

Spic & Span Cleaners
WESTCHESTER COUNTY, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: C360130

Prepared for:

81 Pondfield Road Company
(partnership in dissolution, winding up)
1311 Mamaroneck Avenue, Suite #340
White Plains, NY 10605

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
1	9/3/19	Incorporates 11/24/19 and 11/20/19 comments	11/26/19

SEPTEMBER 2019

CERTIFICATION STATEMENT

I ANDREW R. LEVENBAUM certify that I am currently a NYS registered professional engineer as 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).

This Site Management Plan has been submitted for the continual and proper operation, maintenance, and monitoring of any engineering controls employed at the site including the property maintenance of any remaining monitoring wells, and that this plan has been approved by DER.

 [PE]

December 10, 2019 DATE



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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. **C360130**. Spic & Span Cleaners,
79-81 Pondfield Road, Bronxville, NY 10708.

Institutional Controls:	1. Permitted future uses (commercial and industrial) must comply with 6 NYCRR 375-1.8(g)(2)(iii).
	2. All ECs must be operated and maintained as specified in this SMP.
	3. Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP.
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Westchester Department of Health to render it safe for use as drinking water or for non-potable purposes, and the user must first notify and obtain written approval to do so from the Department.
	5. All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP.
	6. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP.
	7. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP.
	8. 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.
	9. Vegetable gardens and farming on the site are prohibited;

Site Identification:

Site No. **C360130**. Spic & Span Cleaners,
79-81 Pondfield Road, Bronxville, NY 10708.

Engineering Controls:	1. Sub-Slab Depressurization (SSD)
	2. Soil Vapor Extraction (SVE)
	3. Air Sparge (AS)
Inspections:	Frequency
1. SSD, SVE and AS Systems	Quarterly
Monitoring:	
1. SSD, SVE and AS Systems	24/7/365 Wireless Telemetry
2. Vapor-Phase Granular Active Carbon Testing	Quarterly
3. Monitoring wells MW-1S, 2S, 4S, 4I and 5S	Annually
4. Monitoring wells MW-5I and MW-6	Semi-Annually
Maintenance:	
1. Vapor-Phase Granular Active Carbon replacement	As needed
2. SSD/SVE Blower and AS Compressor Pre-filter	As needed or annually
Reporting:	
1. Periodic Review Report	16 months after issuance of Certificate of Completion then every year
2. Site Inspection Report	Annually

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 property known as Spic & Span Cleaners, 79-81 Pondfield Road, Bronxville, New York (hereinafter referred to as the “Site”). See Figure 1. The Site is currently being remediated as part of the New York State (NYS) Brownfield Cleanup Program (Site No. C360130), which is administered by New York State Department of Environmental Conservation (NYSDEC).

81 Pondfield Road Company, a partnership in dissolution, winding up, entered into a Brownfield Cleanup Agreement (BCA) with the NYSDEC on September 19, 2013. A figure showing the site location and boundaries is provided in Figure 2. The boundaries of the site are more fully described in the metes and bounds site description that is part of an Environmental Easement granted to the NYSDEC, and recorded with the Westchester County Clerk (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 requires 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 the Order on Consent (Index #A1-0817-13-11; Site #130217) for the site, and thereby subject to applicable penalties.

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

This SMP was prepared by Andrew R. Levenbaum, PE and Advanced Cleanup Technologies, Inc. (ACT), on behalf of 81 Pondfield Road Company (partnership in dissolution, winding up), in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 3, 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and ECs 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 shutdown of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Environmental Easement for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

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

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

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

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

Table 1 below includes contact information for the above notifications. 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: Notifications*

Name	Contact Information
Janet Brown, Director, Remedial Bureau C, NYSDEC Division of Environmental Remediation	(518) 402-9662, Janet.Brown@dec.ny.gov
John Miller, NYSDEC Project Manager	(518) 402-9589, john.miller@dec.ny.gov
Jacquelyn Nealon, NYSDOH Project Manager	(518) 402-7860, beei@health.ny.gov
Kelly Lewandowski, Chief NYSDEC Site Control Section	(518)402-9581, kelly.lewandowski@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 the Village of Bronxville, County of Westchester, New York and is identified as Block 1, Lot 5 and Lot 8 on Section 4 of the Westchester County Tax Map (see Figure 1). The site is approximately 0.29-acres in area and is bounded by commercial property (the Gramartin Building) to the north, a commercial property (Apple Savings Bank) to the south, Pondfield Road followed by various commercial properties (Village of Bronxville central shopping district) to the west, and a municipal parking area to the east (see Figure 2 – Site Layout Map). The boundaries of the site are more fully described in Appendix A –Environmental Easement. The owner of the site at the time of issuance of this Site Management Plan is 81 Pondfield Road Company (a partnership in dissolution, winding up).

2.2 Physical Setting

2.2.1 Land Use

The Site consists of two adjoining lots totaling approximately 0.29 acres in area. The existing building consists of a 2-story row of 6 retail stores including the New Spic & Span Cleaners, which has non-dry cleaning laundering equipment in the cellar, and 12 office suites on the second floor. An asphalt-paved parking lot, road and municipal parking lot are located along the east side of the property.

The Site is located within the Town of Eastchester Zoning Class A (Business) District. The potable water supply is provided by the United Water Company of New Rochelle. Sanitary wastewater treatment is supplied by Yonkers Sanitary Sewer District. Natural gas and electricity are supplied by Consolidated Edison Utilities. No. 2 fuel oil is supplied to the New Spic & Span Cleaners via a 275-gallon above ground storage tank

located under the back stairs. Site occupants include Silver Spoon, Inc., Esun, Inc., Mano-A-Mano, Inc., Bronxville Art & Frame, Inc., New Spic & Span Cleaners, Inc. and Elite Sweets, Inc. The building is constructed with masonry block foundation walls and concrete floors with full basements beneath 79 and 81 Pondfield Road.

The properties immediately north, south and west of the Site consist of retail and office uses. Properties immediately to the east consist of a municipal parking lot followed by residential dwellings. The properties in the neighborhood surrounding the Site primarily include commercial and residential occupants.

2.2.2 Geology

The topography of the site vicinity generally slopes to the west towards the Bronx River. However, a significant change in elevation is present from the portion of the site along Pondfield Road to the East. Groundwater monitoring wells along Pondfield Road had approximate top of casing elevations of 98 feet above mean sea level (amsl), while monitoring wells in the paved area east of the site had top of casing elevations of approximately 91 feet amsl.

The ground surface in the vicinity of the Site is covered with commercial buildings, concrete pavement and asphalt parking lots. The Site is underlain by red-brown till and glacial outwash above Gneiss and Mica Schist bedrock of Ordovician and Devonian metamorphism (Hartland Formation).

Site-specific soil lithology recorded from soil borings installed during subsurface investigations predominantly consisted of poorly graded sand and silt with occasional gravel to a depth of at least 17 feet below ground surface. During the installation of monitoring wells, weathered bedrock was encountered in the eastern parking lot at depths ranging from 47 to 48 feet bgs.

2.2.3 Hydrogeology

The depth to groundwater varies from 7.63 to 12.95 feet bgs east of Pondfield Road and from 21.55 to 24.56 feet bgs beneath and west of Pondfield Road. Maps of historical groundwater elevations with groundwater contours and inferred flow lines are contained in Figure 3. Site-specific groundwater contours indicate that unconsolidated groundwater flow beneath the Site in a southwesterly direction.

2.3 **Investigation and Remedial History**

A detailed description of all investigations performed at the site is provided in the Remedial Investigation Report (RIR) dated September 2017. Engineering design and construction activities associated with implementation of the IRM Work Plan, including the installation and operation of sub-slab depressurization, soil vapor extraction and air sparge remedial systems at the site are summarized in the Final Engineering Report (FER) dated September 2019.

A summary of the investigations performed before, during and after implementation of the IRM work plan to verify its effectiveness is provided below.

2.3.1 Soil Sampling and Analysis

A summary of historical soil sampling results is provided in Table 2. All exceedances of Unrestricted Use Soil Cleanup Objectives (UUSCOs) are highlighted.

Correspondence from Woodard & Curran dated August 30, 2007 indicates that five soil borings were installed inside the dry cleaner and one soil boring was installed in the parking lot outside the southeast corner of the building. Soil samples were collected from 0-2 ft and 2-4 feet bgs inside the building and 4-5 feet bgs in the parking lot. PCE was detected in three of six soil borings.

Between May 2011 and July 2012, ACT installed eleven soil borings at the site, including two inside the dry cleaner and nine in the eastern parking lot. Only two soil

borings (ACT-1 and ACT-9) contained PCE above regulatory criteria. PCE was not detected above 8 feet bgs in any soil boring.

Residual soil contamination may be present beneath the site. Endpoint soil sampling will be performed at the completion of remedial activities to verify the absence of soil contamination above UUSCOs.

2.3.2 Ground Water Sampling and Analysis

A summary of historical ground water sampling results is provided in Table 3. All exceedances of ground water standards are highlighted.

Between May 2011 and July 2012, thirteen temporary monitoring wells were installed and sampled from water table surface (14 to 16 ft bgs) and approximately 10 feet below the water table surface. A total of 21 volatile organic compounds were detected in one or more of the ground water samples. PCE and TCE were detected above water quality standards from the water table surface to less than 25 feet bgs beneath the eastern parking lot, except in the southwestern portion of the parking lot where PCE was detected above water quality standards only at 25 feet bgs.

In May 2014, three on-site multilevel wells and four off-site conventional wells were purged and sampled. The results indicated that PCE was found above its water quality standard (5 µg/L) in two on-site wells MW-1S (5,800 µg/L) and MW-2S (350 µg/L), and one off-site well MW-5I (2400 µg/L). TCE was also found above its water quality standard (5 µg/L) only in MW-1S (51 µg/L).

Two comprehensive groundwater monitoring events conducted on March 9th and 10th, 2016 and June 14th and 15th, 2016 showed a substantial improvement in groundwater quality beneath and downgradient of the site, which was probably a result of the soil vapor extraction and air sparge remedial systems that have been operating since 2015. Monitoring well MW-1S in the parking lot south of the site contained 34 µg/L of PCE in June 2016 compared with 2,600 µg/L in March 2016 and 5,800 µg/L in June 2014.

Monitoring wells MW-2S in the parking lot and MW-5I on the east side of Pondfield Road were the only monitoring wells showing an increase of PCE between March and June 2016. MW-2S contained 110 µg/L of PCE in June 2016, which is

slightly higher than 100 µg/L in March 2016 but still much lower than 350 µg/L in June 2014. MW-5I contained 1,900 µg/L of PCE in June 2016 compared with 1,600 µg/L in March 2016 and 2,400 µg/L in June 2014. Monitoring well MW-6 on Park Place southwest of the site contained 190 µg/L of PCE in June 2016 compared with 530 µg/L in March 2016. The remaining monitoring wells contained CVOCs at or below water quality standards or detection limits. Trends of increasing groundwater contamination were found to be localized, temporally transient and likely the result of activation of the onsite SSD/SVE/AS system, which produced groundwater mounding beneath the eastern parking lot and a temporary increase in PCE levels in downgradient monitoring wells.

The most recent water quality results collected between January 24 and 26, 2018 indicate an increase in PCE concentrations in groundwater directly south of the treatment area. Concentrations of PCE in MW-2S (890 µg/L) and MW-4 (9.2 µg/L) are higher than previous sampling events, while PCE concentrations in MW-5I (19 µg/L) and MW-6 (24 µg/L) showed improvement approaching water quality standards. The cause and significance of these fluctuations will be investigated in future sampling events.

2.3.3 Soil Vapor Intrusion Sampling and Analysis

On May 6, 2011 ACT collected and analyzed two sub-slab soil vapor samples beneath the central portion of the building near the former dry cleaning machines and the southwestern portion of the building near air compressors and the heating system. Two additional sub-slab soil vapor samples were collected and analyzed beneath the southeastern portion of the building and in a storage room (now the treatment room) in the northwestern portion of the property. Concentrations of PCE and TCE were found in sub-slab soil vapor as high as 67,850 µg/m³ and 13,443 µg/m³, respectively, indicating that a potential source of indoor air contamination was present. As a precaution, depressurization well DP-1 was installed beneath the central portion of the basement to reduce pressure beneath the building through a small regenerative blower.

On January 5, 2012 ACT collected and analyzed air samples from five commercial units on the second floor of the building. Concentrations of PCE were found to be present below its NYSDOH Air Guideline at the time inside three of the five second

floor commercial units ranging from 4.21 µg/m³ to 46.82 µg/m³ and not detected in the remaining two second floor commercial units.

Between in October and November 2013, additional indoor air sampling was performed after the sub-slab depressurization system had been expanded. The results showed that PCE concentrations in indoor air were all below its current NYSDOH air guideline of 30 µg/m³. A summary of post-installation indoor air and sub-slab vapor sampling results is provided in Table 4.

The onsite vapor intrusion results indicate that the sub-slab depressurization system currently operating at the Site is effectively preventing sub-slab vapors from entering air inside the premises. Vacuum measurements recorded in the five permanent vacuum monitoring points following startup of the remedial system are provided in Table 5. The results indicate that vacuum is being maintained beneath the entire site.

2.4 Remedial Action Objectives

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) were identified in the Decision Document for this site dated December 6, 2018:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water.
- Remove the source of groundwater or surface water contamination.

Soil

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings.

2.5 Remaining Contamination

2.5.1 Soil

Soil samples collected during the RI showed detectable concentrations of VOCs in nine of the eleven soil borings excluding, Methylene Chloride, a common laboratory artifact. Tetrachloroethene was detected in two soil borings, ACT-1 and ACT-9. Soil boring ACT-1 exhibited concentrations above UUSCOs in the 10 to 11 foot sample (2,800 µg/kg) and exceedances of CSCOs in the 14 to 15 foot sample (300,000 µg/kg). Soil boring, ACT-9 exhibited exceedances of UUSCOs in the soil sample from 13 to 15 foot depth at 6,000 µg/kg. Additionally, the VOC, 1,2,4,5 Tetramethylbenzene was detected at a concentration of 10,000 µg/kg in soil sample ACT-1 from 14 to 15 foot. This compound is believed to be associated with a closed petroleum spill.

Soil sampling has not been performed since start up of the soil vapor extraction/air sparge system in May 2015. Remaining contaminated soil may be present below the building foundation and asphalt parking lot but at decreasing levels due to reduction in groundwater contamination. The extent of soil contamination remaining beneath the Site as of May 2015 is provided in Figure 4.

2.5.2 Groundwater

Groundwater samples collected during the RI showed VOCs above the NYSDEC TOGS 1.1.1 guidance values in 15 of the 20 groundwater samples collected from thirteen temporary groundwater wells (ACT-1 through ACT-13). Tetrachloroethene was detected in 15 groundwater samples with the highest concentration detected in ACT-9 (14 ft. in depth) at 5,100 µg/L. 1,2-Dichloroethene were also detected above NYSDEC TOGS 1.1.1 guidance values in ACT-8, ACT-9 and ACT-10 approximately 14 feet in depth at the water table surface.

The most recent groundwater monitoring event in March 2019 indicated that Tetrachloroethylene was detected above its NYSDEC guidance value of 5 µg/L in two onsite monitoring wells (MW-1S at 37 µg/L and MW-2S at 9.7 µg/L) and two offsite monitoring wells (MW-5I at 1,800 µg/L and MW-6 at 150 µg/L). These levels indicate continued improvement in groundwater quality beneath the site. However, a spike in Tetrachloroethene was noted in MW-5I over recent sampling events even though it was well below its maximum level of 2,400 µg/L in 2014. The level of Tetrachloroethene in MW-5I will be evaluated in future monitoring events. The extent of groundwater contamination remaining beneath the Site and its vicinity is provided in Figure 5.

2.5.3 Soil Vapor Intrusion

Soil vapor intrusion (SVI) sampling has been performed in occupied structures onsite since May 2011. Upon the discovery of elevated soil vapor beneath the site, an

active Sub-Slab Depressurization System was installed, which continuously maintains negative pressure beneath the foundation to prevent vapors from entering the building.

Between October 2013 and December 2018, a total of 5 SVI studies were performed at commercial properties along Pondfield Road and Park Place. The SVI results indicated that air quality inside all of the tested commercial properties met NYSDOH air guidelines, while sub-slab soil vapor contained PCE and TCE above their respective soil vapor screening levels. Offers to the owners of these off-site properties to install subslab depressurization systems were made but all property owners turned down the offers likely due to the fact that other dry cleaners may have been present under their own sites.

According to the most recent SVI studies, the presence of elevated levels of Tetrachloroethene and Trichloroethene in soil vapor beneath the south side of Park Place but not beneath the north side of Park Place indicates that an offsite source of soil vapor contamination is present along Park Place. It was recently learned that 5 Park Place had formerly been occupied for several decades by Hamilton Cleaners Inc., an onsite dry cleaner (EPA No. NYD982722902). That location may be responsible for the sub-slab soil vapor and groundwater contamination detected beneath buildings along Park Place. The extent of offsite soil vapor contamination is provided in Figure 6.

The 2018 Decision Document required the performance of an off-site soil vapor intrusion investigation, which the BCP Applicant completed. The off-site investigation consisted of soil vapor intrusion sampling in five buildings and identified the potential for soil vapor intrusion impacts in two off-site buildings. In addition, attempts were made to collect soil vapor intrusion samples in two other off-site buildings but the requests were denied by the property owners. As recommended by the New York State Department of Health, the BCP Applicant offered to install subs-lab depressurization systems (SSDSs) in each of the affected off-site buildings. However, both of the owners have rejected the BCP Applicant's offer to install SSDSs at their properties. The New York State Department of Health followed up with the off-site owners regarding the installation of SSDSs, but received no response. Should ownership of the two buildings identified for

mitigation and the others identified for sampling change, the applicant should offer mitigation/sampling, as applicable, to the new owners.

It was also identified that another potential source of soil vapor intrusion existed from a former dry cleaner that had operated near one of the off-site buildings impacted by soil vapor intrusion. The BCP Applicant will continue to perform off-site groundwater monitoring in MW-5i located adjacent to the BCP Site and in MW-6, which is located closer to the off-site former dry cleaner site. To the extent the remaining groundwater impacts in offsite monitoring wells MW-5i and MW-6 continue to decrease over time to levels that are acceptable to the Department as a result of the remediation that has been and is continuing to be performed at the BCP Site, the BCP Applicant's off-site obligations shall be terminated pursuant to this SMP. To the extent the remaining groundwater impacts in MW-5i and MW-6 do not decrease over time, then additional off-site investigation and remediation may be required if determined necessary by the Department.

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 periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix E) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the Construction Completion 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 and will be implemented under 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:

- Permitted future uses (commercial and industrial) must comply with 6 NYCRR 375-1.8(g)(2)(iii) for commercial uses and 6 NYCRR 375-1.8(g)(2)(iv) for industrial uses;
- 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 is prohibited without necessary water quality treatment as determined by the NYSDOH or the Westchester 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.
- Vegetable gardens and farming on the site are prohibited;

3.3 Engineering Controls

Exposure to remaining contamination at the site is prevented by a cover system maintained over portions of the site not occupied by buildings. Sub-Slab Depressurization (SSD), Soil Vapor Extraction (SVE) and Air Sparge (AS) systems installed at the site as part of the IRM are currently mitigating soil vapor intrusion for the on-site building and improving soil and groundwater quality in the vicinity of the site.

Procedures for operating and maintaining the SVE, SSD and AS systems are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). Equipment specifications are included in Appendix F – Operations and Maintenance Manual. Figure 7 shows the as-built locations of the ECs for the site.

The following sections provide a detailed description of the above Engineering Controls installed and currently operating at the site.

3.3.1 Sub-Slab Depressurization System

The SSD system consists of four interior depressurization wells and one exterior depressurization well. Each of the depressurization wells is constructed with 20 mil, 2-inch diameter schedule 40 PVC well screen and riser piping. Each depressurization well is connected through underground lateral piping to a 3-inch diameter overhead PVC header pipe leading to a 7.5 Hp FPZ regenerative blower located in a treatment room in the back of the former dry cleaner.

The interior depressurization wells (DP-1 through DP-4) are screened from the bottom of the concrete slab to 7 feet below the slab. The exterior depressurization well (DP-6) is screened from the bottom of the asphalt layer to approximately 10 feet in depth in the eastern parking lot to ventilate the slab beneath the building to the south.

3.3.2 Soil Vapor Extraction System

The SVE system consists of a soil vapor extraction well (SVE-1, former DP-5) constructed in the same manner as the depressurization wells and screened from the bottom of the asphalt layer to approximately 1-foot above the water table. Riser piping

from SVE-1 is connected through underground lateral piping to the same 3-inch overhead PVC header and regenerative blower in the treatment room. The air stream exiting the blower is split and treated with two parallel sets of primary and secondary 180-pound vapor phase granular activated carbon adsorbers. Exhaust pipes exiting the secondary canisters are combined into one 4-inch exhaust pipe that discharges at the roofline.

The regenerative blower is equipped with a vacuum relief valve, in-line filter and moisture separator with a high-level liquid level shutoff switch. Riser piping for each SVE well is fitted with a ball valve and vacuum port to adjust vacuum beneath the site.

3.3.3 Air Sparge System

The AS system consists of two 1-inch diameter air sparge wells (AS-1 and AS-2), underground lateral piping and an air compressor. Each AS well is installed to a depth of 30-feet below grade and consists of a 2 foot by 1 inch 0.010 slotted PVC well screen followed by 10-foot sections of 1-inch diameter PVC riser pipe. The well screens were backfilled with ¼ inch pea gravel followed by one foot of hydrated bentonite pellets. The annulus was then backfilled with native soil to 6 inches below the asphalt surface. A flush-mounted manhole cover was installed within the existing asphalt surface.

Underground lateral piping is located within individual trenches and later combined into a 1-inch aboveground header pipe that leads into the treatment room. The AS wells are pressurized by a 5 HP Becker rotary vane compressor also located inside the treatment room. Riser piping for each AS well is fitted with a ball valve and pressure gauge to monitor and adjust sparge pressure beneath the site.

3.3.4 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 the NYSDEC DER-10 guidance document.

3.3.4.1 Sub-slab Depressurization System

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

3.3.4.2 Soil Vapor Extraction System

The SVE system will not be discontinued unless prior written approval is granted by the NYSDEC and DOH. 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.

3.3.4.3 Air Sparge System

The AS system will not be discontinued unless prior written approval is granted by the NYSDEC and DOH. In the event that monitoring data indicates that the AS 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 AS system include contaminant concentrations in groundwater 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 AS 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.

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 E.

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

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCO for soil; and

- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

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

- 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 annually 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 F – 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 PRR. 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 Remedial System Monitoring and Sampling

4.3.1 Remedial System Monitoring

Monitoring of the SSDS/SVE/AS systems will be performed on a routine basis, as identified in Table 6 Remedial System Monitoring Requirements and Schedule (see below). Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 6 – Remedial System Monitoring Requirements and Schedule

Remedial System Component	Monitoring Parameter	Operating Range	Monitoring Schedule
FPZ Regenerative Vacuum Blower	Vacuum Pressure	25”-50” w.c.	24/7/265 Telemetry Quarterly Inspections
Becker Rotary Vane Compressor	Air Pressure	5 psi-20 psi	24/7/265 Telemetry Quarterly Inspections
GAC Treatment	Blower Influent Blower Effluent	6”-20” w.c.	24/7/265 Telemetry Quarterly Sampling

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 SSDS/SVE/AS systems has been reported or an emergency occurs that is deemed likely to affect the operation of the system.

A wireless telemetry system has been installed on the entire SSD/SVE/AS system, including analog pressure sensors at influent and effluent ports of the regenerative blower and air compressor. Data from these pressure sensors provide 24/7/365 real-time operating conditions of the SSD/SVE/AS systems.

Unscheduled inspections will take place when the ACT project manager is notified by email and text alerts of an alarm condition other than loss of power to the SVES. In that event, the ACT project manager will immediately schedule a site

inspection to implement procedures outlined in the Operation and Maintenance Plan (Section 6.0). A written service report for the alarm condition will be included in the PRR. Modification to these monitoring requirements will require approval from the NYSDEC.

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix F - 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

Influent and effluent sampling will be performed on a routine basis on the vapor-phase granular activated carbon canisters associated with the SVE system. Detailed sample collection procedures are explained the Field Sampling Plan in Appendix J. The sampling procedures will comply with the most current versions of NYSDEC DER-10 and NYSDOH Vapor Intrusion Guidance.

Air samples shall be collected from the SVE system and analyzed for VOCs via EPA Method TO-15. Detailed analytical procedures and protocols are provided in Appendix E – Quality Assurance Project Plan. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the 14 existing monitoring wells on an annual basis until such time as levels or drinking water standards are met. Table 7 contains a summary of post-remediation groundwater sampling that will be required following approval of this SMP. Options for addressing off-site contamination (i.e. in-situ treatment) will be evaluated if determined necessary by the Department in the future.

**Table 7 – Post Remediation Groundwater Sampling
Requirements and Schedule**

Sampling Location	Analytical Parameter	Schedule
Groundwater Sampling MW-1s MW-2s MW-4s MW-4i MW-5s	VOCs (EPA Method 8260)	Annually
MW-5i MW-6	VOCs (EPA Method 8260)	Semi-Annually

Detailed sample collection and analytical procedures and protocols are provided in Appendix E – Quality Assurance Project Plan.

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix E - 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 Appendix E of this document.

Modification to the frequency or sampling requirements will require approval from the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

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 SSD/SVE/AS Systems;
- Will be updated periodically to reflect changes in site conditions or the manner in which the SSD/SVE/AS Systems are operated and maintained.

Further detail regarding the Operation and Maintenance of the SSD/SVE/AS Systems are provided in Appendix D - 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 Remedial System Performance Criteria

Monitoring of the SSD/SVE/AS Systems will be performed on a 24 hour, 7 day a week, 365 day a year (7/24/365) basis via a wireless telemetry system discussed in Section 4.3 above. Quarterly site inspections will be performed to collect influent and effluent samples from the remedial system exhaust before and after carbon treatment. Modification to the monitoring requirements will require approval from the NYSDEC.

Unscheduled inspections will take place when the ACT project manager is notified of an alarm condition other than loss of power in the SVES.

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix H - 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.

5.3 Operation and Maintenance of Remedial Systems

The following sections provide a description of the operation and maintenance of the SSD/SVE/AS systems. Cut-sheets and as-built drawings for the SSD/SVE/AS systems are provided in Appendix D - Operations and Maintenance Manual.

5.3.1 System Start-Up and Testing

The SSD/SVE/AS systems have started up and are fully operational for optimal performance in their current configuration.

5.3.1.1 SSD/SVE Vacuum Blower

In the event the FPZ regenerative blower shuts down, start the blower using the following start-up procedure:

1. Check circuit breakers to make sure they are in the “On” position.
2. Open all valves on the individual depressurization lines to be operated.
3. Close all sample ports.
4. Turn the START switch to “AUTO” position on a blower starter control box.
5. Obtain the desired system vacuum and flow by adjusting the operating frequency of the VFD Panel.
6. Fine tune vacuum and flow rates at the individual vacuum wells by adjusting the ball valves on each riser pipe.

To stop operation of the FPZ regenerative blower, turn the START switch to “OFF” position on a blower starter control box.

5.3.1.2 AS Air Compressor

In the event the Becker 5 Hp Rotary Vane Air Compressor shuts down, start the compressor using the following start-up procedure:

1. Check circuit breakers to make sure they are in the “On” position.
2. Make sure the SSD/SVE blower is operating by observing vacuum pressure.
3. Turn the START switch to “AUTO” on a compressor starter control box.
4. Adjust operating frequency of the VFD Panel to a desired pressure.
5. Fine tune the sparge pressure by adjusting the bleed valve on the air compressor and the ball valves on the riser pipes to each sparge well.

The system testing described above will be conducted if, in the course of the SSD/SVE/AS systems lifetime, the systems go down or significant changes are made to the systems and the systems must be restarted.

5.3.2 Routine System Operation and Maintenance

The SSD/SVE systems operate by applying a vacuum to each of the vertical depressurization wells, which creates a vacuum beneath the basement slab, thus preventing vapors from entering the building’s breathing zone. The amount of vacuum is controlled by a vacuum relief valve located at the blower and the individual ball valves located on the riser pipes for each depressurization well.

The AS system operates by applying positive air pressure to one or two air sparge wells screened below in the area of groundwater contamination. Entrained air passes through the area of groundwater contamination, taking volatile contaminants with it to the ground surface where the SSD/SVE system removes it via GAC treatment.

The options for operation of each system are as follows:

1. Opening vacuum relief valve - decreases the vacuum on the entire system. Opening the vacuum relief valve increases the exhaust flow rate by adding atmospheric air, but will decrease the concentration of vapors in the exhaust. The flow rate from the individual depressurization pipes will be decreased due to a decrease in vacuum.

5. Closing vacuum relief valve - increases the vacuum on the entire system. Closing the vacuum relief valve decreases the exhaust flow rate, but increases the vacuum on the depressurization pipes.
6. Opening the ball valves on the depressurization pipes - will increase the vacuum and flow rate from each depressurization well.
4. Closing the ball valves on the depressurization pipes - will decrease the vacuum and flow rate from the individual point.

Vacuum Blower

Vacuum blowers require little or no maintenance to perform as designed. The blower is difficult to disassemble and reassemble. Therefore, the manufacturer should be consulted prior to any attempts to repair the blower. Table 8 identifies possible problems, symptoms and potential solutions that may occur while operating the regenerative blower. Once the regenerative blower is either repaired or replaced, the system should be re-started in accordance with Section 5.3.1.

There are no user-serviceable parts located inside the fan unit. Do not attempt to open. In case there is a problem:

1. Check voltage at the fan to insure it corresponds with nameplate.
2. There are no user serviceable parts located inside the fan unit. Do not attempt to open.
3. Before servicing or cleaning the unit, turn the power off to the blower by unplugging the blower from the outlet and turning the switch off. Switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
4. Once the regenerative blower is either repaired or replaced, the system should be re-started in accordance with Section 5.3.1.

AS Air Compressor

The AS air compressor requires regular inspection and maintenance for optimal performance. The compressor is difficult to disassemble and reassemble. Therefore, the manufacturer should be consulted prior to any attempts to service or repair it.

1. Before servicing or cleaning the unit, turn the power off to the blower by unplugging the blower from the outlet and turning the switch off. Switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
2. The air vanes should be regularly inspected for wear, as indicated by changes or increases in noise. A buildup of dust on the vanes should be removed to prevent breakage.
3. There are no other user serviceable parts located inside the compressor unit. Do not attempt to open.
4. Once the air compressor is either repaired or replaced, the system should be re-started in accordance with Section 5.3.1.

Pre-filters

The SSD/SVE blower and AS compressor pre-filter elements should be replaced once a year or when the pressure drop reaches 15 to 20-inches water column for the blower pre-filter or 1 psi for the compressor pre-filter. Table 9 provides a summary and schedule of routine maintenance.

Table 9 – Summary of Routine Maintenance Requirements and Schedule

Remedial System Component	Monitoring Parameter	Operating Range	Replacement Schedule
SSD/SVE Pre-filter Replacement	Pressure Drop across filter media	No more than 15" w.c. across filter media	As needed or Annually
AS Pre-filter Replacement	Pressure Drop across filter media	No more than 1 psi across filter media	As needed or Annually

To change the pre-filter element:

- turn the power off to the blower by pressing the red STOP button on a blower or compressor starter control box.
- Release wire-form clips on pre-filter housing.
- Remove element.
- Clean sealing surfaces of housing so that they are free of dirt or any other particulate.
- Place new element evenly on base. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces.
- Hemisphere O-ring must rest evenly along canister base O-ring groove.
- Hold canister housing against O-ring or sealing ring on main filter head. Re-fasten wire-form clips.

Checklists or forms will be completed during each routine maintenance event.

Checklists/forms will include, but not be limited to the following information:

- Date, current weather condition;
- Name, company, and position of person(s) conducting maintenance activities;
- SVE operational status (arrival and departure) and general condition of exposed system components;
- Regenerative vacuum SVE blower operating parameters including: process air flow rates; ball valve positions (percent open); blower inlet vacuum and discharge pressure;
- Vacuum monitoring point parameters to include: induced (differential) vacuum;
- Maintenance activities conducted;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and

- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

5.3.3 Non-Routine Operation and Maintenance

Non-routine O&M will be done as an as-needed basis given the current situation. Those situations could include the activation of warning devices or alarms, damage done to system components deliberately or from storms, reduced effectiveness not associated with the reduction in concentrations of contaminants, and/or if it is time for parts replacement sooner than anticipated. The maintenance will be conducted as required and the system will be thoroughly inspected to determine why the non-routine measures were needed. The reason for the non-routine maintenance may be indicative of some larger operational issues or changes in site conditions which need to be understood.

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

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

5.3.4 System Monitoring Devices and Alarms

A wireless telemetry system has been installed on the SVE system to monitor system parameters on a continuous 24/7/365 basis. Data from analog vacuum sensors is continuously logged and provides real-time evidence of system operating conditions.

In the event that an alarm condition occurs, the telemetry system will send an email and text alert to the designated project manager. Appropriate maintenance and repairs will be conducted, as specified in this Operation and Maintenance Plan, and the system will be restarted. Operational problems will be noted in the PRR 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.

The following vulnerability assessment was performed for this site. Based upon this assessment, it was determined that there were no assets/vulnerabilities to be included in the evaluation for future assessments.

- Flood Plain: No portion of the site is located in a flood plain, low-lying or low-groundwater recharge area.
- Site Drainage and Storm Water Management: The site does not contain any areas which may flood during severe rain events due to insufficient groundwater recharge capabilities or inadequate storm water management systems.
- High Wind: The remedial system installed at this site is located inside the building. Therefore, there are no areas of the site or remedial system, which may be susceptible to damage from the wind itself or falling objects, such as trees or utility structures during periods of high wind.
- Electricity: The site and/or remedial system is susceptible to power loss and/or dips/surges in voltage during severe weather events, which the 24/7/365 wireless telemetry system will immediately detect and report to the ACT Project Manager.
- Spill/Contaminant Release: There are no chemicals stored at the site or generated by the remedial system that could result in a spill or other contaminant release due to storm-related damage caused by flooding, erosion, high winds, loss of power etc.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation outlines NYSDEC's approach to remediating sites in the context of the larger environment. Green Remediation is defined as "the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprint of cleanup actions."

DER-31 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 PRR.

- The remediation of the Site is being performed utilizing *in-situ* technologies that did not result in excessive truck traffic impacts or the generation of significant solid or liquid wastes. Waste generation is limited to the regeneration of spent carbon from the SVE system. The carbon units are being used to the maximum extent possible before being regenerated offsite.
- Energy usage will be reduced to the extent possible by minimizing the operational use of the SSD/SVE/AS systems as quickly as possible. If possible, the VFD frequency of the blower and air compressor control units will be reduced to potentially lower energy usage while the systems are operating.
- Emissions will be limited by the proper operation of the SSDS/SVE/AS systems. Emissions will be dispersed at the roof top level after passing through two sets of carbon treatment systems with no impact on health or the environment.

Methods to further reduce energy consumption, resource usage, waste generation, water usage, etc. will be included in the PRR.

The enrollee has participated in NYSDEC Paperless Cleanup Program. Under this program, paper usage to accomplish project milestones was eliminated or minimized through a series of steps, including digital transmission of project documents and communications.

The enrollee has also participated in NYSDEC's low-energy project management program. Under this program, whenever possible, meetings were held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion.

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 locations of soil vapor extraction and sub-slab depressurization points. Spent materials will be recycled onsite if possible or sent for recycling, as appropriate.

Remedial system types and associated parameters to be evaluated include, but are not limited to:

- SSDS operations;
- SVE/AS operation rates based on the removal of contaminants;
- GAC treatment (spent carbon replacement and disposal or regeneration);

6.2.3 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.

To reduce the cost of energy and resources, ACT has incorporated a wireless telemetry system into the SSD/SVE/AS systems at the site. The telemetry system records and logs the presence of significant vacuum and positive pressures at the regenerative blower and air compressor and notifies the project manager via email and text message if a loss of vacuum or positive pressure occurs in a remedial system.

Site inspections are only required for sample collection and in the rare event that a blower fails and requires service. Thus, energy and resources are consumed only when needed and not to perform routine tasks that can easily be accomplished remotely without associated transportation or consumables costs.

6.2.4 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix H – Site Management Forms, 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 F. 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 reporting frequency indicated in Table 10 and summarized in the PRR.

Table 10 – Schedule of Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Influent/Effluent Sampling Inspection Report	Quarterly
Periodic Review Report	16 months after issuance of Certificate of Completion then annually

* The frequency of events will be conducted as specified until a reduced frequency is approved by the Department.

All interim monitoring/inspection 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 EQuIS™ database in accordance with the requirements found at this link <http://www.dec.ny.gov/chemical/62440.html>.

7.2 Periodic Review Report

A PRR will be submitted to the Department beginning sixteen (16) months after the Satisfactory Completion and No Further Action Letter is issued. After submittal of the initial PRR, the next PRR shall be submitted every three years 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 PRR will be prepared that addresses the site described in Appendix A -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 PRR. 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 qualified environmental professional will prepare, and include in the PRR, 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, Andrew R. Levenbaum, P.E., am certifying as 81 Pondfield Road Company’s (a partnership in dissolution, winding up) Designated Site Representative for the site.”

The signed certification will be included in the PRR.

The PRR 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 PRR 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. 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

6 NYCRR 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).

NYSDOH, October, 2006. Guidance for Evaluation Soil Vapor Intrusion in the State of New York.

EQASOP-GW 001 Region 1 Low Stress (Low-Flow) SOP, Revision No. 3, July 30, 1996, Revised January 19, 2010.

Phase I Environmental Site Assessment, Team Environmental Consultants, Inc. (October 15th, 1996)

Correspondence from Advanced Tank Services (November 17, 2006)

Environmental Investigation Report by Woodard & Curran, Inc. (August 30, 2007)

Remedial Investigation Report, Advanced Cleanup Technologies, Inc. (September 2017).

Final Engineering Report. NYSDEC Site Number 360130, Advanced Cleanup Technologies, Inc. (September 2019).

