This includes ensuring local and or state laws defining activities or depth of intrusive work/excavation requiring utility clearance are reviewed as they vary by location. For further information refer to [One-Call and State Law Directory](#).
- Efforts are made to work with the client, project site representatives and subcontractors to identify the nature of any utilities, and to determine what control processes need to be implemented by ARCADIS and the subcontractors to prevent damage to these utilities and to properly manage the effects in the event there is utility damage.
- Utility clearance activities are only delegated to a Task Manager or other individual meeting the requirements of section 4.2 below, as appropriate. However, even if the Project Manager delegates certain responsibilities, the Project Manager maintains primary responsibility for a complete utility clearance. For additional information on PM responsibilities and best practices refer to [ARC HSFS-019 Supplement 1](#).

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- Project Managers or designee must review the Utility and Structures Checklist with staff and AUS subcontractors (including “Sub-of-Subs” when conducting subsurface intrusive work) conducting subsurface intrusive work, prior to staff beginning subsurface intrusive work. The PM or designee review must be documented on the Utility and Structures Checklist prior to starting subsurface intrusive work.


4.2 Field Personnel Responsibilities

ARCADIS field personnel conducting work on a project site having the potential to come into contact with utilities have the responsibility to:

- Read, understand, and follow this standard and [ARC HSFS-019 Supplement 2](#) and complete the appropriate checklists during the on-site utility locate process.
- Complete a minimum of 1 year of utility clearance related experience before accepting responsibility for any utility clearance tasks.
- Complete training and have 6 months of experience in operating and interpreting the results of remote sensing technologies, including without limitation, magnetometers and ground penetrating radar, before operating such technologies. Field staff should understand the technologies being utilized by a private utility locate contractor, and how they are operating in comparison with the site conditions. Refer to [ARC HSFS-019 Supplement 3](#) for more information.
- Prior to beginning subsurface intrusive work the Utility and Structures Checklist must be completed and signed off on by the staff member completing or overseeing the clearance. Confirm that the Utility and Structures Checklist was reviewed by the Project Manager or designee as discussed in Section 4.1 above. Review the Utility and Structures Checklist daily during subsurface intrusive activities to insure all utilities are identified and markings are present.
- Use their STOP WORK Authority to eliminate any reasonable concern if utilities cannot be reasonably located and contact the Project Manager to review the STOP WORK situation and confirm the direction of action moving forward.
- Ensure that ARCADIS subcontractors conduct their own reasonable independent utility clearance efforts as required by ARCADIS' standard subcontract, and are aware of any ARCADIS clearance standards used onsite.
- Be on site during utility locate activities, and any active subsurface intrusive activities involving contractor under contract to ARCADIS.

4.3 ARCADIS Subcontractor Responsibilities

According to ARCADIS' standard subcontract, subcontractors have agreed to take responsibility for any damages resulting from a utility impact caused by their work. Therefore, ARCADIS subcontractors are expected to take reasonable time and diligence to conduct their own independent utility clearance using reasonable standards and processes. Subcontractors have the responsibility to

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stop their work if utility concerns are identified and will report those concerns to the ARCADIS employee overseeing their work activities. ARCADIS staff should reinforce these responsibilities with subcontractors during job safety briefings.

In jurisdictions where the actual contractor performing the subsurface intrusive work activity is required to perform utility clearance notifications, the contractor will perform the clearance notification and will provide evidence of the notification to ARCADIS (ticket or ticket number, etc.). Refer to [ARC HSFS-019 Supplement 4](#) for Best Practices for State One Call procedures.

5. STANDARD

5.1 General

Protocols to be followed during utility clearance activities are outlined in:


- Best Practices for Project Managers (or Their Delegates) Concerning Utility Clearance ([ARC HSFS-019 Supplement 1](#)).
- Best Practices for Field Personnel Concerning Utility Clearance ([ARC HSFS-019 Supplement 2](#)).
- Use and Limitations of Common Underground Locating Technologies and Clearance Methods ([ARC HSFS-019 Supplement 3](#))
- Best Practices for State One Call Procedures ([ARC HSFS-019 Supplement 4](#))
- Emergency Action Plan guidelines for Utility Strikes ([HSFS-019 Supplement 5](#))
- Utility Location Standard Operating Procedure for Aquatic Work Activities ([ARC HSFS-019 Supplement 6](#))

5.2 Lines of Evidence

A minimum of 3 lines of evidence are required for an appropriate utility clearance as defined in this standard. Each location of subsurface intrusive work must have at least 3 reliable lines of evidence. All lines of evidence used during the utility clearance procedure will be recorded on the Utility and Structures Checklist of equivalent client provided checklist or permit. If a line of evidence is lost or not apparent, STOP WORK, and reestablish the line of evidence prior to resuming subsurface intrusive work. Generally, the following lines of evidence may be used to meet this minimum utility clearance requirement.

1. Contacting the State One Call or equivalent service (Nationwide “811”) is required by law, regardless if it will be used as a line of evidence. Contacting the State One Call or equivalent service (Nationwide “811”) is an acceptable reliable line of evidence when working within the public right of way or easement. Note that One Call can provide valuable information regarding locations and types of utilities entering the private property.

View the
[Utilities and Structures Checklist](#)


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Note: For work on private property or in areas not served by State One Call or equivalent service, consider using a reputable private utility locating company to locate and mark the utilities. Use of a private utility locator is encouraged for all projects with subsurface or submarine utilities. When working with a private locator it is best practice to pre-plan clearance areas, review required clearance equipment and the re-clearing/confirmation of any public utility mark outs (State One Call or equivalent service Nationwide “811”);

2. Use detailed scaled site utility plans, preferably in the form of an “as-built” or “record” drawing, to identify and/or confirm utility locations. Document request and/or receipt of utility drawings from the property owner/client on the Utilities and Structures Checklist;
3. Interview(s) with knowledgeable site or client personal. The following questions should be asked during the interview and answers documented on the [Utility and Structures Checklist](#):
 - Employees(s) Name and Affiliation(s) with the site
 - Types of utilities , including utility composition and location of utilities onsite
 - Depths of known utilities
 - Any other pertinent information regarding utilities on the site; or
4. Conduct a detailed visual site inspection of areas around all planned subsurface intrusive work points or areas to identify and/or confirm utility locations. For underground utilities, conduct an inspection for structures that tend to indicate the presence and general location of such utilities, including, but not limited to manholes, vaults, valve covers, valve markers, telephone pedestals, transformer housings, fire hydrants, spigots, sprinkler heads, air relief valves, backflow preventers, meters, downspouts going into the subsurface, power poles with wiring going into the subsurface and line markers. Saw cut lines and concrete /asphalt repairs often yield valuable information regarding utility locations. Always discuss the presence of utilities with the site owner, operator and/or occupant to identify any potential utilities that might not be readily identified by non-intrusive clearing methods or may be:
 - At depths > 5 ft. below ground surface; or
 - At very shallow depths (< 2ft below ground surface) such as communication lines, electrical conduits/wiring, irrigation lines, etc.

If one of the above lines of evidence cannot be utilized, or if using the above lines of evidence does not adequately identify utilities with reasonable certainty, one or more additional lines of evidence must be utilized. Commonly used lines of evidence are listed on the [Utility and Structures Checklist](#).

A discussion of use and limitations associated with common utility location and clearance methods is provided in [ARC HSFS-019 Supplement 3](#).

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Standard operating procedures for utility location in subaquatic settings are presented in [ARC HSFS-019 Supplement 6](#).





The lines of evidence will be recorded on the Utility and Structures Checklist or equivalent client provided checklist or permit.

Note: If a line of evidence is lost, utility markings removed / worn, or area of previous clearance not confirmed, STOP WORK and reestablish the line(s) of evidence prior to resuming subsurface intrusive work. Each location of subsurface intrusive work must have 3 reliable lines of evidence. All lines of evidence used during the utility clearance procedure will be recorded on the Utility and Structures Checklist of equivalent client provided checklist or permit. If a line of evidence is lost or not apparent STOP WORK, and reestablish the line of evidence prior to resuming subsurface intrusive work. The Utility Structures and Checklist is valid for 15 business days from the date of completion.

5.3 Color Codes Used for Utility Markings

The following colors are used for marking utilities. Some government agencies or large industrial facilities may use additional colors not provided below. ARCADIS policy is to assume any paint marking or pin flag color not provided below is a subsurface utility marking until proven otherwise.


If utilities or subsurface anomalies are identified but the utility type or anomalies are not classified it is recommend that a pink (Temporary Survey Marking) marking be used. Once the type of utility is established the pink marks should be repainted / remarked to represent the correct type of utility.

COLOR	Utility Line
WHITE 	Proposed Excavation
PINK 	Temporary Survey Markings
RED 	Electrical Power Lines, Cables, Conduit and Lighting Cables
YELLOW 	Gas, Oil, Steam, Petroleum or Gaseous Materials
ORANGE 	Communication, Alarm or Signal Lines, Cables or Conduit
BLUE 	Potable Water
PURPLE 	Reclaimed Water, Irrigation and Slurry Lines
GREEN 	Sewer and Drain Lines

APWA and ANSI standard Z-53.1

5.4 Locating Technologies

There are several types of locating technologies that can be used to identify and locate utilities in the subsurface. Project teams need to work closely with private utility locators (PUL) in order to best match locating technology with site conditions. To provide the best results all possible locating technologies should be available for use and implementation at the project location. Any potential

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interferences should also be discussed up front and then at the project site during utility location activities. Potential interferences could be soil moisture, soil type, standing water on concrete/asphalt, rebar, fencing, and metal structures that are in the subsurface. Employees overseeing locating technology activities should have an understanding of device operation and limitations. For further information refer to [ARC HSFS-019 Supplement 3](#), Use and Limitations of Common Utility Location Technologies and Clearance Methods.