Table 2
Historical Soil Exceedances

Volatile Organic Compounds in Soil (ug/kg)
EPA Method 8260

Spic & Span Cleaners
NYSDEC BCP Site No. C360130

Sample ID	Standard			ACT-1		ACT-2	ACT-3		ACT-4		ACT-6		ACT-7		ACT-9		ACT-14	ACT-15	ACT-16	ACT-17	
Sample Date	UUSCO ¹	RRSCO ²	CSCO ³	3/9/12		3/9/12	4/16/12		4/16/12		5/3/12		5/3/12		5/24/12		7/12/12	7/12/12	7/12/12	7/12/12	
Dample Depth				10-11'	14-15'	9-10'	0-2'	10-11'	14-15'	5-6'	9-10'	0-2'	13-15'	5-7'	15-17'	8-10'	13-15'	13-15'	14-15'	13-15'	13-15'
1,1,1,2-Tetrachloroethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1,1-Trichloroethane	680	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1,2,2-Tetrachloroethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1,2-Trichloro-1,2,2-trifluoroethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1,2-Trichloroethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1-Dichloroethane	270	26,000	240,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1-Dichloroethene	330	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,1-Dichloropropene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2,3-Trichlorobenzene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2,3-Trichloropropane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2,4,5-Tetramethylbenzene	NS	NS	NS	<6.2	10,000	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	620	<2.5	<2.5	<2.3	<2.4
1,2,4-Trichlorobenzene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2,4-Trimethylbenzene	3,600	52,000	190,000	<6.2	57	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	16	<2.5	<2.5	<2.3	<2.4
1,2-Dibromo-3-chloropropane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2-Dibromoethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2-Dichlorobenzene	1,100	100,000	500,000	2	47	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	11	<2.5	<2.5	<2.3	<2.4
1,2-Dichloroethane	20	3,100	30,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,2-Dichloropropane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,3,5-Trimethylbenzene	8,400	52,000	190,000	<6.2	77	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	8.6	<2.5	<2.5	<2.3	<2.4
1,3-Dichlorobenzene	2,400	49,000	280,000	1.4	1.7	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	1.8	<2.5	<2.5	<2.3	<2.4
1,3-dichloropropane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
1,4-Dichlorobenzene	1,800	13,000	130,000	2.6	50	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	7.8	<2.5	<2.5	<2.3	<2.4
1,4-Dioxane	100	13,000	130,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
2,2-Dichloropropane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
2-Butanone	120	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<5.3	<5.9	<6.2	<6.3	<5.9	<6.1
2-Chloroethyl vinyl ether	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
2-Chlorotoluene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
2-Hexanone	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<5.3	<5.9	<6.2	<6.3	<5.9	<6.1
2-Propanol	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
4-Chlorotoluene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
4-Isopropyltoluene	NS	NS	NS	<6.2	31	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	8	<2.5	<2.5	<2.3	<2.4
4-Methyl-2-pentanone	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<5.3	<5.9	<6.2	<6.3	<5.9	<6.1
Acetone	50	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<5.3	<5.9	<6.2	<6.3	<5.9	<6.1
Acrolein	NS	NS	NS	<12	<12	<11	<10	<10	<13	<10	<11	<9.4	<13	<11	<11	<11	<12	<12	<13	<12	<12
Acrylonitrile	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Benzene	60	4,800	44,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Bromobenzene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Bromochloromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Bromodichloromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Bromoform	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Bromomethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Carbon disulfide	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Carbon tetrachloride	760	2,400	22,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4

Sample ID	Standard			ACT-1		ACT-2		ACT-3		ACT-4		ACT-6		ACT-7		ACT-9		ACT-14	ACT-15	ACT-16	ACT-17
Sample Date	UUSCO ¹	RRSCO ²	CSCO ³	3/9/12		3/9/12		4/16/12		4/16/12		5/3/12		5/3/12		5/24/12		7/12/12	7/12/12	7/12/12	7/12/12
Dample Depth				10-11'	14-15'	9-10'	0-2'	10-11'	14-15'	5-6'	9-10'	0-2'	13-15'	5-7'	15-17'	8-10'	13-15'	13-15'	14-15'	13-15'	13-15'
Chlorobenzene	1,100	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Chlorodifluoromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Chloroethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Chloroform	370	49,000	350,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Chloromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
cis-1,2-Dichloroethene	250	100,000	500,000	<6.2	1.6	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	2.3	<2.5	0.81	1.2	<2.4
cis-1,3-Dichloropropene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Dibromochloromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Dibromomethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Dichlorodifluoromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Diisopropyl ether	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Ethanol	NS	NS	NS	<12	<12	<11	<10	<10	<13	<10	<11	<9.4	<13	<11	<11	<5.3	<5.9	<6.2	<6.3	<5.9	<6.1
Ethyl acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Ethylbenzene	1,000	41,000	390,000	<6.2	6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	2.5	<2.5	<2.5	<2.3	<2.4
Freon-114	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Hexachlorobutadiene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Isopropyl acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Isopropylbenzene	NS	NS	NS	<6.2	1.3	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	0.51	<2.5	<2.5	<2.3	<2.4
m,p-Xylene	260	100,000	500,000	<12	7.3	<11	<10	<10	<13	<10	<11	<9.4	<13	<11	<11	<4.3	6.1	<4.9	<5.1	<4.7	<4.8
Methyl Acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Methyl tert-butyl ether	930	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Methylene chloride	50	100,000	500,000	8.5	8.5	4.4	4.6	4.4	5.8	4.9	5.1	5.2	8.3	5.8	7	10	12	8	8.9	7.5	8.3
n-Amyl acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Naphthalene	NS	NS	NS	<6.2	42	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	92	<2.5	<2.5	0.77	<2.4
n-Butyl acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
n-Butylbenzene	12,000	100,000	500,000	<6.2	3.4	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	21	<2.5	<2.5	<2.3	<2.4
n-Propyl acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
n-Propylbenzene	3,900	100,000	500,000	<6.2	4.8	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	1.8	<2.5	<2.5	<2.3	<2.4
o-Xylene	260	100,000	500,000	<6.2	21	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	7.7	<2.5	<2.5	<2.3	<2.4
p-Diethylbenzene	NS	NS	NS	<6.2	160	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	180	<2.5	<2.5	<2.3	<2.4
p-Ethyltoluene	NS	NS	NS	<6.2	60	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	13	<2.5	<2.5	<2.3	<2.4
sec-Butylbenzene	11,000	100,000	500,000	<6.2	3.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	0.91	<2.5	<2.5	<2.3	<2.4
Styrene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
t-Butyl alcohol	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
tert-Butylbenzene	5,900	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Tetrachloroethene	1,300	19,000	150,000	2,800	300,000	1.3	0.75	<5.1	<6.3	<5.2	52	<4.7	3.1	<5.7	<5.7	0.42	6,000	8.2	33	270	0.7
Toluene	700	100,000	500,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	0.31	<2.5	<2.5	<2.3	<2.4
trans-1,2-Dichloroethene	NS	NS	NS	<6.2	1.4	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
trans-1,3-Dichloropropene	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Trichloroethene	470	21,000	200,000	2.5	21	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	6.9	<2.5	2.2	2.1	<2.4
Trichlorofluoromethane	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Vinyl acetate	NS	NS	NS	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4
Vinyl chloride	20	900	13,000	<6.2	<6.2	<5.5	<5.1	<5.1	<6.3	<5.2	<5.7	<4.7	<6.7	<5.7	<5.7	<2.1	<2.4	<2.5	<2.5	<2.3	<2.4

¹ Unrestricted Use Soil Cleanup Objectives, Table 375-6.8(a), 6 NYCRR 375, NYSDEC 2006

² Restricted Residential Soil Cleanup Objectives, Table 375-6.8(b), 6 NYCRR 375, NYSDEC 2006

³ Commercial Soil Cleanup Objectives, Table 375-6.8(b), 6 NYCRR 375, NYSDEC 2006

Bolded values signify detection above method detection limit

Highlighted values signify exceedance of regulatory guidance

NS = No Standard

Sample ID		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives - Restricted Residential	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Commercial	SB-5 (20-22')	
Sampling Date					10/31/16	
Compound	CAS Number				Result	Q
Chlorobenzene	108-90-7	1,100	100,000	500,000	2.0	U
Chloroethane	75-00-3	~	~	~	2.0	U
Chloroform	67-66-3	370	49,000	350,000	2.0	U
Chloromethane	74-87-3	~	~	~	2.0	U
cis-1,2-Dichloroethylene	156-59-2	250	100,000	500,000	2.0	U
cis-1,3-Dichloropropylene	10061-01-5	~	~	~	2.0	U
Cyclohexane	110-82-7	~	~	~	2.0	U
Dibromochloromethane	124-48-1	~	~	~	2.0	U
Dibromomethane	74-95-3	~	~	~	2.0	U
Dichlorodifluoromethane	75-71-8	~	~	~	2.0	U
Ethyl Benzene	100-41-4	1,000	41,000	390,000	2.0	U
Hexachlorobutadiene	87-68-3	~	~	~	2.0	U
Isopropylbenzene	98-82-8	~	~	~	2.0	U
Methyl acetate	79-20-9	~	~	~	2.0	U
Methyl tert-butyl ether (MTBE)	1634-04-4	930	100,000	500,000	2.0	U
Methylcyclohexane	108-87-2	~	~	~	2.0	U
Methylene chloride	75-09-2	50	100,000	500,000	4.0	U
n-Butylbenzene	104-51-8	12,000	100,000	500,000	2.0	U
n-Propylbenzene	103-65-1	3,900	100,000	500,000	2.0	U
o-Xylene	95-47-6	~	~	~	2.0	U
p- & m- Xylenes	179601-23-1	~	~	~	4.0	U
p-Isopropyltoluene	99-87-6	~	~	~	2.0	U
sec-Butylbenzene	135-98-8	11,000	100,000	500,000	2.0	U
Styrene	100-42-5	~	~	~	2.0	U
tert-Butyl alcohol (TBA)	75-65-0	~	~	~	2.0	U
tert-Butylbenzene	98-06-6	5,900	100,000	500,000	2.0	U
Tetrachloroethylene	127-18-4	1,300	19,000	150,000	2.0	U
Toluene	108-88-3	700	100,000	500,000	2.0	U
trans-1,2-Dichloroethylene	156-60-5	190	100,000	500,000	2.0	U
trans-1,3-Dichloropropylene	10061-02-6	~	~	~	2.0	U
Trichloroethylene	79-01-6	470	21,000	200,000	2.0	U
Trichlorofluoromethane	75-69-4	~	~	~	2.0	U
Vinyl Chloride	75-01-4	20	900	13,000	2.0	U
Xylenes, Total	1330-20-7	260	100,000	500,000	6.0	U

Bolded values signify detection above method detection limit

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

~=this indicates that no regulatory limit has been established for this analyte

Sample ID		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives - Restricted Residential	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Commercial	SB-5 (20-22')	
Sampling Date					10/31/16	
Compound	CAS Number				Result	Q
Chlorobenzene	108-90-7	1,100	100,000	500,000	2.0	U
Chloroethane	75-00-3	~	~	~	2.0	U
Chloroform	67-66-3	370	49,000	350,000	2.0	U
Chloromethane	74-87-3	~	~	~	2.0	U
cis-1,2-Dichloroethylene	156-59-2	250	100,000	500,000	2.0	U
cis-1,3-Dichloropropylene	10061-01-5	~	~	~	2.0	U
Cyclohexane	110-82-7	~	~	~	2.0	U
Dibromochloromethane	124-48-1	~	~	~	2.0	U
Dibromomethane	74-95-3	~	~	~	2.0	U
Dichlorodifluoromethane	75-71-8	~	~	~	2.0	U
Ethyl Benzene	100-41-4	1,000	41,000	390,000	2.0	U
Hexachlorobutadiene	87-68-3	~	~	~	2.0	U
Isopropylbenzene	98-82-8	~	~	~	2.0	U
Methyl acetate	79-20-9	~	~	~	2.0	U
Methyl tert-butyl ether (MTBE)	1634-04-4	930	100,000	500,000	2.0	U
Methylcyclohexane	108-87-2	~	~	~	2.0	U
Methylene chloride	75-09-2	50	100,000	500,000	4.0	U
n-Butylbenzene	104-51-8	12,000	100,000	500,000	2.0	U
n-Propylbenzene	103-65-1	3,900	100,000	500,000	2.0	U
o-Xylene	95-47-6	~	~	~	2.0	U
p- & m- Xylenes	179601-23-1	~	~	~	4.0	U
p-Isopropyltoluene	99-87-6	~	~	~	2.0	U
sec-Butylbenzene	135-98-8	11,000	100,000	500,000	2.0	U
Styrene	100-42-5	~	~	~	2.0	U
tert-Butyl alcohol (TBA)	75-65-0	~	~	~	2.0	U
tert-Butylbenzene	98-06-6	5,900	100,000	500,000	2.0	U
Tetrachloroethylene	127-18-4	1,300	19,000	150,000	2.0	U
Toluene	108-88-3	700	100,000	500,000	2.0	U
trans-1,2-Dichloroethylene	156-60-5	190	100,000	500,000	2.0	U
trans-1,3-Dichloropropylene	10061-02-6	~	~	~	2.0	U
Trichloroethylene	79-01-6	470	21,000	200,000	2.0	U
Trichlorofluoromethane	75-69-4	~	~	~	2.0	U
Vinyl Chloride	75-01-4	20	900	13,000	2.0	U
Xylenes, Total	1330-20-7	260	100,000	500,000	6.0	U

Bolded values signify detection above method detection limit

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

~=this indicates that no regulatory limit has been established for this analyte

Table 3
Historical Groundwater Exceedances

Volatile Organic Compounds in Groundwater (ug/L)
 EPA Method 8260
 BCP Site No. C360130

[illegible]

Volatile Organic Compounds in Groundwater (ug/L)
 EPA Method 8260
 BCP Site No. C360130

[illegible]

Volatile Organic Compounds in Groundwater (ug/L)
 EPA Method 8260
 BCP Site No. C360130

[illegible]

Volatile Organic Compounds in Groundwater (ug/L)
 EPA Method 8260
 BCP Site No. C360130

Sample ID		NYSDEC TOGS Standards and Guidance Values - GA	MW-5 (Intermediate)												MW-6												MW-7							
York ID	Sampling Date		16C0469-13		16F0640-08		16K0570-14		17E1035-14		17J0059-13		18A0960-11		19C0614-01		16C0469-14		16F0640-12		16K0570-10		17B0846-01		17E1035-01		17J0059-14		18A0960-12		19C0544-01		16C0469-15	
Client Matrix	Compound		3/10/16 Water		6/15/16 Water		11/10/16 Water		5/24/17 Water		9/29/17 Water		1/26/18 Water		3/14/19 Water		3/9/16 Water		6/14/16 Water		11/9/16 Water		2/22/17 Water		5/22/17 Water		9/28/17 Water		1/26/18 Water		3/13/19 Water		3/9/16 Water	
	CAS Number		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
		ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L			
Volatile Organics, NJDEP/TCL/Part 375 List			10		25		25		10		1		1		25		5		2		10		10		5		5		1		5			
Dilution Factor																																		
1,1,1,2-Tetrachloroethane	630-20-6	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,1,1-Trichloroethane	71-55-6	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,1,2,2-Tetrachloroethane	79-34-5	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,1,2-Trichloroethane	79-00-5	1	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,1-Dichloroethane	75-34-3	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,1-Dichloroethylene	75-35-4	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2,3-Trichlorobenzene	87-61-6	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2,3-Trichloropropane	96-18-4	0.04	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2,4-Trichlorobenzene	120-82-1	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2,4-Trimethylbenzene	95-63-6	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2-Dibromo-3-chloropropane	96-12-8	0.04	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2-Dibromoethane	106-93-4	0.0006	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2-Dichlorobenzene	95-50-1	3	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.44	J	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2-Dichloroethane	107-06-2	0.6	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,2-Dichloropropane	78-87-5	1	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,3,5-Trimethylbenzene	108-67-8	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,3-Dichlorobenzene	541-73-1	3	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,4-Dichlorobenzene	106-46-7	3	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.53	J	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
1,4-Dioxane	123-91-1	~	400	U	1,000	U	40	U	40	U	40	U	40	U	40	U	200	U	80	U	40	U	40	U	40	U	200	U	40	U	40	U		
2-Butanone	78-93-3	50	2	U	8.8	BD	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	0.57		
2-Hexanone	591-78-6	50	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
4-Methyl-2-pentanone	108-10-1	~	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Acetone	67-64-1	50	10	U	57	BD	1.2	J	1.6	J	1.2	J	1	U	1	U	5	U	4.1	BD	1	U	1	U	1	U	5.2	JD	1	U	1.1	J		
Acrolein	107-02-8	~	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Acrylonitrile	107-13-1	~	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Benzene	71-43-2	1	2	U	5	U	3	U	0.59	J	1.7	J	0.34	J	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	0.23		
Bromochloromethane	74-97-5	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Bromodichloromethane	75-27-4	50	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Bromoform	75-25-2	50	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Bromomethane	74-83-9	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Carbon disulfide	75-15-0	~	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Carbon tetrachloride	56-23-5	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Chlorobenzene	108-90-7	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Chloroethane	75-00-3	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Chloroform	67-66-3	7	2	U	5	U	0.57	U	0.21	J	1.2	J	0.73	U	0.24	J	1	U	0.4	U	0.45	J	0.62	J	0.42	J	1	U	27	U	2.1	U		
Chloromethane	74-87-3	5	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
cis-1,2-Dichloroethylene	156-59-2	5	2	U	5	U	10	U	3.6	U	7	U	3.4	U	1.1	U	1	U	0.42	JD	0.63	U	0.59	U	0.48	J	1	U	0.2	U	0.39	J		
cis-1,3-Dichloropropylene	10061-01-5	0.4	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Cyclohexane	110-82-7	~	2	U	5	U	0.62	U	0.2	U	0.45	J	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Dibromochloromethane	124-48-1	50	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Dibromomethane	74-95-3	~	2	U	5	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1	U	0.4	U	0.2	U	0.2	U	0.2	U	1	U	0.2	U	0.2	U		
Dichlorodifluoromethane	75-71-8	5	2	U	5																													

Table 4

**Historical Indoor Air and Soil
Vapor Exceedances**

<p>Table 1</p> <p>Volatile Organic Compounds in Indoor Air, Outdoor Air and Sub-Slab Soil Vapor (ug/m³)</p> <p>EPA Method: TO-15</p> <p>79-81 Pondfield Road</p> <p>Bronxville, NY</p> <p>Sample Date: October 22, 2013</p>													
Sample ID	NYSDOH Indoor Air Guideline ¹	Store #1	Store #2	Store #3	Unit 1	Unit 4	Unit 9	Unit 12	Unit 14	OA-2	USEPA Soil Vapor Guideline ²	VP-7	VP-8
Sample Date		10/22/13	10/22/13	10/22/13	10/29/13	11/2/13	10/29/13	10/29/13	11/2/13	10/26/13		10/29/13	10/26/13
1,1,1-Trichloroethane	NA	<1.09	<1.09	0.82	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	100 ³	<1.09	<1.09
1,1,2,2-Tetrachloroethane	NA	<1.37	<0.37	<1.37	<1.37	<1.37	<1.37	<1.37	<1.37	<1.37	0.42	<1.37	<1.37
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	<0.77	<0.77	<0.77	<0.77	1.00	1.30	<0.77	<0.77	<0.77	300,000	<0.77	<0.77
1,1,2-Trichloroethane	NA	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	1.5	<1.09	<1.09
1,1-Dichloroethane	NA	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	5,000	<0.81	<0.81
1,1-Dichloroethene	NA	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	2,000	<0.79	<0.79
1,2,4-Trichlorobenzene	NA	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	2,000	<1.48	<1.48
1,2,4-Trimethylbenzene	NA	0.59	<0.98	0.88	0.84	<0.98	1.43	0.69	0.49	0.79	60	10.6	6.59
1,2-Dibromoethane	NA	<1.54	<1.54	<1.54	<1.54	<1.54	<1.54	<1.54	<1.54	<1.54	0.11	<1.54	<1.54
1,2-Dichlorobenzene	NA	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	2,000	<1.20	<1.20
1,2-Dichloroethane	NA	<0.81	<0.81	<0.81	<0.81	0.57	<0.81	<0.81	<0.81	<0.81	0.94	2.23	<0.81
1,2-Dichloroethene (cis)	NA	<0.79	<0.79	1.7	0.40	<0.79	0.91	<0.79	0.79	<0.79	350	13.5	4.08
1,2-Dichloroethene (trans)	NA	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	<0.79	700	<0.79	<0.79
1,2-Dichloropropane	NA	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	40	<0.92	<0.92
1,2-Dichlorotetrafluoroethane	NA	<1.40	<1.40	<1.40	<1.40	<1.40	<1.40	<1.40	<1.40	<1.40	NA	<1.40	<1.40
1,3,5-Trimethylbenzene	NA	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	60	2.85	1.72
1,3-Butadiene	NA	<0.44	<0.44	<0.44	<0.44	<0.44	<0.44	<0.44	1.28	<0.44	0.09	<0.44	<0.44
1,3-Dichlorobenzene	NA	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	1,100	<1.20	<1.20
1,3-Dichloropropene (cis)	NA	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	6.1	<0.91	<0.91
1,3-Dichloropropene (trans)	NA	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	6.1	<0.91	<0.91
1,3-Hexachlorobutadiene	NA	<2.13	<2.13	<2.13	<2.13	<2.13	<2.13	<2.13	<2.13	<2.13	1.1	<2.13	<2.13
1,4-Dichlorobenzene	NA	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20	8,000	<1.20	<1.20
1,4-Dioxane	NA	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	NA	<0.72	<0.72
2,2,4-Trimethylpentane	NA	0.93	0.56	1.59	1.17	0.70	1.45	0.79	0.56	1.40	NA	2.71	1.64
4-Ethyltoluene	NA	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	NA	3.74	2.11
Acetone	NA	9.38	7.48	10.6	17.8	4.11	22.2	9.98	7.29	8.46	3,500	7.93	58.7
Benzene	NA	0.51	0.48	0.99	0.89	0.48	1.12	0.58	0.51	0.99	3.1	2.11	1.21
Bromodichloromethane	NA	<1.34	<1.34	<1.34	<1.34	<1.34	<1.34	<1.34	<1.34	<1.34	1.4	<1.34	<1.34
Bromoform	NA	<2.07	<2.07	<2.07	<2.07	<2.07	<2.07	<2.07	<2.07	<2.07	22	<2.07	<2.07
Bromomethane	NA	<0.78	<0.78	<0.78	<0.78	<0.78	<0.78	<0.78	<0.78	<0.78	NA	<0.78	<0.78
Carbon disulfide	NA	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	7,000	0.44	<0.62
Carbon tetrachloride	NA	<1.26	0.63	<1.26	<1.26	0.94	<1.26	<1.26	<1.26	<1.26	5 ⁴	<1.26	<1.26
Chlorobenzene	NA	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	600	<0.92	<0.92
Chloroethane	NA	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	100,000	<0.53	<0.53
Chloroform	NA	<0.98	0.73	0.68	<0.98	0.68	<0.98	<0.98	<0.98	<0.98	1.1	1.17	2.39
Chloromethane	NA	0.91	0.58	0.91	0.89	0.43	1.16	0.85	0.50	0.85	24	<0.41	0.89
Cyclohexane	NA	<0.69	<0.69	0.41	0.86	0.55	2.00	<0.69	0.65	0.34	NA	1.24	0.69
Dibromochloromethane	NA	<1.70	<1.70	<1.70	<1.70	<1.70	<1.70	<1.70	<1.70	<1.70	NA	<1.70	<1.70
Dichlorodifluoromethane	NA	2.13	1.48	2.13	2.03	1.14	2.37	2.08	1.19	2.03	2,000	1.98	2.13
Ethanol	NA	28.9	7.78	27.5	59.7	13.1	87.1	35.3	17.7	19.8	NA	5.88	42.8
Ethyl acetate	NA	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	32,000	<0.72	<0.72
Ethylbenzene	NA	0.48	0.48	0.6	0.78	0.61	1.09	0.43	<0.87	0.56	22	8.86	4.21
Isopropanol	NA	5.63	2.41	22.6	6.32	1.23	164	6.32	12.2	5.85	NA	0.74	18.6
Methyl butyl ketone	NA	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	NA	<0.82	<0.82
Methyl ethyl ketone	NA	1.36	0.88	1.56	1.71	0.77	2.01	1.12	0.97	1.24	10,000	2.45	2.45
Methyl isobutyl ketone	NA	<0.82	0.41	0.78	0.45	0.66	1.11	<0.82	0.53	0.41	800	0.45	0.33
Methyl tert-butyl ether	NA	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	<0.72	30,000	<0.72	<0.72
Methylene chloride	60	1.01	10.8	1.20	1.16	0.82	1.51	1.55	0.89	1.55	52	1.67	22.6
n-Heptane	NA	0.53	0.57	0.98	2.54	3.16	1.80	0.86	0.78	0.78	NA	3.73	4.34
n-Hexane	NA	0.70	0.63	1.27	0.99	0.53	1.20	0.78	0.63	1.06	2,000	<0.70	2.26
Propylene	NA	0.67	0.38	1.14	0.98	0.41	0.81	0.57	0.57	1.05	NA	1.94	0.86
Styrene	NA	<0.85	<0.85	<0.85	<0.85	<0.85	2.04	<0.85	<0.85	<0.85	10,000	<0.85	<0.85
tert-Butyl Alcohol	NA	<0.61	<0.61	<0.61	0.30	<0.61	0.64	<0.61	<0.61	<0.61	NA	25.4	15.6
Tetrachloroethane	30	1.22	0.95	20.5	5.49	1.97	10.4	2.03	14.2	5.43	100 ³	881	399
Tetrahydrofuran	NA	0.38	<0.59	0.32	0.35	0.44	0.74	<0.59	<0.59	<0.59	NA	1.47	0.77
Toluene	NA	3.16	1.24	3.54	8.17	1.54	12.5	2.11	4.29	2.98	4,000	36.9	22.0
Trichloroethene	5	<1.07	<1.07	2.63	0.59	0.75	1.45	<1.07	1.34	<1.07	5 ⁴	22.1	5.05
Trichlorofluoromethane	NA	1.18	1.01	1.18	1.29	0.90	2.02	1.24	0.62	1.12	7,000	1.18	1.40
Vinyl acetate	NA	0.85	0.53	1.62	<0.70	<0.70	1.48	<0.70	0.88	1.41	2,000	<0.70	1.51
Vinyl bromide	NA	<0.87	<0.87	<0.87	<0.87	<0.87	<0.87	<0.87	<0.87	<0.87	NA	<0.87	<0.87
Vinyl chloride	NA	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	2.8	<0.51	<0.51
Xylenes (m&p)	NA	1.13	1.09	1.74	2.04	1.26	2.61	1.22	0.91	1.56	70,000	34.2	16.5
Xylenes (o)	NA	0.48	0.52	0.74	0.83	0.65	1.13	0.52	<0.87	0.65	70,000	11.8	5.9

¹ Table 3.1, NYSDOH "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (October 2006)

² Draft Subsurface Vapor Intrusion Guidance, USEPA (November, 2002)

³ Matrix 1, NYSDOH "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (October 2006)

⁴ Matrix 2, NYSDOH "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (October 2006)

Bolded values signify detection above method detection limit

Highlighted values signify detection above guidance value

NA = Not Available

Table 5

Historical Onsite Sub-Slab Vacuum Measurements

Induced Vacuum at Vacuum Monitoring Points
79 Pondfield Road
Bronxville, NY

Date		9/4/14	1/19/15	3/9/15	4/1/15	5/12/2015 (baseline)	5/12/15	5/13/15	5/28/15	6/18/15	7/30/15	8/12/15	8/19/15
VP-1	Inch of H ₂ O	0.002	-0.05	-0.03	-0.085	-0.023	-0.06	-0.009	-0.31	-0.11	-0.21	-0.38	-0.22
VP-2	Inch of H ₂ O	0.003	-0.45	-0.08	-0.063	-0.022	-0.02	-0.012	-0.113	-0.11	-0.69	-0.17	-0.093
VP-3	Inch of H ₂ O	-0.41	-0.1	-0.06	-0.08	-0.123	-0.02	-0.161	-0.1	-0.087	-0.023	-0.167	-0.308
VP-4	Inch of H ₂ O	-1.15	-0.06							-0.53		-0.36	-0.78
VP-5	Inch of H ₂ O	-0.61	-0.06							-0.56		-0.45	-1.7
VP-6	Inch of H ₂ O		-0.37	Ice				Sensor	Sensor	Sensor	Sensor	Sensor	Sensor

Induced Vacuum at Vacuum Monitoring Points
79 Pondfield Road
Bronxville, NY

[illegible]

Table 8

Equipment Troubleshooting Guide

7.6 OPERATION PROBLEMS

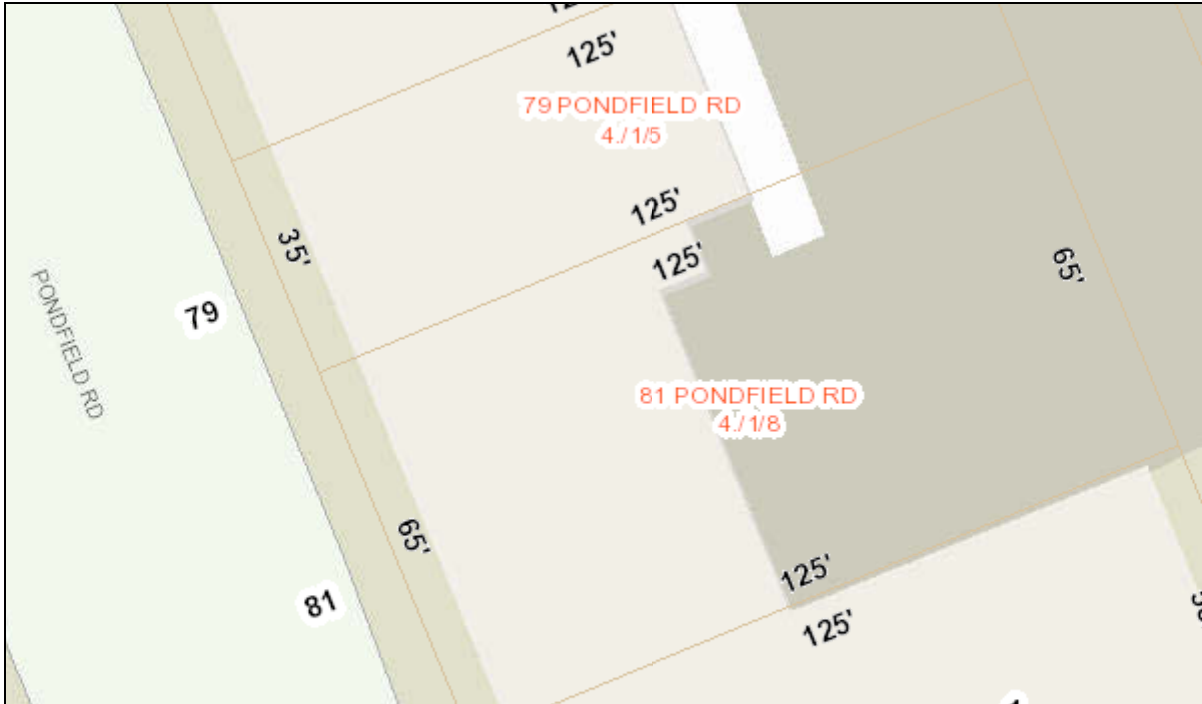
Problem	Serious ³ ness	Cause	Cure
The unit does not start	F	Incorrect electrical wiring.	Have the electrical connection checked by the Technician, referring to the diagram in the terminal box.
	F	Unsuitable supply voltage.	Make sure the supply voltage, measured at the motor terminals, matches the rated voltage +/-10%.
	G	The impeller is stuck.	Have the unit repaired by FPZ After-Sales Service.
Insufficient or no air flow	G	The suction filter is clogged.	Have the cartridge cleaned or replaced by the Technician.
	G	Wrong frequency (for inverter powered units).	Correct the frequency.
	G	Profile of impeller blades modified (due to deposits on the profile).	Have the impeller checked by FPZ After-Sales Service
Insufficient or no differential pressure	F	Wrong rotation direction.	Have the rotation direction reversed by the Technician, switching around the two power supply wires.
	G	Leak in the system	Find the leak and seal it.
Current absorption higher than the permissible value	F	Incorrect electrical wiring.	Have the electrical connection checked by the Technician, referring to the diagram in the terminal box.
	F	Supply voltage drop.	Have the supply voltage at the terminals restored within the permissible values by the Technician.
	G	The suction filter is clogged.	Have the cartridge cleaned or replaced by the Technician.
	G	The unit has accumulated deposits inside.	Have the unit cleaned inside by FPZ After-Sales Service.
	G	The unit is operating at a pressure and/or vacuum higher than the permissible value.	Operate on the system and/or control valve to decrease the pressure differentials.
High delivery air temperature	G	The unit is operating at a pressure/vacuum higher than the permissible value.	Operate on the system and/or control valve to decrease the pressure differentials.
	G	The suction filter is clogged.	Have the cartridge cleaned or replaced by the Technician.
	G	The unit has accumulated deposits inside.	Have the unit cleaned inside by FPZ After-Sales Service.
	G	Suction and/or delivery pipes obstructed.	Have the obstructions removed by the Technician.
	G	Intake air temperature above 40°C (+104°F).	Use heat exchangers to reduce the intake air temperature.
Abnormal noise	F	The sound absorbing material is damaged.	Have the sound absorbing material replaced by the Technician.
	G	The impeller rubs against the casing: - The unit is operating at a pressure/vacuum higher than the permissible value.	Operate on the system to decrease the pressure differentials.
	G	- Reduction of assembly play due to internal deposits (dust, dirt on pipes, process residues, etc.).	Have the unit cleaned inside by FPZ After-Sales Service.
	G	Worn bearing.	Have the bearing replaced by FPZ After-Sales Service.
	F	Unit installation position unsuitable.	Have the units installed on structures that cannot transmit or amplify the noise (tanks, metal plates, etc.) by the Technician.
Abnormal vibration	G	The impeller is damaged.	Have the impeller replaced by FPZ After-Sales Service.
	G	The impeller has accumulated deposits.	Have the unit cleaned inside by FPZ After-Sales Service.
	G	Unit fixed without vibration dampers.	Have the unit secured with vibration dampers by the Technician.
	F	Rigid connection to the system	Have flexible sleeves installed between the unit and the pipes by the Technician.
	G	Faulty bearing on blower side or motor side.	Have the bearing replaced by FPZ After-Sales Service.
Leaks	G	Faulty gaskets on the silencer.	Have the gaskets checked and, if necessary, replaced by FPZ After-Sales Service.
	G	Faulty gaskets on the cover.	Have the gaskets checked and, if necessary, replaced by FPZ After-Sales Service.

³ Divided as follows: F for functional fault and G for serious fault

Figure 1

**Tax Map for 79-81 Pondfield Road,
Bronxville, NY**

Tax Parcel Maps

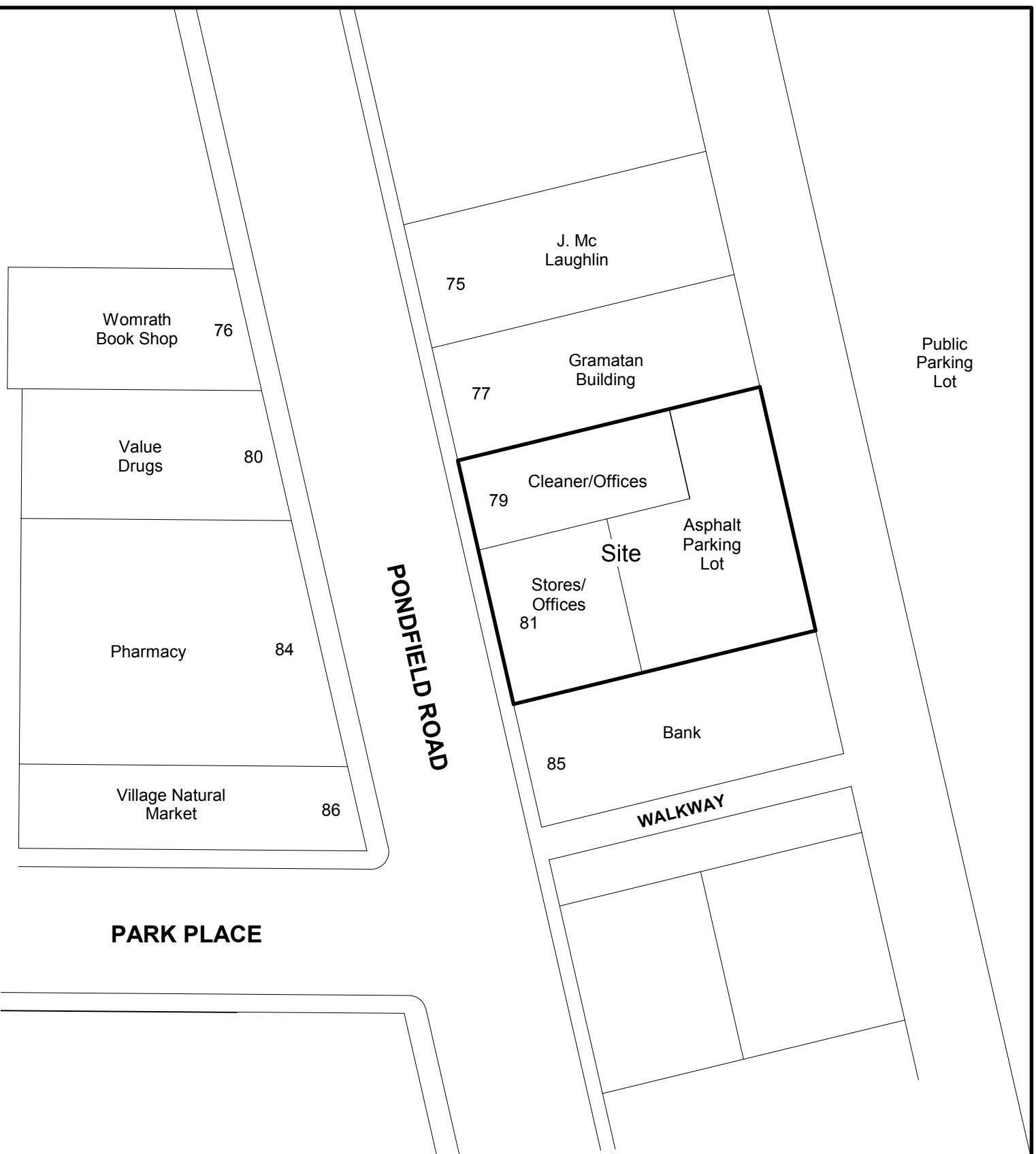


Disclaimer:

This tax parcel map is provided as a public service to Westchester County residents for general information and planning purposes only, and should not be relied upon as a sole informational source. The County of Westchester hereby disclaims any liability from the use of this GIS mapping system by any person or entity. Tax parcel boundaries represent approximate property line location and should NOT be interpreted as or used in lieu of a survey or property boundary description. Property descriptions must be obtained from surveys or deeds. For more information please contact the assessor's office of the municipality.