5.5 Clearance Methods

In some cases, proposed subsurface intrusive locations may be pre-cleared using other intrusive methods. Determine the clearance or soft dig method based on site conditions and utilize the least invasive method possible. The number of subsurface intrusive locations and soil type should be taken into consideration. The following clearance methods are listed from least invasive to most:


1. Vacuum Extraction/Potholing (air or water based),
2. Air knifing,
3. Hydro knifing,
4. Probing,
5. Hand auguring
6. Hand digging, and
7. Posthole digging.

Single point clearance must be 110% of the proposed subsurface intrusive area, or the diameter plus 2", whichever is greater. 3-Point clearance must be installed in a triangular pattern around the proposed borehole and in a configuration not to allow for utilities to enter the borehole. 3-Point clearance must be 110% of the proposed intrusive area, or the diameter of the intrusive area plus 2", whichever is greater. Each method of clearance should be documented on the Utility and Structure Checklist.

Manual clearing methods such as shoveling, using pick axes, digging bars and other hand tools should be avoided completely or only used when absolutely necessary and used with caution. Excessive down force, prying or use in poor/obstructed visibility conditions is prohibited as these tools can damage utilities.

Surface cover (e.g., asphalt) removal methods within the 30-inch Tolerance Zone that pose excessive down force such as Jackhammering should be used with extreme caution. Methods that only cut the surface cover (coring or saw cutting) present less risk due to the absence of the downward force which could cause collateral damage to shallow subsurface utilities. Note that utilities are often present at the concrete or pavement/soil interface or encased within the concrete or pavement and are easily damaged during concrete coring or pavement removal. Always work slowly, methodically and frequently STOP WORK to evaluate conditions during these work activities.

For borings and excavations, if the utility is known to be at depths where hand clearing is not feasible or creates additional safety concerns, no work will be performed within the 30 inch Tolerance Zone vertically or horizontally of the utility unless manual clearing is performed under the oversight of an Excavation Competent Person as defined in [ARC HSCS005 ARCADIS Excavation and Trenching](#).

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5.5.1 Temporary Backfilling of Pre-Cleared Boreholes


In some cases, it may be necessary to temporarily backfill a pre-cleared location until the remaining subsurface activities are performed. At these locations where subsurface intrusive work does not immediately follow pre-clearance, it is important to properly backfill and mark the pre-cleared location in order to relocate the pre-cleared location. In general, wooden stakes, survey markers, whiskers, paint marking or other surficial markings alone are inadequate because these markings can be easily removed, damaged or otherwise lost leading to uncertainty regarding the pre-cleared location. Although the specific steps for backfilling a pre-cleared location will depend on site specific conditions, use the following additional steps to prevent loss of the pre-cleared location:

- Backfill a pre-cleared location with clean sand or other granular material that is significantly different than the surrounding subsurface native material. Native soil should not be used to backfill a pre-cleared location that may require further subsurface work.
- Backfill the top 2 feet of a pre-cleared location with dyed sand or gravel to facilitate re-location.
- Use hammered wooden stakes or delineators to mark locations as an additional measure, if practical.
- In the event that the pre-cleared borehole is located on asphalt or concrete and an asphalt cold patch is required, use white paint to mark the intrusive location with a circle over the asphalt cold patch.
- In some instances, such as projects potentially affected by unexploded ordinance (UXO), the pre-cleared borehole may require that a PVC of matching diameter pipe be inserted into the pre-cleared borehole, filled with clean sand and affixed with a matching cap. Contact the project manager to identify any client-specific requirements.
- Always use a physical subsurface marker such as described above to identify the pre-cleared borehole location. Never rely solely on field measurements or GPS coordinates.
- If a utility or anomaly/obstruction is encountered during the pre-clearing process, backfill the hole with the native soil and mark the location with a pink painted X and/or NO.

In the event that a previously pre-cleared location cannot be located, the location must be re-cleared prior to performing subsurface intrusive work.

5.6 Acceptable Clearance for Working in Vicinity of Subsurface Utilities

Prior to the start of subsurface intrusive activities (i.e. excavations, vertical drilling, installing grounding rod, etc.), all utilities must be located and measures instituted to avoid subsurface utility hazards. Do not conduct subsurface work within 30 inches of a line marking in all directions. If the centerline of the utility is marked, the diameter of the utility or utility bank must be incorporated into the 30 inch Tolerance Zone, See Figure 1 located in [Exhibit 2](#). If subsurface work must take place within the 30 inch Tolerance Zone of the line marking, the utility must be exposed (potholed) by soft dig / clearance methods prior to starting subsurface intrusive work (see Section 5.5 for options); **no mechanized equipment is permitted for the exposing of the utility**. Once the utility has been exposed, if mechanized equipment is planned for use within the 30 inch

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Tolerance Zone of the utility, such activity must receive pre-approval by Corporate H&S, as necessary, to mitigate or accept the risk associated with the planned work. Additional excavation safety procedures may have to be developed as part of the approval to proceed. It should be noted that any disturbance within the 30 inches or disruption of the bedding materials could affect the integrity of the utility.


For horizontal borings, to avoid striking a utility, damage from vibration, damage by pressure of the advancing boring, do not drill within 30 inches in all directions (3D cylinder) of a line marking. Make sure to factor the diameter of the line or utility bank when computing 30 inch Tolerance Zone. When crossing a utility during horizontal drilling it is recommended that the utility be exposed 30 inches in a 360° direction. When exposing utilities for horizontal borings the utility must be exposed (potholed) by soft dig / clearance methods. This recommendation applies even if the operating contractor has technology that places the location to within a few inches. Make sure to factor the diameter of the utility when determining the 30 inch Tolerance Zone. If subsurface work must take place within the 30 inch Tolerance Zone of the line marking, the utility must be exposed (potholed) by soft dig / clearance methods prior to starting subsurface intrusive work (see Section 5.5 for options); **no mechanized equipment is permitted for the exposing of the utility**. Once the utility has been exposed, if mechanized equipment is planned for use within the 30 inch Tolerance Zone of the utility, such activity must receive pre-approval by Corporate H&S, as necessary, to mitigate or accept the risk associated with the planned work. Additional excavation safety procedures may have to be developed as part of the approval to proceed. It should be noted that any disturbance within the 30 inches or disruption of the bedding materials could affect the integrity of the utility.

Additional cautions for horizontal borings include gravity utilities such as sewers and storm drains as the depth of these utilities will change (sometimes significantly) as they run across the project site. Always obtain the utility depth at the location where the boring will actually cross the line by collecting sewer depth inverts from identified manholes and interpolating those depths to the area of the subsurface intrusive work.

During well installations and well abandonment via mechanical equipment, the 30 inch Tolerance Zone rule applies outward from the outside edge of the largest diameter auger or tool to be used for installation and abandonment (over drilling). In cases where wells have been previously installed and the 30 inch rule has not been followed, work proposed using mechanized equipment to work within the 30 inch Tolerance Zone will require approval from Corporate H&S.

5.7 Acceptable Clearance for Working in Vicinity of Overhead Power Lines

No work will be performed by ARCADIS or our subcontractor near overhead power lines where any Unqualified Person or equipment is within the limits specified below, unless the power line has been properly covered or de-energized by the owner or operator of the power line. Qualified Person approach distances are defined in Exhibit 5A and 5B of [ARC HSFS0006 Electrical Safety Standard](#).

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Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI standard B30.5-1994, 5-3.4.5


5.7.1 Reducing Vehicle and Mechanical Equipment Clearance Requirements

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 ft. (305 cm) is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10kV over that voltage. However, under any of the following conditions, the clearance may be reduced:

- If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. (122 cm). If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10 kV over that voltage.
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.
- If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance (between the uninsulated portion of the aerial lift and the power line) may be reduced to the distance given in OSHA 1910.333(c)(3)(ii)(C) Table S-5. Reference information from OSHA 1910.333 Table S-5 and NFPA 70E Table 130.4(C)(a) for alternating-current systems and 130.4(C)(b) for the distances associated with direct-current voltage Systems is included as Exhibit 5 of [ARC HSFS0006 Electrical Safety Standard](#).

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments unless:

- The employee is using protective equipment rated for the voltage; or
- The equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the line than permitted in this section of this standard.

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If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

When a machine is in contact with an overhead power line, do not allow anyone to come near or touch the machine. Stay away from the machine and summon outside assistance.

5.8 Reporting Utility Incidents

ARCADIS field personnel involved with any subsurface, submarine, and above-ground utility strikes should immediately STOP WORK and contact the Project Manager to discuss the incident. The utility strike must be reported to Corporate Health and Safety and Legal Departments immediately, and no later than 24 hours. Use the [Utility Line Strike Investigation Form](#) as part of the notification process.

Selected utility strike incidents may also utilize a conference call with operations management to review findings and lessons learned. The Divisional Health and Safety Director will make the determination concerning the need to have the incident review call, and will arrange the call, if deemed necessary.


5.9 Relationship of this standard to the Project Specific HASP

With the exception of the Utility and Structures Checklist, this standard, including most supplements, are not designed to be printed off and attached to project HASPs. During project health and safety planning, this standard will be reviewed and applicable clearance technologies and methods will be documented on the Utility and Structures Checklist.