Figure 2

Site Layout Map



Site layout Map



960 S. Broadway, Suite 100, Hicksville, New York 11801
Tel: 516-933-0655 Fax: 516-933-0659

Project No.: 6832-BVNY

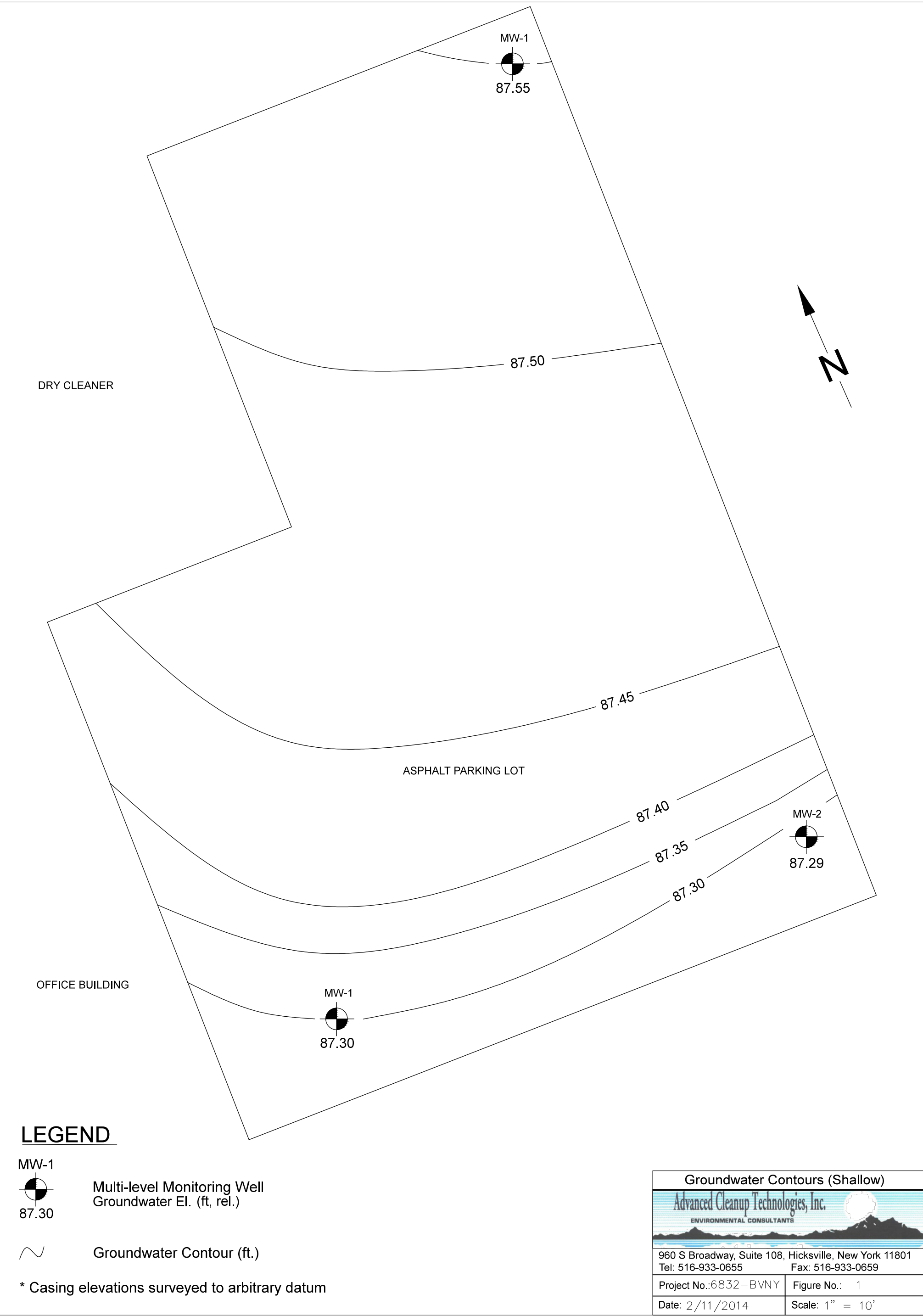
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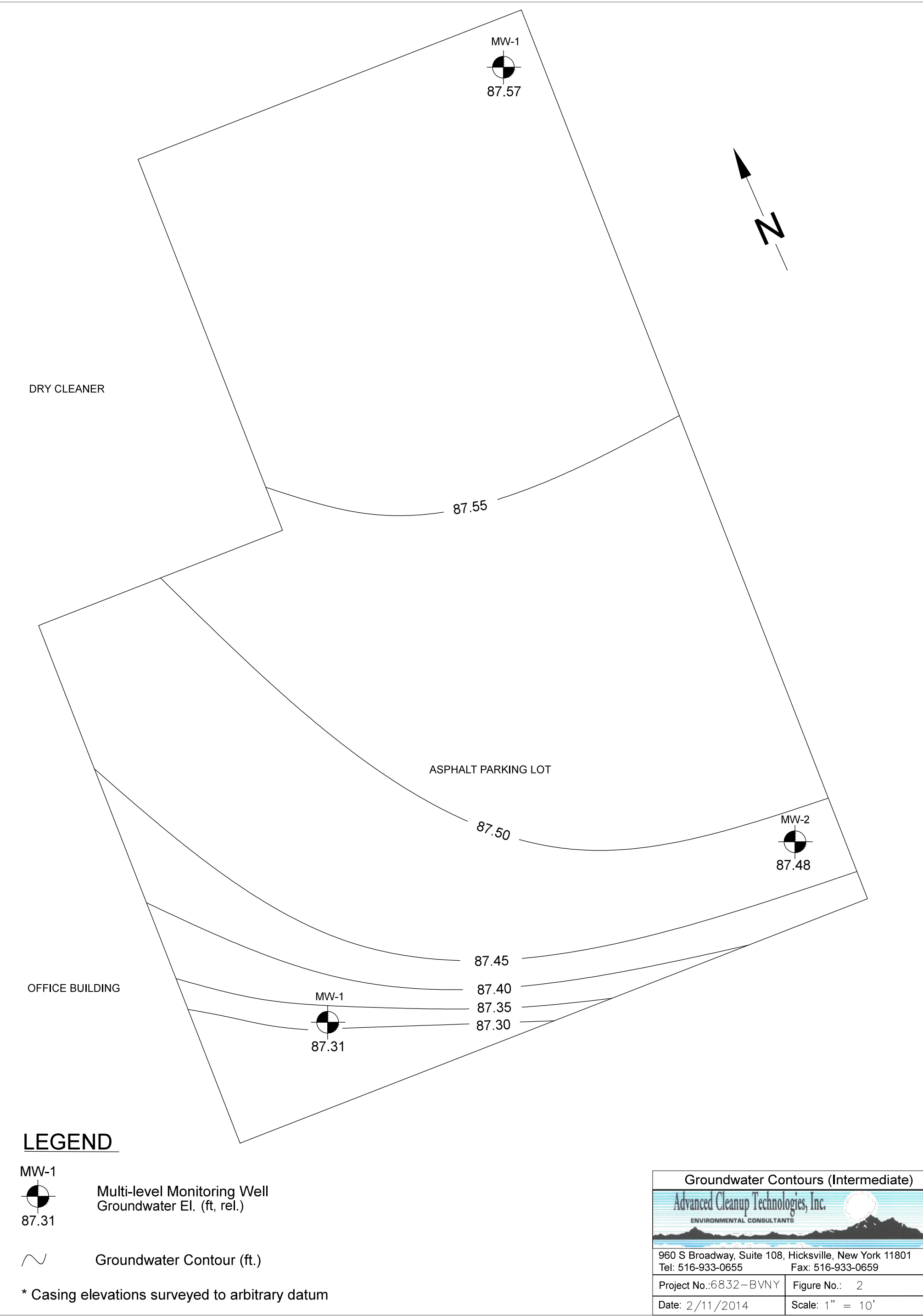
Date: 02/19/2013

Scale: 1" = 50' (Approx.)

Figure 3

Groundwater Contour Maps





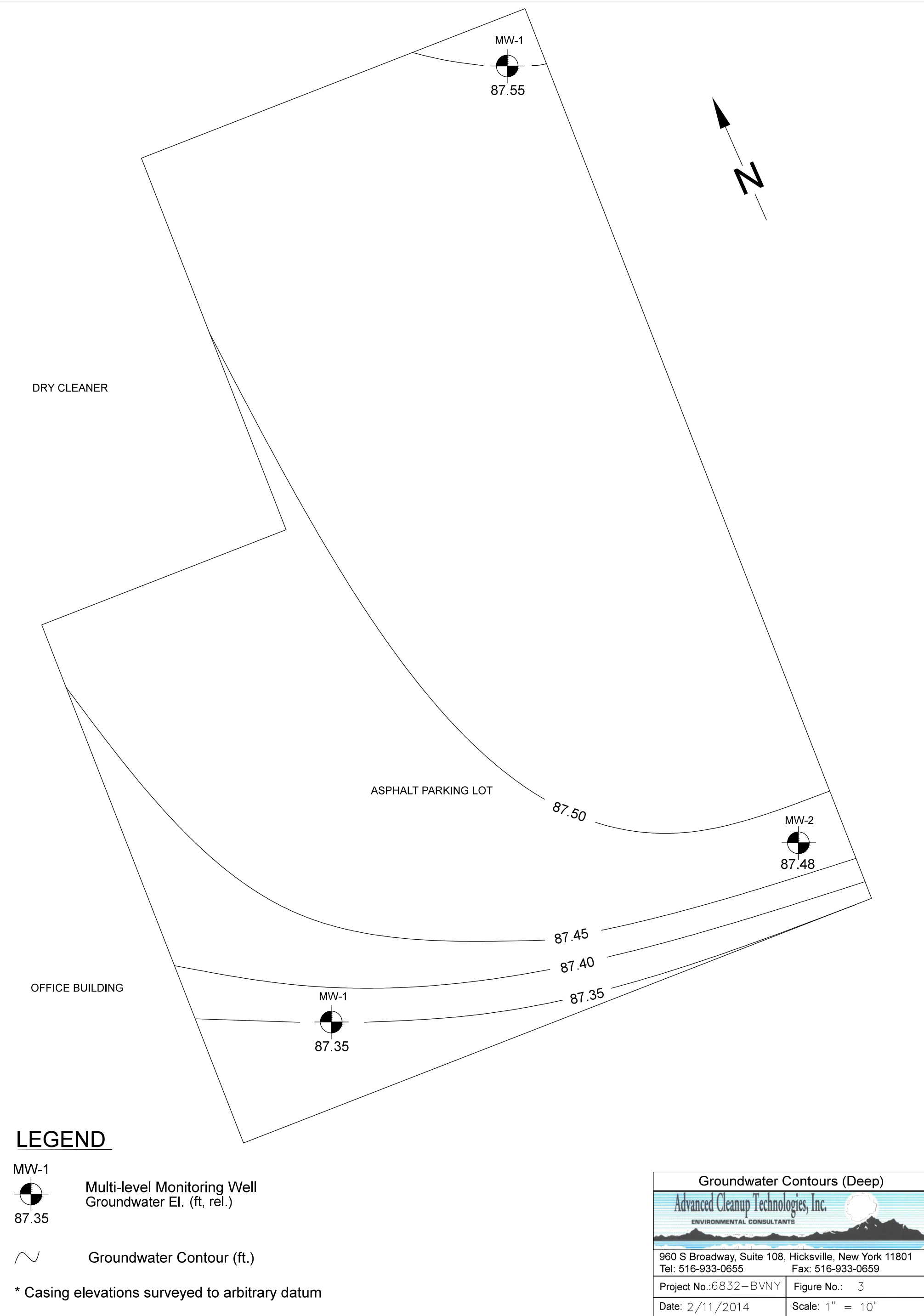


Figure 4

Soil Exceedances

PONDFIELD ROAD

Commercial building

ACT-7
(5-7 ft.) (15-17 ft.)
< 5.7 < 5.7
< 5.7 < 5.7
< 5.7 < 5.7

Commercial building

Former dry cleaner

Adjacent commercial building

ACT-17
(13-15 ft.)
0.7
< 2.4
< 2.4

ACT-15
(14-15 ft.)
33
2.2
0.81

ACT-6
(0-2 ft.) (13-15 ft.)
< 4.7 3.1
< 4.7 < 6.7
< 4.7 < 6.7

ACT-16
(13-15 ft.)
270
2.1
1.2

ACT-9
(8-10 ft.) (13-15 ft.)
0.42 6,000
< 2.1 6.9
< 2.1 2.3

ACT-1
(10-11 ft.) (14-15 ft.)
2,800 300,000
2.5 21
< 6.2 1.6

ACT-3
(0-2 ft.) (10-11 ft.) (14-15 ft.)
0.75 < 5.1 < 6.3
< 5.1 < 5.1 < 6.3
< 5.1 < 5.1 < 6.3

Asphalt Parking Lot

ACT-14
(13-15 ft.)
8.2
< 2.5
< 2.5

ACT-4
(5-6 ft.) (9-10 ft.)
< 5.2 52
< 5.2 < 5.7
< 5.2 < 5.7

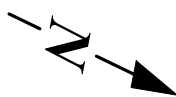
LEGEND

ACT-2
(9-10 ft.)
1.3
< 5.5
< 5.5
< 5.5

Soil Boring

Sample depth (feet below ground surface)
Tetrachloroethene concentration (ug/kg)
Trichloroethene concentration (ug/kg)
cis-1,2-Dichloroethene concentration (ug/kg)

Less than method detection limit at indicated feet below ground surface



SOIL QUALITY



960 S. Broadway, Suite 100, Hicksville, New York 11801
Tel: 516-933-0655 Fax: 516-933-0659

Project No.: 6832-BVNY

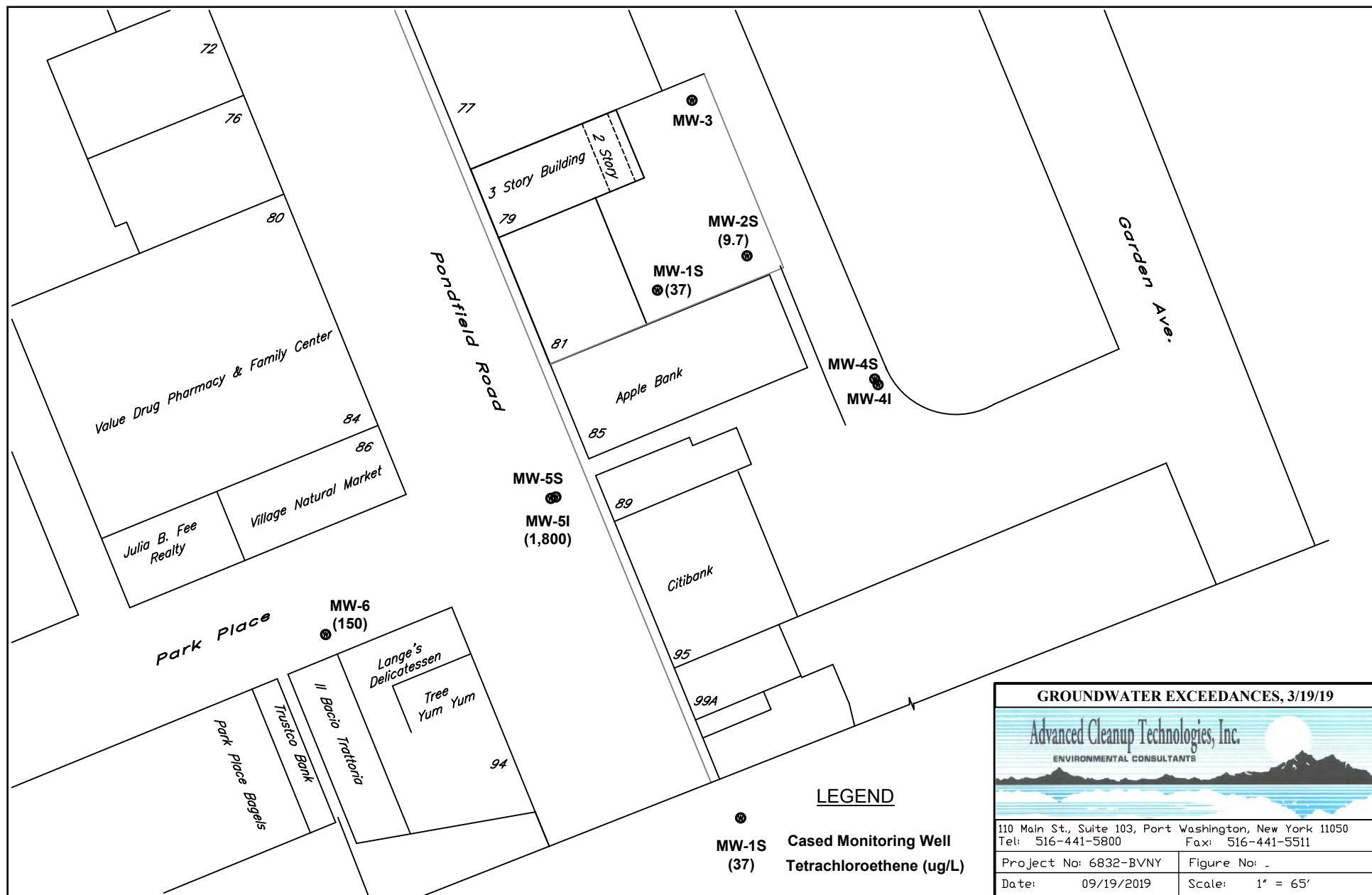
Figure No.: 7

Date: 02/19/2013

Scale: 1" = 15.25'

Figure 5

Groundwater Exceedances



GROUNDWATER EXCEEDANCES, 3/19/19

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS

110 Main St., Suite 103, Port Washington, New York 11050
Tel: 516-441-5800 Fax: 516-441-5511

Project No: 6832-BVNY	Figure No: -
Date: 09/19/2019	Scale: 1" = 65'

Figure 6

Off-Site Soil Vapor Exceedances

PONDFIELD ROAD

Public
Parking
Lot

Site Parking
Lot

WALKWAY

PARK PLACE

SV-5P
(2,500)

SV-5M
(330)

9PPSS-1
(3,200)

7PPSS-2
(10,000)



LEGEND

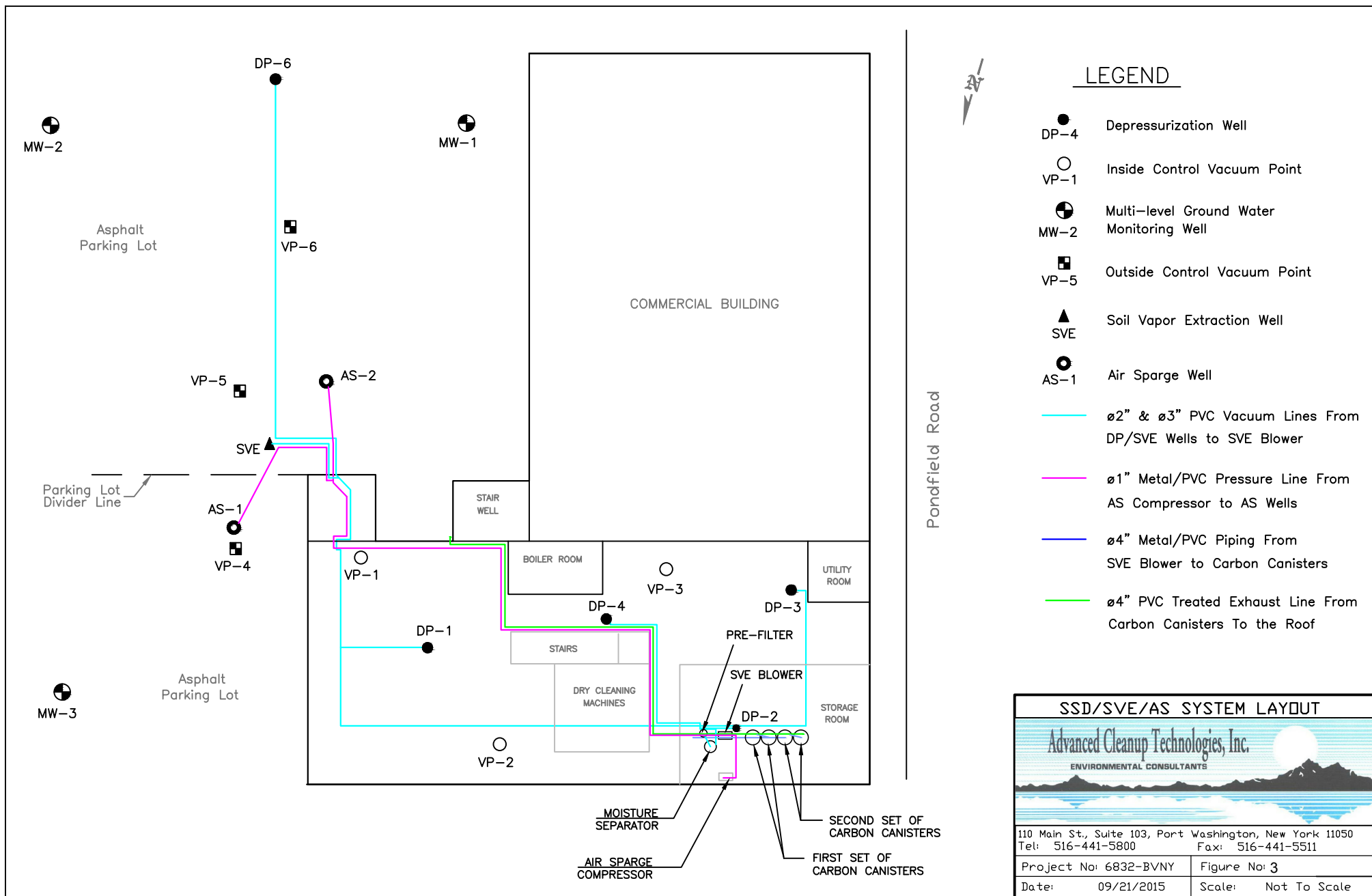
SV-5P Sub-Slab Vapor Sample
2,500 Tetrachloroethene (ug/m3)

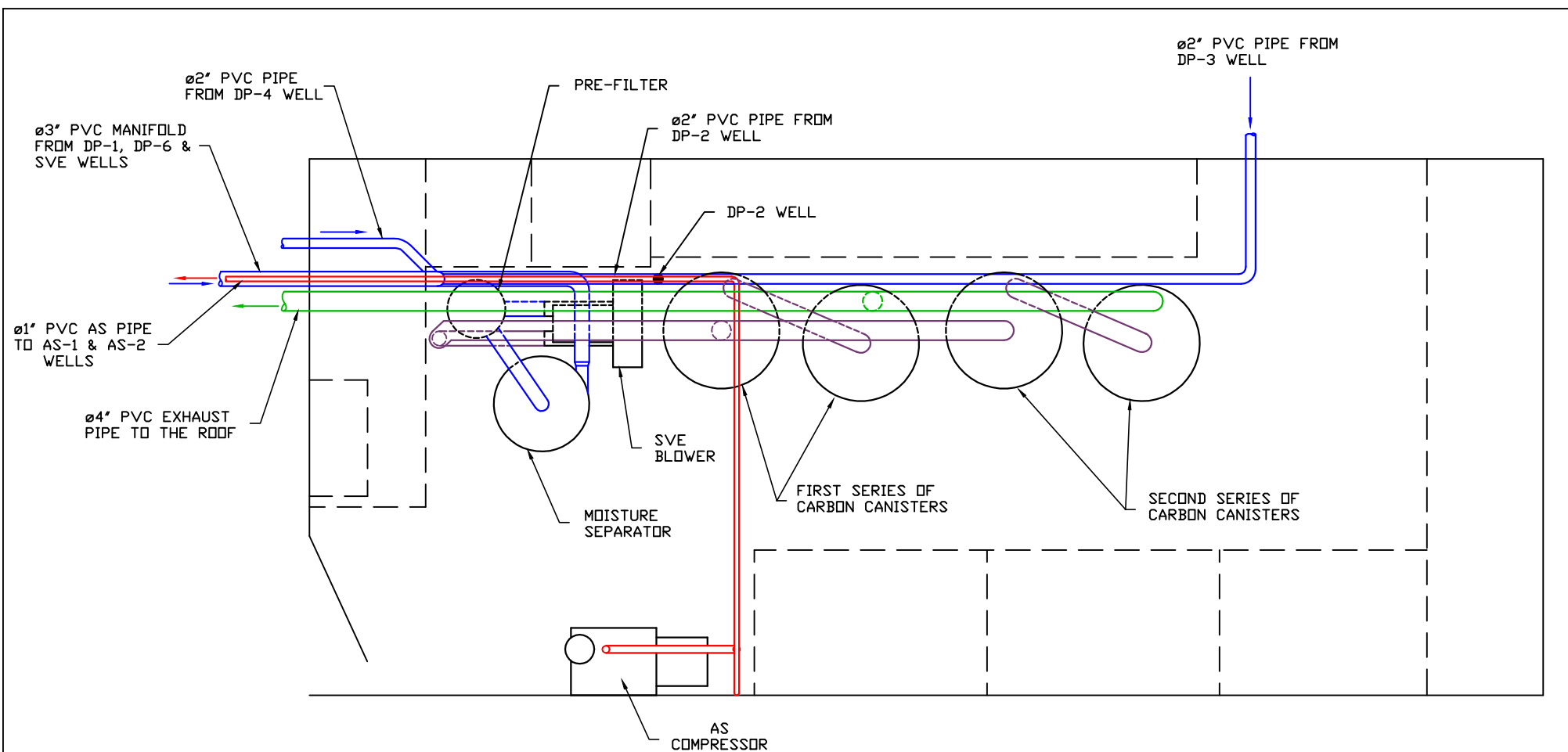
OFFSITE SOIL VAPOR EXCEEDANCES

<p>Advanced Cleanup Technologies, Inc. ENVIRONMENTAL CONSULTANTS</p>	
<p>110 Main Street, Suite 103, Port Washington, New York 11050 Tel: 516-441-5800 Fax: 516-441-5511</p>	
Project No.: 6832-BVNY	Figure No.: 6
Date: 11/26/2019	Scale: 1" = 50' (Approx.)

Figure 7

As-Built Locations of Engineering Controls





LEGEND

- | | |
|--|--|
| — 2" & 3" PVC Vacuum Lines From DP/SVE Wells to SVE Blower | — 4" Metal/PVC Piping From SVE Blower to Carbon Canisters |
| — 1" Metal/PVC Pressure Line From AS Compressor to AS Wells | — 4" PVC Treated Exhaust Line From Carbon Canisters To the Roof |

AS BUILT TREATMENT SYSTEM ROOM LAYOUT	
<p>Advanced Cleanup Technologies, Inc. ENVIRONMENTAL CONSULTANTS</p>	
110 Main St., Suite 103, Port Washington, New York 11050 Tel: 516-441-5800 Fax: 516-441-5511	
Project No: 6832-BVNY	Figure No: 2
Date: 11/12/2015	Scale: 1 = 3'

Appendix A
Environmental Easement

The Office of the Westchester County Clerk: This page is part of the instrument; the County Clerk will rely on the information provided on this page for purposes of indexing this instrument. To the best of submitter's knowledge, the information contained on this Recording and Endorsement Cover Page is consistent with the information contained in the attached document.



581593529EAS001B

Westchester County Recording & Endorsement Page

Submitter Information

Name: National Real Estate Services Inc. (PICK UP ALL NEV) Phone: 914-686-5600
Address 1: 222 Bloomingdale Road Fax: 914-686-1440
Address 2: Suite 306 Email: nresirecordings@allnyt.com
City/State/Zip: White Plains NY 10605 Reference for Submitter: ACR-8562^

Document Details

Control Number: **581593529** Document Type: **Easement (EAS)**
Package ID: 2018060800281001001 Document Page Count: **9** Total Page Count: **11**

Parties

☐ Additional Parties on Continuation page

1st PARTY

1: 81 PONDFIELD RD CO
2:

- Other

2nd PARTY

1: NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERV - Other
2:

Property

☒ Additional Properties on Continuation page

Street Address: 79 PONDFIELD RD Tax Designation: 4-1-5
City/Town: EASTCHESTER Village: BRONXVILLE

Cross- References

☐ Additional Cross-Refs on Continuation page

1: 2: 3: 4:

Supporting Documents

1: TP-584

Recording Fees

Statutory Recording Fee: \$40.00
Page Fee: \$50.00
Cross-Reference Fee: \$0.00
Mortgage Affidavit Filing Fee: \$0.00
RP-5217 Filing Fee: \$0.00
TP-584 Filing Fee: \$5.00
Total Recording Fees Paid: **\$95.00**

Transfer Taxes

Consideration: \$10.00
Transfer Tax: \$0.00
Mansion Tax: \$0.00
Transfer Tax Number: 16163

Mortgage Taxes

Document Date:
Mortgage Amount:

Basic: \$0.00
Westchester: \$0.00
Additional: \$0.00
MTA: \$0.00
Special: \$0.00
Yonkers: \$0.00
Total Mortgage Tax: **\$0.00**

Dwelling Type: Exempt: ☐
Serial #:

RECORDED IN THE OFFICE OF THE WESTCHESTER COUNTY CLERK



Recorded: 07/26/2019 at 04:24 PM
Control Number: **581593529**
Witness my hand and official seal

Timothy C. Idoni

Timothy C. Idoni
Westchester County Clerk

Record and Return To

☐ Pick-up at County Clerk's office

McCullough, Goldberger & Staudt, LLP
1311 Mamaroneck Avenue
Suite 340
White Plains, NY 10605
Attn: Linda B. Whitehead, Esq.

The Office of the Westchester County Clerk: This page is part of the instrument; the County Clerk will rely on the information provided on this page for purposes of indexing this instrument. To the best of submitter's knowledge, the information contained on this Recording and Endorsement Cover Page is consistent with the information contained in the attached document.

581593529EAS001B

Westchester County Recording & Endorsement Page

Document Details

Control Number: **581593529**

Document Type: **Easement (EAS)**

Package ID: 2018060800281001001

Document Page Count: 9

Total Page Count: 11

Properties Addendum

81 PONDFIELD RD 10708

EASTCHESTER

BRONXVILLE

4 1 8

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

as of
THIS INDENTURE made this 10th day of June, 2019, between Owner(s) 81 Pondfield Road Company, having an office at c/o McCullough, Goldberger & Staudt, LLP, 1311 Mamaroneck Avenue, Suite 340, White Plains, New York 10605, County of Westchester, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

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

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

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

WHEREAS, Grantor, is the owner of real property located at the address of 79 and 81 Pondfield Road in the Village of Bronxville, Town of Eastchester, County of Westchester and State of New York, known and designated on the tax map of the County Clerk of Westchester as tax map parcel numbers: Section 4 Block 1 Lots 5 and 8, being the same as that property conveyed to Grantor by deed dated April 28, 1992 and recorded in the Westchester County Clerk's Office in Liber and Page 8220/343. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.2873 +/- acres, and is hereinafter more fully described in the Land Title Survey dated April 29, 2014 prepared by William H. Free, Jr., L.L.S. of Ward Carpenter Engineers Inc., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

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

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

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C360130-07-13, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

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

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

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

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

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

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

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

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

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

(7) All future activities on the property that will disturb remaining

contaminated material must be conducted in accordance with the SMP;

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(i) are in-place;

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

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

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

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

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

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

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

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

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

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

5. Enforcement

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

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

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

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

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

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

Parties shall address correspondence to: Site Number: C360130
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

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

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

communicating notices and responses to requests for approval.

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

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

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

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

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

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

81 Pondfield Road Company:

By: Paul A. Lee

Print Name: Paul A. Lee

Title: Co-executor and Representative
of Estate of John J. Lee,
Winding-up Partner of
81 Pondfield Road Company Date: 5/29/19

Grantor's Acknowledgment

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

On the 29TH day of MAY, in the year 2019, before me, the undersigned, personally appeared PAUL A. LEE, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Eileen Bartosh
Notary Public - State of New York

EILEEN BARTOSH
Notary Public, State of New York
No. 01BA4790408
Qualified in Dutchess County
Certificate Filed in Westchester County
Commission Expires 11-13-2021

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

By:


Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

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

On the 10th day of June, in the year 2019, before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.


Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2022

SCHEDULE "A" PROPERTY DESCRIPTION

ALL that certain plot, piece or parcel of land, with the building and improvements thereon erected, situate, lying and being in the Village of Bronxville, Town of Eastchester, County of Westchester and State of New York, consisting of parts of Lots 3 and 4 and parts of Lots 18 and 19, in Block H., on a certain map entitled, "Map Number 2 of Lawrence Park and Associated Properties, situated at Bronxville, Westchester Co. N.Y." made by William A. Smith, dated February 17, 1920, and filed in the Office of the County Clerk, Division of Land Records, formerly Register's Office of Westchester County, New York, on March 24, 1920, as Map Number 2237, said plot being more particularly bounded and described as follows:

BEGINNING at a point on the easterly side of Pondfield Road as widened, said point being distant southerly 186.63 feet from the southerly end of a curve having a radius of 15.07 feet and a length of 26.28 feet, which curve connects the southerly side of Garden Road, formerly known as Underhill Avenue, with the easterly side of Pondfield Road, as widened; running thence through Lot 19 and Lot 3, in Block H, as shown on said map, north 76° 48' east 125 feet to the northeasterly corner of premises being described herein; running thence through Lots 3 and 4 on a course, south 13° 12' east 99.98 feet to the southeasterly corner of premises being described; running thence south 76° 40' 40" west through Lots 4 and 18, in Block "H", 125 feet to the easterly side of Pondfield Road as widened; running thence along the easterly side of Pondfield Road as widened, north 13° 12' west 100.25 feet to the point and place of beginning.

Containing approximately 0.2873 acres more or less.

Said premises also known as Section 4, Block 1, Lots 5 and 8 on the Official Tax Map.

Appendix B

List of Site Contact Information

Current First Floor Occupants:

Nancy Zaccario
Elite Sweets, Inc.
79 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-337-3344

Edward Han
New Spic & Span Cleaners, Inc.
79 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-337-2287

Charles DiPietro
Bronxville Art & Frame, Inc.
81 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-337-6015

Saverio Grosso
Mano-A-Mano, Inc.
81 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-793-8329

Michelle Ahn
Esun, Inc.
81 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-779-0140

Barbara Amar
Silver Spoon, Inc.
81 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-771-7645

Current Second Floor Occupants:

Enzo Pasini
Pansini Stone Setting, Inc.
81 Pondfield Road, Suite 2
Bronxville, NY 10708
Tel. No. 914-337-5566

Ricky Restiano
Park Place Photographers, Inc.
81 Pondfield Road, Suites 3 and 5
Bronxville, NY 10708
Tel. No. 914-961-1650

James Vanmetter
James Vanmetter Associates
81 Pondfield Road, Suite 4
Bronxville, NY 10708
Tel. No. 914-793-1213

Janet Lyons
New Think Creative, LLC
81 Pondfield Road, Suites 6 and 12
Bronxville, NY 10708
Tel. No. 914-961-0705

Susan Miele
Bronxville Chamber of Commerce
81 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-337-6040

Joan Iacono, Attorney
81 Pondfield Road, Suite 8
Bronxville, NY 10708
Tel. No. 914-961-0565

Sean D/Arcy
81 Pondfield Road, Suite 10
Bronxville, NY 10708
Tel. No. 914-779-9696

Current Owners of Adjacent Properties:

North: 77 Pondfield Road (Section 4, Block 1, Lot 5A)
Dan Faggianelli
Barhite and Holzinger, Inc.
71 Pondfield Road
Bronxville, NY 10708
914-337-1312

South: 85 Pondfield Road (Section 4, Block 1, Lot 9A)
Arthur Miller
Windsor Junior Ltd.
89 Pondfield Road
Bronxville, NY 11708
914-395-0270

East: Municipal parking lot
Village of Bronxville
200 Pondfield Road
Bronxville, NY 10708
Tel. No. 914-337-6500

Appendix C
Soil Boring Logs

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-1

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 3/9/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 12.55'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-2": Asphalt				No odor throughout boring
1			0		
2					
3	2"-5': Tan very fine grain sand		1	60	
4			47		
5			47		
6			0		
7			277		
8	5-10': Tan very fine grain sand		460	80	
9			950		
10		10	760		
11		to 11'	19 ppm		
12			50 ppm		
13	10-15': Tan very fine grain sand		267 ppm	80	Groundwater encountered at 12.55'
14		14	499 ppm		
15		to 15'	120 ppm		

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-2

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 3/9/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 10.7'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-2": Asphalt				No odor throughout boring
1			586		
2					
3	2"-5': Tan very fine grain sand		715	60	
4					
5			605		
6			442		
7			404		
8	5-10': Tan very fine grain sand		142	80	
9		9	295		
10		to 10'	677		
11			0		Groundwater encountered at 10.7'
12			0		
13	10-15': Tan very fine grain sand		99	80	
14			0		
15			0		

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-3

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 4/16/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 13.58'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-2": Asphalt	0 to 2'	0	60	No odor throughout boring
1					
2					
	2"-5': Tan very fine grain sand		0	60	
3					
4					
			0	80	
5					
6					
7					
	5-10': Tan very fine grain sand		0	80	
8					
9					
			0	80	Groundwater encountered at 13.58'
10					
11					
12		14 to 15'	0	80	
	10-15': Tan very fine grain sand				
13					
14					
15					

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-4

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 4/16/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 11.5'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-2": Asphalt				No odor throughout boring
1					
2					
3	2"-5': Tan very fine grain sand		0	60	
4					
5		5			
6		to 6'			
7					
8	5-10': Tan very fine grain sand		0	80	
9		9 to			
10		10'			
11					Groundwater encountered at 11.5'
12					
13	10-15': Tan very fine grain sand		0	80	
14					
15					

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-6

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 5/3/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 15.03'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppmv)	% Recovery	Remarks
0	0-6": Concrete floor				No odor throughout boring
	6"-1': Brown fine sand with some large	0			
1	rocks	to			
	1-2': Brown fine sand with some small	2'			
2	rocks				
			0.0	40	
3	2-4': Light brown fine to medium sand				
	with some small pebbles				
4	4-5': Light brown fine to medium sand				
	with thin layers of dark brown fine sand				
5	encountered at 4-4.5'				
	5-6': Light brown fine to medium sand				
6					
	6-7.5': Orange to brown fine to medium				
7	sand				
			0.0	90	
8	7.5-8.5': Light brown fine to medium				
	sand				
9					
	8.5-10': Brown silt, moist				
10					
	10-11': Brown silt, moist				
11					
	11-12': Orange to brown fine to				
12	medium sand				
			0.0	100	
13					
	12-15': Brown fine to medium sand	13			
		to			
		15'			
15					Groundwater encountered at 15.03'

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log



Project No: 6832-BVNY

Site: 79 Pondfield Road, Bronxville, New York

Client: 81 Pondfield Road Company

Boring No: ACT-7

Date Drilled: 5/3/2012

Geologist: Steven Walls

Water Table Level: 15.07'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppmv)	% Recovery	Remarks
0	0-6": Concrete floor				No odor throughout boring
1					
2					
3	6"-5": Light brown fine to medium sand		0.0	10	
4					
5					
6	5-6': Orange to brown fine to medium sand	5 to 7'	0.0	100	
7	6-7': Mixture of orange to brown and light brown fine to medium sand				
8					
9	7-10': Light brown fine to medium sand				
10					
11	10-11': Orange to brown fine to medium sand		0.0	100	
12	11-12': Mixture of orange to brown and light brown fine to medium sand				
13					
14	12-15': Light brown fine to medium sand				
15					Groundwater encountered at 15.07'
16	15-16': Brown fine to medium sand, moist	15 to 17'	0.0	100	
17	16-17': Brown fine to medium sand, wet				

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-9

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 5/24/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 13.7'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-6": Concrete floor				
1	6"-2': Black to brown and red to brown fine to medium sand, moist				
2	2-3': Brown fine to medium sand, moist with a layer of red to brown sand at 3'		0	10	
3					
4	3-5': Light brown fine to medium sand, moist				
5					
6	5-6': Light brown fine to medium sand, moist				
7	6-8': Light brown silt, moist		55	80	
8			264		
9	8-10': Orange to brown silt, moist	8 to 10'	257		
10			241		
11	10-12': Orange to brown silt, moist		620		
12			980		
13	12-13.5': Brown silt, wet		1720	80	
14	13.5-14': Orange to red silt, wet	13			Groundwater encountered at 13.7'
14	14-14.5': Gray to brown silt, wet	to	59 ppm		Solvent odor from 13 to 15'
15	14.5-15': Orange to brown silt, wet	15'	113 ppm		

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-14

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 7/12/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 14.5'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-6": Asphalt				
1	6"-2.5': Brown fine to medium sand				
2					
3	2.5-3.5': Light brown fine to medium sand		0	50	
4	3.5-5': Light brown silt, moist				
5					
6	5-6': Light brown silt, moist and a 2" layer of fine to medium brown side at 6'				
7	6-7': Orange to brown silt, moist				
8	7-7.5': Brown silt, moist		0	50	
9	7.5-9': Light brown fine sand, moist				
10	9-10': Light brown silt, moist				
11	10-11': Brown silt, moist		0		
12	11-13': Light brown medium to coarse sand, moist		251	30	
13	13-14.5': Brown silt, moist	13	430		
14		to			
15	14.5-15': Orange-brown silt, wet	15'	560		Slight solvent odor near water table Groundwater encountered at 14.5'

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-15

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 7/12/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 14.5'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-6": Asphalt				No odor throughout boring
1					
2	6"-3': Orange to brown fine sand, moist		0	70	
3					
4	3-5': Light brown fine sand, moist				
5					
6	5-6.5': Light brown fine sand				
7	6.5-8': Orange to brown fine sand		0	20	
8					
9	8-10': Light brown fine sand				
10					
11					
12	10-13': Orange to brown fine sand, moist		0	50	
13					
14	13-14.5': Brown silt, moist	14			
15	14.5-15': Brown silt, wet	to 15'			Groundwater encountered at 14.5'

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-16

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 7/12/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 13.5'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-6": Asphalt				
1	6"-2': Orange to brown fine to medium sand				
2					
3			0	50	
4	2-5': Light brown fine to medium sand				
5					
6	5-7": Light brown fine to medium sand				
7					
8			0	70	
9	7-10': Orange to brown silt, moist				
10	10-11': Light brown fine to medium sand with a dark 1-2" layer of gray sand at 11'				
11	11-12': Orange to brown fine sand, moist		0		
12	12-13.5': Brown fine sand, moist with a 3-4" layer of wet brown fine sand at 13.5'		66	80	
13	13.5-14.5': Orange to brown medium to coarse sand, wet	13 to 15'	889		Slight solvent odor near water table Groundwater encountered at 13.5'
14					
15	14.5-15': Brown fine to med. sand, wet		3419		

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

Soil Boring Log

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS



Project No: 6832-BVNY

Boring No: ACT-17

Site: 79 Pondfield Road, Bronxville, New York

Date Drilled: 7/12/2012

Client: 81 Pondfield Road Company

Geologist: Steven Walls

Water Table Level: 13'

Depth (feet)	Description (Unified Soils Classification)	Sample Depth	PID (ppbv)	% Recovery	Remarks
0	0-6": Asphalt				No odor throughout boring
1					
2					
3	6"-5': Orange to brown fine to medium sand, moist		0	40	
4					
5					
6					
7	5-8': Orange to brown fine to medium sand, moist		0	70	
8					
9	8-10': Brown fine to medium sand, moist				
10					
11	10-12': Brown fine sand, moist				
12					
13	12-13': Dark brown fine sand, moist		0	60	
14	13-15': Dark brown fine sand, wet	13 to 15'			Groundwater encountered at 13'
15					

Rig Type: AMS Power Probe

Reviewed by: Paul Stewart

Driller: ACT - Steven Walls

Sheet No: 1 of 1

SOIL BORING LOG

Advanced Cleanup Technologies, Inc.
ENVIRONMENTAL CONSULTANTS

100 Main Street, Port Washington, NY

Project No.:

6832-BVNY

SOIL BORING No.:

SB-5

Location:

Pondfield Rd.