Additionally, emergency action standards specific to utility strikes should be addressed. [ARC HSFS-019 Supplement 5](#) provides general guidelines for emergency response to utility strikes. Applicable information may be attached to the Utility and Structures Checklist to facilitate communication of response expectations.

5.10 Required Contract Terms and Conditions

ARCADIS' standard client and subcontractor contracts contain required terms and conditions defining responsibility for utility clearance and the allocation of risk associated with an impacted utility. These terms and conditions have prescribed language concerning subsurface work that is presented in ARCADIS client contracts and ARCADIS subcontractor contracts, which can be found on the [Legal Source](#) site. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions should be identified, such as limits of liability, add additional physical investigations, additional lines of evidence or utility location, assignment of risk to subcontractors, etc. In addition, any changes to these terms and conditions require approval by Legal Services.

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6. TRAINING

Employees responsible for coordinating or conducting utility clearance activities will be familiar with the requirements of this standard. ARCADIS in-house 8-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) refresher provides awareness-level training regarding this utility location and clearance standard.


7. REFERENCES

- [Utility and Structures Checklist](#)
- [Utility Line Strike Investigation Form](#)
- [ARC HSFS-019 Supplement 1](#), Best Practices for Project Managers (or Their Delegates) Concerning Utility Clearance
- [ARC HSFS-019 Supplement 2](#), Best Practices for Field Personnel Concerning Utility Clearance
- [ARC HSFS-019 Supplement 3](#), Use and Limitations Associated with Location Technologies and Common Utility Clearance Methods
- [ARC HSFS-019 Supplement 4](#), Best Practices for State One Call Procedures and Notifications
- [ARC HSFS-019 Supplement 5](#), Emergency Action Plan guidelines for Utility Strikes
- [ARC HSFS-019 Supplement 6](#), Utility Location SOP for Aquatic Work Activities
- Figure 1 - 30 inch Tolerance Zone
- [ARC HSCS005 Excavation and Trenching](#)
- [One-Call and State Law Directory](#)

8. RECORDS

8.1 Utility Clearance Records

All records (maps, checklists and documentation of communications) used to determine the location of utilities should be retained and kept in the project file.

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9. APPROVALS AND HISTORY OF CHANGE

Approved By: Tony Tremblay, CSP – Corporate H&S, Director of Technical Programs



History of Change

Revision Date	Revision Number	Standard Developer or Revised By / Approver	Reason for change
13 December 2006	01	Mike Thomas/Pat Vollertsen	Original document
26 March 2007	02	Mike Thomas/Pat Vollertsen	Put in new company format
15 May 2007	03	Mike Thomas/Pat Vollertsen	Added nation-wide 811 number
6 September 2007	04	Mike Thomas/Pat Vollertsen	Changing over to new template format
22 February 2008	05	Mija Coppola	Changing over to new template format
13 January 2009	06	Mija Coppola	Define lines of evidence
4 October 2010	07	Sam Moyers/Mija Coppola	Reformatting and addition of utility clearance information
13 February 2012	08	Sam Moyers/Mija Coppola	Modified link information for utility strike reporting, clarified local/state requirements in section 4.1 and 4.3
28 January 2013	09	Tony Tremblay	Utility and Structures Checklist revised; hyperlink updated
12 February 2013	10	Amanda Tine/Tony Tremblay	Clarified clearance boundaries for Unqualified staff in Section 5.7 and added information about vehicles and equipment being used near power lines in Section 5.7.1

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Revision Date	Revision Number	Standard Developer or Revised By / Approver	Reason for change
15 March 2013	11	Kurt Merkle, Rebecca Lindeman / Tony Tremblay	Added additional text to standard for recent lessons learned, added section 5.4 (Locating Technologies) and 5.5 (Clearance Methodologies), added additional details to section 5.6 when working in close proximity to subsurface utilities, and added Supplement 6 - Utility Location SOP for Aquatic Work Activities.
07 July 2013	12	Andrew McDonald/ Tony Tremblay	Removed HSFS-019 Supplement 1, Utility Definitions. Added hyperlink for One-Call and State Law Directory. Segregated evidence of sewer or storm drains in USC list. Removed Sam Moyers and added Andrew McDonald as author.
26 September 2014	13	Andrew McDonald/Tony Tremblay	Added Exhibit 1. Definitions and 30 inch tolerance zone. Clarified use of 811 or state one call as a reliable line of evidence. Added best practice to cover backfilling of pre-cleared boreholes. Updated USC list to cover soft dig termination depths and PM review.
23 February 2015	14	Tony Tremblay	Page number correction


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EXHIBIT 1 – DEFINITIONS

Above Ground Utilities - For the purpose of this procedure, above ground utilities include, but are not limited to: any above ground line, pipe, conduit, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications signals, electricity, gas, liquid, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, sanitary sewage, storm water, or other materials, liquids, or gases.

Subsurface Utilities - For the purposes of this procedure, subsurface utilities include, but are not limited to: any underground line, pipe, conduit, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications signals, electricity, gas, liquid, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, storm water, or sanitary sewage; underground storage tanks; tunnels and cisterns; and septic tanks and lines.

Tolerance Zone – The area within 30 inches in all directions from the outside diameter of a located/marked utility in which special care is to be taken. If the centerline of the utility is marked, the diameter of the utility or utility bank must be incorporated into the 30 inches. This area must be hand cleared with non-mechanized equipment. Once the utility has been exposed, if mechanized equipment is planned for use within the 30 inch Tolerance Zone of the utility, such activity must receive pre-approval by Corporate H&S, to mitigate or accept the risk associated with the planned work. See Figure 1 – 30" Tolerance Zone.


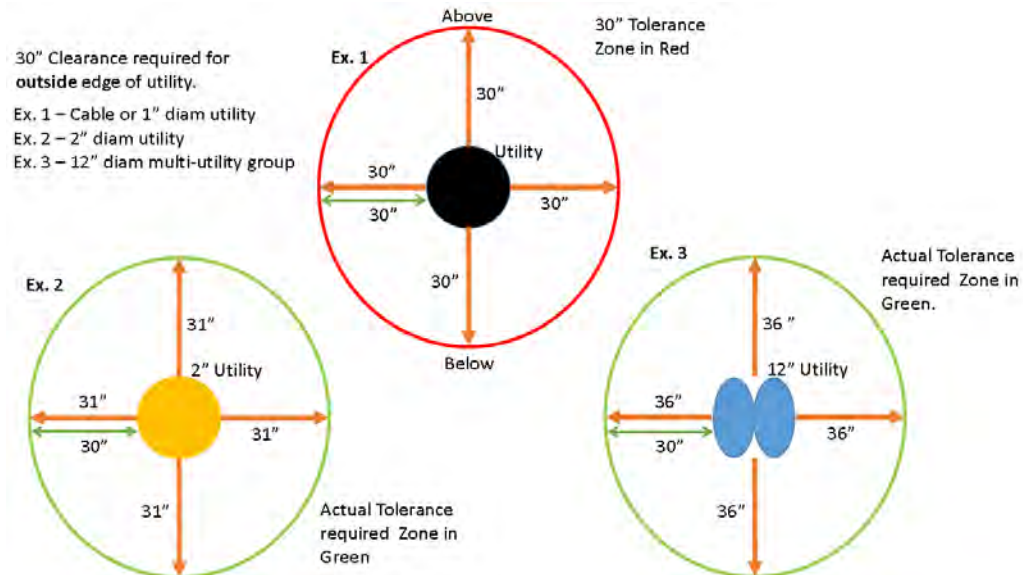

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EXHIBIT 2 – TOLERANCE ZONE (Figure 1)



	<h1 style="text-align: right;">RemOx® L</h1> <h2 style="text-align: right;">ISCO Reagent</h2>
	<p style="text-align: center;">EC- SAFETY DATA SHEET according to Regulation (EC) № 1907/2006 of the European Parliament and of the Council, of 18 December 2006 concerning REACH</p>
	<p style="text-align: right;">Material Safety Data Sheet Page 1 of 8</p>

Section 1 Chemical Product and Company Identification

PRODUCT NAME: RemOx® L ISCO Reagent TRADE NAME: RemOx® L ISCO Reagent		Revision Date: April 2008												
USES OF SUBSTANCE: RemOx® L ISCO Reagent is a liquid oxidant recommended for in-situ and ex-situ remediation of sites that require a strong oxidant.														
COMPANY NAME (Europe): CARUS NALON S.L. COMPANY NAME (US): CARUS CORPORATION	<table border="0"> <tr> <td>COMPANY ADDRESS:</td> <td>Carus Nalon S.L. Barrio Nalon, s/n 33100 Trubia-Oviedo Espana, Spain</td> </tr> <tr> <td>INFORMATION:</td> <td>(34) 985-785-513 (34) 985-785-513 www.caruseurope.com (Web) carus@carusnalon.com (Email)</td> </tr> <tr> <td>EMERGENCY TELEPHONE:</td> <td>(34) 985-785-513</td> </tr> <tr> <td>COMPANY ADDRESS:</td> <td>315 Fifth Street Peru, IL 61354, USA</td> </tr> <tr> <td>INFORMATION:</td> <td>(815)-223-1500 www.caruscorporation.com (Web) salesmkt@caruscorporation.com (Email)</td> </tr> <tr> <td>EMERGENCY TELEPHONE:</td> <td>(800) 435-6856 (USA) (800) 424-9300 (CHEMTREC, USA) (815)-223-1500 (Other countries)</td> </tr> </table>		COMPANY ADDRESS:	Carus Nalon S.L. Barrio Nalon, s/n 33100 Trubia-Oviedo Espana, Spain	INFORMATION:	(34) 985-785-513 (34) 985-785-513 www.caruseurope.com (Web) carus@carusnalon.com (Email)	EMERGENCY TELEPHONE:	(34) 985-785-513	COMPANY ADDRESS:	315 Fifth Street Peru, IL 61354, USA	INFORMATION:	(815)-223-1500 www.caruscorporation.com (Web) salesmkt@caruscorporation.com (Email)	EMERGENCY TELEPHONE:	(800) 435-6856 (USA) (800) 424-9300 (CHEMTREC, USA) (815)-223-1500 (Other countries)
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Section 2 Hazards Identification