DATE:

10/31

Drilling Method:

Direct Push drilling technology

WEATHER:

sunny

Drilling Rig:

TRUCK

chilly

Geologist:

TY

Completed depth:

25'

Depth to

Groundwater:

~ 21 - 22' ft

Drilling Company:

ACT

Driller:

TY

1.5 LINER (actual 1.3 ~ 24.7')

Depth (ft. bgs)	Depth (ft)	Recovery (ft)	PID (ppm)	USCS Symbol	Description	Environmental Description
1	0-5	3'ft	0.0	ppb	Asphalt ~ 9-10" inches thick (very dense)	
2			↓		Mostly fill material Bricks, concrete, asphalt dark brown to medium brown medium to coarse soils damp (recent rain)	
3			0.0		2-4'ft light tan to cream white very fine sands, very dense damp compact	
4			↓		4-5'ft - dark brown soils, fine to medium compact w/ FILL	
5			0.0			
6	5-10	3.5'ft	↓		5-6'ft asphalt w/ fill mix	
7			↓		6-10' - tan to orange (rusty) to light brown medium sands - rounded weathered BR appearance micas + gtz + PYR damp Natural Backfill	
8			0.0			
9			↓			
10			0.0		large gravels throughout	

SOIL BORING LOG

Project No.:		SOIL BORING No.:				
Location:		DATE:				
Depth (ft. Sgs)	Depth (ft)	Recovery (ft)	PID (ppm)	USCS Symbol	Description	Environmental Description
	10-15	4' ft	0.0		10-11 - REBORILL material asphalt -	
11			↓		11- 15' - uniform layers to rustic orange / light brown medium sands - abundant gtz mica	
12			0.0		lens of finer sands (greenish color) silty	
13			↓		ten fine sands matrix rounded	
14			↓		decapitated BR	
15			0.0			
	15-20	4' ft	↓		15-16 REBORILLED from above depths	
16			↓		16- 20 - uniform natural / native sands - silt - clay layer rustic orange / sandest fine grained compact - medium dense	
17			0.0		silts + clay layering (olive green grays)	
18			↓			
19			0.0			
20						
	20-25	Full (some reborill)	0.0		Very very fine sands abundant silts very compact light brown / dark tan alternating layers w/ clays silt sands	
21			↓		~23' ft - more gray / olive gray in color	
22			0.0			
23			↓			
24			↓			
25			0.0			

6W
~21-22
in liner

Sample
20-22'
1120 AM

Appendix D

Operation and Maintenance Manual



Operation & Maintenance Manual

NES PROJECT NUMBER: 12-198, August, 2012

PROJECT NAME: **SVE Blower, Control Panel, and Instruments**

Prepared for:

**Advanced Cleanup Technologies Inc.
960 South Broadway
Suite 100
Hicksville, NY 11801**

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www.nes-inc.biz

**MAJOR COMPONENT SUMMARY**

Project No.:

12-198 (August 2012)

Project:

Advanced Cleanup Technologies - SVE Blower, Control Panel, and Instruments

COMPONENT	QTY	MANUFACTURER	MODEL	SERIAL NO:
Control Panel Components				
Panel Enclosure	1	Hoffman	C-SD242012	UL: CB-822754
Variable Frequency Drive, 15hp	1	AC Tech	ESV113N02TXB	13365180360461219
Soil Vapor Extraction Components				
Regenerative Blower, 7.5hp	1	FPZ	K08-MS-7.5-3	U05750
MS Level Switches	2	Dwyer	F6-HPS-31	N/A
Discharge Temperature Switch	1	United Electric	B54-103	K1751996-475410

CONTROL SYSTEM DESCRIPTION

NES JOB NUMBER: 12-198

Advanced Cleanup Technologies – Regenerative Blower Control Panel

CONTROLLER – Relay based

CAPABLE OF CONTROLLING

(1) SVE Blower 7.5HP, 230V, 3 Phase (via VFD used as a phase converter)

ALARMS - Manual reset unless noted otherwise

- Moisture separator warning level (auto reset)
- Moisture separator high level
- SVE Blower High Discharge Temperature
- VFD Fault

NORMAL OPERATION

Equipment will operate if the panel switch is in the AUTO position and no alarm is present. Equipment will operate if the panel switch is in the HAND position with or without an alarm condition.

ALARM OPERATION

Alarm – Moisture separator warning level

Panel response – The alarm light is illuminated only when liquid level within the separator is above the warning level switch.

Alarm – Moisture separator high sump level

Panel response – The SVE blower is shut down and the alarm light is illuminated.

Alarm – SVE Blower High Discharge Temperature

Panel response – The SVE blower is shut down and the alarm light is illuminated.

Alarm – Moisture separator high sump level

Panel response – The SVE blower is shut down and the alarm light is illuminated.

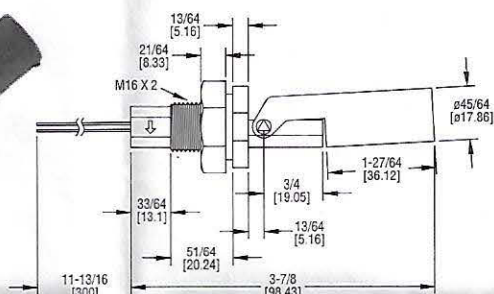
The control panel also includes a timer to automatically restart the SVE blower following a power outage.

Refer to the Control Panel Drawings & Individual Component Instructions for further information.

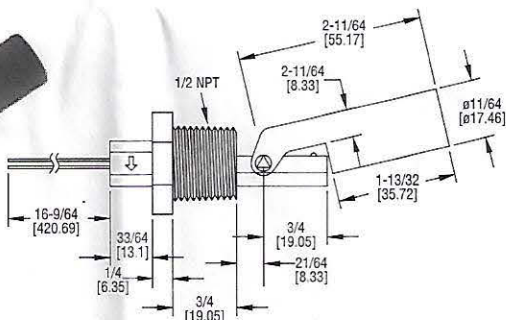
Specifications - Installation and Operating Instructions



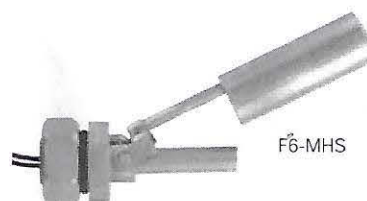
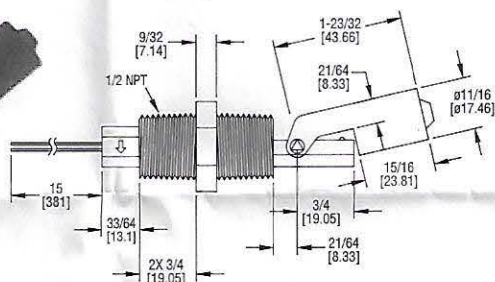
F6-HPS-11



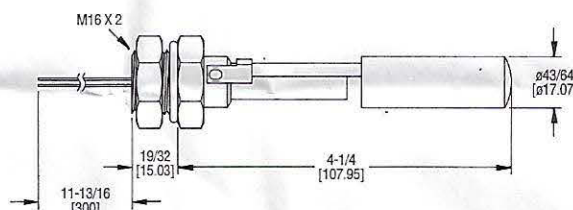
F6-HPS-21



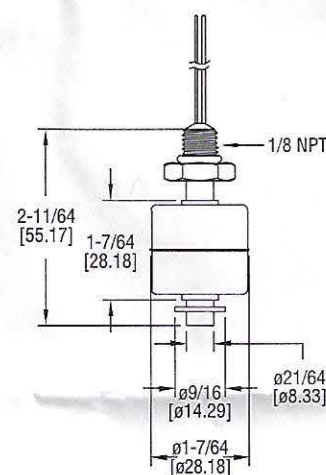
F6-HPS-31



F6-MHS



F6-SS



Series F6 Level Switches provide a simple, inexpensive control of the liquid level within a tank. Switch ratings are suitable for many solid-state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels.

SPECIFICATIONS

Service: Compatible liquids.

Wetted Materials: See model table.

Temperature Limit: F6-SS & F6-MHS: -4 to 257°F (-20 to 125°C). F6-HPS-11, 21, 31: 14 to 176°F (-10 to 80°C).

Pressure Limit: F6-SS & F6-MHS: 218 psi (15 bar). F6-HPS-11, 21, 31: 116 psi (8 bar).

Enclosure Rating: General purpose.

Switch Type: SPST Hermetically sealed reed switch, reversible for N.O. or N.C.

Electrical Rating: 20VA: 0.17A @ 120VAC, 0.08A @ 240 VAC.

Electrical Connections: 22 AWG, 11.811" (300mm) long.

Process Connection: F6-SS: 1/8" NPT, HPS-21, 31: 1/2" NPT, F6-MHS, F6-HPS-11: M16*2.

Mounting Orientation: F6-SS: vertical $\pm 20^\circ$, F6-MHS/HPS: horizontal with index arrow pointing up or down.

Weight: F6-HPS-11, 21: 1.23 oz (38 g), F6-MHS-31: 1.41 oz (40 g), F6-MHS: 3.35 oz (95 g), F6-SS: 1.59 oz (45 g).

Agency Approvals: CE.

Specific Gravity: F6-SS: 0.65, F6-MHS: 0.85, F6-HPS-11, 21, 31: 0.6.

Switch Action (Normally Open, Normally Closed)

Vertical Models

Vertical mount models are shipped with normally open switch contacts that close as the float rises toward the mounting threads. To reverse the switch action, remove the float, rotate it end-for-end, and then replace it back on the stem. The floats will be marked for Normal Open and Normal Closed orientation.

Horizontal Models

Contacts in the horizontal models F6-HPS-11 (internally mounted), F6-HPS-21 (externally mounted), and F6-HPS-31 (internally or externally mounted) have indicating arrows on the wrench flat end of the switch to confirm float alignment. When the indicating arrow points up and the float is below the stem the switch is normally open and when the indicating arrow points down and the float is above the stem the switch is normally closed. The model F6-MHS does not have an indication arrow to show normally open or closed orientation. The F6-MHS is normally open when the switch is oriented so that the float is directly below the stem and normally closed when the switch is oriented so that the float is directly above the stem.

Installation

Choose a location away from fill pipes, drains, or other areas where turbulence or wave motion might occur. Turbulence will cause false actuations and shorten contact life. Excess contaminants in fluid may inhibit float operation and an occasional wipe-down may be necessary. Care should be taken that switches are always operated within electrical ratings.

Mounting

Install the vertical mount model in an appropriate 1/8" NPT fitting. The vertical model mounts internally. It should be aligned within $\pm 20^\circ$ of vertical, or select optional fittings for external mounting. Models F6-HPS-11 and F6-MHS must be mounted internally, which means the switch must be secured to the wall of the tank or vessel from the inside. Install horizontal models F6-HPS-11 and F6-MHS in a M16 suitable size hole and secure them with the nut provided. Model F6-HPS-21 requires a horizontal 1/2" NPT fitting and can be fitted to the tank or vessel from the outside. Model F6-HPS-31 requires a horizontal 1/2" NPT fitting and can be mounted from the inside or outside (internally or externally) of the tank or vessel.

MAINTENANCE

Upon final installation of the Series F6 Level Switches, no routine maintenance is required. A periodic check of system calibration is recommended. The Series F6 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.



54 Series Temperature Switches

Types

**B54, B54S, C54, C54S, C54A, C54AS,
E54, E54S, F54, F54S**



UNITED ELECTRIC
CONTROLS

Installation and Maintenance Instructions

Please read all instructional literature carefully and thoroughly before starting. Refer to the final page for the listing of Recommended Practices, Liabilities and Warranties.

GENERAL

Type B54, B54S, C54, C54S, C54A, C54AS (Immersion Stem)

Temperature variations are sensed by a liquid filled sensor which expands or contracts against a bellows which actuates a snap-action switch at a predetermined set point.

Type E54, E54S, F54, F54S (Bulb & Capillary)

Temperature variations of a liquid filled sensing bulb are hydraulically transmitted to a diaphragm which actuates a snap-acting switch at a predetermined set point.



MAXIMUM TEMPERATURE* STATED IN LITERATURE AND ON NAMEPLATE MUST NEVER BE EXCEEDED, EVEN BY SURGES IN THE SYSTEM. OCCASIONAL OPERATION OF UNIT UP TO MAX. TEMPERATURE IS ACCEPTABLE (E.G., START-UP, TESTING). CONTINUOUS OPERATION SHOULD BE RESTRICTED TO THE DESIGNATED ADJUSTABLE RANGE.

*Maximum Temperature - the highest temperature to which a sensing element may be occasionally operated at, without adversely affecting set point calibration and repeatability.



THIS PRODUCT DOES NOT HAVE FIELD REPLACEABLE PARTS.

Please refer to product bulletin for product specifications. Product bulletins may be found at www.ueonline.com.

Part I - Installation

Tools Needed

Screwdriver
Adjustable wrench

MOUNTING



INSTALL UNIT WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT MOUNT UNIT IN AMBIENT TEMPERATURES EXCEEDING PUBLISHED LIMITS. 54 SERIES TEMPERATURE SWITCHES CAN BE MOUNTED IN ANY POSITION, PROVIDED THE ELECTRICAL CONDUIT IS NOT FACING UP. ORIENT UNIT SO THAT MOISTURE IS PREVENTED FROM ENTERING THE ENCLOSURE*.

Remove Cover (Enclosed version only). Cover is held on by one captive screw located on the front of the cover.

54 Series temperature switches can be mounted in any position by using either the Mounting Screw holes on the bracket or the NPT connector on the

immersion stem (local mounted only). Optional union connectors or separable well kits are available for remote bulb types.

A 7/8" diameter hole has been provided in the bracket plate for mounting a standard conduit fitting.



FOR LOCAL MOUNTING, ALWAYS HOLD A WRENCH ON THE TEMPERATURE HOUSING HEX WHEN MOUNTING UNIT. DO NOT TIGHTEN BY TURNING ENCLOSURE. THIS WILL DAMAGE SENSOR AND WEAKEN SOLDERED OR WELDED JOINTS.

For remote mounting, fully immerse the bulb and 6" of capillary in the control zone. It is generally desirable to place the bulb close to the heating or cooling source in order to sense temperature fluctuations quickly. Be sure to locate the bulb so that it will not be exposed to temperatures beyond the instrument range limits.

WIRING



DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING UNIT. ELECTRICAL RATINGS STATED IN LITERATURE AND ON NAMEPLATE MUST NOT BE EXCEEDED. OVERLOAD ON A SWITCH CAN CAUSE FAILURE ON THE FIRST CYCLE. WIRE UNITS ACCORDING TO NATIONAL AND LOCAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS #14 AWG.

Conduit Connection (Enclosed units only)



FOR ENCLOSED UNITS, CONNECT THE CONDUIT TO THE HOLE IN ACCORDANCE WITH NATIONAL AND LOCAL CODES. BRING WIRES UP TO THE TERMINALS FROM THE REAR. MAXIMUM RECOMMENDED WIRE SIZE - #14 AWG.

Part II - Adjustments

Tools Needed

1/4" Open-ended wrench
1/16" Allen wrench
(single switch calibrated units)



MAKE SURE THAT LIVE ELECTRICAL SUPPLIES TO THE TEMPERATURE SWITCH ARE DISCONNECTED BEFORE PERFORMING ANY DISASSEMBLY. THIS MAY REQUIRE DISCONNECTING MORE THAN ONE CIRCUIT.

Dual Switch Units (C54A, C54AS)



ON DUAL SWITCH UNITS, "LOW SET" SWITCH MUST ALWAYS BE SET EQUAL OR BELOW THE "HIGH SET" SWITCH.

* If applicable



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COMPRESSORI - ASPIRATORI A CANALE LATERALE 'SCL K-MS MOR'

LATERAL CHANNEL BLOWERS - EXHAUSTERS 'SCL K-MS MOR'

COMPRESSEURS - ASPIRATEURS A CANAL LATERAL 'SCL K-MS MOR'

SEITENKANALVERDICHTER - VAKUUMPUMPEN BAUREIHE 'SCL K-MS MOR'

COMPRESORES - ASPIRADORES DE CANAL LATERAL 'SCL K-MS MOR'

ISTRUZIONI I

INSTRUCTIONS GB

INSTRUCTIONS F

BETRIEBSANLEITUNG D

INSTRUCCIONES E



LEGGERE ATTENTAMENTE TUTTE LE ISTRUZIONI E CONSERVARLE I

PLEASE READ CAREFULLY ALL INSTRUCTIONS AND KEEP THEM FOR FUTURE REFERENCE GB

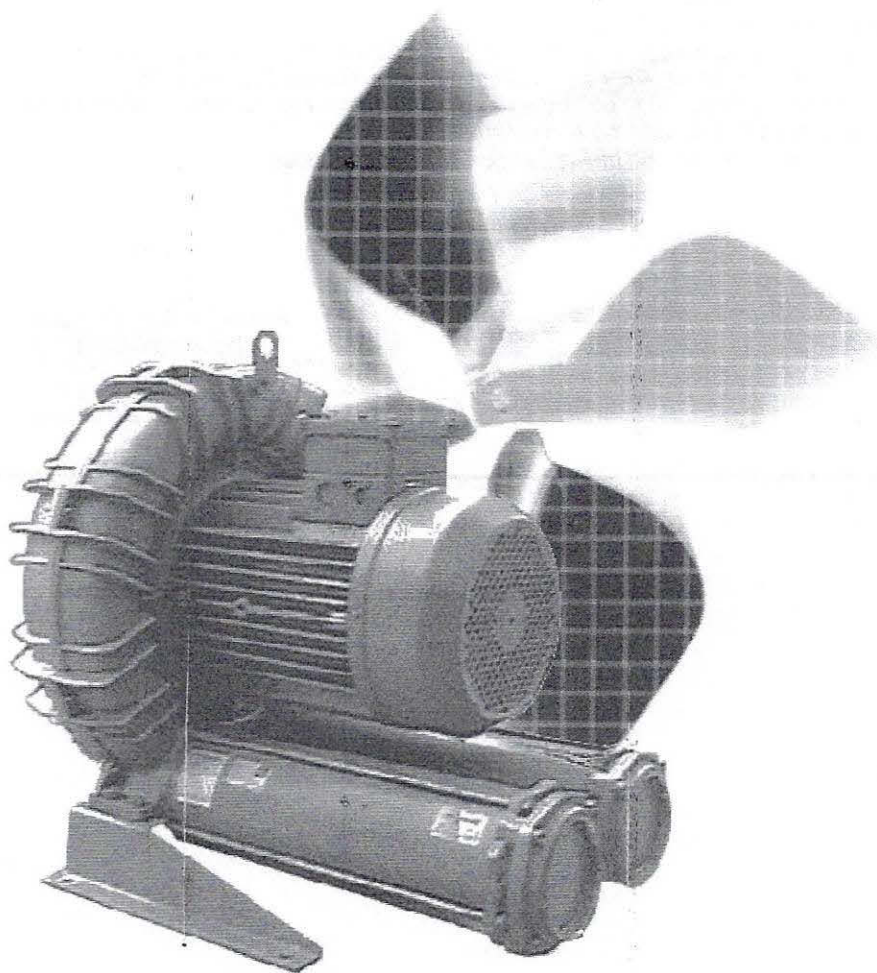
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SN 1968-2

SCL K07 / K75 / K08 / K09 / K10 / K11



AZIENDA CON SISTEMA DI
GESTIONE PER LA QUALITÀ
CERTIFICATO DA DNV
= UNI EN ISO 9001:2000 =



**DICHIARAZIONE DI CONFORMITÀ ALLA DIRETTIVA MACCHINE
DECLARATION OF CONFORMITY TO THE MACHINERY DIRECTIVE**

Unità tipo - *Unit type*

**SCL K07-MS MOR - SCL K75-MS MOR - SCL K08-MS MOR
SCL K09-MS MOR - SCL K10-MS MOR - SCL K11-MS MOR**

1. L'unità è in conformità con:

- DIRETTIVA MACCHINE CE 98/37;
- DIRETTIVA EMC CE 89/336 come modificata dalle Direttive CE 92/31 e CE 93/68;
- DIRETTIVA BASSA TENSIONE CE 73/23 come modificata dalla Direttiva CE 93/68.

È tuttavia vietata la messa in servizio prima che la macchina in cui sarà incorporata sia dichiarata conforme con le citate Direttive.

2. Sottoposta a collaudo funzionale è risultata conforme alle caratteristiche richieste.

1. *The unit conforms to the:*

- *MACHINERY DIRECTIVE CE 98/37;*
- *EMC DIRECTIVE CE 89/336 as ammended by the CE Directives 92/31 and 93/68;*
- *LOW VOLTAGE DIRECTIVE CE 73/23 as ammended by the CE Directive 93/68.*

Nevertheless it is forbidden to put the unit in service before the machine in which will be incorporated is declared in conformity with the above Directives.

2. *The unit has been tested and meets its operating performances.*

10.06

Amministratore Delegato
Managing Director

DATI CARATTERISTICI I
PERFORMANCE TABLE GB
CARACTÉRISTIQUES TECHNIQUES F
LEISTUNGSDATEN D
DATOS CARACTERISTICOS E

SI - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installée Installierte Motorleistung Potencia instalada	Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima	Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumoresidad máxima	Pressione massima assoluta Maximum absolute pressure Pression absolue maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso			
	kW		hPa (mbar)		Lp / Lw (1) dB (A)		Ps max A	M
	50 Hz 2900 min ⁻¹	60 Hz 3500 ml/n ⁻¹	50 Hz 2900 min ⁻¹	60 Hz 3500 min ⁻¹	50 Hz 2900 min ⁻¹	60 Hz 3500 min ⁻¹	MPa (bar)	kg
SCL K07-MS	2.2	2.55	- 130 / + 130	- 100 / + 100	76.4	78.4	0.28 (2.8)	46.5
	3.0	3.45	- 200 / + 200	- 175 / + 175	76.7	78.7	0.28 (2.8)	47.5
	4.0	4.6	- 280 / + 280	- 250 / + 250	77.0	79.0	0.28 (2.8)	51.0
	5.5	6.3	- 325 / + 400	- 375 / + 375	77.3	79.3	0.28 (2.8)	61.5
	-	8.7	- / -	- / + 450	-	79.6	0.28 (2.8)	66.5
SCL K75-MS	4.0	4.6	- 150 / + 150	- 100 / + 100	77.4	79.4	0.28 (2.8)	51.5
	5.5	6.3	- 250 / + 250	- 200 / + 200	77.7	79.7	0.28 (2.8)	62.0
	7.5	8.7	- / + 325	- 300 / + 300	78.0	80.0	0.28 (2.8)	67.0
	9.2	10.6	- / -	- / + 400	-	80.3	0.28 (2.8)	76.5
SCL K08-MS	3.0	3.45	- 125 / + 125	- 100 / + 100	77.4	79.4	0.28 (2.8)	49.0
	4.0	4.6	- 180 / + 180	- 150 / + 150	77.7	79.7	0.28 (2.8)	52.5
	5.5	6.3	- 275 / + 275	- 250 / + 250	78.0	80.0	0.28 (2.8)	63.0
	7.5	8.7	- 350 / + 400	- 375 / + 375	78.3	80.3	0.28 (2.8)	68.0
	9.2	10.6	- / + 450	- / + 450	78.6	80.6	0.28 (2.8)	77.5
SCL K09-MS	4.0	4.6	- 130 / + 130	- 85 / + 85	78.0	80.0	0.28 (2.8)	62.0
	5.5	6.3	- 210 / + 210	- 150 / + 150	78.2	80.2	0.28 (2.8)	72.5
	7.5	8.7	- 290 / + 290	- 250 / + 250	78.5	80.5	0.28 (2.8)	77.5
	9.2	10.6	- 350 / + 350	- 325 / + 325	78.7	80.7	0.28 (2.8)	87.0
	11	12.7	- / + 450	- 375 / + 400	79.0	81.0	0.28 (2.8)	87.5
	-	17.4	- / -	- / + 500	-	81.3	0.28 (2.8)	92.5
SCL K10-MS	5.5	6.3	- 160 / + 160	- 115 / + 115	78.1	80.1	0.28 (2.8)	75.0
	7.5	8.7	- 250 / + 250	- 200 / + 200	78.5	80.5	0.28 (2.8)	80.0
	9.2	10.6	- 300 / + 300	- 270 / + 270	79.0	81.0	0.28 (2.8)	89.5
	11	12.7	- 350 / + 400	- 375 / + 375	79.4	81.4	0.28 (2.8)	90.0
	15	17.4	- / + 500	- / + 500	79.6	81.6	0.28 (2.8)	95.0
SCL K11-MS	5.5	-	- 100 / + 100	- / -	78.5	-	0.28 (2.8)	78.5
	7.5	8.7	- 175 / + 175	- 130 / + 130	80.0	82.0	0.28 (2.8)	83.5
	9.2	10.6	- 230 / + 230	- 175 / + 175	80.5	82.5	0.28 (2.8)	93.0
	11	12.7	- 300 / + 300	- 250 / + 250	81.0	83.0	0.28 (2.8)	93.5
	15	17.4	- 350 / + 400	- 350 / + 350	81.8	83.8	0.28 (2.8)	98.5
	18.5	21.5	- / + 500	- / + 500	83.6	85.6	0.28 (2.8)	128.5

- (1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré à 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumoresidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, según la Normativa ISO 3744.

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		Hp	In Hg / In WG		Lp / Lw (1) dB (A)		Ps max	M	
		60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	In Hg	lbs
SCL K07-MS		4	4	- 3.7 / + 50	- 4.6 / + 63	78.7	76.7	82.7	104.50
		5 ½	5 ½	- 5.6 / + 75	- 6.3 / + 86	79.0	77.0	82.7	112.20
		7 ½	7 ½	- 9.6 / + 130	- 8.9 / + 138	79.3	77.3	82.7	135.20
		10	10	- 11.1 / + 181	- / + 161	79.6	77.6	82.7	146.30
SCL K75-MS		5 ½	5 ½	- 2.9 / + 40	- 4.8 / + 65	79.4	77.4	82.7	113.30
		7 ½	7 ½	- 4.8 / + 65	- 7.4 / + 100	79.7	77.7	82.7	136.30
		10	10	- 7.4 / + 100	- / + 130	80.0	78.0	82.7	147.40
		15	15	- 8.8 / + 160	- / -	80.3	78.3	82.7	168.40
SCL K08-MS		5 ½	5 ½	- 2.9 / + 40	- 3.8 / + 52	79.7	77.7	82.7	115.70
		7 ½	7 ½	- 5.9 / + 80	- 6.6 / + 90	80.0	78.0	82.7	138.90
		10	10	- 8.5 / + 115	- 9.2 / + 125	80.3	78.3	82.7	150.00
		15	15	- 11.1 / + 181	- / + 181	80.6	78.6	82.7	170.80
SCL K09-MS		7 ½	7 ½	- 3.7 / + 50	- 4.6 / + 63	80.2	78.2	82.7	159.80
		10	10	- 5.9 / + 80	- 7.0 / + 95	80.5	78.5	82.7	170.90
		15	15	- 10.3 / + 140	- 10.4 / + 155	81.0	79.0	82.7	192.90
		20	20	- 11.1 / + 181	- / + 181	81.3	79.3	82.7	203.90
SCL K10-MS		7 ½	7 ½	- 2.7 / + 36	- 3.8 / + 51	80.1	78.1	82.7	165.30
		10	10	- 4.7 / + 64	- 5.9 / + 80	80.5	78.5	82.7	176.40
		15	15	- 8.8 / + 120	- 9.9 / + 135	81.0	79.0	82.7	198.40
		20	20	- 11.1 / + 167	- / + 191	81.4	79.4	82.7	253.00
	25	25	- / + 211	- / + 201	81.6	79.6	82.7	319.10	
SCL K11-MS		10	10	- 2.9 / + 40	- 3.9 / + 53	82.0	80.0	82.7	184.10
		15	15	- 6.0 / + 82	- 7.1 / + 97	82.5	80.5	82.7	206.10
		20	20	- 9.2 / + 125	- 10.4 / + 141	83.0	81.0	82.7	217.20
		25	25	- 11.1 / + 162	- / + 162	85.6	83.6	82.7	283.30

- (1) Rumorosità misurata alla distanza di 1 m con aspirazione e mandata canalizzate, secondo la Normativa ISO 3744.
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(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, según la Normativa ISO 3744.

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1. GENERAL INSTRUCTIONS

CAUTION!

The 'SCL K' blowers - exhausters have been designed and manufactured for use in an industrial environment, operated by qualified personnel and as a unit to be incorporated in a machine, which conforms to the CE Machinery Directive.



The 'SCL K' blowers - exhausters, like all machinery and equipment with live and moving parts, can be a source of serious hazards unless properly used and protected.



The user is committed to ensure that:

All handling, assembly, installation, connection, maintenance and repair operations are undertaken by qualified personnel. Such people who by their background, training and experience as well as through their knowledge of statutory regulations, legislation, safety measures and operating conditions are able to carry out any necessary steps avoiding all possible risks to health and damage.

Such personnel should have received all the instructions and information, including any local legislation, and will follow them during the performance of any operation.

It shall be forbidden for unqualified personnel to carry out any operation, even indirectly, on the machines and equipment.

During the installation, all the prescribed working conditions, including any possible local requirements, shall be observed.

Additionally it is forbidden to put the unit in service before the machines of which they are a part are declared to conform to the CE Machinery Directive.

The user must be aware that in operation:

- the surface temperatures can reach 160°C;
- the unit cannot contain high internal pressures, no greater than P_s max referred to in PERFORMANCE TABLE - page 3-4;
- there is small loss of the fluid handled;
- the level of noise may be unacceptable in certain applications.

1.1 CONDITIONS OF USE

The 'SCL K' blowers - exhausters are designed for the continuous movement of air or non-explosive, non-hazardous and non-flammable gases and for service in non-explosive environments.

Solid particles, however small, including dirt can cause serious damage; therefore it is essential that such substances should be removed from the gas by suitable filters upstream of the inlet. (Units which do not have an adequate filter ARE NOT COVERED BY THE GUARANTEE).

The maximum driving pressure must never be exceeded (Maximum differential pressure of PERFORMANCE TABLE - page 3-4).

UNDER NO CIRCUMSTANCES OPERATE THE UNIT WITH THE GAS INLET OR OUTLET CLOSED. IN PARTICULAR THIS APPLIES TO THE UNITS WITH THE CAPACITY FOR HIGHER DRIVING PRESSURES.

Protect the units with an appropriate safety valve.

The performance characteristics are liable to variations due to the following factors:

- Differences of the suction or discharge pressures from the reference conditions (1013 mbar);

- Operation in a system with both a low suction pressure and a high back pressure;
- Operation with a gas at a different temperature or of a different specific gravity from the reference data (1.23 kg/m³; 15 °C);
- Variations in the rotational velocity of the fan with respect to the reference value.

Both the gas inlet temperature and the ambient temperature must be in the range of -15°C to +40°C.

At the same time, ensure that the unit has good ambient ventilation, especially when subjected to severe operating conditions.

A unit subjected to frequent starting or to high ambient temperatures may be prone to overheating and in such cases further information should be requested.

Similarly, where flammable gases may be present, information must be requested for alternative models certified for the Ex. environment.

1.2 STORAGE AND SHIPPING

Store the unit in a dry place, preferably in original packaging.

Do not remove the protection plugs from the ports.

Avoid stacking anything on top of the packaging.

To move the packed boxes, use the largest pallet or support base possible to obtain the maximum stability. On all occasions handle the units with care and avoid sudden impacts.

Lifting eyes are provided to unpack units weighting more than 25 kg.

(The weight of the unit is M in PERFORMANCE TABLE - page 3-4).

1.3 INSTALLATION

1.3.1 'SCL K' BLOWER - EXHAUSTER

It is important that the unit is installed in a well-ventilated environment where the temperature does not exceed 40°C.

If outside, protect the unit from direct sunlight and avoid the possibility of water collecting in the external crevices especially when installed with the axis vertical.

IMPORTANT!

Ingress of foreign matter, however small, will cause serious damage.

Such matter includes dust, sand, masonry debris, impurities in the tubes, cutting burrs or filings, welding or soldering slag and splatter, metal burrs and any residues from sealing and making the tube connections.

The unit can be mounted with the axis in any position.

As supplied, the unit is balanced and will not transmit vibrations, however it is recommended that it be mounted on vibration damping supports.

To connect the machine to the piping, remove the flanges and connect using flexible hoses. Do not use rigid connections as these may cause stress and harmful vibrations. Insert gaskets and tighten.

Remember to protect the inlet with suitable filters.

If it is necessary to regulate the flow, install a bypass valve (refer to section 1.5).

Only remove the plugs on the ports when making the final connections.

Select the tube size and the couplings to minimize the pressure drop, in particular:

- Do not use tubing of a smaller diameter than the ports of the unit; When installing units in parallel, size the manifold and main conduit accordingly;
- Utilise large radius bends and avoid using elbows;
- Avoid using valves which have a reduced orifice relative to the general system; Use swing check valves (utilising lightweight discs) which have the lowest pressure drop, rather than spring loaded check valves;
- For oxygenation select low loss diffusers (lowest pressure drop) and note that the pressure drop across plugs and porous membranes will increase over time due to progressive logging.

A safety relief valve should be installed to avoid overloading the unit as a result of pressure differential variations.

Make the electrical connections to the motor and check the direction of rotation before connecting the conduit.

The 'SCL K' blowers - exhausters are already supplied as standard with silencers in the suction and exhaust ports (the noise levels L_p / L_w , with piped inlet and outlet flow, are detailed in PERFORMANCE TABLE - page 3-4).

For operation into free air (either suction or discharge) the free flow noise can be muffled with additional silencers.

In every situation avoid installing the unit on a structure, which can transmit or amplify any noise (tanks, sheet metal etc.).

Installation sketches - please refer to next page.

Further information should be requested regarding additional noise reduction by installing the unit in soundproof enclosures.

1.3.2 ELECTRIC MOTOR

WARNING

BEFORE UNDERTAKING ANY OPERATION ENSURE THAT THE UNIT IS DISCONNECTED FROM THE ELECTRICITY SUPPLY.

The electric motor has been selected for service in an ambient temperature between -15°C and $+40^{\circ}\text{C}$ at an altitude no higher than 1000 m. Ensure that the information on the nameplate is consistent with the supply voltage and frequency.

Variations in the supply voltage up to $\pm 10\%$ are acceptable.

Outside the normal operating conditions the motor cannot deliver full power and problems can arise with starting, especially for single-phase motors.

Make the electrical connections referring to the wiring diagram in the terminal box, connecting an earth cable of adequate capacity to the earth terminal.

The fuses are designed only for short circuit protection and not to safeguard the motor. Therefore overload cut-outs (temperature or current) are essential to guard against the risk of overloads on the motor --- for example failure of one line in a three phase supply, an excessively high start up frequency, unacceptable variations in the supply voltage, stalled rotor, etc.

Set the overload cutouts at the nominal current specified on the nameplate.

The fuses should be rated for the peak currents or use "slow blow" fuses especially in applications of direct starting.

THE ENTIRE GUARANTEE SHALL CEASE TO APPLY WHEN INADEQUATE PROTECTION IS PROVIDED.

1.3.2.1 CURRENT MEASUREMENT

The current drawn refers to normal operating conditions.

Departures from the nominal operating conditions can result in variations of 10%.

There can be small differences in the measured value of each phase. These are tolerable up to a maximum deviation of 9% (ref. IEC 34-1).

1.4 COMMISSIONING

To commission the unit:

- Set the operating pressure or vacuum using a suitable gauge.
- Check the relieving pressure of the safety valve.
- Measure the current drawn by the motor and verify that it is within the limit stated on the name plate (refer to Para. 1.3.2.1).
- Adjust the overload cutouts accordingly.
- After one hour's operation, repeat the current measurements and verify that they are still within the stated limits.

1.5 OPERATING ADJUSTMENTS

The 'SCL K' blowers - exhausters will automatically generate the driving pressure required at the point of use.

Since the power absorbed and the operating temperature is primarily a function of the driving pressure, it is possible that these can exceed the permitted operating conditions for the unit.

Frequently the pressure losses of the tubing are overlooked as the major factor determining the driving pressure.

The driving pressure can be reduced by eliminating all possible obstructions and restrictions in the flow path.

If it is still too high, the flow can be reduced by installing a bypass valve.

Never choke the flow by throttling the suction or the discharge.

1.6 MAINTENANCE

After every 10-15 days of use clean the cartridge filter. Replace the cartridge frequently in dusty environments.

A dirty filter will create a strong suction resistance and consequently a higher driving pressure, a higher operating temperature and an increase in the absorbed power.

Check that the driving pressure does not change over time.

It is important that a unit in service is subjected to periodic inspections by qualified personnel to insure against failures, which, directly or indirectly, could cause damage.

Departures from the normal operating conditions (e.g. a rise in the absorbed power, unusual operating noises, vibrations, etc.) are a sign of abnormal operation, which can lead to failure.

See paragraph 5 - TROUBLESHOOTING to be dealt with and/or avoiding possible breakage or faults.

Under normal working conditions (refers to PERFORMANCE TABLE - page 3-4) the machine's bearings should be replaced by qualified personnel after 25,000 working hours max or 4 years.

In the event of difficulties please contact F.P.Z. or the relevant sales agent.

Please note that repairs undertaken by a third party will invalidate the guarantee.

Periodically remove any surface deposits which otherwise can cause the operating temperature to rise.

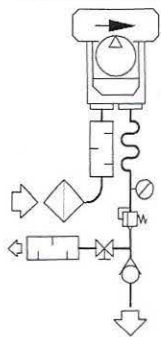
Commitments, agreements or legal relationships are governed by the corresponding sales contract. The above items are in no way limited by the contents of this manual.

The quality of the materials and of the workmanship is guaranteed as set out by the standard conditions of sales. The guarantee is not valid for the following: damage incurred during transport; inadequate storage; faulty installation; incorrect use; exceeding performance limits; electrical or mechanical mis-use.

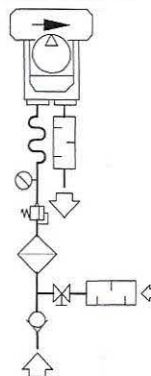
Store the packaging for possible future use.