<ol style="list-style-type: none"> 1. <u>Eye Contact</u> RemOx® L ISCO Reagent is damaging to eye tissue on contact. It may cause burns that result in damage to the eye. 2. <u>Skin Contact</u> Momentary contact of solution at room temperature may be irritating to the skin, leaving brown stains. Prolonged contact is damaging to the skin. 3. <u>Inhalation</u> Acute inhalation toxicity data are not available. However, airborne concentrations of RemOx® L ISCO Reagent in the form of mist may cause irritation to the respiratory tract. 4. <u>Ingestion</u> RemOx® L ISCO Reagent if swallowed, may cause burns to mucous membranes of the mouth, throat, esophagus, and stomach.
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Section 3 Hazardous Ingredients

<u>Material or Component</u>	<u>CAS No.</u>	<u>%</u>	<u>Hazard Data</u>
Sodium Permanganate	10101-50-5	40	PEL/C 5 mg Mn per cubic meter of air TLV-TWA 0.2 mg Mn per cubic meter of air
<u>HAZARD SYMBOLS:</u>			
			
<u>RISK PHRASES:</u>			
8 Contact with combustibles may cause fire.			
22 Harmful if swallowed.			
50/53 Very toxic to aquatic organisms, may cause long-term effects in the aquatic environment.			
<u>SAFETY PHRASES:</u>			
17 Keep away from combustible materials.			
24/25 Avoid contact with skin and eyes.			
26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice			

Section 4 First Aid Measures

1. <u>Eyes</u>	Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Do not attempt to neutralize chemically. Seek medical attention immediately. Note to physician: Decomposition products are alkaline.
2. <u>Skin</u>	Immediately wash contaminated areas with water. Remove contaminated clothing and footwear. (Caution: Solution may ignite certain textiles). Wash clothing and decontaminate footwear before reuse. Seek medical attention immediately if irritation is severe and persistent.
3. <u>Inhalation</u>	Remove person from contaminated area to fresh air. If breathing has stopped, resuscitate and administer oxygen if readily available. Seek medical attention immediately.
4. <u>Ingestion</u>	Never give anything by mouth to an unconscious or convulsing person. If person is conscious, give large quantities of water or milk. Seek medical attention immediately.

Section 5 Fire Fighting Measures

NFPA* HAZARD SIGNS:	
Health Hazard	1 = Materials which under fire conditions would give off irritating combustion products. (less than 1 hour exposure) Materials which on the skin could cause irritation.
Flammability Hazard	0 = Materials that will not burn.
Reactivity Hazard	0 = Materials which in themselves are normally stable, even under fire exposure



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Special Hazard OX = conditions, and which are not reactive with water.
Oxidizer

***National Fire Protection Association 704**

FIRST RESPONDERS:

Wear protective gloves, boots, goggles, and respirator. In case of fire, wear positive pressure breathing apparatus. Approach incident with caution. Use 2004 Emergency Response Guidebook (U.S. DOT RSPA, TC and STC). Guide No. 140. (<http://hazmat.dot.gov/pubs/erg2004/erg2004.pdf>).

FLASHPOINT

None

FLAMMABLE OR EXPLOSIVE LIMITS

Lower: Nonflammable Upper: Nonflammable

EXTINGUISHING MEDIA

Use large quantities of water.
Water will turn pink to purple if in contact with RemOx® L ISCO Reagent. Dike to contain.
Do not use dry chemicals, CO₂Halon® or foams.

SPECIAL FIREFIGHTING PROCEDURES

If material is involved in fire, flood with water. Cool all affected containers with large quantities of water. Apply water from as far as a distance as possible. Wear self-contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION

Powerful oxidizing material. May decompose spontaneously if exposed to heat (135°C/275°F). May be explosive in contact with certain other chemicals (Section 10). May react violently with finely divided and readily oxidizable substances. Increases burning rate of combustible material. May ignite wood and cloth.

Section 6 Accidental Release Measures

PERSONAL PRECAUTIONS

Personnel should wear protective clothing suitable for the task. Remove all ignition sources and incompatible materials before attempting clean up.

ENVIRONMENTAL PRECAUTIONS:

Do not flush into sanitary sewer system or surface water. If accidental release into the environment occurs, inform the responsible authorities. Keep the product away from drains, sewers, surface and ground water and soil.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Contain spill by collecting the liquid in a pit or holding behind a dam (sand or soil). Dilute to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite or ferrous salt solution. The bisulfite or ferrous



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salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Decant or filter and deposit sludge in approved landfill. Where permitted, the sludge may be drained into sewer with large quantities of water. To clean contaminated floors, flush with abundant quantities of water into sewer, if permitted by federal, state, and local regulations. If not, collect water and treat as above.

Section 7 Handling and Storage

WORK/HYGIENIC PRACTICES

Wash hands thoroughly with soap and water after handling RemOx® L ISCO Reagent. Do not eat, drink or smoke when working with RemOx® L ISCO Reagent. Wear proper protective equipment. Remove clothing, if it becomes contaminated.

VENTILATION REQUIREMENTS

Provide sufficient mechanical and/or local exhaust to maintain exposure below the TLV/TWA.

CONDITIONS FOR SAFE STORAGE

Store in accordance with NFPA 430 requirements for Class II oxidizers. Protect containers from physical damage. Store in a cool, dry area in closed containers. Segregate from acids, peroxides, formaldehyde, and all combustible, organic, or easily oxidizable materials including antifreeze and hydraulic fluid.

Section 8 Exposure Controls and Personal Protection

RESPIRATORY PROTECTION

In cases where overexposure to mist may occur, the use of an approved NIOSH-MSHA mist respirator or an air supplied respirator is advised. Engineering or administrative controls should be implemented to control mist.

EYE

Faceshield, goggles, or safety glasses with side shields should be worn. Provide eyewash in working area.

GLOVES

Rubber or plastic gloves should be worn.

OTHER PROTECTIVE EQUIPMENT

Normal work clothing covering arms and legs, and rubber, or plastic apron should be worn. Caution: If clothing becomes contaminated, wash off immediately. Spontaneous ignition may occur with cloth or paper.

Section 9 Physical and Chemical Properties

APPEARANCE AND ODOR	Dark purple solution, odorless
BOILING POINT, 760 mm Hg	105 °C
VAPOR PRESSURE (mm Hg)	760 mm at 105°C
SOLUBILITY IN WATER % BY SOLUTION	Miscible in all proportions
PERCENT VOLATILE BY VOLUME	61% (as water)
EVAPORATION RATE	Same as water
FREEZING POINT	-15.0 °C
SPECIFIC GRAVITY	1.36-1.39



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pH	5-9
OXIDIZING PROPERTIES	Strong oxidizer. May ignite wood and cloth.
EXPLOSIVE PROPERTIES	Explosive in contact with sulfuric acid or peroxides, or readily oxidizable substances.

Section 10 Stability and Reactivity

STABILITY	Under normal conditions, the material is stable.
CONDITIONS TO AVOID could	Contact with incompatible materials or heat (135°C / 275°F) result in violent exothermic chemical reaction.
INCOMPATIBLE MATERIALS	Acids, peroxides, formaldehyde, antifreeze, hydraulic fluids, and all combustible organic or readily oxidizable materials, including metal powders. With hydrochloric acid, toxic chlorine gas is liberated.
HAZARDOUS DECOMPOSITION PRODUCTS	When involved in a fire, liquid permanganate may form corrosive fumes.
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION	Material is not known to polymerize.

Section 11 Toxicological Information

SODIUM PERMANGANATE: Acute oral LD₅₀ not known.

1. Acute toxicity

Irritating to body tissue with which it comes into contact. No acute toxicity data is available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate. The toxicity data for potassium permanganate is given below:

Ingestion:

LD 50 oral rat: 780 mg/kg male (14 days); 525 mg/kg female (14 days).

Harmful if swallowed. ALD: 10g. Ingestion may cause nausea, vomiting, sore throat, stomach-ache and eventually lead to a perforation of the intestine. Liver and kidney injuries may occur.

Skin contact:

LD 50 dermal no data available.

The product may be absorbed into the body through the skin. Major effects of exposure: severe irritation, brown staining of skin.

Inhalation:

LC 50 inhal. no data available.

The product may be absorbed into the body by inhalation. Major effects of exposure: respiratory disorder, cough.

2. Chronic toxicity

No known cases of chronic poisoning due to permanganates have been reported. Prolonged exposure, usually



RemOx® L ISCO Reagent

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over many years, to heavy concentrations of manganese oxides in the form of dust and fumes may lead to chronic manganese poisoning, chiefly involving the central nervous system.

3. Carcinogenicity

Sodium permanganate has not been classified as a carcinogen by ACGIH, NIOSH, OSHA, NTP, or IARC.

4. Medical Conditions Generally Aggravated by Exposure

Sodium permanganate solution will cause further irritation of tissue, open wounds, burns or mucous membranes.

Section 12 Ecological Information

Entry to the Environment

Permanganate has a low estimated lifetime in the environment, being readily converted by oxidizable materials to insoluble MnO_2 .

Bioconcentration Potential

In non-reducing and non-acidic environments MnO_2 is insoluble and has a very low bioaccumulative potential.

Aquatic Toxicity

No data.

Section 13 Disposal Considerations

Waste Disposal

RemOx® L ISCO Reagent, once it becomes a waste, is considered a D001 hazardous (ignitable) waste. For disposal of RemOx® L ISCO Reagent solutions, follow procedures in Section 6 and deactivate the permanganate to insoluble manganese dioxide. Dispose of it in a permitted landfill. Contact Carus Chemical Company for additional recommendations.

Section 14 Transport Information

USA (land, D.O.T.)	Proper Shipping Name: 49 CFR172.101 Permanganates, inorganic, aqueous solution, n.o.s. (contains sodium permanganate) Hazard Class: 49 CFR172.101....Oxidizer ID Number: 49 CFR172.101....UN 3214 Packing Group: 49 CFR172.101....II Division: 49 CFR172.101....5.1
European Labeling in accordance Road/Rail Transport (ADR/RID)	ID Number: UN 3214 ADR/RID Class 5.1 Description of Goods: Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate) Hazard Identification No. 50
European Labeling in accordance with EC directive (Water, I.M.O.)	Proper Shipping Name: Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate) Hazard Class: Oxidizer ID Number: UN 3214



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	Packing Group: II Division: 5.1 Marine Pollutant: No
European Labeling in accordance with EC directive (Air, I.C.A.O.)	Proper Shipping Name: Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate) Hazard Class: Oxidizer ID Number: UN 3214 Packing Group: II Division: 5.1

Section 15 Regulatory Information (Sodium Permanganate)

TSCA	Listed in the Toxic Substances Control Act (TSCA) Chemical Substance Inventory.
CERCLA	Not listed.
RCRA	Oxidizers such as RemOx® L ISCO Reagent solution meet the criteria of ignitable waste. 40 CFR 261.21.
SARA TITLE III Information	
Section 302/303	Extremely hazardous substance: Not listed
Section 311/312	Hazard categories: Fire, acute and chronic toxicity.
Section 313	RemOx® L ISCO Reagent contains 40% manganese compounds as part of the chemical and is subject to the reporting requirements of Section 313 of Title III, Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.
FOREIGN LIST	Canadian Non-Domestic Substance List , EINECS

Section 16 Other Information

NIOSH	National Institute for Occupational Safety and Health
MSHA	Mine Safety and Health Administration
OSHA	Occupational Safety and Health Administration
NTP	National Toxicology Program
IARC	International Agency for Research on Cancer
PEL	Permissible Exposure Limit
C	Ceiling Exposure Limit
TLV-TWA	Threshold Limit Value-Time Weighted Average
CAS	Chemical Abstract Service
EINECS	Inventory of Existing Chemical Substances (European)

Chithambarathanu Pillai (S.O.F.)
April 2008

The information contained herein is accurate to the best of our knowledge. However, data, safety standards and government regulations are subject to change and, therefore, holders and users should satisfy themselves that they are aware of all current data and regulations relevant to their particular use of product. CARUS CORPORATION DISCLAIMS ALL LIABILITY FOR RELIANCE ON THE COMPLETENESS OR ACCURACY OR THE INFORMATION INCLUDED HEREIN. CARUS CORPORATION MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR USE OR PURPOSE OF THE PRODUCT DESCRIBED HEREIN. All conditions relating to storage, handling, and use of the product are beyond the control of Carus Corporation, and shall be the sole responsibility of the holder or user of the product.



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Responsible Care®
Good Chemistry at Work

Material Safety Data Sheet

Sodium thiosulfate

ACC# 21710

Section 1 - Chemical Product and Company Identification

MSDS Name: Sodium thiosulfate**Catalog Numbers:** AC202870000, AC202870010, AC202870025, AC202870050, AC202875000, S75222, S78930-1, S78930-2, S78930-3, S78930-4, S79809, NC9417189, S446-3, S446-500, S446-500LC**Synonyms:** Sodium Hyposulfite; Sodium Oxide Sulfide; Thiosulfuric Acid Disodium Salt**Company Identification:**

Fisher Scientific
 1 Reagent Lane
 Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7772-98-7	Sodium thiosulfate	>98	231-867-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: white solid.

Caution! May cause eye, skin, and respiratory tract irritation. Hygroscopic (absorbs moisture from the air).**Target Organs:** No data found.

Potential Health Effects

Eye: May cause eye irritation.**Skin:** May cause skin irritation. May be harmful if absorbed through the skin.**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed.**Inhalation:** May cause respiratory tract irritation. May be harmful if inhaled.**Chronic:** No information found.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and

lower eyelids. Get medical aid.

Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, or carbon dioxide.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 1; Flammability: 0; Instability: 1

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with skin and eyes. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from strong acids.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Sodium thiosulfate	none listed	none listed	none listed

OSHA Vacated PELs: Sodium thiosulfate: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to minimize contact with skin.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: white

Odor: odorless

pH: 6.5-8 (solution)

Vapor Pressure: Negligible.

Vapor Density: Not applicable.

Evaporation Rate: negligible

Viscosity: Not available.

Boiling Point: Not available.

Freezing/Melting Point: 43 deg C

Decomposition Temperature: Not available.

Solubility: Soluble.

Specific Gravity/Density: 1.66

Molecular Formula: Na₂O₃S₂

Molecular Weight: 158.0978

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures. Deliquescent (tending to absorb atmospheric water vapor and become liquid).

Conditions to Avoid: High temperatures, moisture.

Incompatibilities with Other Materials: Strong acids.

Hazardous Decomposition Products: Oxides of sulfur, hydrogen sulfide, sodium oxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7772-98-7: XN6476000

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 7772-98-7: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.

Teratogenicity: No information available.

Reproductive Effects: No information available.

Mutagenicity: Please refer to RTECS# XN6476000 for specific information.

Neurotoxicity: No information available.

Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not Regulated	Not Regulated
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7772-98-7 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7772-98-7 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

Not available.

Risk Phrases:**Safety Phrases:**

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 7772-98-7: 0

Canada - DSL/NDSL

CAS# 7772-98-7 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of Not controlled..

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

Section 16 - Additional Information
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MSDS Creation Date: 12/12/1997

Revision #5 Date: 2/12/2007

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET

ALCONOX®

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Union REACH Regulations



SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: **ALCONOX®**
CHEMICAL FAMILY NAME: Detergent.
PRODUCT USE: Critical-cleaning detergent for laboratory, healthcare and industrial applications
U.N. NUMBER: Not Applicable
U.N. DANGEROUS GOODS CLASS: Non-Regulated Material
SUPPLIER/MANUFACTURER'S NAME: Alconox, Inc.
ADDRESS: 30 Glenn St., Suite 309, White Plains, NY 10603. USA
EMERGENCY PHONE: **TOLL-FREE in USA/Canada** 800-255-3924
International calls 813-248-0585
BUSINESS PHONE: 914-948-4040
DATE OF PREPARATION: May 2011
DATE OF LAST REVISION: February 2008

SECTION 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: This product is a white granular powder with little or no odor. Exposure can be irritating to eyes, respiratory system and skin. It is a non-flammable solid. The Environmental effects of this product have not been investigated.

US DOT SYMBOLS

Non-Regulated

CANADA (WHMIS) SYMBOLS



EUROPEAN and (GHS) Hazard Symbols



Signal Word: **Warning!**

EU LABELING AND CLASSIFICATION:

Classification of the substance or mixture according to Regulation (EC) No1272/2008 Annex 1

EC# 205-633-8 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 268-356-1 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 231-838-7 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 231-767-1 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 207-638-8 Index# 011-005-00-2

EC# 205-788-1 This substance is not classified in the Annex I of Directive 67/548/EEC

GHS Hazard Classification(s):

Eye Irritant Category 2A

Hazard Statement(s):

H319: Causes serious eye irritation

Precautionary Statement(s):

P260: Do not breath dust/fume/gas/mist/vapors/spray

P264: Wash hands thoroughly after handling

P271: Use only in well ventilated area.

P280: Wear protective gloves/protective clothing/eye protection/face protection/

Hazard Symbol(s):

[Xi] Irritant

MATERIAL SAFETY DATA SHEET

ALCONOX®**Risk Phrases:**

R20: Harmful by inhalation
R36/37/38: Irritating to eyes, respiratory system and skin

Safety Phrases:

S8: Keep container dry
S22: Do not breath dust
S24/25: Avoid contact with skin and eyes

HEALTH HAZARDS OR RISKS FROM EXPOSURE:

ACUTE: Exposure to this product may cause irritation of the eyes, respiratory system and skin. Ingestion may cause gastrointestinal irritation including pain, vomiting or diarrhea.

CHRONIC: This product contains an ingredient which may be corrosive.

TARGET ORGANS:

ACUTE: Eye, respiratory System, Skin

CHRONIC: None Known

SECTION 3 - COMPOSITION and INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS:	CAS #	EINECS #	ICSC #	WT %	HAZARD CLASSIFICATION; RISK PHRASES
Sodium Bicarbonate	144-55-8	205-633-8	1044	33 - 43%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	268-356-1	Not Listed	10 – 20%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Tripolyphosphate	7758-29-4	231-838-7	1469	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Tetrasodium Pyrophosphate	7722-88-5	231-767-1	1140	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Carbonate	497-19-8	207-638-8	1135	1 - 10%	HAZARD CLASSIFICATION: [Xi] Irritant RISK PHRASES: R36
Sodium Alcohol Sulfate	151-21-3	205-788-1	0502	1 – 5%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Balance of other ingredients are non-hazardous or less than 1% in concentration (or 0.1% for carcinogens, reproductive toxins, or respiratory sensitizers).					