2. INSTALLATION SKETCHES

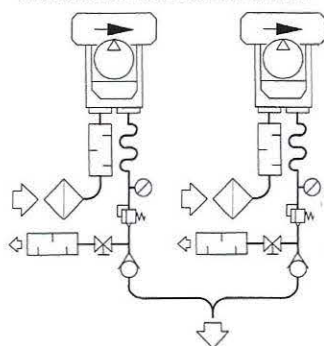
2.1 PRESSURE SERVICE



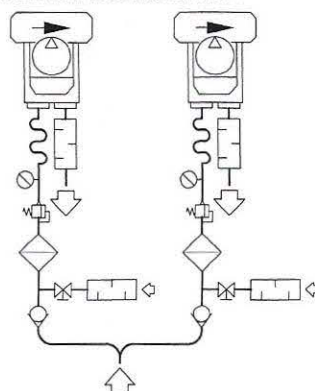
2.4 VACUUM SERVICE



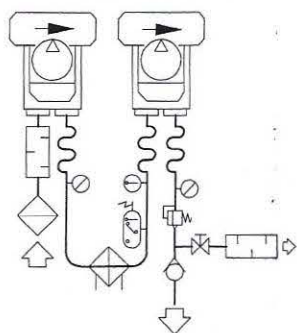
2.2 PARALLEL PRESSURE SERVICE



2.5 PARALLEL VACUUM SERVICE



2.3 SERIES PRESSURE SERVICE



2.6 LIST ACCESSORIES

Item		Denomination	Item		Denomination
1		Filter – Inline filter	7		Valve
(2)		Silencer	(8)		Cooler
3		Flexible coupling	(9)		Thermometer
4		Pressure – Vacuum gauge	(10)		Temperature switch
5		Safety valve			
6		Non return valve	(x) IF NECESSARY		

3. INTERNAL CLEANING INSTRUCTIONS

CAUTION!

Internal deposit build up can cause:

- performance variations;
- alteration in clearances resulting in seizing;
- out of balance rotor.

3.1 CLEANING INSTRUCTIONS

In case it is necessary to clean the inside of the blower, proceed as follows:

1. Remove in order #915 and #902 screws placed on #162 cover.
2. Remove #162 cover by using the two threaded holes placed on cover itself.
3. Remove the #900 screw and #365 washer.
4. Remove the #360 bearing cover and extract the #321 bearing using a bearing puller.

N.B.: The #935 shims washers are included when necessary to accommodate the axial clearance. Be careful not to misplace.

5. Remove the #230 impeller, using a puller if necessary.

6. Clean and reassemble in reverse order.

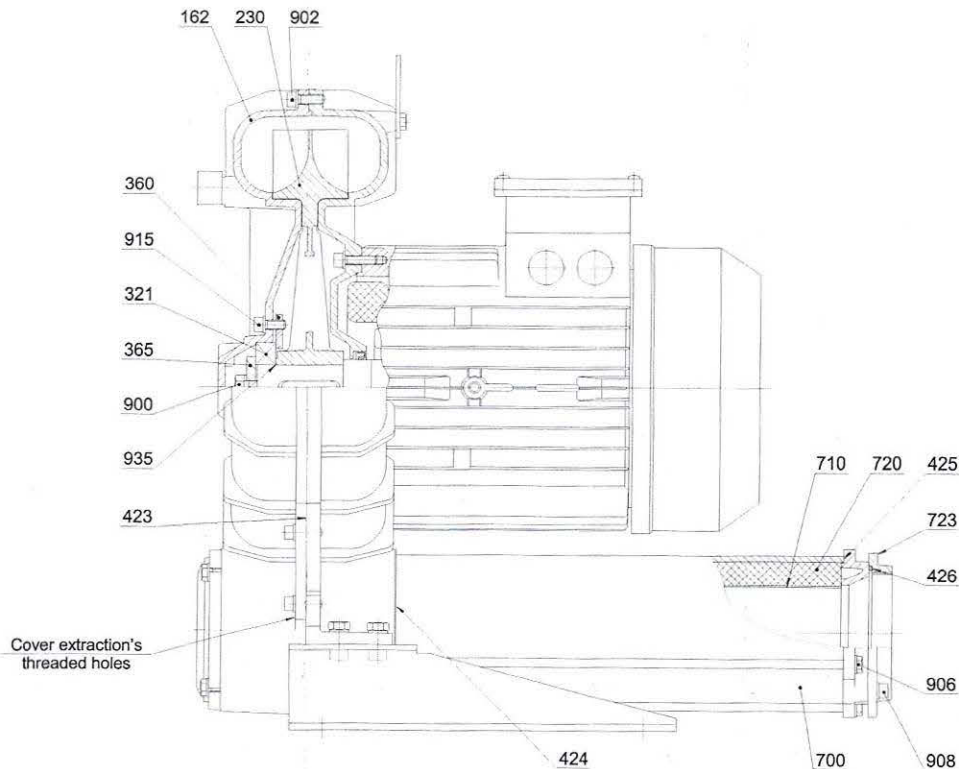
If needed, reconstruct #423 seal using Loctite 598 or similar, after cleaning the sealing surfaces of any existing sealant.

3.2 REPLACEMENT SOUND-ABSORBING PANELS

If needed, replace the foam sound-absorbing panels, proceed as follows:

1. Remove #723 flange and related #426 O-Ring by removing #908 screws.
2. Remove #906 screws.
3. Take away the #700 silencers from the unit, being careful not to lose the #424 gaskets.
4. Extract the #720 panels from the silencer housings.
5. Clean up the #710 retaining screen.
6. Replace and reassemble proceeding in reverse order, remembering to include the #424 and #426 gaskets.

If needed, reconstruct #425 seal using Loctite 598 or similar, after cleaning the sealing surfaces of any existing sealant.



4. SILENCER HOUSING MOUNTING INSTRUCTIONS

The 'SCL K-MS' series was designed to provide maximum flexibility in the positioning of the silencer housings to meet various installation configurations.

The blower is supplied with the silencers configured as in Fig. 1

If this configuration needs to be modified, proceed as follows:

1. Identify the desired configuration (Fig. 2, Fig. 3, Fig. 4).
2. **Disassembly of the silencer housing:**
 - 2.1 Remove #908 screws, taking away #723 flange with the #426 O-ring.
 - 2.2 Remove the #906 screws.
 - 2.3 Take away the #700 silencer from the unit along with the #424 gasket.
3. **Disassembly of the #730 blind flange:**
 - 3.1 Remove the #909 screws, taking away the #730 flange along with the #427 gasket.

Reassemble in reverse order-do not forget the #424 #426 and #427 gaskets.

If needed, reconstruct #425 seal using Loctite 598 or similar, after cleaning the sealing surfaces of any existing sealant.

4.1 USING THE 90° MANIFOLD KIT TYPE CK (accessory)

The 90° manifold can only be installed on the #162 cover ports and as shown in the Figures below, there are multiple configurations.

The 90° manifold kit type CK comes supplied with;

- 1 x manifold
- 1 x gasket and
- 4 x M8x25 UNI 5739 screws.

To mount the 90° manifold, proceed as follows:

1. Disassemble the silencer housing (see point 2)
2. Place the gasket between the #162 cover and the 90° manifold and seal with the M8x25 UNI 5739 screws.

Assemble the silencer housing in reverse order-do not forget the #424 and #426 gaskets.

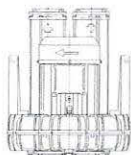
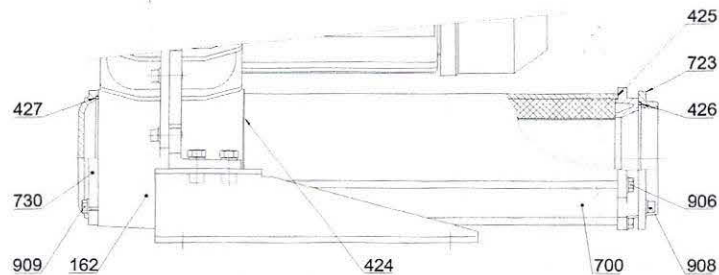


Fig.1

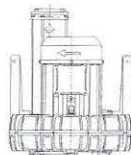


Fig.2

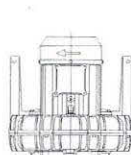


Fig.3

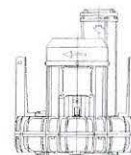


Fig.4

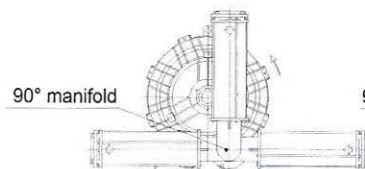


Fig. 2 with 90° manifold

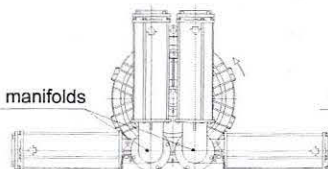


Fig.3 with two 90° manifolds

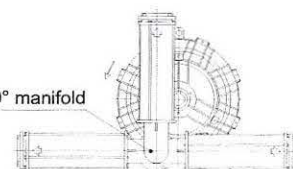


Fig.4 with 90° manifold

5. TROUBLESHOOTING

Problem	Cause	Solution
The unit does not start	The electric wiring is incorrect.	Check the electric wiring against the wiring diagram in the terminal board box.
	The power supply voltage is not suitable.	Check that the power supply voltage, measured at the motor's terminals, is within $\pm 5\%$ of the nominal voltage.
	The impeller is stuck.	Get trained personnel to repair the machine.
Air flow rate zero or insufficient	Rotation direction incorrect.	Check that the direction of rotation is as indicated on the motor's fan cowling.
	Intake filter clogged.	Clean or replace the cartridge.
Power absorption exceeds the maximum allowed	Wiring incorrect.	Check the electric wiring against the wiring diagram in the terminal board box.
	Voltage drop on the power supply.	Return the power supply voltage at the terminals to within the values allowed.
	Intake filter clogged.	Clean or replace the cartridge.
	Deposits have built up inside the unit.	Get trained personnel to clean the machine internally.
	The unit is operating at a pressure and/or vacuum that exceeds that allowed.	Adjust the plant and/or the regulating valve to reduce the pressure differentials.
Delivery air temperature high	The unit is operating at a pressure / vacuum that exceeds that allowed.	Adjust the plant and/or the regulating valve to reduce the pressure differentials.
	Intake filter clogged.	Clean or replace the cartridge.
	Deposits have built up inside the unit.	Get trained personnel to clean the machine internally.
	Intake and/or delivery piping clogged.	Remove the obstructions.
	Air temperature at intake exceeds 40°C.	Use a heat exchanger to reduce the air temperature at the intake.
Excessive noise	The soundproofing fabric is damaged.	Replace the soundproofing fabric.
	The impeller is scraping against the chassis:	
	a. The unit is operating at a pressure / vacuum that exceeds that allowed.	Adjust the plant to reduce the pressure differentials.
	b. The play allowed during assembly has been reduced due to internal deposits (dust, impurities in the pipes, process residue, etc.).	Get trained personnel to clean the machine internally.
	Bearing worn.	Replace the bearing.
Abnormal vibrations	Installation position of the unit not suitable.	Install the units on structures that cannot transmit or amplify the noise (tanks, steel plating, etc.).
	The impeller is damaged.	Replace the impeller.
	Deposits have built up on the impeller.	Get trained personnel to clean the machine internally.
	The unit is fixed incorrectly.	Fix the unit on anti-vibration supports.



Operation & Maintenance Manual

NES PROJECT NUMBER: 12-198 April 2015
PROJECT NAME: Air Sparge Equipment & Control Panel System

Prepared for:

**Advanced Cleanup Technologies Inc.
110 Main Street
Suite 103
Port Washington, NY 11050**

**Sales: (508)226-1100 Option 2
Technical Support: (508)226-1100 Option 3**

Phone (508) 226-1100 Fax (508) 226-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz



OPERATION & MAINTENANCE MANUAL

12-198 - AIR SPARGE EQUIPMENT - ACT - NY

SECTION 1 - SUMMARY OF EQUIPMENT

COMPONENT SUMMARY

WARRANTY STATEMENT

SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)

M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)

T-1, P&ID INSTRUMENTATION TABLE

SECTION 3 - PROCESS EQUIPMENT & VALVES

ROTARY VANE COMPRESSOR - BECKER KDT3.60 -5 HP

INLET FILTER SILENCER, 1.5 IN - SOLBERG FS-19P-150

BLEED FILTER SILENCER, 1 IN - SOLBERG FS-19P-100

GATE VALVE, 1.5 IN BRASS - LEGEND LEG104-467

SWING CHECK VALVE, 1.5 IN BRASS - LEGEND PRO105-107

SECTION 4 - PROCESS INSTRUMENTATION

PRESSURE INDICATOR, 0-60 PSI - DWYER SGY-D10422N-GF

PRESSURE SWITCH, 0-10 PSI - DWYER CS-10

PRESSURE SWITCH, 0-30 PSI - DWYER CS-30

TEMPERATURE SWITCH, 0-225 F - UNITED ELECTRIC B54-103

TEMPERATURE GAUGE, 0-250 F - AV 1NFY4

SECTION 5 - ELECTRICAL DRAWINGS & TABLE(S)

T-2, INTERLOCK TABLE

I-1, CONTROL PANEL LAYOUT DRAWING



T-3, PANEL BILL OF MATERIALS (BOM)

I-2, WIRING DIAGRAMS & TERMINAL DETAILS

E-1, LINE DIAGRAM

E-2, VFD SETTINGS

SECTION 6 - CONTROL COMPONENTS

CONTROL PANEL ENCLOSURE 24 X 24 X 12 - MILD STEEL/GRAY - HAMMOND EN4SD242412GY

VENT FAN 105CFM 115VAC 4.7" W/ FILTER GRILL 24 IN CORD - HAMMOND DNFF120BK115

VENT FAN ADJUSTABLE 30-140F BI-METAL TEMP SWITCH N.O. - HAMMOND SKT011419NO

VFD, 33 AMP RATING - AC TECH ESV752N02TXB

POWER SUPPLY, 24VDC, 1.3A, 1PH, 30W - IDEC PS5R-C24

TIMER ON-DELAY - SQUARE D RE17RAMU_



SECTION 1 - SUMMARY OF EQUIPMENT

COMPONENT SUMMARY

WARRANTY STATEMENT

NES MAJOR COMPONENT SUMMARY

REVISION A

APRIL 2015

PROJECT NO.:

12-198

AIR SPARGE EQUIPMENT

ACT - NY

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
SECTION 1 - SUMMARY OF EQUIPMENT					
COMPONENT SUMMARY					
WARRANTY STATEMENT					
SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)					
M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)	M-1				
T-1, P&ID INSTRUMENTATION TABLE	T-1				
SECTION 3 - PROCESS EQUIPMENT & VALVES					
ROTARY VANE COMPRESSOR	C-1	1	BECKER	KDT3.60 -5 HP	D2855726
COMPRESSOR MOTOR, 5 HP, 208VAC, 3-PHASE, TEFC	C-1	1	TOSHIBA	00545DSR44A-P	14100140897
INLET FILTER SILENCER, 1.5 IN	F-1	1	SOLBERG	FS-19P-150	N/A
BLEED FILTER SILENCER, 1 IN	F-2	1	SOLBERG	FS-19P-100	N/A
GATE VALVE, 1.5 IN BRASS	GV	1	LEGEND	LEG104-467	N/A
SWING CHECK VALVE, 1.5 IN BRASS	CV	1	LEGEND	PRO105-107	N/A
SECTION 4 - PROCESS INSTRUMENTATION					
PRESSURE INDICATOR, 0-60 PSI	PI-101, 102	2	DWYER	SGY-D10422N-GF	KC-L14 / KC-L14
PRESSURE SWITCH, 0-10 PSI	PSL-101	1	DWYER	CS-10	M13092-T10AA
PRESSURE SWITCH, 0-30 PSI	PSH-102	1	DWYER	CS-30	M13316-T10AA
TEMPERATURE SWITCH, 0-225 F	TSH-101	1	UNITED ELECTRIC	B54-103	1509-K2116292
TEMPERATURE GAUGE, 0-250 F	TI-101, 102	2	AV	1NFY4	N/A
SECTION 5 - ELECTRICAL DRAWINGS & TABLE(S)					
T-2, INTERLOCK TABLE (BY TERRATHERM)	T-2				
I-1, CONTROL PANEL LAYOUT DRAWING	I-1				
T-3, PANEL BILL OF MATERIALS (BOM)	T-3				
I-2, WIRING DIAGRAMS & TERMINAL DETAILS	I-2				
E-1, LINE DIAGRAM	E-1				
E-2, VFD SETTINGS	E-2				
SECTION 6 - CONTROL COMPONENTS					
CONTROL PANEL ENCLOSURE 24 X 24 X 12 - MILD STEEL/GRAY	ENCL	1	HAMMOND	EN4SD242412GY	UL: A11975128
BACK-PANEL - FITS ENCL, 24 X 24 - STEEL/WHT	ENCL	1	HAMMOND	EP2424	N/A
MOUNTING FEET SET OF 4 - ZINC PLATED	ENCL	1	HAMMOND	EZPMFHD	N/A
VENT FAN 105CFM 115VAC 4.7" W/ FILTER GRILL 24 IN CORD	VF	1	HAMMOND	DNFF120BK115	N/A
VENT FAN ADJUSTABLE 30-140F BI-METAL TEMP SWITCH N.O.	VF	1	HAMMOND	SKT011419NO	N/A
VENT FAN RAINHOOD NEMA 3R	VF	2	HAMMOND	RH20000GY	N/A
VENT FAN GRILL / SOLID COVER KIT	VF	2	HAMMOND	RHA20000G	N/A
CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	CB	1	SQUARE D	MG24430_	N/A
VFD, 33 AMP RATING	VFD	1	AC TECH	ESV752N02TXB	13469543329651500
RELAY 1 POLE 24VDC	CR	3	IDEC	RV8H-L-D24_	N/A
RELAY 3PDT 120VAC W/INDICATOR LIGHT	CR	4	IDEC	RH3B-UL-AC 120V	N/A
RELAY SOCKET FOR RH3B	CR	4	IDEC	SH3B- 05	N/A
RH1B-ULDC12V SPDT W/ LIGHT RELAY	CR	2	IDEC	RH1B-ULDC12V	N/A
RELAY SOCKET FOR RH1B	CR	3	IDEC	SH1B- 05	N/A
POWER SUPPLY, 24VDC, 1.3A, 1PH, 30W	PS	1	IDEC	PS5R-C24	914701D02244R
TIMER ON-DELAY	T	2	SQUARE D	RE17RAMU_	N/A
LEGEND PLATE HOLDER	PB	6	SQUARE D	ZBZ33-	N/A
PILOT LIGHT HEAD, RED	LT	4	SQUARE D	ZB5AV04 3	N/A
MOUNTING BASE, 120V RED PROTECTED LED	LT	4	SQUARE D	ZB5AVG 4	N/A
PUSH BUTTON OPERATOR NON-ILLUM BLACK	SW	1	SQUARE D	ZB5AA 2	N/A
3 POSITION SELECTOR SWITCH ILLUM. GREEN MOMENTARY	SW	1	SQUARE D	ZB5AK1733_	N/A
MOUNTING BASE 120V GREEN PROTECTED LED	SW	1	SQUARE D	ZB5AVG3_	N/A
TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	TB	12	SQUARE D	NSYTRV22	N/A
TERMINAL BLOCK END BARRIERS GRAY	TB	3	SQUARE D	NSYTRAC22	N/A
TERMINAL BLOCK END ANCHORS	TB	6	SQUARE D	NSYTRAABV35	N/A

NES MAJOR COMPONENT SUMMARY

REVISION A

APRIL 2015

PROJECT NO.:

12-198

AIR SPARGE EQUIPMENT

ACT - NY

COMPONENT	TAG	QTY	MANUFACTURER	MODEL	SERIAL NUMBER
LOAD CENTER GROUND BAR 12 TERMINALS	GB	1	SQUARE D	PK15GTA	N/A



WARRANTY

All products not manufactured by RapidTech LLC d/b/a National Environmental Systems, carry the original manufacturer's warranty. Copies are available on request.

RapidTech LLC d/b/a National Environmental Systems, warrants its packaged and manufactured equipment against any defect in material or workmanship, under normal use and storage for a period of twelve (12) months from date of manufacture and invoice, regardless of system start-up date. In the event that products are found to be defective within the warranty period, RapidTech LLC d/b/a National Environmental Systems, sole obligation and remedy shall be the furnishing of replacements for any defective parts, and such replacement parts shall be furnished but not installed by RapidTech LLC d/b/a National Environmental Systems. RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, WILL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES IN ANY CLAIM SUIT OR PROCEEDINGS ARISING UNDER WARRANTY, NOR WILL RAPIDTECH LLC D/B/A NATIONAL ENVIRONMENTAL SYSTEMS, ACCEPT ANY LIABILITY FOR CLAIMS FOR LABOR, LOSS OR PROFIT, REPAIRS OR OTHER EXPENSES INCIDENTAL TO REPLACEMENT.

The warranty requires that the purchaser complete all operations and maintenance as detailed in each section of the Operation & Maintenance Manual supplied with the purchased system. In addition installation must comply with nationally recognized electrical and mechanical standards as well as best engineering practices in effect at the time of purchase.

The product warranty expressed above is our only warranty and may not be verbally changed or modified by any representative of RapidTech LLC d/b/a National Environmental Systems. All freight costs incurred in shipping parts to or from RapidTech LLC d/b/a National Environmental Systems, or to the manufacturer if necessary are at the expense of the customer.

RapidTech LLC dba National Environmental Systems, will invoice the cost of any replacement parts. These parts will be credited upon certification the original part was defective and the defective part was returned within one week of notifying RapidTech LLC d/b/a National Environmental Systems, of the malfunction. If the part is found to have been misused no credit will be issued. In order for RapidTech LLC d/b/a National Environmental Systems, to ship a replacement part on account, all outstanding invoices must be current.

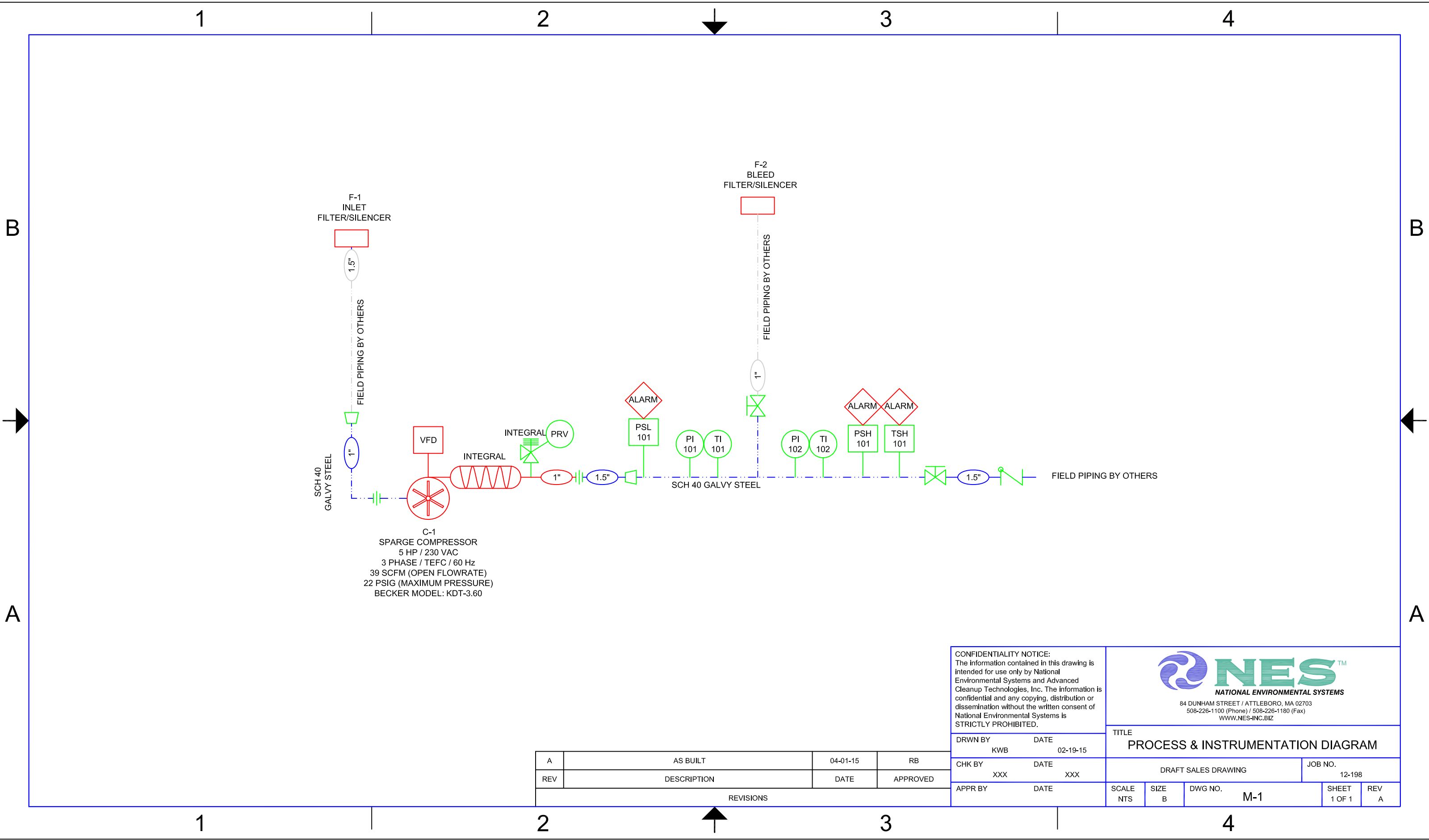
RapidTech LLC d/b/a National Environmental Systems, expressly disclaims any warranties, expressed or implied, including any warranty of merchantability or fit for particular purpose or any warranty arising from a course of dealing or usage of trade. Except to the extent required by applicable law. RapidTech LLC d/b/a National Environmental Systems, shall not be liable, in tort, contract or otherwise, for any loss or damage, whether direct, consequential or incidental, of any person or entity arising in connections with the equipment.



SECTION 2 - MECHANICAL DRAWINGS & TABLE(S)

M-1, PROCESS & INSTRUMENTATION DIAGRAM (P&ID)

T-1, P&ID INSTRUMENTATION TABLE



F-1
INLET
FILTER/SILENCER

F-2
BLEED
FILTER/SILENCER

SCH 40
GALVY STEEL

SCH 40 GALVY STEEL

FIELD PIPING BY OTHERS

C-1
SPARGE COMPRESSOR
5 HP / 230 VAC
3 PHASE / TEFC / 60 Hz
39 SCFM (OPEN FLOWRATE)
22 PSIG (MAXIMUM PRESSURE)
BECKER MODEL: KDT-3.60

ALARM

PSL
101

PI
101

TI
101

PI
102

TI
102

ALARM

PSH
101

ALARM

TSH
101

CONFIDENTIALITY NOTICE:
The information contained in this drawing is intended for use only by National Environmental Systems and Advanced Cleanup Technologies, Inc. The information is confidential and any copying, distribution or dissemination without the written consent of National Environmental Systems is STRICTLY PROHIBITED.



A	AS BUILT	04-01-15	RB
REV	DESCRIPTION	DATE	APPROVED
REVISIONS			

DRWN BY KWB	DATE 02-19-15
CHK BY XXX	DATE XXX
APPR BY	DATE

TITLE PROCESS & INSTRUMENTATION DIAGRAM					
DRAFT SALES DRAWING				JOB NO. 12-198	
SCALE NTS	SIZE B	DWG NO. M-1		SHEET 1 OF 1	REV A

TABLE 1
PROCESS INSTRUMENTATION DIAGRAM INSTRUMENT LIST

REVISION A

APRIL 2015

12-198

AIR SPARGE EQUIPMENT

TAG	ITEM	MODEL	MANUFACTURER	SPECIFICATION
PI-101, 102	PRESSURE INDICATOR, 0-60 PSI	SGY-D10422N-GF	DWYER	0-60 PSI RANGE / 2.5 INCH STAINLESS STEEL CASE / BRASS WETTED PARTS / GLYCERIN FILLED / 0.25 INCH BOTTOM MOUNT
PSL-101	PRESSURE SWITCH, 0-10 PSI	CS-10	DWYER	1-10 PSIG ADJUSTABLE RANGE / 0.4 PSIG FIXED DEADBAND / 0.25" BOTTOM MOUNT / BUNA-N & STEEL WETTED / 15 A @ 120 VAC / NEMA 1
PSH-102	PRESSURE SWITCH, 0-30 PSI	CS-30	DWYER	1-30 PSIG ADJUSTABLE RANGE / 1.0 PSIG FIXED DEADBAND / 0.25" BOTTOM MOUNT / BUNA-N & STEEL WETTED / 15 A @ 120 VAC / NEMA 1
TSH-101	TEMPERATURE SWITCH, 0-225 F	B54-103	UNITED ELECTRIC	IMMERSION PROBE TEMPERATURE SWITCH / 1-SETPOINT ADJUSTABLE - SPDT / 0° to 225°F / NEMA 1 ALUMINUM INDOOR / NON HAZARDOUS / 2-1/8 IN L BRASS PROBE / 3/8 IN NPT / 15 AMP RATING
TI-101, 102	TEMPERATURE GAUGE, 0-250 F	1NFY4	AV	BIMETAL THERMOMETER / 0 TO 250 F / 2.5 INCH STEM / 3 INCH DIAL / 0.5 INCH MNPT BACK-MOUNT / SS CASE



SECTION 3 - PROCESS EQUIPMENT & VALVES

ROTARY VANE COMPRESSOR - BECKER KDT3.60 -5 HP

INLET FILTER SILENCER, 1.5 IN - SOLBERG FS-19P-150

BLEED FILTER SILENCER, 1 IN - SOLBERG FS-19P-100

GATE VALVE, 1.5 IN BRASS - LEGEND LEG104-467

SWING CHECK VALVE, 1.5 IN BRASS - LEGEND PRO105-107

KDT Series

ISO 9001 Certified
CE Compliant

100% OIL-LESS COMPRESSORS

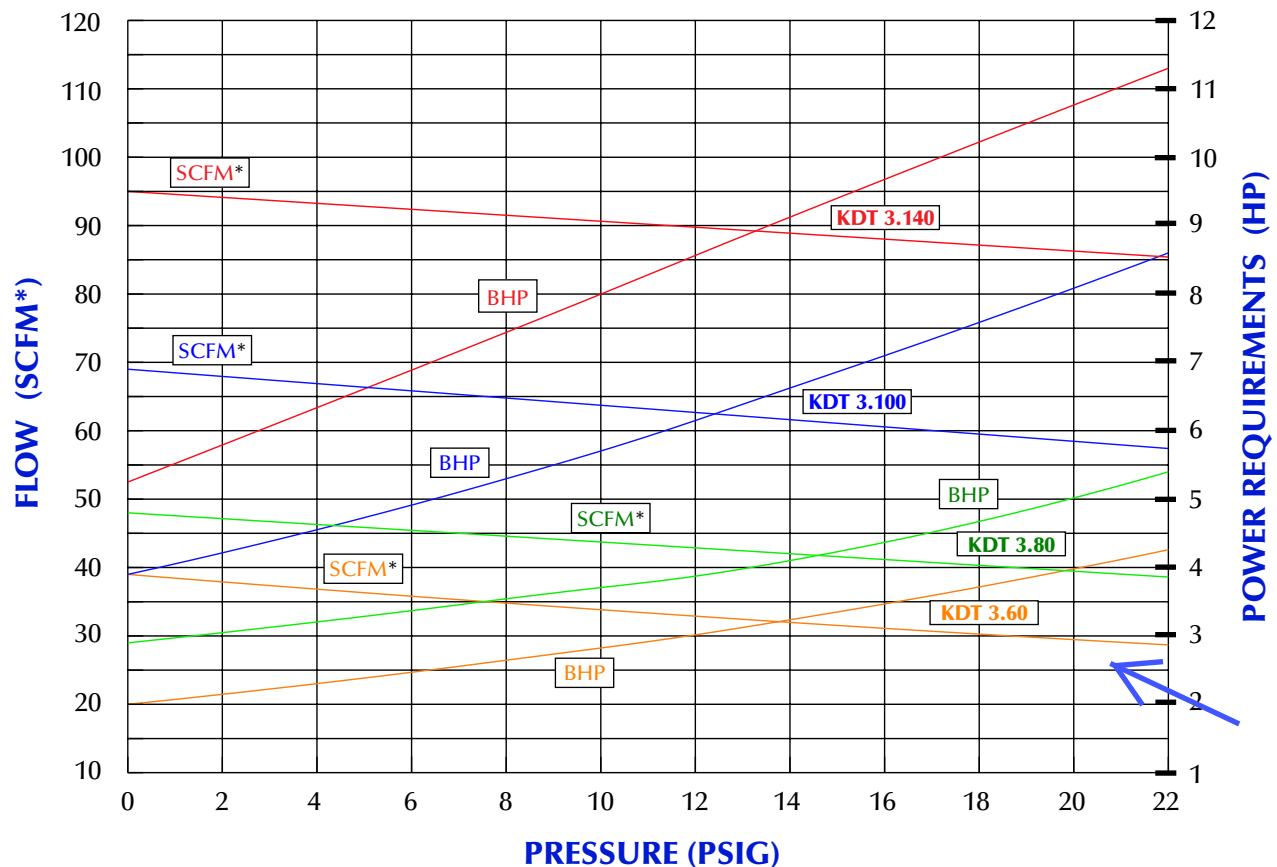
The Becker KDT series is a line of 100% Oil-less, rotary vane, low pressure compressors. They are designed to operate on a continuous basis throughout a pressure range from atmospheric pressure to 22 PSIG.

Each KDT unit is a direct drive compressor and is supplied with a TEFC flange mounted electric motor. Each unit is equipped with inlet and discharge filters, a pressure regulating valve, and vibration isolators as

standard equipment, all of which are an integral part of the compressor.

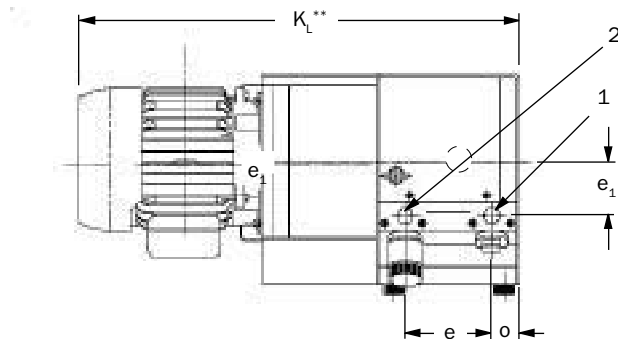


The Becker KDT compressor is ideal for applications where air is the gas and where operation is in the low pressure range where high pressure compressors are less efficient. Applications for the KDT compressor include graphic arts, soil remediation, pneumatic conveying, robotics and material handling, packaging, and paper converting.

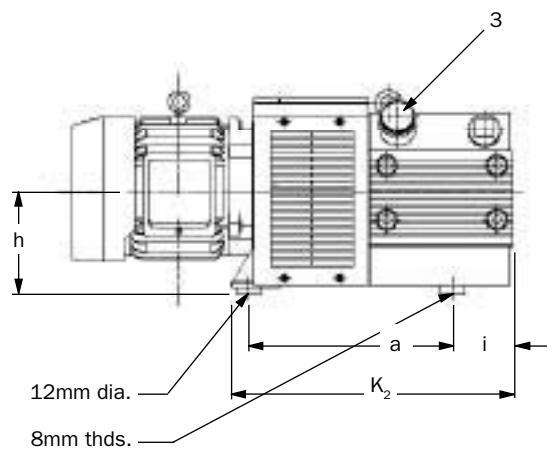


* @ 29.92" Hg Bar. Pr.; 68°F; 36% R.H.; 0.075#/ft³

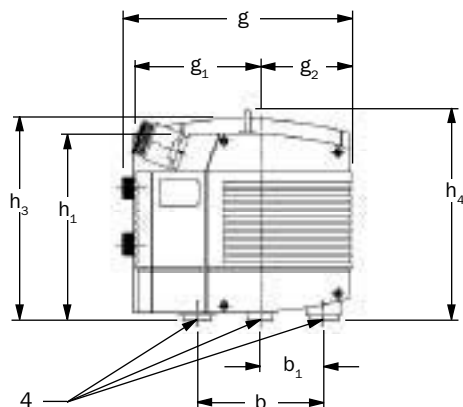
TECHNICAL DATA



Top View



Side View



End View (Opposite Motor End)

All data based on 60 Hz operation

	KDT 3.60	KDT 3.80	KDT 3.100	KDT 3.140
Flow (SCFM @ 0 PSIG)	39	48	69	95
Horsepower	5*	7 ¹ / ₂ *	10*	12*
Speed (RPM)	1740	1740	1740	1740
Maximum Pressure (PSIG)	22	22	22	22
Weight (lbs.)—w/o motor	104	108	156	172
Weight (lbs.)—w/ motor**	191*	265*	323*	368*
Noise Level (Max. dBA)	74	76	78	84
Outlet size (BSP, inches)	1	1	1 ¹ / ₂	1 ¹ / ₂
Dimensional Data				
	(Inches)			
a	12.83	12.83	15.67	15.67
b	7.5	7.5	9.65	9.65
b ₁	3.75	3.75	4.82	4.82
e	5.43	5.43	7.5	7.5
e ₁	2.56	2.56	3.75	3.75
g	13.9	13.9	18.5	18.5
g ₁	7.68	7.68	8.78	8.78
g ₂	5.55	5.55	9.06	9.06
h	6.38	6.38	6.38	6.38
h ₁	11.38	11.38	11.7	11.7
h ₃	12.28	12.28	13.0	13.0
h ₄	12.9	12.9	13.25	13.25
i	3.78	3.78	5.5	5.5
k ₂	17.64	17.64	22.17	22.17
k _L	28.2	30	34.15	36.6
o	1.81	1.81	2.36	2.36

Manufacturer reserves right to alter data without notice.

* Operation at lower pressure may use smaller motor.