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard JIS Z 7250: 2000.

SECTION 4 - FIRST-AID MEASURES

Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with contaminated individual.

EYE CONTACT: If product enters the eyes, open eyes while under gentle running water for at least 15 minutes. Seek medical attention if irritation persists.

SKIN CONTACT: Wash skin thoroughly after handling. Seek medical attention if irritation develops and persists. Remove contaminated clothing. Launder before re-use.

INHALATION: If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if breathing difficulty continues.

INGESTION: If product is swallowed, call physician or poison control center for most current information. If professional advice is not available, do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or MSDS with the victim to the health professional.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing skin, or eye problems may be aggravated by prolonged contact.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

MATERIAL SAFETY DATA SHEET

ALCONOX®

SECTION 5 - FIRE-FIGHTING MEASURES

FLASH POINT:

Not Flammable

AUTOIGNITION TEMPERATURE:

Not Applicable

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): NA Upper (UEL): NA

FIRE EXTINGUISHING MATERIALS:

As appropriate for surrounding fire. Carbon dioxide, foam, dry chemical, halon, or water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

This product is non-flammable and has no known explosion hazards.

Explosion Sensitivity to Mechanical Impact:

Not Sensitive.

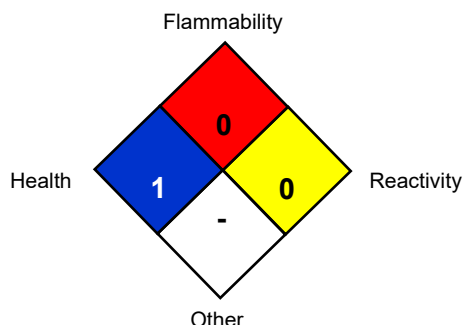
Explosion Sensitivity to Static Discharge:

Not Sensitive



SPECIAL FIRE-FIGHTING PROCEDURES:

Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

NFPA RATING SYSTEM



HMIS RATING SYSTEM

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD (BLUE)			1
FLAMMABILITY HAZARD (RED)			0
PHYSICAL HAZARD (YELLOW)			0
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Sect 8		See Sect 8
For Routine Industrial Use and Handling Applications			

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

SECTION 6 - ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Personnel should be trained for spill response operations.

SPILLS: Contain spill if safe to do so. Prevent entry into drains, sewers, and other waterways. Sweep, shovel or vacuum spilled material and place in an appropriate container for re-use or disposal. Avoid dust generation if possible. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations).

SECTION 7 - HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: Containers of this product must be properly labeled. Store containers in a cool, dry location. Keep container tightly closed when not in use. Store away from strong acids or oxidizers.

MATERIAL SAFETY DATA SHEET

ALCONOX®

SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/GUIDELINES:

Chemical Name	CAS#	ACGIH TWA	OSHA TWA	SWA
Sodium Bicarbonate	144-55-8	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Sodium Tripolyphosphate	7758-29-4	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Tetrasodium Pyrophosphate	7722-88-5	5 mg/m ³	5 mg/m ³	5 mg/m ³
Sodium Carbonate	497-19-8	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Sodium Alcohol Sulfate	151-21-3	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust

Currently, International exposure limits are not established for the components of this product. Please check with competent authority in each country for the most recent limits in place.

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Use local exhaust ventilation to control airborne dust. Ensure eyewash/safety shower stations are available near areas where this product is used.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.

RESPIRATORY PROTECTION: Based on test data, exposure limits should not be exceeded under normal use conditions when using Alconox Detergent. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Use chemical resistant gloves to prevent skin contact.. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate to prevent contact (e.g. lab coat, overalls). If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards.

SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

PHYSICAL STATE:	Solid
APPEARANCE & ODOR:	White granular powder with little or no odor.
ODOR THRESHOLD (PPM):	Not Available
VAPOR PRESSURE (mmHg):	Not Applicable
VAPOR DENSITY (AIR=1):	Not Applicable.
BY WEIGHT:	Not Available
EVAPORATION RATE (nBuAc = 1):	Not Applicable.
BOILING POINT (C°):	Not Applicable.
FREEZING POINT (C°):	Not Applicable.
pH:	9.5 (1% aqueous solution)
SPECIFIC GRAVITY 20°C: (WATER =1)	0.85 – 1.1
SOLUBILITY IN WATER (%)	>10% w/w
COEFFICIENT OF WATER/OIL DIST.:	Not Available
VOC:	None
CHEMICAL FAMILY:	Detergent

MATERIAL SAFETY DATA SHEET

ALCONOX®

SECTION 10 - STABILITY and REACTIVITY

STABILITY: Product is stable

DECOMPOSITION PRODUCTS: When heated to decomposition this product produces Oxides of carbon (COx)

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids and strong oxidizing agents.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and dust generation.

SECTION 11 - TOXICOLOGICAL INFORMATION

TOXICITY DATA: Toxicity data is available for mixture:

CAS# 497-19-8 LD50 Oral (Rat)	4090 mg/kg
CAS# 497-19-8 LD50 Oral (Mouse)	6600 mg/kg
CAS# 497-19-8 LC50 Inhalation (Rat)	2300 mg/m ³ 2H
CAS# 497-19-8 LC50 Inhalation (Mouse)	1200 mg/m ³ 2H
CAS# 7758-29-4 LD50 Oral (Rat)	3120 mg/kg
CAS# 7758-29-4 LD50 Oral (Mouse)	3100 mg/kg
CAS# 7722-88-5 LD50 Oral (Rat)	4000 mg/kg

SUSPECTED CANCER AGENT: None of the ingredients are found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Contact with this product can be irritating to exposed skin, eyes and respiratory system.

SENSITIZATION OF PRODUCT: This product is not considered a sensitizer.

REPRODUCTIVE TOXICITY INFORMATION: No information concerning the effects of this product and its components on the human reproductive system.

SECTION 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: No Data available at this time.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plants or animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

SECTION 13 - DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.

SECTION 14 - TRANSPORTATION INFORMATION

US DOT; IATA; IMO; ADR:

THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Non-Regulated Material

HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable

UN IDENTIFICATION NUMBER: Not Applicable

PACKING GROUP: Not Applicable.

DOT LABEL(S) REQUIRED: Not Applicable

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): Not Applicable

MARINE POLLUTANT: None of the ingredients are classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION (DOT) SHIPPING REGULATIONS:

This product is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:

This product is not classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA):

This product is not classified as Dangerous Goods, by rules of IATA:

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION:

This product is not classified as Dangerous Goods by the International Maritime Organization.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

MATERIAL SAFETY DATA SHEET

ALCONOX®

This product is not classified by the United Nations Economic Commission for Europe to be dangerous goods.

SECTION 15 - REGULATORY INFORMATION

UNITED STATES REGULATIONS

SARA REPORTING REQUIREMENTS: This product is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows: None

TSCA: All components in this product are listed on the US Toxic Substances Control Act (TSCA) inventory of chemicals.

SARA 311/312:

Acute Health: Yes Chronic Health: No Fire: No Reactivity: No

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): None

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): None of the ingredients are on the California Proposition 65 lists.

CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: All of the components of this product are on the DSL Inventory

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: No component of this product is on the CEPA First Priorities Substance Lists.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: This product is categorized as a Controlled Product, Hazard Class D2B as per the Controlled Product Regulations

EUROPEAN ECONOMIC COMMUNITY INFORMATION:

EU LABELING AND CLASSIFICATION:

Classification of the mixture according to Regulation (EC) No1272/2008. See section 2 for details.

AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: All components of this product are listed on the AICS.

STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS: Not applicable.

JAPANESE INFORMATION FOR PRODUCT:

JAPANESE MINISTER OF INTERNATIONAL TRADE AND INDUSTRY (MITI) STATUS: The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

INTERNATIONAL CHEMICAL INVENTORIES:

Listing of the components on individual country Chemical Inventories is as follows:

Asia-Pac:	Listed
Australian Inventory of Chemical Substances (AICS):	Listed
Korean Existing Chemicals List (ECL):	Listed
Japanese Existing National Inventory of Chemical Substances (ENCS):	Listed
Philippines Inventory of Chemicals and Chemical Substances (PICCS):	Listed
Swiss Giftlist of Toxic Substances:	Listed
U.S. TSCA:	Listed

SECTION 16 - OTHER INFORMATION

PREPARED BY: Paul Eigbrett Global Safety Management, 10006 Cross Creek Blvd. Suite 440, Tampa, FL 33647

MATERIAL SAFETY DATA SHEET

ALCONOX®

Disclaimer: To the best of Alconox, Inc. knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness is not guaranteed and no warranties of any type either express or implied are provided. The information contained herein relates only to this specific product.

ANNEX:

IDENTIFIED USES OF ALCONOX® AND DIRECTIONS FOR USE


Used to clean: Healthcare instruments, laboratory ware, vacuum equipment, tissue culture ware, personal protective equipment, sampling apparatus, catheters, tubing, pipes, radioactive contaminated articles, optical parts, electronic components, pharmaceutical apparatus, cosmetics manufacturing equipment, metal castings, forgings and stampings, industrial parts, tanks and reactors. Authorized by USDA for use in federally inspected meat and poultry plants. Passes inhibitory residue test for water analysis. FDA certified.

Used to remove: Soil, grit, grime, buffing compound, slime, grease, oils, blood, tissue, salts, deposits, particulates, solvents, chemicals, radioisotopes, radioactive contaminations, silicon oils, mold release agents.

Surfaces cleaned: Corrosion inhibited formulation recommended for glass, metal, stainless steel, porcelain, ceramic, plastic, rubber and fiberglass. Can be used on soft metals such as copper, aluminum, zinc and magnesium if rinsed promptly. Corrosion testing may be advisable.

Cleaning method: Soak, brush, sponge, cloth, ultrasonic, flow through clean-inplace. Will foam—not for spray or machine use.

Directions: Make a fresh 1% solution (2 1/2 Tbsp. per gal., 1 1/4 oz. per gal. or 10 grams per liter) in cold, warm, or hot water. If available use warm water. Use cold water for blood stains. For difficult soils, raise water temperature and use more detergent. Clean by soak, circulate, wipe, or ultrasonic method. Not for spray machines, will foam. For nonabrasive scouring, make paste. Use 2% solution to soak frozen stopcocks. To remove silver tarnish, soak in 1% solution in aluminum container. RINSE THOROUGHLY—preferably with running water. For critical cleaning, do final or all rinsing in distilled, deionized, or purified water. For food contact surfaces, rinse with potable water. Used on a wide range of glass, ceramic, plastic, and metal surfaces. Corrosion testing may be advisable.

	<h1 style="text-align: center;">LIQUOX[®] sodium permanganate</h1> <p style="text-align: center;">EC- SAFETY DATA SHEET according to Regulation (EC) № 1907/2006 of the European Parliament and of the Council, of 18 December 2006 concerning REACH</p> <p style="text-align: right;">Material Safety Data Sheet Page 1 of 9</p>
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Section 1 Chemical Product and Company Identification

PRODUCT NAME: LIQUOX [®] sodium permanganate, NaMnO ₄ TRADE NAME: LIQUOX [®] sodium permanganate SYNONYMS: Permanganic acid sodium salt Sodium permanganate	Revision Date: April 2008
USES OF SUBSTANCE: LIQUOX [®] sodium permanganate is a liquid oxidant recommended for applications that require a concentrated permanganate solution.	
COMPANY NAME (Europe): CARUS NALON S.L. COMPANY NAME (US): CARUS CCORPORATION	COMPANY ADDRESS: Barrio Nalon, s/n 33100 Trubia-Oviedo Espana, Spain INFORMATION: (34) 985-785-513 EMERGENCY TELEPHONE: (34) 985-785-513 COMPANY ADDRESS: 315 Fifth Street Peru, IL 61354, USA INFORMATION: (815) 223-1500 (815) 224-6816 (FAX) www.caruscorporation.com (Web) salesmkt@caruscorporation.com (Email) EMERGENCY TELEPHONE: (800) 435 -6856 (USA) (815) 223-1500 (Other countries) (800) 424-9300(CHEMTREC®, USA) (703) 527-3887 (CHEMTREC®, Other countries)

Section 2 Hazards Identification

<ol style="list-style-type: none"> <u>EYE CONTACT</u> Sodium Permanganate is damaging to eye tissue on contact. It may cause burns that result in damage to the eye. <u>SKIN CONTACT</u> Momentary contact of solution at room temperature may be irritating to the skin, leaving brown stains. Prolonged contact is damaging to the skin. <u>INHALATION</u> Acute inhalation toxicity data are not available. However, airborne concentrations of sodium permanganate in the form of mist may cause irritation to the respiratory tract. <u>INGESTION</u> Sodium permanganate solution, if swallowed, may cause burns to mucous membranes of the mouth, throat, esophagus, and stomach.
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LIQUOX[®] sodium permanganate

EC- SAFETY DATA SHEET according to Regulation (EC) № 1907/2006 of the European Parliament and of the Council, of 18 December 2006 concerning REACH

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Section 3 Hazardous Ingredients

<u>MATERIAL OR COMPONENT</u>	<u>CAS NO.</u>	<u>EINECS</u>	<u>%</u>	<u>HAZARD DATA</u>
Sodium Permanganate air	10101-50-5	233-251-1	20-40	PEL/C 5 mg Mn per cubic meter of TLV-TWA 0.2 mg Mn per cubic meter of air
<u>HAZARD SYMBOLS:</u>				
  				
<u>RISK PHRASES:</u>				
8 Contact with combustibles may cause fire.				
22 Harmful if swallowed.				
50/53 Very toxic to aquatic organisms, may cause long-term effects in the aquatic environment.				
<u>SAFETY PHRASES:</u>				
17 Keep away from combustible materials.				
24/25 Avoid contact with skin and eyes.				
26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.				

Section 4 First Aid Measures

1. EYES

Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Do not attempt to neutralize chemically. Seek medical attention immediately.

Note to physician: Decomposition products are alkaline. Brown stain formed is insoluble manganese dioxide.

2. SKIN


Immediately wash contaminated areas with water. Remove contaminated clothing and footwear. (**Caution:** Solution may ignite certain textiles). Wash clothing and decontaminate footwear before reuse. Seek medical attention if irritation is severe or persistent.

3. INHALATION

Remove person from contaminated area to fresh air. If breathing has stopped, resuscitate and administer oxygen if readily available. Seek medical attention immediately.

4. INGESTION

Never give anything by mouth to an unconscious or convulsing person. If person is conscious, give large quantities of water or milk. Seek medical attention immediately.

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Section 5 Fire Fighting Measures

NFPA* HAZARD SIGNS

Health Hazard	1	=	Materials which under fire conditions would give off irritating combustion products. (less than 1 hour exposure) Materials that on the skin could cause irritation.
Flammability Hazard	0	=	Materials that will not burn.
Reactivity Hazard	0	=	Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.
Special Hazard	OX	=	Oxidizer

*National Fire Protection Association 704 (USA)

FIRST RESPONDERS:

Wear protective gloves, boots, goggles, and respirator. In case of fire, wear positive pressure breathing apparatus. Approach incident with caution.

FLASHPOINT

None

FLAMMABLE OR EXPLOSIVE LIMITS

Lower: Nonflammable Upper: Nonflammable

EXTINGUISHING MEDIA

Use large quantities of water. Water will turn pink to purple if in contact with sodium permanganate. Dike to contain. Do not use dry chemicals, CO₂ Halon[®] or foams.

SPECIAL FIREFIGHTING PROCEDURES

If material is involved in fire, flood with water. Cool all affected containers with large quantities of water. Apply water from as far a distance as possible. Wear self-contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION

Powerful oxidizing material. May decompose spontaneously if exposed to heat (135°C / 275°F). May be explosive in contact with certain other chemicals (Section 10). May react violently with finely divided and readily oxidizable substances. Increases burning rate of combustible material. May ignite wood and cloth.

Section 6 Accidental Release Measures

PERSONAL PRECAUTIONS


Personnel should wear protective clothing suitable for the task. Remove all ignition sources and incompatible materials before attempting clean up.

ENVIRONMENTAL PRECAUTIONS:

Do not flush into sanitary sewer system or surface water. If accidental release into the environment occurs, inform the responsible authorities. Keep the product away from drains, sewers, surface and ground water and soil.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Contain spill by collecting the liquid in a pit or holding behind a dam (sand or soil). Dilute to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Decant or filter and deposit sludge in approved landfill. Where permitted, the sludge may be drained into sewer with large quantities of water. To clean contaminated floors, flush with abundant quantities of water into sewer, if permitted by federal, state, and local regulations. If not, collect water and treat as above.

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Section 7 Handling and Storage

WORK/HYGIENIC PRACTICES

Wash hands thoroughly with soap and water after handling permanganate solution. Do not eat, drink or smoke when working with sodium permanganate. Wear proper protective equipment. Remove clothing, if it becomes contaminated.

VENTILATION REQUIREMENTS

Provide sufficient mechanical and/or local exhaust to maintain exposure below the TLV/TWA.

CONDITIONS FOR SAFE STORAGE

Store in accordance with NFPA 430 requirements for Class II oxidizers. Protect containers from physical damage. Store in a cool, dry area in closed containers. Segregate from acids, peroxides, formaldehyde, and all combustible, organic, or easily oxidizable materials including antifreeze and hydraulic fluid.

Section 8 Exposure Controls and Personal Protection

RESPIRATORY PROTECTION

In cases where overexposure to mist may occur, the use of an approved NIOSH-MSHA mist respirator or an air supplied respirator is advised. Engineering or administrative controls should be implemented to control mist.

EYE

Faceshield, goggles, or safety glasses with side shields should be worn. Provide eyewash in working area.

GLOVES

Rubber or plastic gloves should be worn.

OTHER PROTECTIVE EQUIPMENT

Chemically resistant clothing covering arms and legs, and rubber, or plastic apron should be worn. **Caution:** If clothing becomes contaminated, wash off immediately. Spontaneous ignition may occur with cloth or paper.

Section 9 Physical and Chemical Properties

APPEARANCE AND ODOR

Dark purple solution, odorless

BOILING POINT, 760 mm Hg

>101°C

VAPOR PRESSURE (mm Hg)

760 mm at 105°C

SOLUBILITY IN WATER % BY SOLUTION

Miscible in all proportions with water

PERCENT VOLATILE BY VOLUME

61-85% (as water)

EVAPORATION RATE

Same as water

FREEZING POINT

<-4.0 °C

SPECIFIC GRAVITY

1.16 - 1.36

pH


6-9

OXIDIZING PROPERTIES

Strong oxidizer. May ignite wood and cloth.