** May vary with motor type and manufacturer

- 1 - Inlet Port
- 2 - Discharge Port
- 3 - Pressure Relief Valve
- 4 - Vibration Isolators


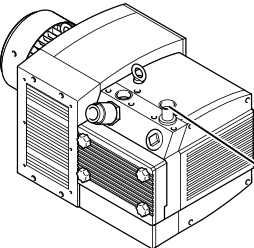


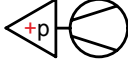
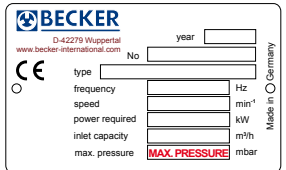
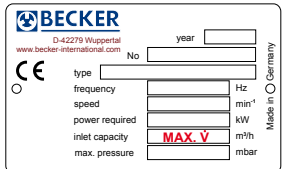




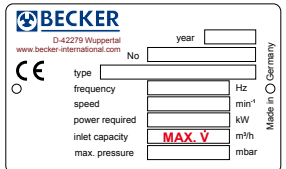


Betriebsanleitung
 Operating Instructions
 Instructions de service
 Istruzioni d'uso
 Handleiding
 Instrucciones para el manejo
 Manual de instruções
 Naudojimosi instrukcija
 Kasutusjuhend
 Lietošanas instrukcija
 Οδηγίες χρήσης
 取扱説明書
 사용설명서


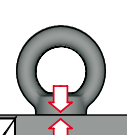



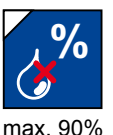
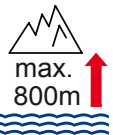
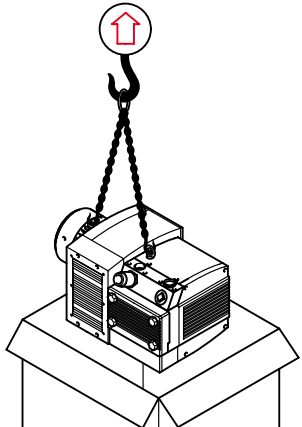
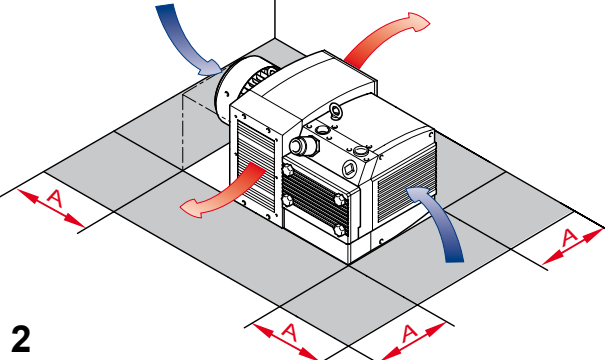
Driftsinstruks
 Driftsinstruktioner
 Käyttöohje
 Driftsvejledning
 Instrukcja obsługi
 Kezelési útmutató
 Návod k obsluze
 Navodilo za uporabo
 Návod na obsluhu
 El Kitabi
 Инструкция по эксплуатации
 使用说明书

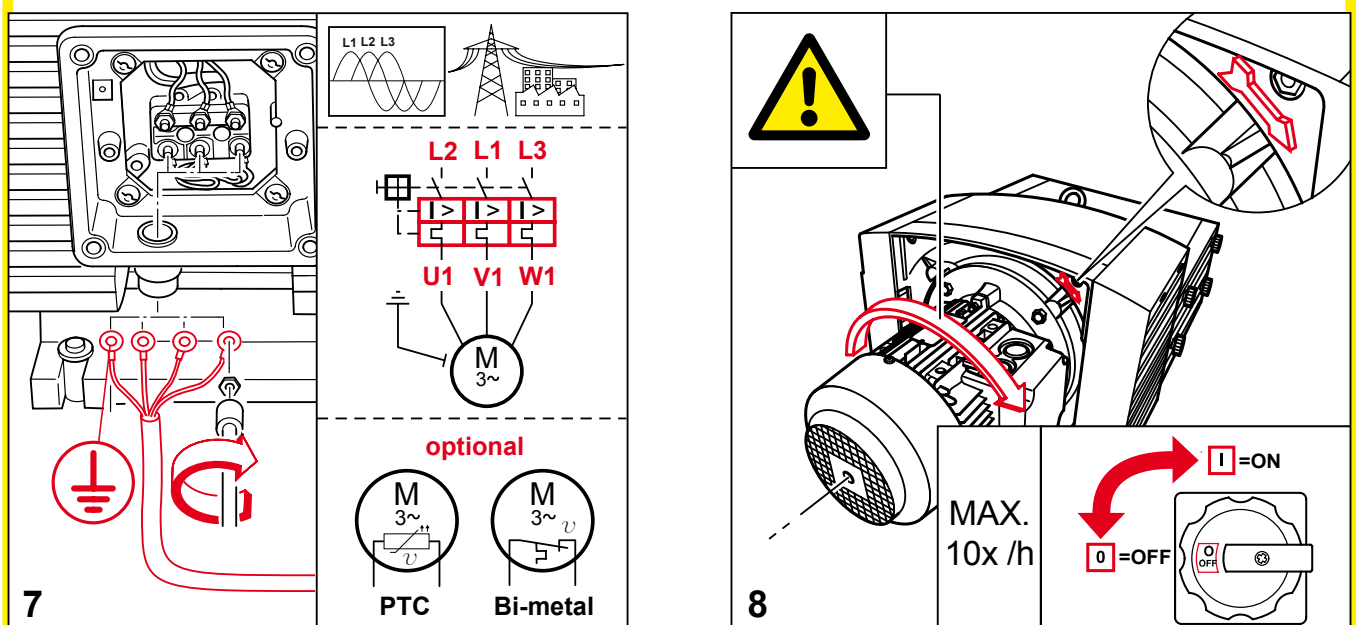
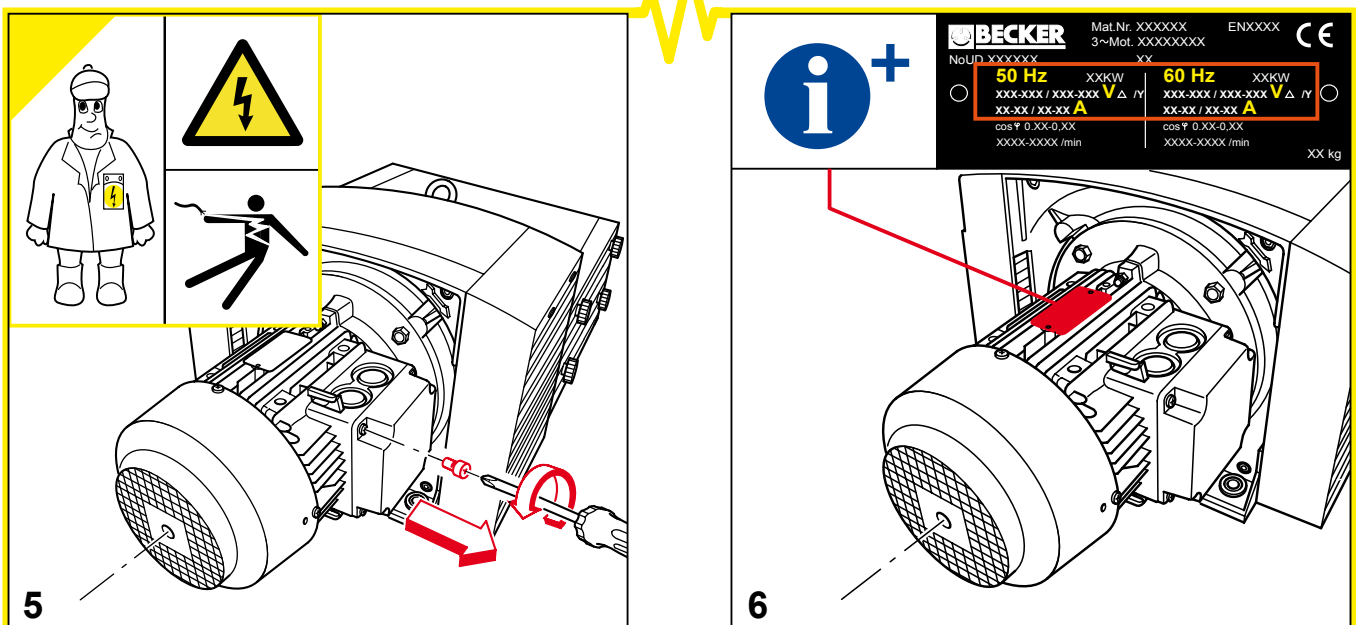
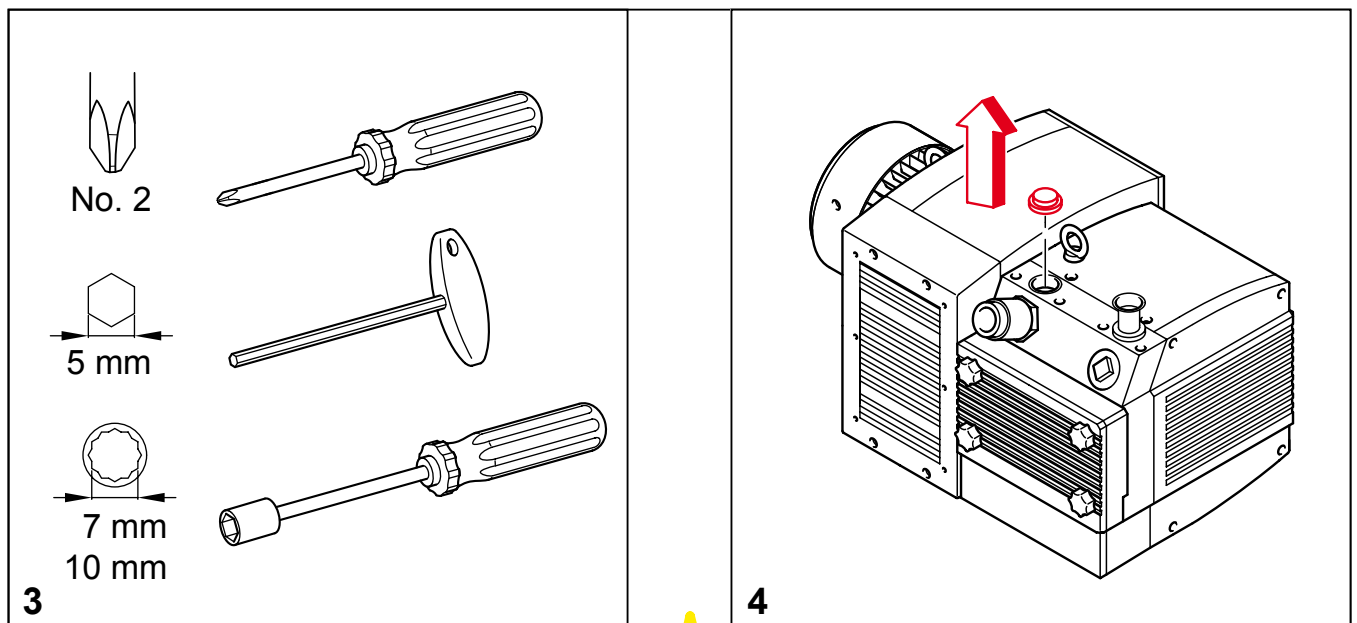
KDT 3.60

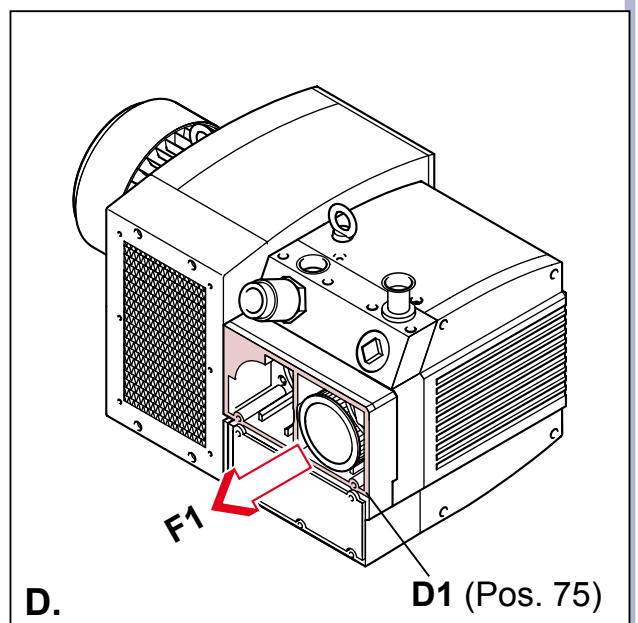
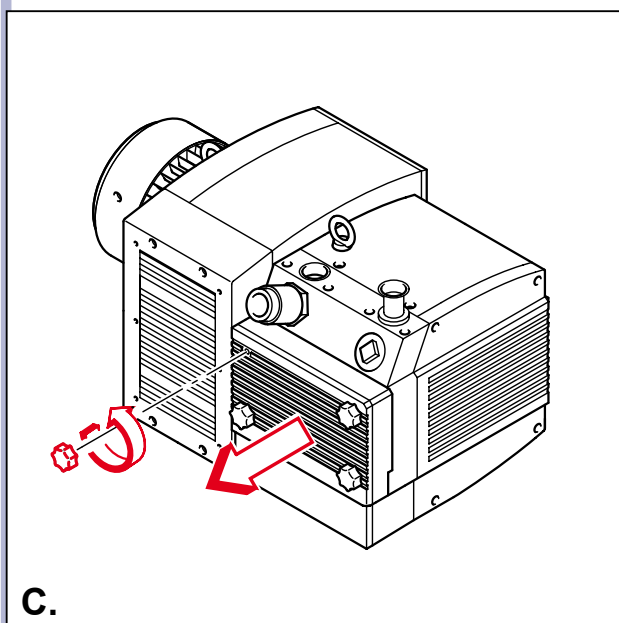
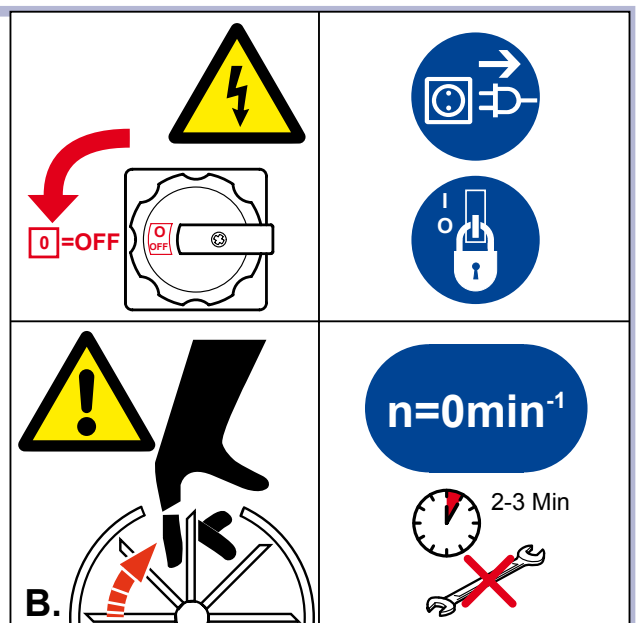
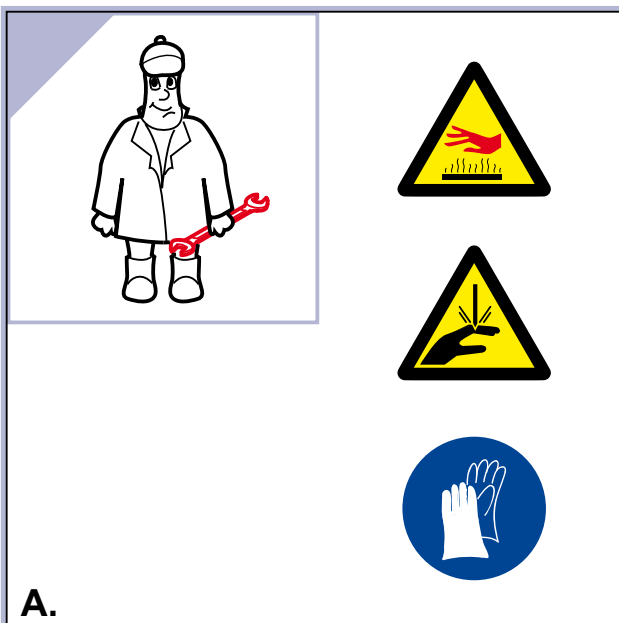
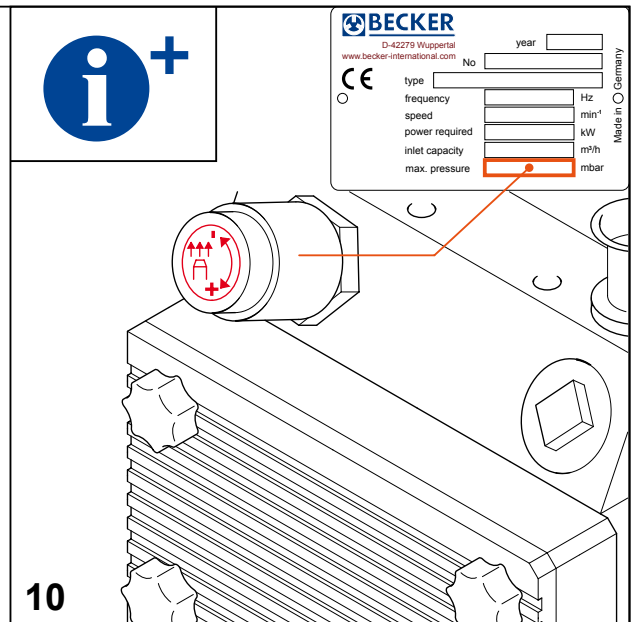
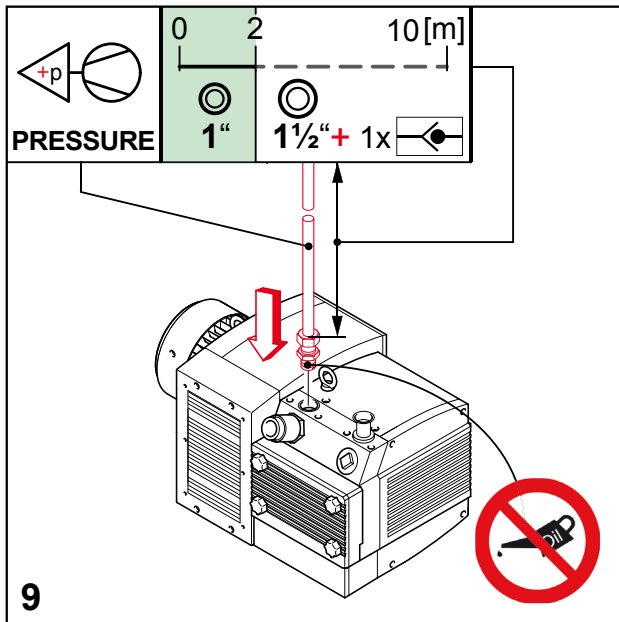
2006/42/EG

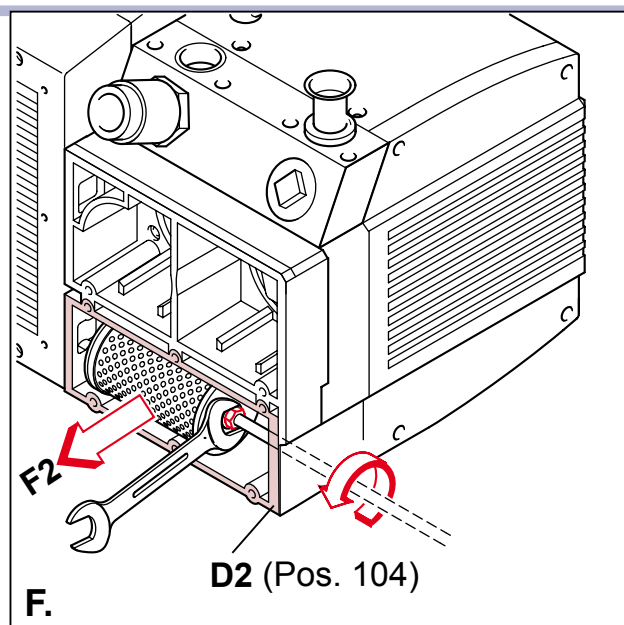
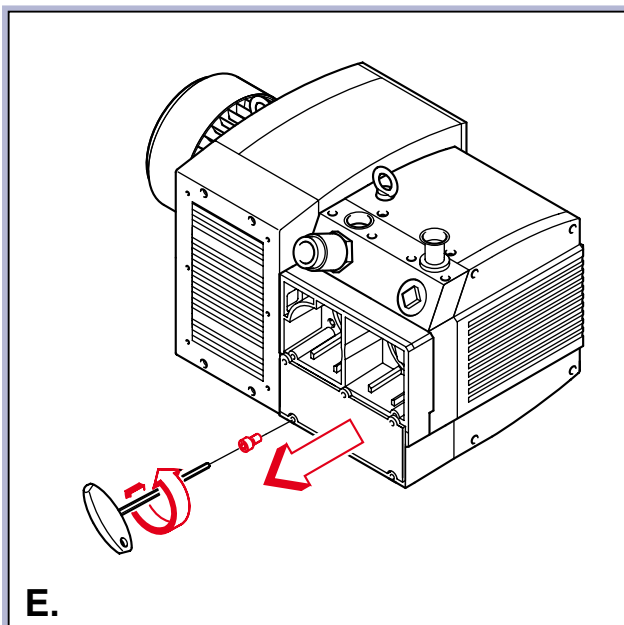


 	 	 <p>MAX. PRESSURE</p>	 <p>mbar</p>
			 <p>m³/h</p>
 <p>AIR</p>	 	 <p>MAX. V</p>	 <p>m³/h</p>
 	<p>DIN EN ISO 3744</p> <p> $L_{pA} = 72 \text{ dB(A)} - 50\text{Hz}$ $L_{pA} = 74 \text{ dB(A)} - 60\text{Hz}$ $K_{pA} = 3 \text{ dB(A)}$ </p>		

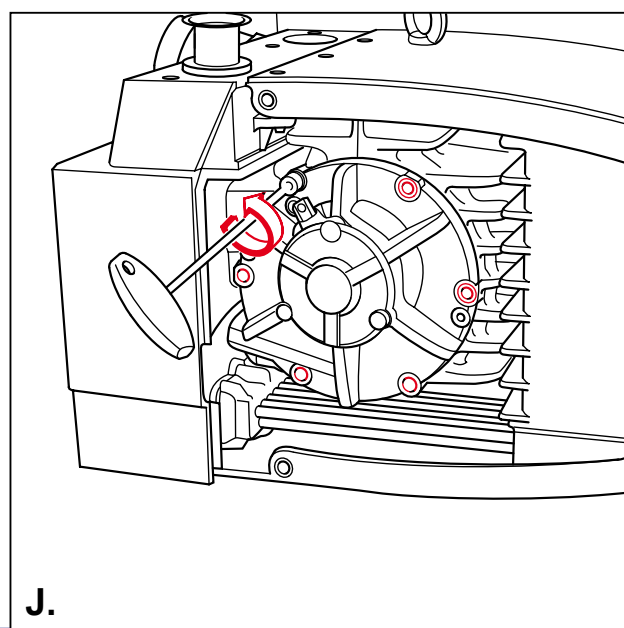
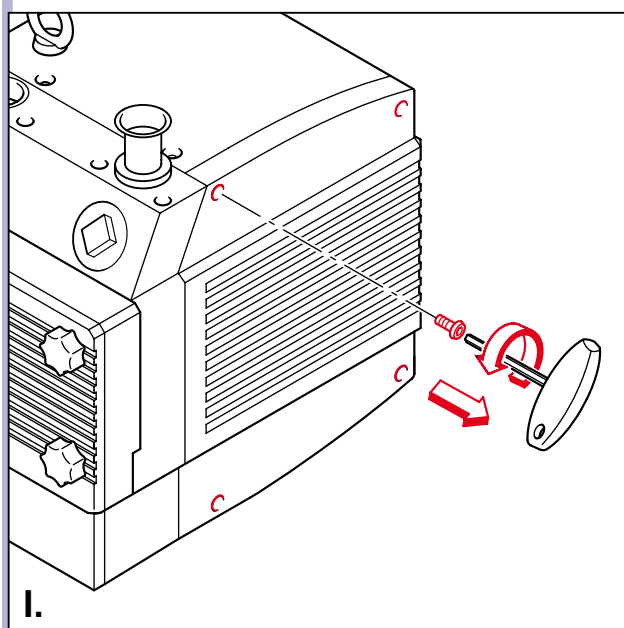
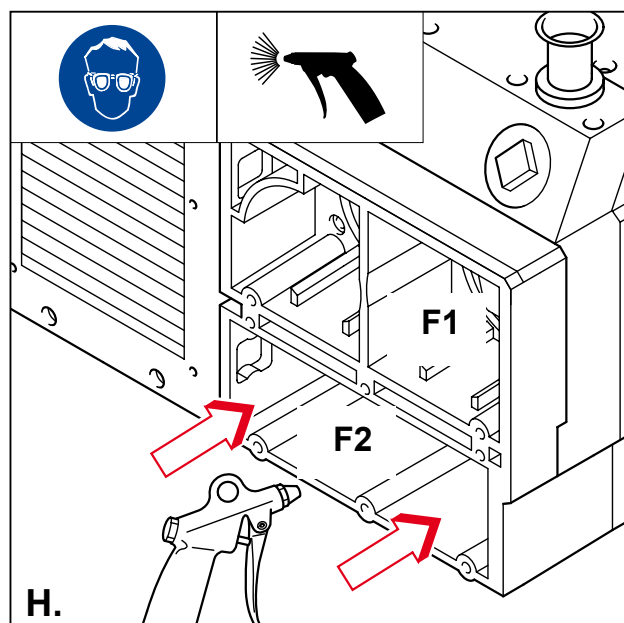
			 <p>71-80 kg 156-176 lbs</p>	<p> $A > 100\text{mm}$ $A > 4"$ </p>	 <p> $> 5^\circ\text{C}/41^\circ\text{F}$ $< 45^\circ\text{C}/113^\circ\text{F}$ </p>	 <p>max. 90%</p>	 <p>max. 800m</p>
<p>1</p> 				<p>2</p> 			

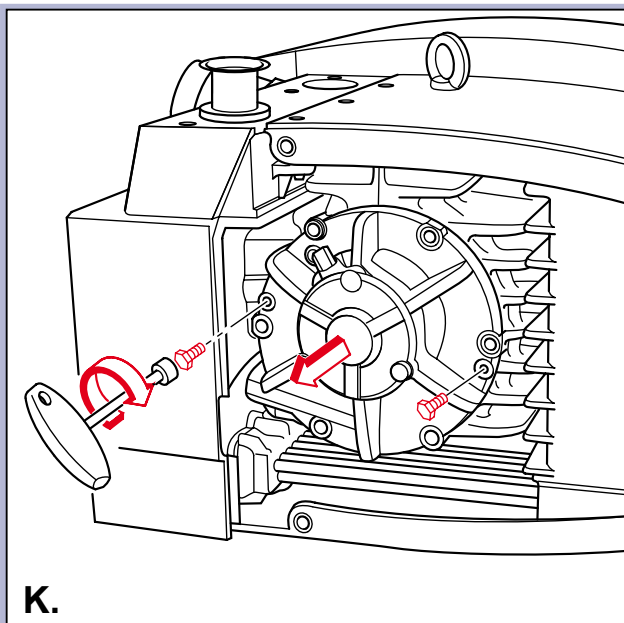



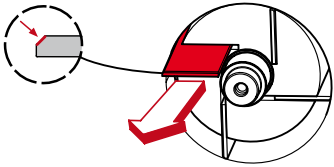
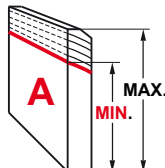





<p>F1 (standard) No.: 909507</p>	<p>F1* (polyester) KDT 3.60/6 No.: 909587</p>	<p>F2 (standard) No.: 909510</p>
<p>D1 D2</p>	<p>Satz / Kit Pos.: 20, 24, 62, 75, 76, 85, 104, 125, 126, 127, 146, 288 No.: 549000 21100</p>	

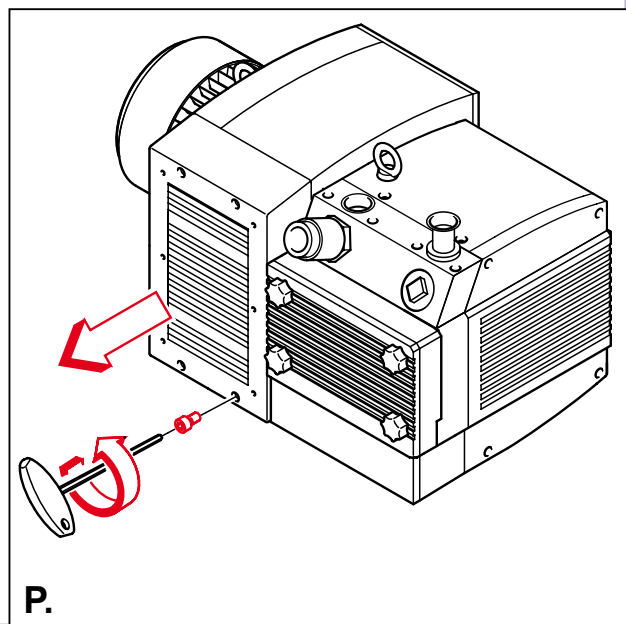
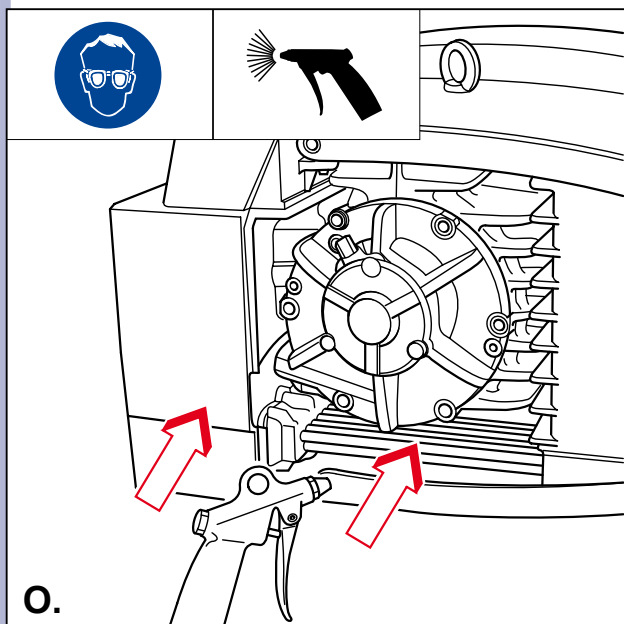
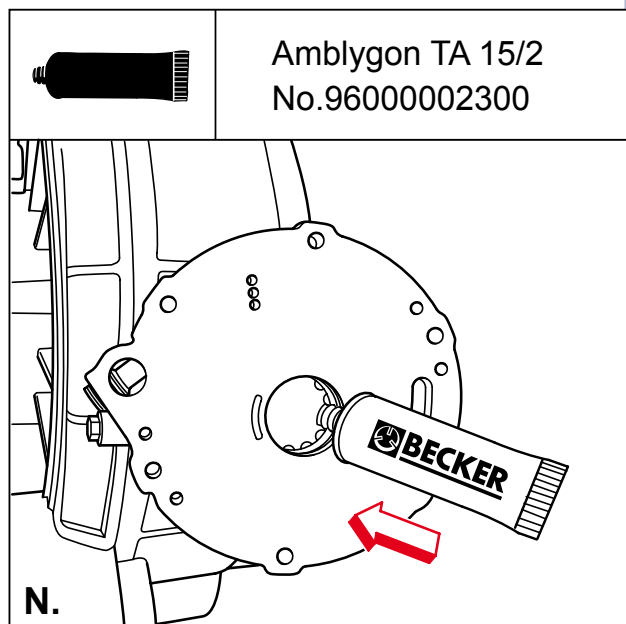
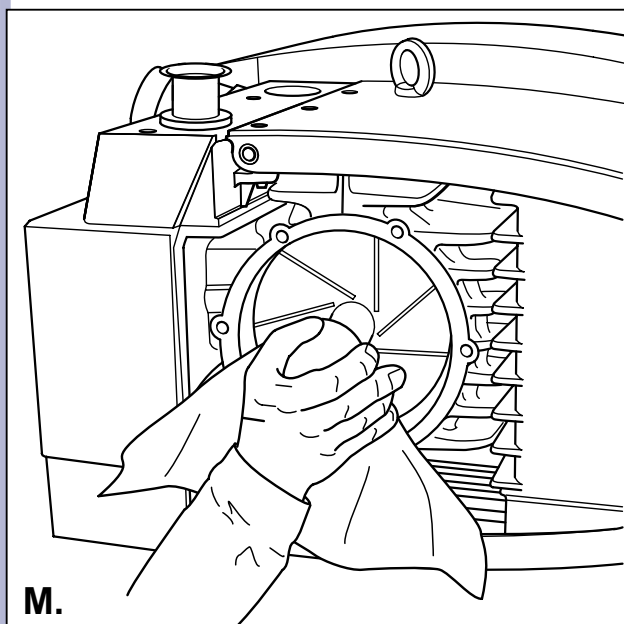


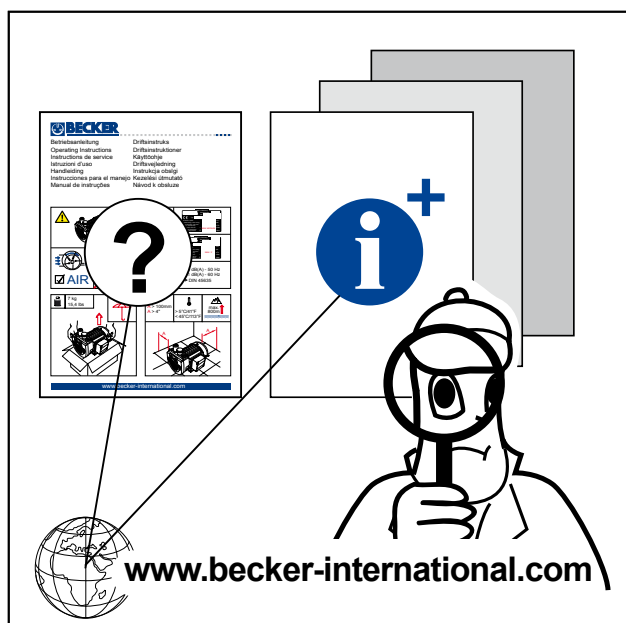
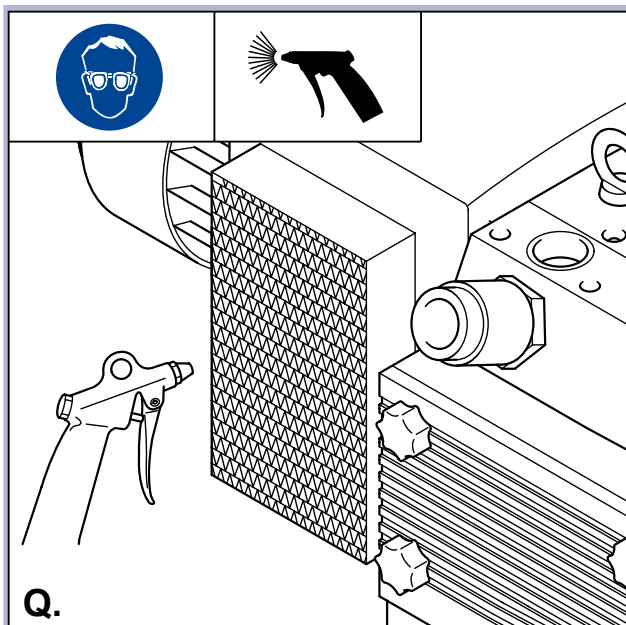


 3000 h	
	<p>$A_{MIN} > 21mm$</p> <p>$A_{MIN} < 21mm$</p> 

L.

KDT 3.60 (standard)	→ No. 90133000004 (SET)
KDT 3.60/0-52	→ No. 90137900004 (SET)
KDT 3.60/6	→ No. 90137900004 (SET)
KDT 3.60/6-29	→ No. 90137900007 (SET)





Gebr. Becker GmbH
 Hölker Feld 29-31
 D-42279 Wuppertal

info@becker-international.com

(D) Service:

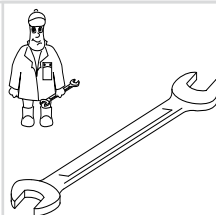
Tel: +49 (0)202 697-171

Fax: +49 (0)202 64 44 74



Gebr. Becker GmbH
Hölker Feld 29-31
D-42279 Wuppertal

**Wartung
Maintenance
Entretien
Manutenzione
Mantenimiento**



	Pos.	Menge ²⁾ Quantity Quantité Quantità Cantidad	Bestell-Nr. Ident No. No. Identificatio No. Identificazion No. de pedido	Bezeichnung Description Designation Designazione Descripción
KDT 3.60 - 3.80	...	1	549000 21100	Dichtungssatz, Complete set of seals, Jeu de joints, Kit di guarnizioni, Junta Completa
	11	SATZ (KIT)	901330 00004	Schieber, Rotor Vane, Palette, Empujador
	11	SATZ (KIT)	901379 00004	" KDT 3.60/0-52 + KDT 3.80/0-52
	11	SATZ (KIT)	"	" KDT 3.60/6 + KDT 3.80/6
	11	SATZ (KIT)	901379 00007	" KDT 3.60/6-29
	68	1	909507 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filt
	68	1	909587 00000	" KDT 3.60/6 + KDT 3.80/6
	91	1	909510 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filt

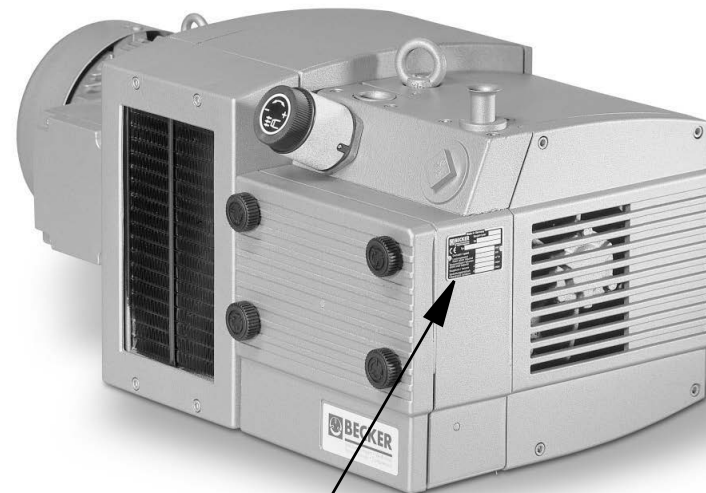
²⁾ erforderliche Bestellmenge / necessary order quantity / quantité nécessaire / quantità di ordinazione necessari / cantidad necesario



Ersatzteilliste
Spare parts list
Liste de pièces de rechange
Listino pezzi di ricambio
Lista de piezas de recambio
Lista de peças sobresselentes
Reserveonderdelenlijst
Reservedelsliste
Reservdelslista

Reservedelsliste
Varaosaluettelo
Wykaz części zamiennych
Seznam náhradních dílů
Tartalékalkatrész lista
Κατάλογος ανταλλακτικών
Перечень запасных частей
备用零件目录
スเปアパーツリスト

KDT 3.60
KDT 3.80



28000021601 07/2009

Index-D

SERVICE

Qingpu - PR CHINA
www.becker-international.com

CE

type **KDT 3.60-XX**

frequency Hz

speed min⁻¹

power required kW

inlet capacity m³/h

pressure + mbar

vacuum - mbar

year

No

Index Option

Made in

1000 001 1 025

D Service:
Tel: +49 (0)202 697-171
Fax: +49 (0)202 64 44 74
E-Mail: info@becker-international.com

www.becker-international.com



Pos.

Ident No.

Description



KDT 3.60 - 3.80



...	549000 21100	SET OF SEALS ¹⁾
6	000100 21600	PUMP BODY, KDT 3.60
6	000100 21100	PUMP BODY, KDT 3.80
9	020004 21100	ROTOR
11	901330 00004	CARBON VANES (KIT) ²⁾
15	000801 21100	LID
16	000701 21100	LID
18	001100 21100	BEARING COVER
19	001000 21100	BEARING COVER
20	025511 21100	GASKET
24	911312 00000	SEAL
26	917152 00000	COMPENSATING DISC
27	906540 00000	SHAFT-SEALING RING
28	906612 50000	BALL BEARING
29	906657 00000	BALL BEARING
31	511400 10100	SET DISTANCE DISC
37	945217 00000	HEX HEAD SCREW
38	016801 21100	CLAMPING DISC
39	949807 00000	SCREW
41	945224 00000	HEX-HEAD SCREW
42	945222 00000	HEX-HEAD SCREW
45	948742 00000	STRAIGHT PIN
47	947736 00000	KEY
50	053201 21100	CONNECTION FLANGE
52	950308 00000	WASHER
53	945337 00000	SOCKET HEAD SCREW
57	949409 00000	WASHER
58	945270 00000	SHAFT END BOLD
61	040101 21100	FILTER HOUSING
62	025501 21100	GASKET
64	946955 00000	STUD
65	951003 00000	STUD
67	964407 00000	SILENCER TUBE
68	909507 00000	FILTER CARTRIDg E C 1112/2 (1x) ²⁾
71	009000 27000	LEAF SPRING
72	948750 00000	BLIND RIVET
73	040201 21100	FILTER-COVER
75	025518 21100	GASKET
76	025516 21100	GASKET
77	022802 21100	FILTER HOLDER
79	945321 00000	SOCKET HEAD SCREW
80	946971 00000	STUD
81	947504 00000	WASHER
82	947104 00000	HEX.NUT
83	952019 00000	LOCATING PEG
85	025514 21100	GASKET
86	025515 21100	GASKET
88	560203 21100	COOLER
91	909510 00000	FILTER CARTRIDg E C 713 (1x) ²⁾
93	946965 00000	STUD
94	947105 00000	HEX.NUT
95	949450 00000	WASHER
97	950304 00000	WASHER
98	945322 00000	SOCKET HEAD SCREW
103	068801 21100	COVER
104	025513 21100	GASKET
105	945319 00000	SOCKET HEAD SCREW
110	921500 50000	HANDLE
121	560204 21100	COOLER
125	025504 21100	GASKET



Pos.