EXPLOSIVE PROPERTIES

Explosive in contact with sulfuric acid or peroxides, or readily oxidizable substances.

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Section 10 Stability and Reactivity

STABILITY	Under normal conditions, the material is stable.
CONDITIONS TO AVOID	Contact with incompatible materials or heat (135°C / 275°F) could result in violent exothermic chemical reaction.
INCOMPATIBLE MATERIALS	Acids, peroxides, and all combustible organic or readily oxidizable materials including inorganic oxidizable materials and metal powders. With hydrochloric acid, chlorine gas is liberated.
HAZARDOUS DECOMPOSITION PRODUCTS	When involved in a fire, sodium permanganate may form corrosive fumes.
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION	Material is not known to polymerize.

Section 11 Toxicological Information

SODIUM PERMANGANATE: Acute oral LD₅₀ not known.

1. ACUTE TOXICITY

Irritating to body tissue with which it comes into contact. No acute toxicity data is available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate. The toxicity data for potassium permanganate is given below:

INGESTION:

LD 50 oral rat: 780 mg/kg male (14 days); 525 mg/kg female (14 days).

Harmful if swallowed. ALD: 10g. Ingestion may cause nausea, vomiting, sore throat, stomach-ache and eventually lead to a perforation of the intestine. Liver and kidney injuries may occur.

SKIN CONTACT:

LD 50 dermal no data available.

Major effects of exposure: severe irritation, brown staining of skin.

INHALATION:

LC 50 inhal. no data available.

The product may be absorbed into the body by inhalation. Major effects of exposure: respiratory disorder, cough.

2. CHRONIC TOXICITY


No known cases of chronic poisoning due to permanganates have been reported. Prolonged exposure, usually over many years, to heavy concentrations of manganese oxides in the form of dust and fumes may lead to chronic manganese poisoning, chiefly involving the central nervous system.

3. CARCINOGENICITY

Sodium permanganate has not been classified as a carcinogen by ACGIH, NIOSH, OSHA, NTP, or IARC.

4. MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

Sodium permanganate solution will cause further irritation of tissue, open wounds, burns or mucous membranes.

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Section 12 Ecological Information

ENTRY TO THE ENVIRONMENT

Permanganate has a low estimated lifetime in the environment, being readily converted by oxidizable materials to insoluble MnO₂.

BIOCONCENTRATION POTENTIAL

In non-reducing and non-acidic environments, MnO₂ is insoluble and has a very low bioaccumulative potential.

AQUATIC TOXICITY

No aquatic toxicity data is available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate. The toxicity data for potassium permanganate is given below:

Rainbow trout, 96 hour LC ₅₀ for potassium permanganate:	1.8 mg/L
Bluegill sunfish, 96 hour LC ₅₀ LC50 for potassium permanganate:	2.3 mg/L
Milk fish (Chanos Chanos)/ 96 hour LC ₅₀ LC50 for potassium permanganate:	>1.4mg/l


Section 13 Disposal Considerations

WASTE DISPOSAL

When it becomes a waste, sodium permanganate is considered a D001 hazardous (ignitable) waste. For disposal of sodium permanganate solutions, follow procedures in Section 6 and deactivate the permanganate to insoluble manganese dioxide. Dispose of it in a permitted landfill. Contact Carus Corporation for additional recommendations.

Section 14 Transport Information

USA (land, D.O.T.)	Proper Shipping Name: 49 CFR172.101 Permanganates, inorganic, aqueous solution, n.o.s. (contains sodium permanganate) Hazard Class: 49 CFR172.101....Oxidizer ID Number: 49 CFR172.101....UN 3214 Packing Group: 49 CFR172.101....II Division: 49 CFR172.101....5.1
European Labeling in accordance Road/Rail Transport (ADR/RID)	ID Number: UN 3214 ADR/RID Class 5.1 Description of Goods: Permanganates, inorganic, aqueous solution, n.o.s. (contains sodium permanganate) Hazard Identification No. 50
European Labeling in accordance with EC directive (Water, I.M.O.)	Proper Shipping Name: Permanganates, inorganic, aqueous solution, n.o.s. (contains sodium permanganate) Hazard Class: Oxidizer ID Number: UN 3214 Packing Group: II Division: 5.1 Marine Pollutant: No

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Section 14 Transport Information (contd.)

European Labeling in accordance with EC directive (Air, I.C.A.O.)	Proper Shipping Name: Permanganates, inorganic, aqueous solution, n.o.s (contains sodium permanganate) Hazard Class: Oxidizer ID Number: UN 3214 Packing Group: II Division: 5.1
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Section 15 Regulatory Information

EUROPEAN AND INTERNATIONAL REGULATIONS:

MARKINGS ACCORDING TO EU GUIDELINES:

The product has been classified and marked in accordance with EU directives/ordinances on hazardous materials.

<u>CHEMICAL NAME</u>	<u>CAS NO.</u>	<u>EINECS</u>	<u>UN NUMBER</u>
Sodium Permanganate	10101-50-5	233-251-1	UN 3214

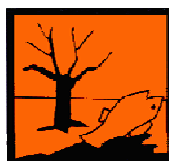
CODE LETTER AND HAZARD DESIGNATION OF THE PRODUCT:



O
Oxidizer



Xn
Harmful



N
Dangerous to the Environment

RISK PHRASES:

- 8 Contact with combustibles may cause fire.
- 22 Harmful if swallowed.
- 50/53 Very toxic to aquatic organisms, may cause long-term effects in the aquatic environment.

SAFETY PHRASES:

- 17 Keep away from combustible materials.
- 24/25 Avoid contact with skin and eyes.
- 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.



LIQUOX[®] sodium permanganate

EC- SAFETY DATA SHEET according to Regulation (EC) № 1907/2006 of the European Parliament and of the Council, of 18 December 2006 concerning REACH

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Section 15 Regulatory Information (contd.)

US FEDERAL REGULATIONS:

CHEMICAL INVENTORY STATUS – PART 1

<u>Ingredient</u>	<u>CAS. NO.</u>	<u>TSCA</u>	<u>EC</u>	<u>Japan</u>	<u>Australia</u>
Sodium permanganate	10101-50-5	Yes	Yes		

CHEMICAL INVENTORY STATUS – PART 2 --- CANADA --

<u>Ingredient</u>	<u>CAS. NO.</u>	<u>Korea</u>	<u>DSL</u>	<u>NDSL</u>	<u>PHIL</u>
Sodium permanganate	10101-50-5	No	No	Yes	


This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation (CPR, Canada) and the MSDS contains all of the information required by the CPR.

FEDERAL, STATE & INTERNATIONAL REGULATIONS – PART 1

<u>Ingredient</u>	<u>CAS. NO.</u>	<u>SARA 302</u>	<u>SARA 313</u>
		<u>RQ</u>	<u>TPQ</u>
Sodium permanganate	10101-50-5	N/A	N/A
		<u>List</u>	<u>Chemical Catg.</u>
		No	Yes
			(Manganese compounds)

FEDERAL, STATE & INTERNATIONAL REGULATIONS – PART 2

<u>Ingredient</u>	<u>CAS. NO.</u>	<u>CERCLA</u>	<u>RCRA</u>	<u>TSCA 8(d)</u>			
Sodium permanganate	10101-50-5	No	D001	No			
<u>Ingredient</u>	<u>CAS. NO.</u>	<u>CWC</u>	<u>TSCA 12(b)</u>	<u>CDTA</u>	<u>SARA</u>		
Sodium permanganate	10101-50-5	No	No		311/312 4545 Kg		
<u>Ingredient</u>	<u>CAS. NO.</u>	<u>Acute</u>	<u>Chronic</u>	<u>Fire</u>	<u>Pressure</u>	<u>Reactivity</u>	<u>Pure/Liquid</u>
Sodium permanganate	10101-50-5	Yes	Yes	Yes	No	No	Liquid
<u>Ingredient</u>	<u>CAS. NO.</u>	<u>Australian Hazchem Code</u>			<u>Poison Schedule</u>	<u>WHMIS</u>	
Sodium permanganate	10101-50-5					C, D2B	

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Section 16 Other Information


NIOSH	National Institute for Occupational Safety and Health
MSHA	Mine Safety and Health Administration
OSHA	Occupational Safety and Health Administration
NTP	National Toxicology Program
IARC	International Agency for Research on Cancer
PEL	Permissible Exposure Limit
C	Ceiling Exposure Limit
TLV-TWA	Threshold Limit Value-Time Weighted Average
CAS	Chemical Abstract Service
EINECS	Inventory of Existing Chemical Substances (European)

Chithambarathanu Pillai (S.O.F.)
April 2008

The information contained herein is accurate to the best of our knowledge. However, data, safety standards and government regulations are subject to change and, therefore, holders and users should satisfy themselves that they are aware of all current data and regulations relevant to their particular use of product. CARUS CORPORATION DISCLAIMS ALL LIABILITY FOR RELIANCE ON THE COMPLETENESS OR ACCURACY OR THE INFORMATION INCLUDED HEREIN. CARUS CORPORATION MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR USE OR PURPOSE OF THE PRODUCT DESCRIBED HEREIN. All conditions relating to storage, handling, and use of the product are beyond the control of Carus Corporation, and shall be the sole responsibility of the holder or user of the product.

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