Ident No.

Description



KDT 3.60 - 3.80



126	025512 21100	GASKET
127	025517 21100	GASKET
129	945372 00000	SOCKET HEAD SCREW
130	945328 00000	SOCKET HEAD SCREW
132	946930 00000	STUD
134	005602 21100	COVER
141	016606 21100	CONNECTING PIECE
146	025507 21100	GASKET
148	945368 00000	SOCKET HEAD SCREW
149	741310 30000	RUBBER BUFFER
161	918300 21100	COVERING HOOD
163	920800 21100	AIR GUIDE HOOD
165	960700 21100	VENTILATOR HOOD
166	960701 21100	VENTILATOR HOOD
170	945321 00000	SOCKET HEAD SCREW
171	945371 00000	SOCKET HEAD SCREW
173	949806 00000	SCREW
174	951703 00000	SPRING DISC
175	741302 00000	RUBBER BUFFER
176	945634 00000	THREADED PIN
178	951602 00000	RING UNIT
182	014902 21100	FLANGES
184	951916 00000	RUBBER BUSHING
185	948772 00000	PIPE RIVET
186	947508 00000	WASHER
188	945333 00000	SOCKET HEAD SCREW
190	951018 00000	STUD
191	947506 00000	WASHER
192	947106 00000	HEX.NUT
195	902108 00000	COUPLING
196	902209 00000	COUPLING DISC
197	544501 21100	COUPLING WITH FAN
285	728000 99622	PRESSURE REGULATING VALVE / 8,7 PSI
285	728001 99622	PRESSURE REGULATING VALVE / 14,5 PSI
285	728002 99622	PRESSURE REGULATING VALVE / 29 PSI
288	948066 00000	SEALING RING
290	964307 00000	SILENCER TUBE
291	912805 00000	PLUG
400	769302 40840	FREQUENCY CONVERTOR
401	961301 19600	GASKET
402	945315 00000	SOCKET HEAD SCREW

GREASE 960000 02300 AMBLYGON TA15/2 (TUBE, 8g)

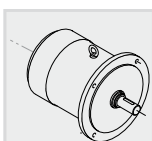
¹⁾ Set of seals - 54900021100 - Pos.: 20, 24, 62, 75, 76, 85, 86, 104, 125, 126, 127, 146, 288
²⁾ necessary order quantity / maintenance

OPTIONAL

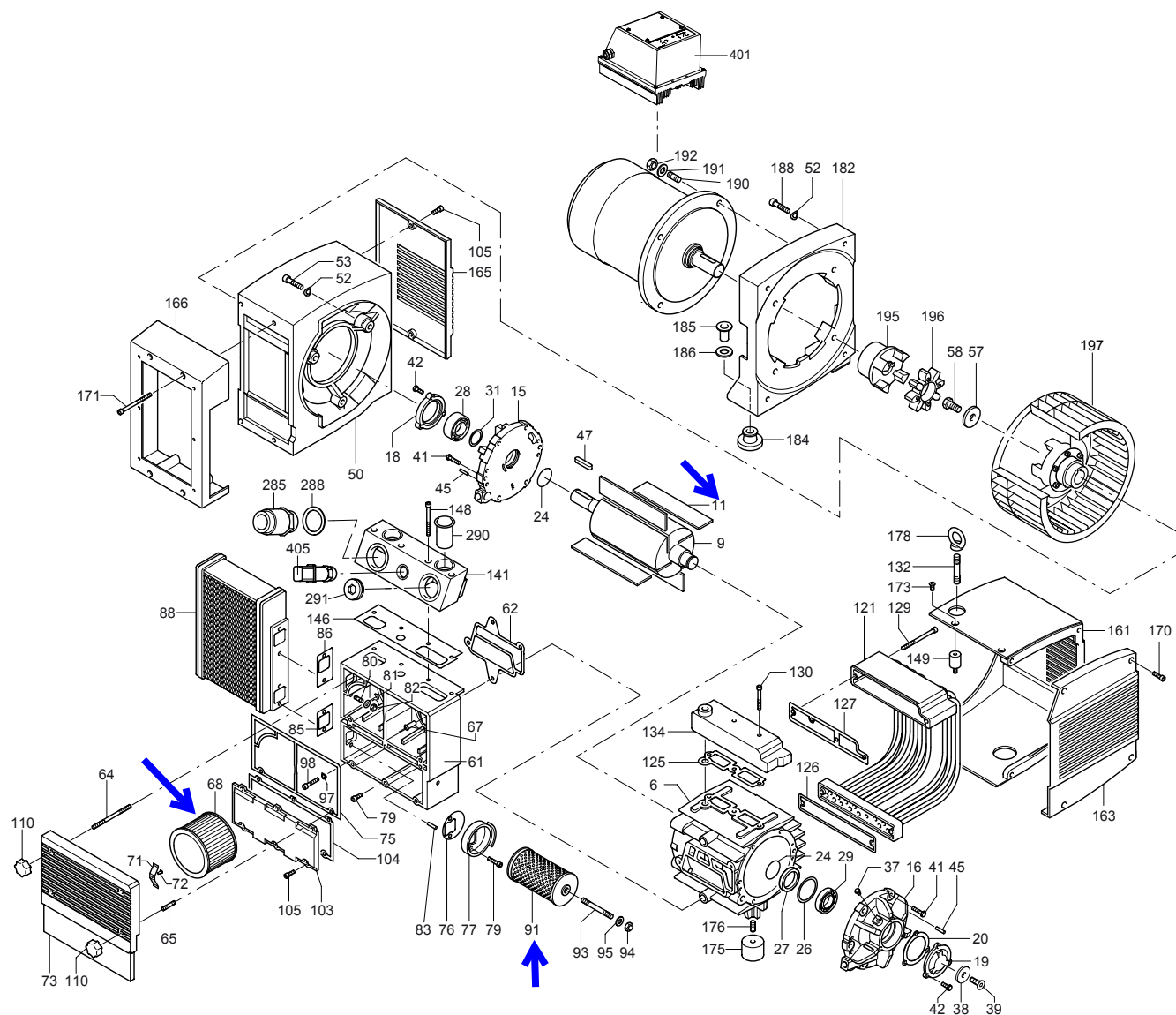
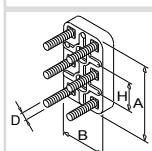
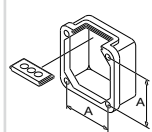
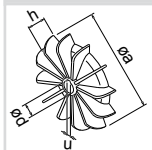
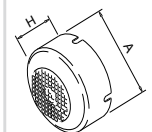
KDT 3.60	USA	all types
KDT 3.80	/0-05	Special design – corrosion protection
	/0-34	Special design – > air flow rat
	/0-52	Special design – corrosion protection and special vanes
	/0-54	Special design – refrigeration
	/0-400	Special design – with frequency convertor
	/6	Special design – corrosion protection
	/B5-200	Special design – motor flang

Items different from standard appliance see appendix (back of drawing)










SERVICE ? 



 standard

 **KDT 3.60**
KDT 3.80

optional
en option
opcionale
opcional 

optional en option optionale opcional	Variante(n) Modification Variantes	Pos ³⁾	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido		Beschreibung / Description / Designation / Designazione / Descripcion
					
KDT 3.60/XX KDT 3.80/XX	KDT 3.60 (USA) KDT 3.80 (USA)	190 191 192 195 195		951018-00000 947506-00000 947106-00000 902100-21100 902100-21300	STIFTSCHRAUBE / STUD / PRISONNIER / L'ASTA A VITE / ESPÁRRAGO UNTERLEGSCHIEBE / WASHER / RONDELLE / RONDELLA / ARANDELA SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL KDT 3.60 - MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO KDT 3.80 - MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
	KDT 3.60/0-05 KDT 3.80/0-05	9	020005 21100	020004-21100	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
	KDT 3.80/0-34	6 61	000103 21100 040102 21100	000100-21100 040101-21100	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA FILTERGEHÄUSE / FILTER HOUSING / BOITE POUR FILTRE / CARCASSA DEL FILTRO / CARCASA DE FILTRO
	KDT 3.60/0-52 KDT 3.80/0-52	9 11 285 403	020005 21100 901379 00004 734000 02000	020004-21100 901330-00004 72800X-99622	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO SATZ (KIT) SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR DRUCKREGULIERVENTIL / PRESSURE REGULATING VALVE / SOUPAPE REGLAGE PRESSION / VALVOLA REGOLAZIONE PRESSIONE / VÁLVULA REGULADORA DE PRESIÓN DRUCKREGULIERVENTIL 2,2 BAR / PRESSURE REGULATING VALVE 32 PSI / SOUPAPE REGLAGE PRESSION 2,2 BAR / VALVOLA REGOLAZIONE PRESSIONE 2,2 BAR / VÁLVULA REGULADORA DE PRESIÓN 2,2 BAR
	KDT 3.60/0-54 KDT 3.80/0-54	88 166 210 230	560700 21100 019901 21100	560203-21100 960701-21100	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR LÜFTERHAUBE / VENTILATOR HOOD / CARTER DE VENTILATEUR / CAPPOTTA DEL VENTILATORE / CAPERUZA DE VENTILADOR LÜFTERHAUBE / VENTILATOR HOOD / CARTER DE VENTILATEUR / CAPPOTTA DEL VENTILATORE / CAPERUZA DE VENTILADOR UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
	KDT 3.80/0-400	61 141 400 405	040103 21100 016608 21100 769302 41115 769302 42100	040101-21100 016606-21100	FILTERGEHÄUSE / FILTER HOUSING / BOITE POUR FILTRE / CONTENITORE FILTRO / CARCASA DE FILTRO ANSCHLUSS-STÜCK / CONNECTING PIECE / PIECE RACCORD / PEZZI RACCORDI / PIEZA DE EMPALME FREQUENZUMFORMER / FREQUENCY CONVERTOR / CONVERTISSEUR DE FRÉQUENCE / CONVERTITORE DI FREQUENZA / CONVERTIDOR DE FRECUENCIA MESSUMFORMER / MEASUREMENT CONVERTER / CONVERTISSEUR DE MESURE / CONVERTITORE DI MISURA / CONVERTIDOR DE MEDIDA
	KDT 3.60/6 KDT 3.80/6	6 6 9 11 15 16 68	000110 21600 000110 21100 020011 21100 901379 00004 000811 21100 000711 21100 909587 00000	000100-21600 000100-21100 020004-21100 901330-00004 000801-21100 000701-21100 909507-00000	KDT 3.60 - GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA KDT 3.80 - GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO SATZ (KIT) SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
	 KDT 3.60/6-29	9 11 230	020012 21100 901379 00007 019901 21100	020011-21100 901379-00004 019901-21100	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO SATZ (KIT) SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
	KDT 3.60/B5/200	182 195	014900 21600 902100 21600	014900-21100 902100-00000	ZWISCHENFLANSCH / INTERMEDIATE FLANGE / BRIDE INTERMEDIAIRE / FLANGE INTERMEDIA / BRIDA INTERMEDIA MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO

³⁾ variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes



BROKEN VANE REPLACEMENT



Becker Vacuum Pumps are leaders in their field in dependability and design. The nature of an oil-free, carbon vane, rotary sliding vane vacuum pump is that the vanes do wear out eventually.

The Becker KVT 3000 series vacuum pump requires a minimum amount of preventative maintenance to ensure optimum vane life and volumetric performance. Please do not over maintain this pump. Maintenance after the initial 500 hour break-in period should be limited to once every 6 months. Grease the pump with the amblygon grease provided and inspect the vane width.

Filter cleaning is truly a function of the ambient dirt load conditions. In most plastic manufacturing facilities, they may never need to be changed. Conversely, in a CNC router operation, daily cleaning is necessary.

27 mm is the minimum recommended vane width. To remove the risk of broken vanes you may wish to replace them at 29 mm. In the event the vanes have chipped severely or broken, it is important to remove all of the broken pieces to ensure they do not re-enter the pump and break or chip the new set just installed.

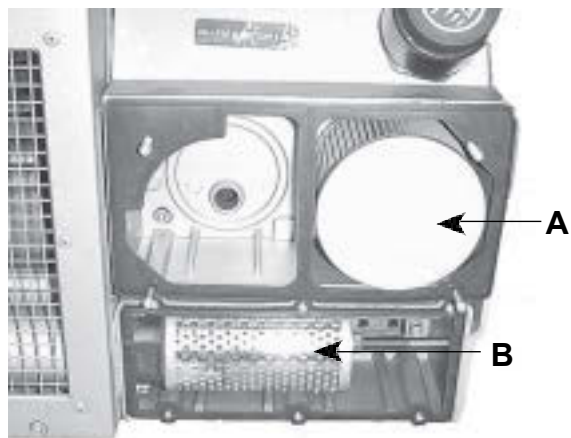


Broken Vane Replacement Procedure

NOTE: Broken vanes will be easily visible during the inspection of both the inlet filter and carbon dust separator housing. The inlet filter will have a heavy coating of dust and the carbon dust separator will be clogged and there will be broken pieces inside the housing around the filter.

To ensure that the new set of vanes will not break, immediately following installation, it is necessary to use the procedure detailed below:

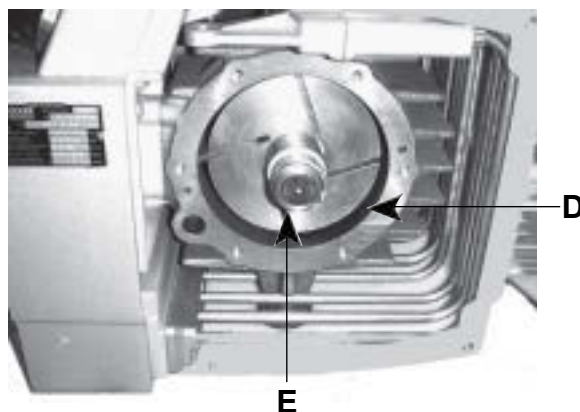
BECKER KVT 3.60



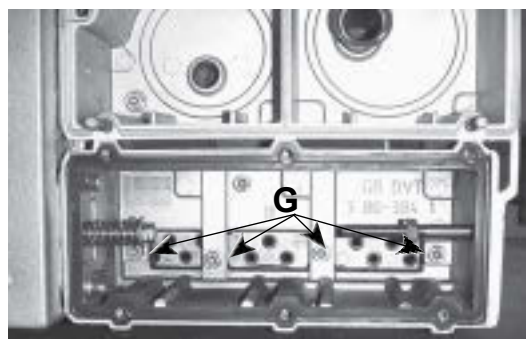
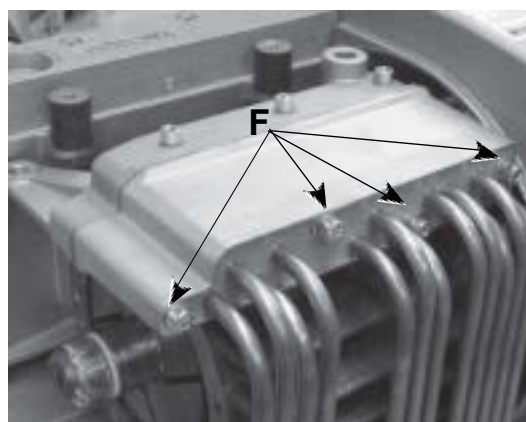
1. Remove the inlet filter (A) and carbon dust separator (B) from the pump and discard. Do not reuse these filters.



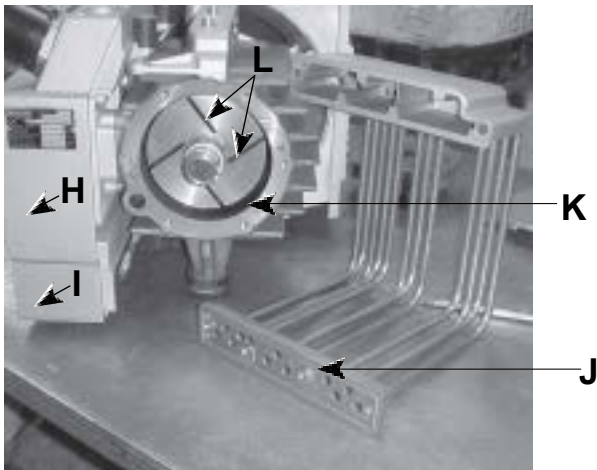
2. Remove the endshield (C) to gain access to the pump housing.



3. Remove the broken vanes from the housing (D) and rotor vane slots (E).



4. Unbolt the cooling tubes from both the top of the pump (F) and the carbon dust separator housing (G).



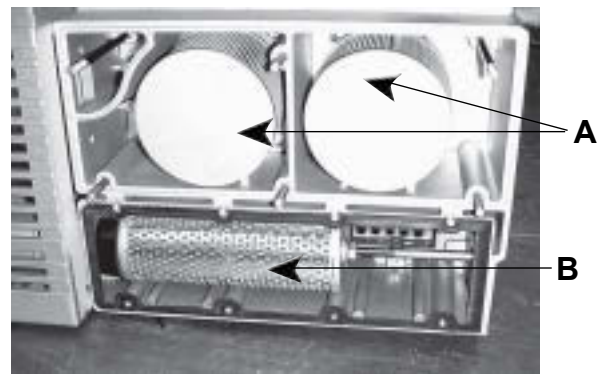
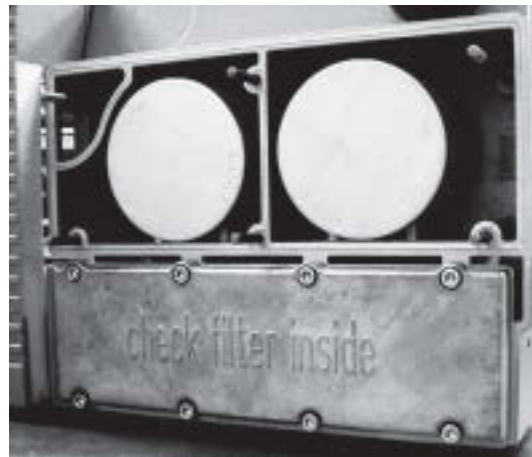
5. Using compressed air, blow out the inlet (H) and carbon dust separator (I) housings. Blow out the cooling tubes (J). Blow out the pump housing (K) and rotor vane slots (L) be sure to spin the rotor and blow out pieces from top dead center. Use a flashlight to check for pieces.

Care should be taken during this step to remove all broken pieces. This will prevent any particles from working their way back into the pump and breaking a new set of vanes.

6. After the pump is free of broken vanes, bolt cooling tubes back onto pump housing and dust separator box.
7. Install new vanes. Check to be sure high point in the tapered edge points in the direction of rotation. Ensure vanes fit freely into vane slots. Reinstall end shield ensuring no dust or debris is in the bearing chamber. Grease bearing if required. Install **new** filters. Start pump and check rotation.

The parts required to undertake the replacement of the vanes in the KVT 3.60 Becker pump are listed on page 6.

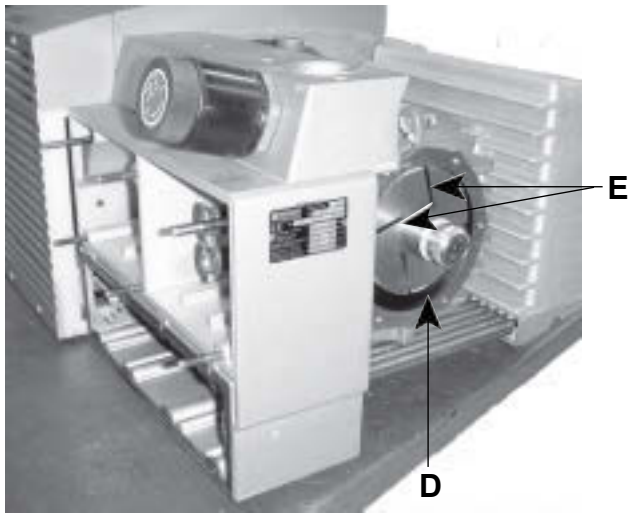
BECKER KVT 3.100



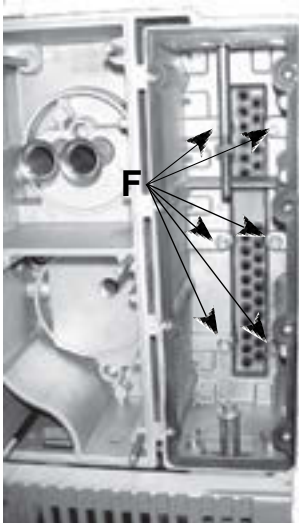
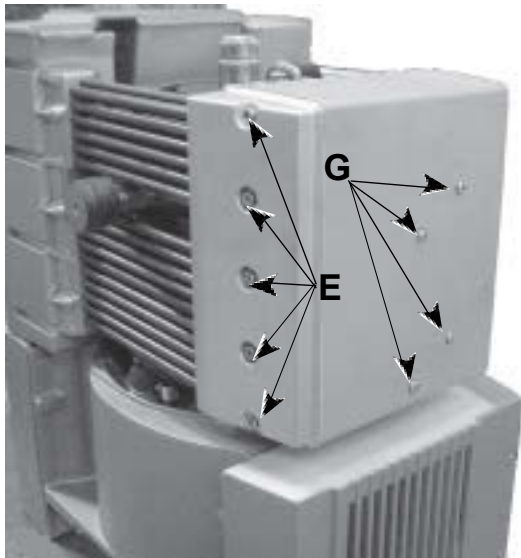
1. Remove the inlet filter (A) and carbon dust separator (B) from the pump and discard. Do not reuse these filters.



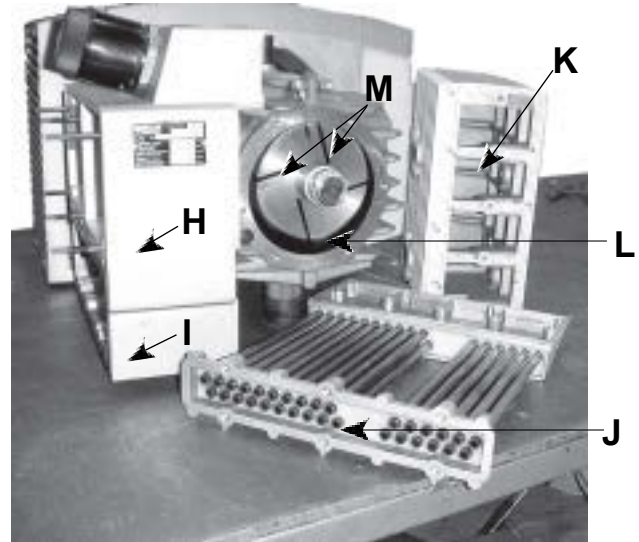
2. Remove the endshield (C) to gain access to the pump housing.



3. Remove the broken vanes from the housing (D) and rotor vane slots (E).



4. Unbolt the cooling tubes from both the discharge box (E) and the carbon dust separator housing (F). Unbolt the discharge box from the pump cylinder (G).



5. Using compressed air, blow out the inlet (H) and carbon dust separator (I) housings. Blow out the cooling tubes (J). Blow out the discharge box (K). Blow out the pump housing (L) and rotor vane slots (M). Be sure to spin the rotor and blow out debris from top dead center. Use a flashlight to check for pieces.

Care should be taken during this step to remove all broken pieces. This will prevent any particles from working their way back into the pump and breaking a new set of vanes.

6. After the pump is free of broken vanes, bolt discharge box back to cylinder. Bolt cooling tubes back to discharge box and separator housing.
7. Install new vanes. Check to be sure high point in the tapered edge points in the direction of rotation. Ensure vanes fit freely into vane slots. Reinstall end shield ensuring no dust or debris is in the bearing chamber. Grease bearing if required. Install **new** filters. Start pump and check rotation.

The parts required to undertake the replacement of the vanes in the KVT 3.100 Becker pump are listed on page 6.

Vane Replacement Parts List

Becker KVT 3.60

Vanes (4 Pc) 901330

Mann & Hummel Filters	2 only	C 1112
	1 only	C 713

Becker KVT 3.100

Vanes (4 Pc) 901333

Mann & Hummel Filters	2 only	C 1112
	1 only	C 718

Compact Filter Silencers

FS Series 1/2" - 6" MPT, Flange

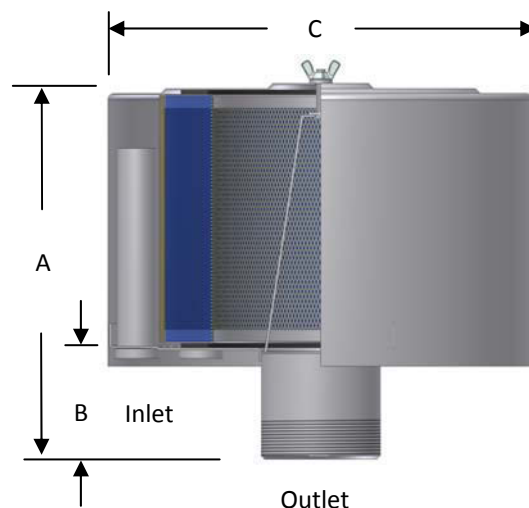


Features

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

Technical Specifications

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



Options

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

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



SOLBERG®

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

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 1/2"	75	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 $\pm 1/4"$

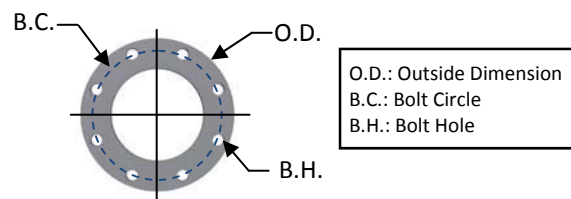
Flange Outlet Connections

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.



SOLBERG



Filter Silencers and Inlet Filters Maintenance Manual

www.solbergmfg.com

Note: Please read the maintenance instructions given by the OEM for the machinery first. The OEM's manual should be adhered to in order to protect the equipment. Solberg Manufacturing, Inc has made every effort to make sure that these instructions are accurate but is not responsible for any typos, slight variations or for human errors that may occur.

Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA
Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Rev: MMIFS-1146

Maintenance Manual

Solberg Air Inlet Filters and Filter Silencers

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****For Further Information Please Call: 630-773-1363***



Section A

INTRODUCTION

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet air filters.

WARNING

This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the inlet air filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will meet your application requirements.

Section B

GENERAL INFORMATION

1. Identification of Solberg Inlet Air Filters.

All Solberg inlet air filters should have an identification label/nameplate that gives the following information:

Assembly Model #
Replacement Element #

(The exception is OEM supplied units. In this case, please enter the OEM part numbers below.)

Fill in the actual nameplate data from your new Solberg inlet filter(s):

Page 3

*Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA
Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Rev: MMIFS-1146*

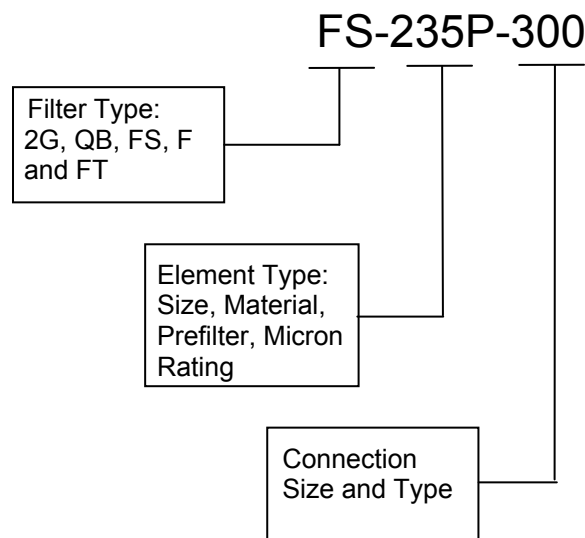


SOLBERG

No.	Filter Model Number	Replacement Element	Initial Delta P Readings
1			
2			
3			
4			
5			

Table 1

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'FS' design filter with a 235 element with prefilter and 3" MPT connection size:



2. Filtration Rules of Thumb

General: For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary



goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

Rule of Thumb #1: Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

Rule of Thumb #2: Always ask or specify a filter based on a micron rating **with filtration efficiencies**. As an example, stating a requirement for a 1-micron filter is misleading because no efficiency rating has been specified. A 1-micron filter at 95% efficiency may be less efficient than a 5-micron filter at 99% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99% filtration efficiency at 5 microns is required.

Rule of Thumb #3: Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.

Filtration Efficiency Requirements (99%+ efficiency)	Environmental Conditions	Air to Media Ratio	
<i>Industrial Grade 2-micron Paper</i>	Industrial Duty (clean, office/warehouse-like)	30 CFM/ft ²	(51m ³ /h)/cm ²
	Severe Duty (workshop, factory-like)	15 CFM/ft ²	(25.5m ³ /h)/cm ²
	Extreme Duty (Foundry, Construction-like)	10 CFM/ft ²	(17m ³ /h)/cm ²
<i>Industrial Grade 5-micron Polyester</i>	Industrial Duty (clean, office/warehouse-like)	50 CFM/ft ²	(85m ³ /h)/cm ²
	Severe Duty (workshop, factory-like)	40 CFM/ft ²	(68m ³ /h)/cm ²
	Extreme Duty (Foundry, Construction-like)	25 CFM/ft ²	(42.5m ³ /h)/cm ²
<i>Industrial Grade 1-micron Polyester</i>	Severe Duty (Foundry, Construction-like)	10 CFM/ft ²	(17m ³ /h)/cm ²
<i>Industrial Grade 0.3-micron HEPA Glass @ 99.97% Efficiency</i>	Industrial Duty (Pre-filtered Applications)	10 CFM/ft ²	(17m ³ /h)/cm ²
	Severe Duty (workshop, factory-like)	7 CFM/ft ²	(12m ³ /h)/cm ²
	Extreme Duty (Foundry, Construction-like)	5 CFM/ft ²	(8.5m ³ /h)/cm ²

Table 2

Rule of Thumb #4: Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is



important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" / 250-280mm H₂O over the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200m³/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Airflow	
1/4"	6 CFM	10m ³ /h	1 1/4"	60 CFM	102m ³ /h	6"	1,100 CFM	1870m ³ /h
3/8"	8 CFM	14m ³ /h	1 1/2"	80 CFM	136m ³ /h	8"	1,800 CFM	3060m ³ /h
1/2"	10 CFM	17m ³ /h	2"	135 CFM	230m ³ /h	10"	3,300 CFM	5610m ³ /h
3/4"	20 CFM	34m ³ /h	2 1/2"	195 CFM	332m ³ /h	12"	4,700 CFM	7990m ³ /h
1"	35 CFM	60m ³ /h	3"	300 CFM	510m ³ /h	14"	6,000 CFM	10200m ³ /h
			4"	520 CFM	884m ³ /h			
			5"	800 CFM	1360m ³ /h			

Table 3 **Note: This information is for general use only. A qualified engineer must properly design each system.*

3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C

Filter Change-Out Differential: 10" to 15" / 250-380mm H₂O Over Initial Delta P

Media	Micron Rating
Standard Paper	99+% @ 2 micron
Standard Polyester	99+% @ 5 micron
"S" Series Wire Mesh	Epoxy Coated Wire Mesh
"Z" Series Polyester	99+% @ 1 micron
"HE" Series HEPA	99.97% @ 0.3 microns
"U" Series Polyester	99+% @ 25 micron
"W" Series Polyester	99+% @ 100 micron
"S2" Series	Stainless Steel Wire Mesh
"AC" & "ACP" Series	N/A
"Y" Series Polypropylene	99+% @ 5 micron

Table 4

Temperature Range: -15° to 385°F / -26° to 196°C

Filter Change-Out Differential: 10" to 15" / 250-380mm H₂O Over Initial Delta P



Media	Micron Rating
"MX" & "MXD" Series – Nomex Cloth	99+% @ 5 micron

Table 5

4. Element Cleaning - Inlet Filtration

Solberg elements should be cleaned or replaced, once the pressure drop reaches 15 to 20-inches water column (380 - 500mm WC) above the initial pressure drop of the installation.

The decision to clean the element rather than replace it is left to the discretion of the operator. Any damage which results from by-pass or additional pressure drop created by element cleaning is the sole responsibility of the operator.

WARNING

The overall performance of a filter element is altered once cleaned.

The initial pressure drop after cleaning will be greater than the original, clean pressure drop of the element.

After each subsequent cleaning, the initial pressure drop will continue to increase.

Under all circumstances, the initial pressure drop of the element needs to be maintained at less than 20-inches water column (500mm WC).

Cleaned elements that exceed 20-inches water column (500mm WC) at start-up should be replaced with new elements.

With many types of equipment, the maximum pressure drop allowed will be dictated by the ability of the equipment to perform to its rated capacity. Under all circumstances, the operator should avoid exceeding the manufacturer's recommended maximum pressure drop for their specific equipment.

- A. **Polyester Element:** The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element



should be dry before reinstallation. The element should be replaced after a maximum of three cleanings.

- B. **Paper Element:** The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.
- C. **Polyurethane Prefilter:** The prefilter may be washed as a sponge or replaced to give the element a longer service life.
- D. **Epoxy Coated Wire Mesh and Stainless Steel Wire Mesh Elements:** Cleaning instructions similar to polyester, except mild solvents may be used.
- E. **Activated Carbon Element:** Not cleanable
- F. **Polypropylene Element:** Cleaning instructions similar to polyester
- G. **Nomex Cloth Element:** Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wing nuts and washers can be supplied upon request.

Section C

PROCEDURES

1. Installation.

- A. Maximum operating temperature for most Solberg inlet air filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers. High temperature products are available.
- B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on the inlet and outlet ports.
- C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

2. Disconnecting canister top from canister base.

- A. FS-04-06-10 (or 05-07-11): Twist top housing to open. Use care to support bottom housing while removing top housing. Fitting damage can occur if fitting is torqued in the wrong direction.
- B. Small QB/FS/F/FT: Remove weather hood or top plate by loosening hex nut or wing nut and lifting off.



- C. Large 2Q/QB/FS/F/FT: Remove cover by loosening hex nut or wing nut and lifting off.

3. Removing element for service/maintenance.

- A. Carefully remove retaining hex head/wing-nut and washer over top plate, and then remove element. Note: Model "04-06-10" elements should be free when housing tops are removed.
- B. Clean sealing surfaces of housing, top plates and element endcaps so that they are free of dirt or any other particulate.

WARNING

Failure to comply with these instructions may result in system or equipment contamination.

4. Securing Element.

- A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces. With multiple element stacks place elements in line with base element and ensure elements seat properly.
- B. Place top plate (if necessary) on element by centering on tap bolt.
- C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: Do NOT over tighten!

WARNING

Defective installation may cause system or pump contamination. Use only genuine Solberg replacement parts.



5. Securing canister top to canister base.

- A. Make sure all surfaces are free from dust and other particulate.
- B. Small QB/FS/F/FT: Replace top plate and/or weather hood if necessary. Feed threaded rod into corresponding bolthole and tighten. Note: Do NOT over tighten!
- C. Large 2G/QB/FS/F/FT: Replace cover. Feed threaded rod into corresponding bolt hole(s) and tighten. Note: Do NOT over tighten!
- D. FS-04-06-10 (or 05-07-11): Reassemble top housing to bottom housing by aligning tabs and turning into place.

6. Equipment Startup.

- A. Be sure to read the instructions on installation or element replacement as listed above before starting equipment.

WARNING

If at any time the operator is unable to verify the integrity of the element or any housing feature, the factory or a regional representative should be contacted prior to start-up.

- B. Please check the listed steps prior to startup.

- 1. Check element to make sure it is seated properly on element base or sealing surface.

WARNING

Failure to seat the element properly may result in contaminant by-pass resulting in damage to equipment.

- 2. Check element top plate or cover to make sure it is seated properly on element.
- 3. Check housing cover (if applicable) that it is installed correctly onto housing.



4. Be sure all fasteners and hardware (if applicable) have been tightened.

WARNING

If the air flow is reversed through a Solberg filter unit, be sure to check the element and housing internals for damage. Failure to do so may result in damage to equipment.

Section D

MAINTENANCE RECOMMENDATIONS

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10" to 15" / 250-380mm H²O above drop above the initial reading. Refer to page 4 for initial values.
2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change!
3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.
4. Operate only when a proper seal exists.

SPARE PARTS LIST:

Contact your Solberg Representative for spare part model numbers.



BRASS GATE VALVES

CAST BRASS ECONOMY VERSION
I.P.S. AND CXC



MODEL
T-408



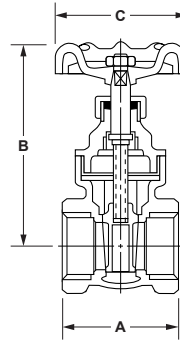
MODEL
S-408

MATERIAL SPECIFICATION	
PART	MATERIAL
BODY	BRASS
BONNET	BRASS
STEM	BRASS
PACKING NUT	BRASS
DISC	BRASS
HAND WHEEL	CAST IRON
WHEEL NUT	BRASS
LOCK NUT	BRASS
GLAND	BRASS
PACKING	ASBESTOS FREE GRAPHITE

PRESSURE RATING
200 W.O.G.
NON-SHOCK to 200°F

LEGEND MODELS T-408/S-408 gate valves are constructed of heavy duty cast brass. Body and bonnet are connected with a tight metal to metal leakproof seat. They have a screwed bonnet, non-rising stem, solid wedge disc, and integral seats. Recommended for non-steam use in residential applications. The T-408/S-408 is Legend's newest entry into the competitive gate valve market.

DIMENSIONS IN INCHES				
VALVE SIZE	A (I.P.S.)	A (CXC)	B	C
1/2"	1.71	1.69	2.92	2.01
3/4"	1.81	2.33	3.31	2.21
1"	2.13	2.72	3.90	2.56
1 1/4"	2.24	2.94	4.61	2.76
1 1/2"	2.44	3.29	5.08	3.11
2"	2.68	3.98	5.99	3.70
2 1/2"	3.70		6.90	4.02
3"	4.02		8.47	5.00
4"	4.53		9.89	5.00



COMPRESSION END GATE VALVE

CAST BRASS



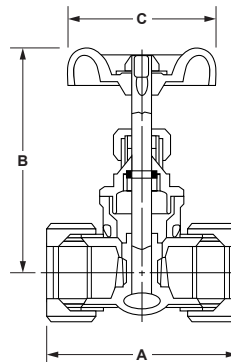
MODEL
T-402

MATERIAL SPECIFICATION	
PART	MATERIAL
BODY	BRASS
BONNET	BRASS
STEM	BRASS
PACKING NUT	BRASS
DISC	BRASS
HAND WHEEL	CAST IRON
GLAND	BRASS
PACKING	ASBESTOS FREE GRAPHITE
COMPRESSION RING	BRASS TUBE
NUT	BRASS

PRESSURE RATING
200 W.O.G.
NON-SHOCK to 200°F

LEGEND MODEL T-402 gate valves are the same construction as the T-401/S-401 but with labor saving compression ends. They have a screwed bonnet, non-rising stem, solid wedge disc, and integral seats. Recommended for non-steam use in residential and light commercial applications. May be repacked while in service under pressure. Excellent for use as a repair valve.

DIMENSIONS IN INCHES			
VALVE SIZE	A	B	C
1/2"	2.52	3.39	2.13
3/4"	2.76	4.00	2.13
1"	3.15	4.45	2.40



BRONZE GLOBE VALVE

I.P.S.



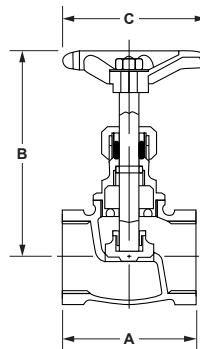
**MODEL
T-421**

MATERIAL SPECIFICATION	
PART	MATERIAL
BODY	BRONZE
BONNET	BRONZE
STEM	FORGED BRASS
PACKING NUT	BRASS
DISC	BRASS
HAND WHEEL	ALUMINUM
WHEEL NUT	BRASS
GLAND	BRASS
GLAND PACKING	GRAPHITE/TEFLON*

*DUPONT REG T.M.

PRESSURE RATING
200 W.O.G. NON-SHOCK
125 W.S.P.

LEGEND MODEL T-421 bronze globe valves have a screwed bonnet, rising stem, integral seat and swivel disc for accurate throttling and flow control. The body and bonnet are constructed of heavy duty bronze. Recommended for heavy industrial use when the valve is to be operated frequently



DIMENSIONS IN INCHES

VALVE SIZE	A (I.P.S.)	B	C
1/2"	1.96	2.81	1.97
3/4"	2.18	3.27	2.21
1"	2.56	3.90	2.36
1 1/4"	2.92	4.30	3.23
1 1/2"	3.29	4.94	3.34
2"	3.90	5.95	3.94

BRASS SWING CHECK VALVE

I.P.S. AND CxX



**MODEL
T-451**

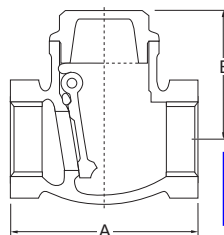


**MODEL
S-451**

MATERIAL SPECIFICATION	
PART	MATERIAL
CAP	BRASS
BODY	BRASS
DISC	BRASS
HINGE PIN	BRASS
SCREW	BRASS

PRESSURE RATING
200 W.O.G. NON-SHOCK

LEGEND MODELS T-451/S-451 check valves are constructed of heavy duty brass. They have a screwed cap, swing type disc and integral seat. They prevent backflow while offering full flow performance with a minimum of turbulence or pressure loss. Recommended for residential and commercial applications.



DIMENSIONS IN INCHES

VALVE SIZE	A (I.P.S.)	A (CXX)	B
3/8"	2.01		1.40
1/2"	2.01	2.44	1.34
3/4"	2.29	3.03	1.42
1"	2.48	3.74	1.54
1 1/4"	3.15	4.37	1.89
1 1/2"	3.47	5.12	2.17
2"	3.98	5.95	2.56
2 1/2"	5.16	6.90	2.96
3"	5.79	7.60	3.82
4"	6.86		3.94



SECTION 4 - PROCESS INSTRUMENTATION

PRESSURE INDICATOR, 0-60 PSI - DWYER SGY-D10422N-GF

PRESSURE SWITCH, 0-10 PSI - DWYER CS-10

PRESSURE SWITCH, 0-30 PSI - DWYER CS-30

TEMPERATURE SWITCH, 0-225 F - UNITED ELECTRIC B54-103

TEMPERATURE GAUGE, 0-250 F - AV 1NFY4



Series
SGY

2.5" Stainless Steel Industrial Pressure Gage

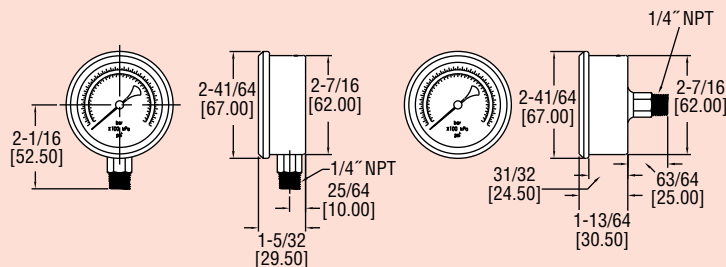
1.5% FS Accuracy, Brass Wetted Parts, Dual PSI/Bar x100 kPa Scales



SGY Bottom



SGY Back with
Accessory Pointers



The **Series SGY Gages** have dual psi and bar (x100 kPa) scales with $\pm 1.5\%$ full-scale accuracy. The Series SGY gages are designed with 304 SS housings and brass wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges from full vacuum to 1,000 psi and are available in both bottom or back connections. Series SGY gages employ an easy-open breather plug on top, which allows liquid filled units to breathe, relieving any built up internal pressures. Plug easily pops open and does not need to be entirely removed or cut like a typical gages' rubber plug grommet.

APPLICATIONS

- Vacuums in pneumatic conveying lines
- Positive pressure in compressed air headers

Model	Range	Model	Range
SGY-D10122N	30" Hg to 0	SGY-D10722N	0 to 200 psi
SGY-D10322N	0 to 30 psi	SGY-D11022N	0 to 300 psi
SGY-D10422N	0 to 60 psi	SGY-D11122N	0 to 500 psi
SGY-D10522N	0 to 100 psi	SGY-D11222N	0 to 1000 psi
SGY-D10622N	0 to 160 psi		

Note: To order with glycerin fill add - GF to the end of the model

For back connect, change ending from 22N to 42N

SPECIFICATIONS

Service: Compatible gases and liquids.

Wetted Materials: Brass connection, bronze tube.

Housing: 304 SS.

Lens: Polycarbonate.

Accuracy: $\pm 1.5\%$ FS.

Pressure Limit: FS range.

Temperature Limits: -4 to 140°F (-20 to 60°C).

Size: 2.5" (63 mm).

Process Connections: 1/4" male NPT.

Weight: 4.9 oz (139 g) bottom, 5.8 oz (164 g) back. Add 2.8 oz (78 g) for fill.

ACCESSORIES

A-445D, U-Bracket Mounting Kit for 2.5" Gage

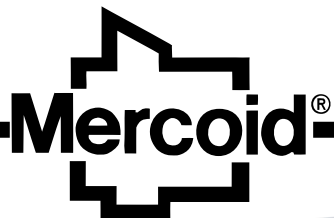
A-499R, Red Sliding Color Pointer

A-499Y, Yellow Sliding Color Pointer

A-499G, Green Sliding Color Pointer

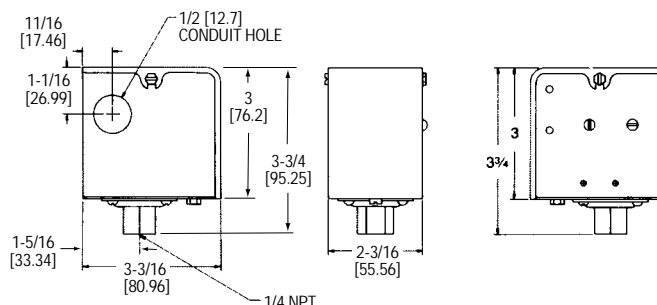
OPTION

For NIST traceable calibration certificate, use order code NISTCAL-PG1.



Series CS Low Cost Diaphragm Pressure Switches

Specifications – Installation and Operating Instructions



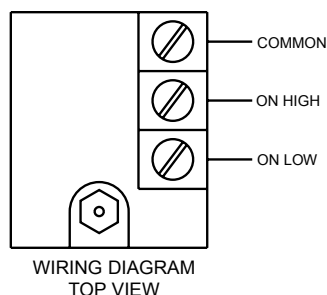
The **Series CS Low Cost Diaphragm Pressure Switch** is ideal for instrument panels, small compressors and general industrial applications. Visible set point and easy-to-wire SPDT snap switch reduce installation time. This switch operates in any position and is vibration resistant.

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

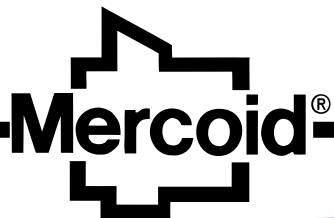
Diaphragm: Buna-N/Nylon

Calibration Spring: Plated steel

Installation: Any position

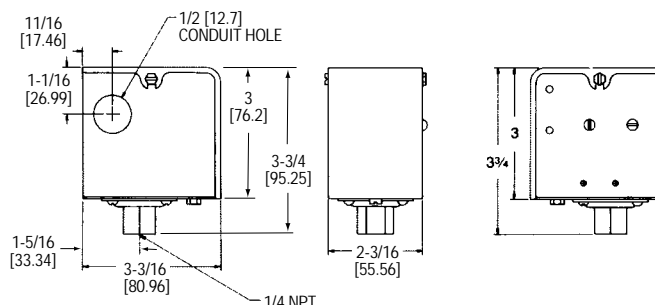
Weight: 1/2 lb. (0.23 kg)

Model No.	Adjustable Operating Range	Fixed Deadband		Max. Pressure
		Maximum	Minimum	
CS-1	1-30" Hg. Vac.	1.5" Hg.	1" Hg. VAC	30 psig
	2.5-75 cm Hg. Vac	3.8 cm Hg. Vac	2.5 cm Hg. Vac	
CS-3	10-100" w.c.	7" w.c.	5" w.c.	30 psig
	2.5-250 cm w.c.	17.8 cm w.c.	12.7 cm w.c.	
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



Series CS Low Cost Diaphragm Pressure Switches

Specifications – Installation and Operating Instructions



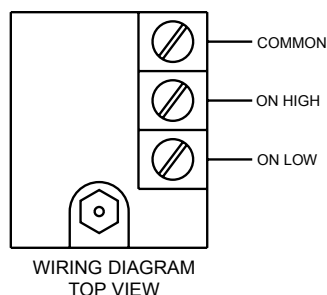
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INSTALLATION/MOUNTING

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

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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

PRESSURE, VACUUM AND TEMPERATURE



FEATURES

- Compact Size
- Wide Selection of Adjustable Ranges:
Pressure: 30" Hg Vac to 6000 psi (-1 to 413,7 bar)
Temperature: -130 to 650°F (-90 to 343.3°C)
- Choice of One or Two Switch Outputs
- Adjustable or Narrow Deadband Options
- Reference Dial or Hex Screw-Type Setting

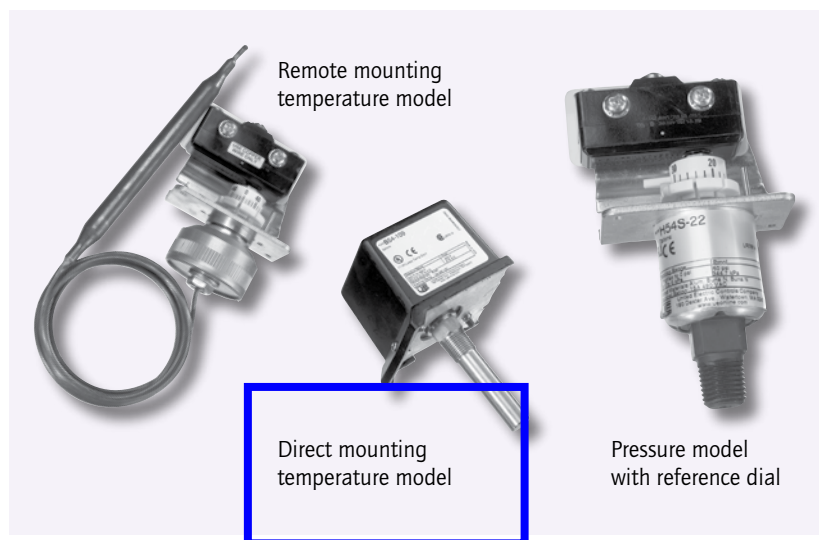
OVERVIEW

The 54 Series offers the OEM a combination of reliable performance and low cost. Available in pressure and temperature versions, with single or dual SPDT outputs and enclosed or open frame (skeleton) construction, the 54 Series family provides design versatility.

The 54 has been field-proven in a wide variety of OEM applications, including medical, laboratory, fire protection and heating equipment.

FEATURES

- Compact size
- Choice of one or two switch outputs
- Reference dial or hex screw-type setting
- Optional 1/2" NPT (male) by 1/8" NPT (female) polysulfone® pressure connection
- Optional external manual reset
- NEMA 1 or open frame (skeleton) versions for OEM applications
- Brass bellows models



Polysulfone® is a registered trademark of Amoco

SPECIFICATIONS

STORAGE TEMPERATURE	-65 to 160°F (-54 to 71°C)
AMBIENT TEMPERATURE LIMITS	
Pressure Models	Models 126-164, 610-614: -40 to 160°F (-40 to 71°C); Models 22-28: 0 to 160°F (-18 to 71°C)
Temperature Models	-40 to 160°F (-40 to 71°C). Set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change.
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 CPS
ENCLOSURE CLASSIFICATION	Types C54, C54A, B54, F54, E54, J54, J54A, H54: complies with NEMA 1 requirements. Types C54S, B54S, F54S, E54S, J54S, J54AS, H54S: not applicable
SET POINT REPEATABILITY	
Pressure Models	Models 22-28, 126-164: ± 1% of adjustable range; Models 610-614: ± 1.5% of adjustable range
Temperature Models	± 1% of adjustable range
SWITCH OUTPUT	One or two SPDT snap action switch(es); dual switch may be separated up to 100% of range; switches may be wired "normally open" or "normally closed"
ELECTRICAL RATING	15A 125/250/480 VAC resistive. Electrical switches have limited DC capabilities. Consult UE for additional information.
ENCLOSURE MATERIAL	Lexan® black finish for Types J54, J54A, H54, B54, C54, C54A, E54, F54 only
WEIGHT	Approximately 12 oz.
ELECTRICAL CONNECTION	Types J54 & H54, C54, C54A, B54, E54, F54: 7/8" diameter hole; Type J54A: 1-1/16" diameter hole
PRESSURE CONNECTION	Models 22-28: 1/4" NPT (male); 126-164, 610-614: 1/4" NPT (female)
TEMPERATURE ASSEMBLY	Bulb and Capillary: 6 feet copper or 304 stainless steel capillary Immersion Stem: Brass
TEMPERATURE FILL	Non-toxic oil
TEMPERATURE DEADBAND	Typically 1% of range under laboratory conditions (70°F circulating bath at rate of 1/2°F per minute change)

APPROVALS

**UNITED STATES AND CANADA**

Type J54, J54A, H54
UL Listed, cUL Certified

Pressure: UL 508, CSA C22.2 No. 14, file # E42272

Type J54S, J54AS, H54S

UL Recognized, cUL Recognized

Pressure: UL 508, CSA C22.2 No. 14, file #E42272

Type B54, C54, E54, F54

UL listed, CSA Certified

Temperature: UL 873, file # E10667;

CSA C22.2 No. 0 & 24, file # LR7814

Type B54S, C54S, E54S, F54S

UL Recognized, CSA Certified

Temperature: UL 873, file # E10667;

CSA C22.2 No. 0 & 24, file # LR7814

EUROPE

Low Voltage Directive (LVD) (73/23/ED & 93/68/EEC)

UEC compliant to LVD

Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD

Pressure Equipment Directive (PED) (97/23/EC)

Compliant to PED

Products rated lower than 7.5 psi are outside the scope of the PED

Lexan® is a registered trademark of General Electric Company

TEMPERATURE MODEL CHART

Model	Adjustable Set Point Range		Max. Temperature		Scale*** Division		Stem Size
	°F	°C	°F	°C	°F	°C	NPT x BT (inches)
B54, B54S, C54, C54S, C54A, C54AS , Brass immersion stem							
103	0 to 225	-17.8 to 107.2	250	121.1	10	5	3/8 x 2-1/8
109	200 to 425	93.3 to 218.3	425	218.3	10	5	3/8 x 2-1/8
							OD x Length
E54, F54 , Copper bulb and capillary							
D20BC	-130 to 120	-90 to 48.9	170	76.7	10	5	3/8 x 4-1/2
D21BC	0 to 150	-17.8 to 65.6	200	93.3	5	5	3/8 x 6-7/8
D22BC	50 to 300	10 to 148.9	350	176.7	10	5	3/8 x 4-1/2
D23BC	150 to 650	65.6 to 343.3	700	371.1	25	10	3/8 x 3-5/8
E54, F54 , Stainless steel bulb and capillary							
D20BS†	-130 to 120	-90 to 48.9	170	76.7	10	5	3/8 x 4-1/2
D21BS	0 to 150	-17.8 to 65.6	200	93.3	5	5	3/8 x 6-7/8
D22BS	50 to 300	10 to 148.9	350	176.7	10	5	3/8 x 4-1/2
D23BS	150 to 650	65.6 to 343.3	700	371.1	25	10	3/8 x 3-5/8
E54S, F54S , Copper bulb and capillary							
D21BC	0 to 150	-17.8 to 65.6	200	93.3	5	5	3/8 x 6-7/8
D22BC	50 to 300	10 to 148.9	350	176.7	10	5	3/8 x 4-1/2
D23BC	150 to 650	65.6 to 343.3	700	371.1	25	10	3/8 x 3-5/8
E54S, F54S , Stainless steel bulb and capillary							
D21BS	0 to 150	-17.8 to 65.6	200	93.3	5	5	3/8 x 6-7/8
D22BS	50 to 300	10 to 148.9	350	176.7	10	5	3/8 x 4-1/2
D23BS	150 to 650	65.6 to 343.3	700	371.1	25	10	3/8 x 3-5/8

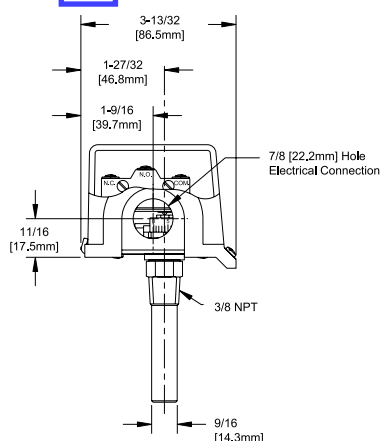
† Not available Type F54

*** Applies to Types B54, B54S, E54, E54S only

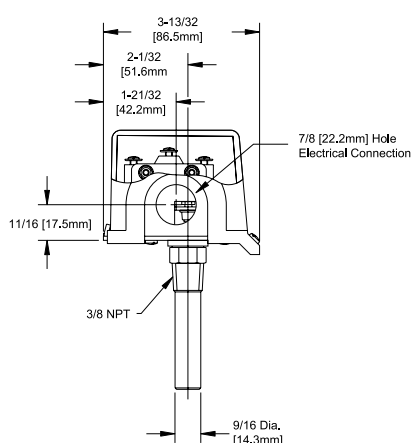
DIMENSIONAL DRAWINGS

Temperature Models

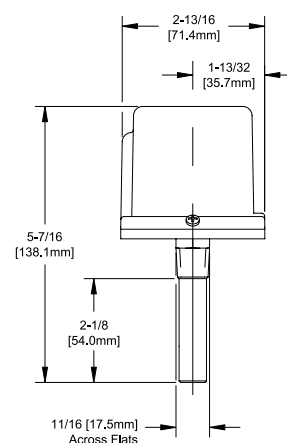
Types B54, C54



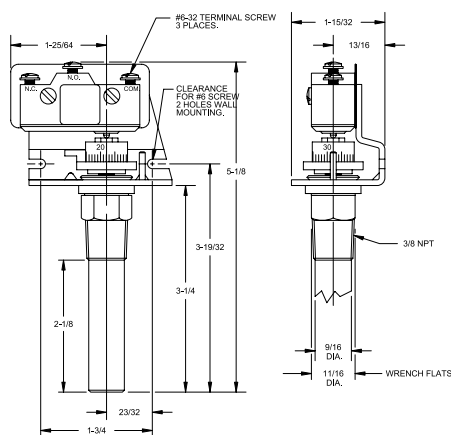
Type C54A



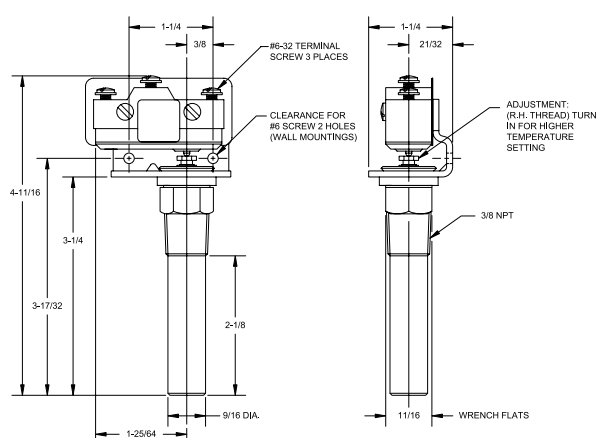
Types B54, C54, C54A



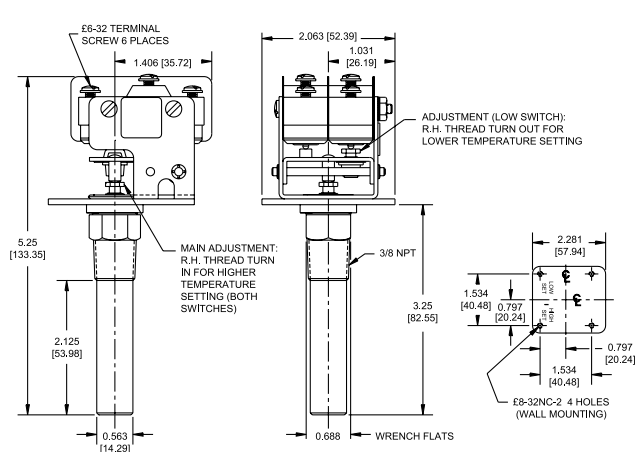
Type B54S



Type C54S



Type C54AS



All dimensions stated in inches (millimeters)

GRAINGER® FOR THE ONES WHO GET IT DONE GRAINGER INTERNATIONAL, INC. GLOBAL SOURCING DIVISION	-- GGS TECHNICAL SPECIFICATION --			
	SPECIFICATION NUMBER: 1NFY4_TSRev1.doc	AUTHOR: Hoskinson	TITLE: ENG	REL. DATE: 5/25/07
	GGS MODEL NUMBER(s): 1NFY4	DESCRIPTION: Industrial thermometer	REVISION #: 1	REV. DATE: 8/10/07

1.0 BRAND:	No brand
2.0 PRODUCT DESCRIPTION:	Bimetal Industrial Thermometer

3.0 PRODUCT PHOTO(S):



4.0 PRODUCT REQUIREMENTS:

4.1 Features & Performance	Requirement
Temperature scale(s)	°F: 0 to 250 °C: -20 to 120
Connection location/type	Back; 1/2 inch NPT
Dial size (inches)	3
Stem length (inches)	2 1/2
Stem diameter (inches)	1/4 In
Rotated degrees	N/A
Angled degrees	N/A
Full scale accuracy	≤40°F: ±1.5% 41 to 200°F: ±1% ≥201°F: ±1.5%
Calibration	External Adjustment

4.2 Materials & Construction	Requirement
Case	Stainless Steel Hermetically Sealed to Prevent Icing/Fogging Inside
Stem	Stainless Steel
Coil dampening	Silicone for Superior Time Response and Vibration Dampening
Dial face	Glass

4.3 Finish / Color	Requirement
All Surface Finishes	a) Surface finishes must be uniform and continuous. The surface finish must not exhibit any visual defects such as blisters, rust, corrosion, scratches, peeling, bubbles, and/or cracking. b) All exposed surfaces must be free of burrs and sharp edges. c) All applied finishes must adhere to the surface and show no signs of delamination or peeling.
Finish	Stainless Steel



SECTION 5 - ELECTRICAL DRAWINGS & TABLE(S)

T-2, INTERLOCK TABLE

I-1, CONTROL PANEL LAYOUT DRAWING

T-3, PANEL BILL OF MATERIALS (BOM)

I-2, WIRING DIAGRAMS & TERMINAL DETAILS

E-1, LINE DIAGRAM

E-2, VFD SETTINGS



TABLE 2

INTERLOCK SCHEDULE
NES 12-198, REVISION A (04-01-15)
Advanced Cleanup Technologies
Sparge Blower Control

Interlock	Interlock ID	Interlock Description							
			C-1, Sparge Blower	OPERATOR INTERFACE					
			Alarm Notification (Local Panel Display)						
			Manual Reset (Warning / Alarm)						
			Remote Alarm Contacts (for Notification)						
			INSTRUMENT TYPE						
0		No alarm present and SVE Running	I						
1	PSL-101	Sparge Low Pressure Switch				Y*		Y	D
2	PSH-101	Sparge High Pressure Switch	O			Y	Y	Y	D
3	TSH-101	Sparge High Temperature Switch	O			Y	Y	Y	D
4	VFD FAULT	VFD Fault (Overload is most common fault)	O			Y			
5	SVE RUN	SVE Running Contact	I/O						

Note:

- O - Off
- I - On
- I/O - On / Off Control
- Y - Yes
- D - Digital
- * - Time Delayed

1

2

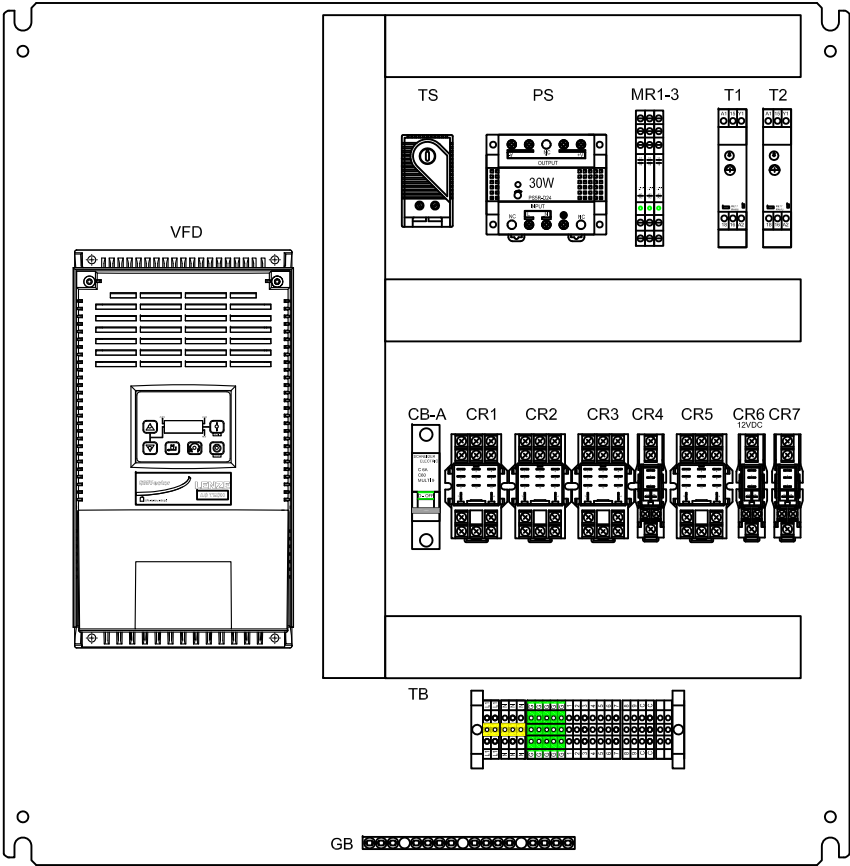
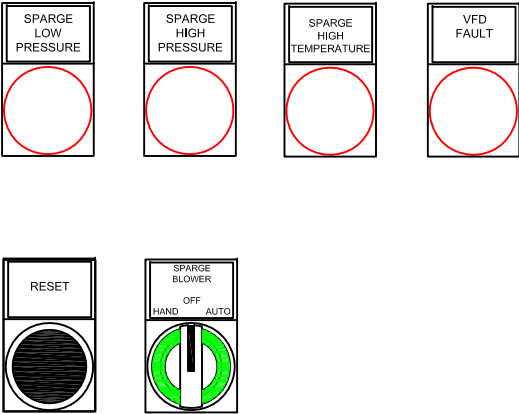
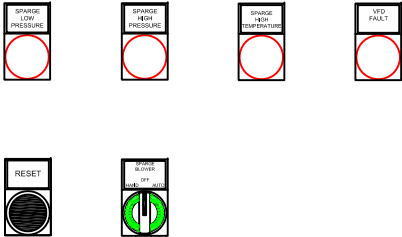
3

4

PANEL EXTERIOR

OPERATOR DETAIL

PANEL INTERIOR



ENCLOSURE EXTERNAL DIMENSIONS: 24"L X 24"W X 12"D


NOTES:
1. CONTROL PANEL HAS COOLING FAN AND RAIN HOODS
INSTALLED ON ENCLOSURE.
2. ALL OPERATORS ARE SPRING RETURN FROM HAND TO OFF POSITION.

ABBREV.	LEGEND
CB	- CIRCUIT BREAKER
CR	- CONTROL RELAY
GB	- GROUND BAR
MR	- MINI-RELAY
PS	- POWER SUPPLY
T	- TIMER
TB	- TERMINAL BLOCK
TS	- THERMOSTAT
VFD	- VARIABLE FREQUENCY DRIVE

A	AS BUILT	RB	04-02-15
REV	DESCRIPTION	DATE	APPROVED
REVISIONS			

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DRWN BY	DATE
RJD	03-12-15
CHK BY	DATE
APPR BY	DATE



NATIONAL ENVIRONMENTAL SYSTEMS

84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ

TITLE

CONTROL PANEL LAYOUT DRAWING

ADVANCED CLEANUP TECHNOLOGIES (ACT) SPARGE CONTROL PANEL	JOB NO. 12-198			
SCALE NTS	SIZE B	DWG NO. I-1	SHEET 1 OF 1	REV A

**TABLE 3
PANEL BILL OF MATERIALS**

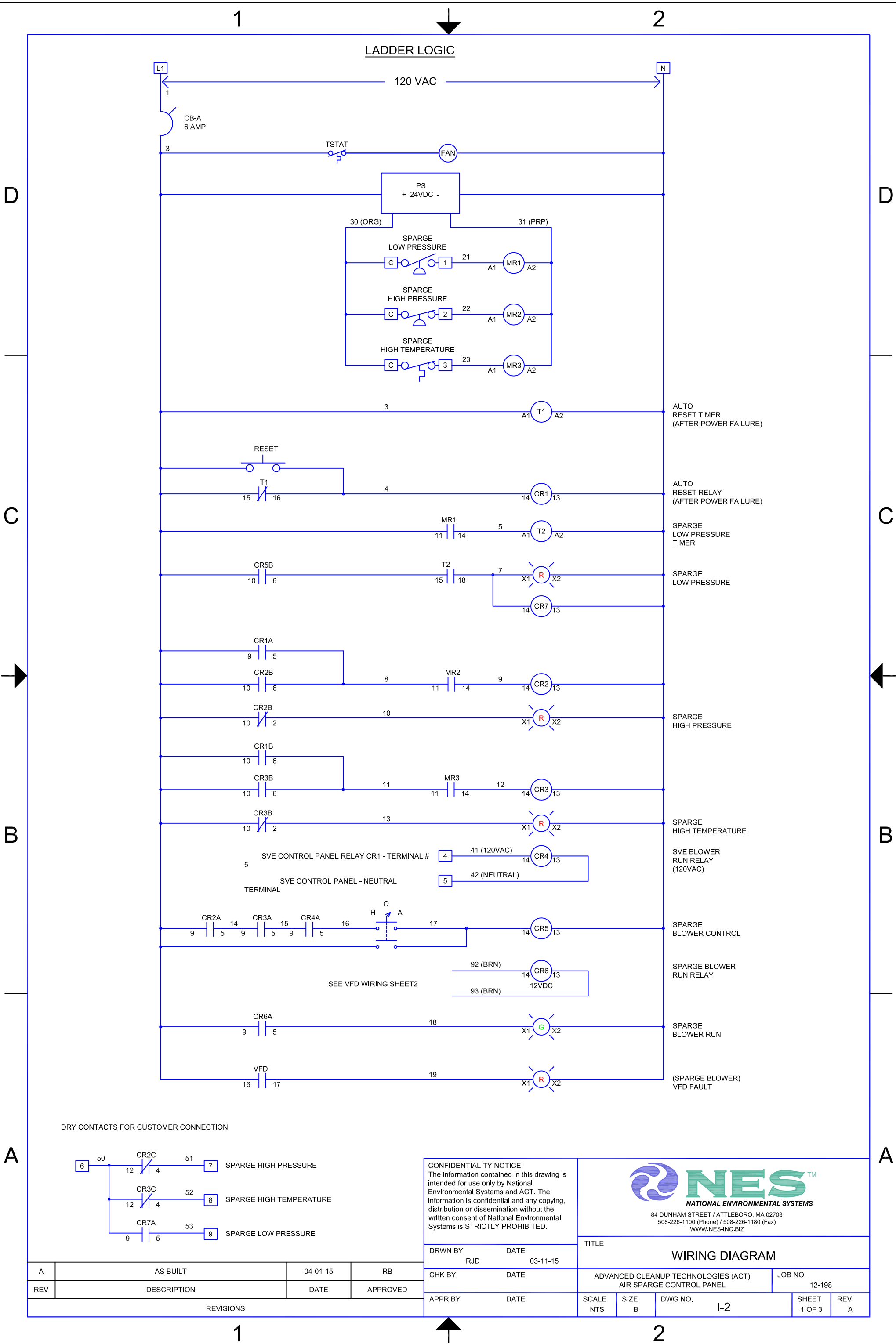
REVISION A

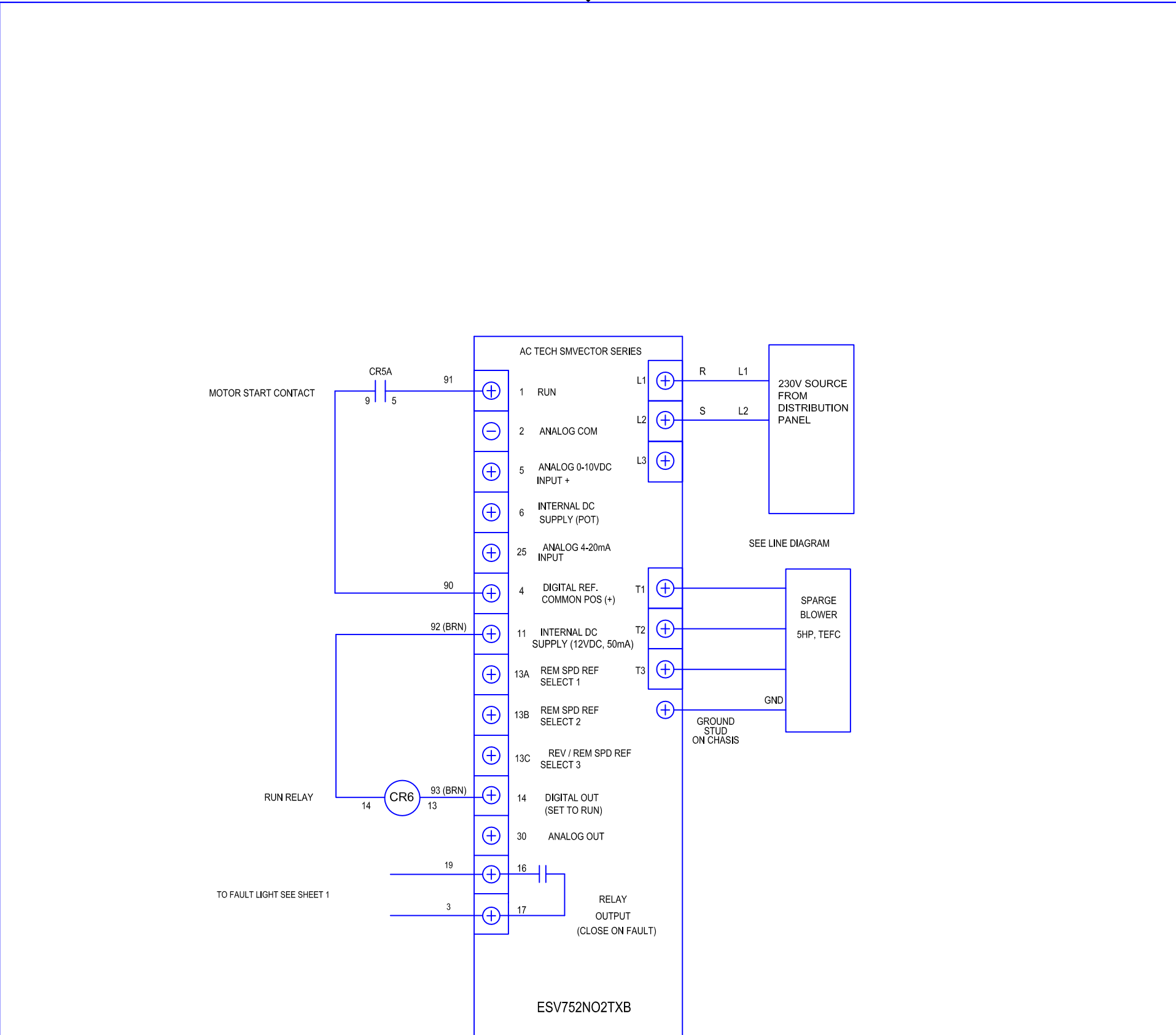
APRIL 2015


12-198

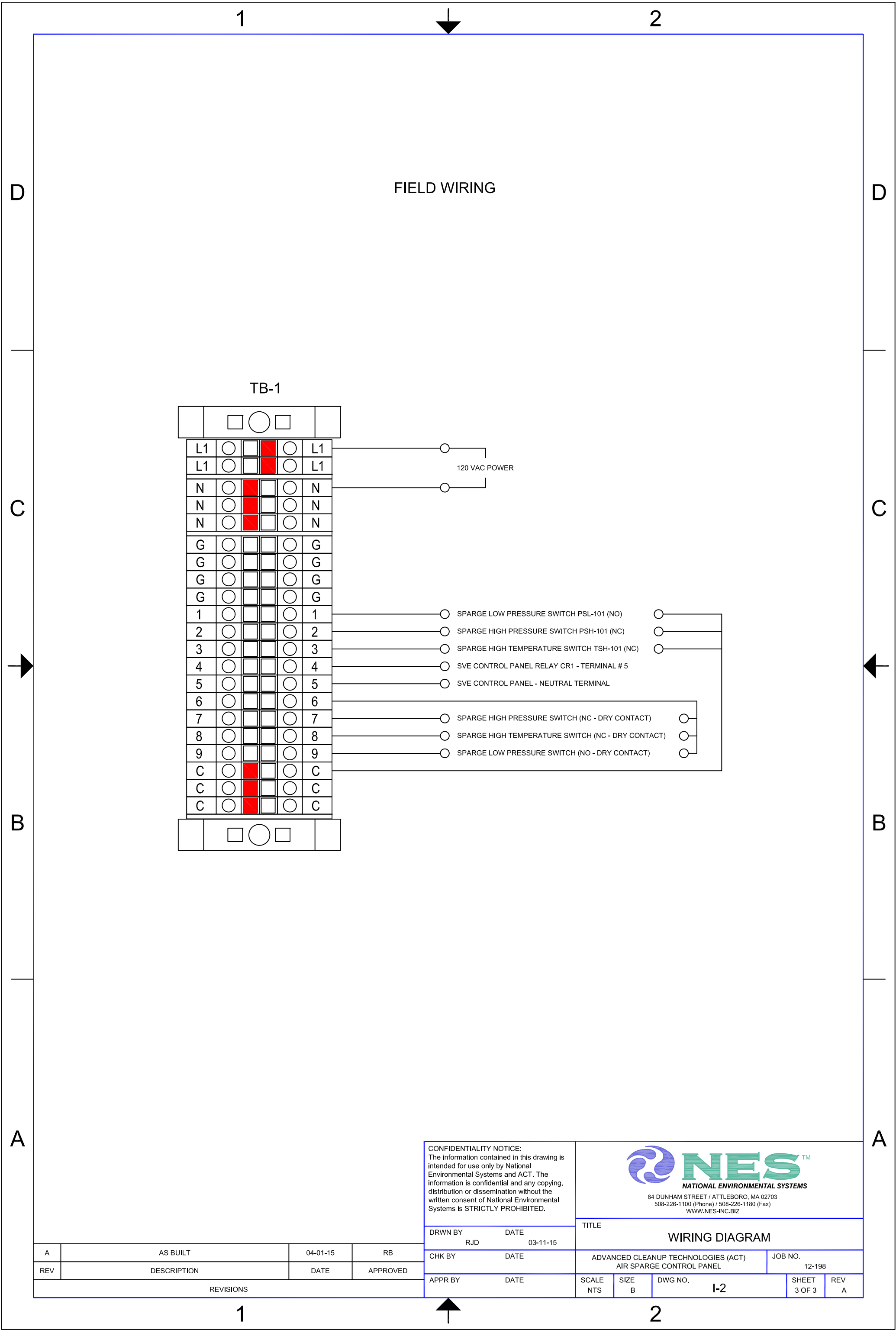
AIR SPARGE EQUIPMENT

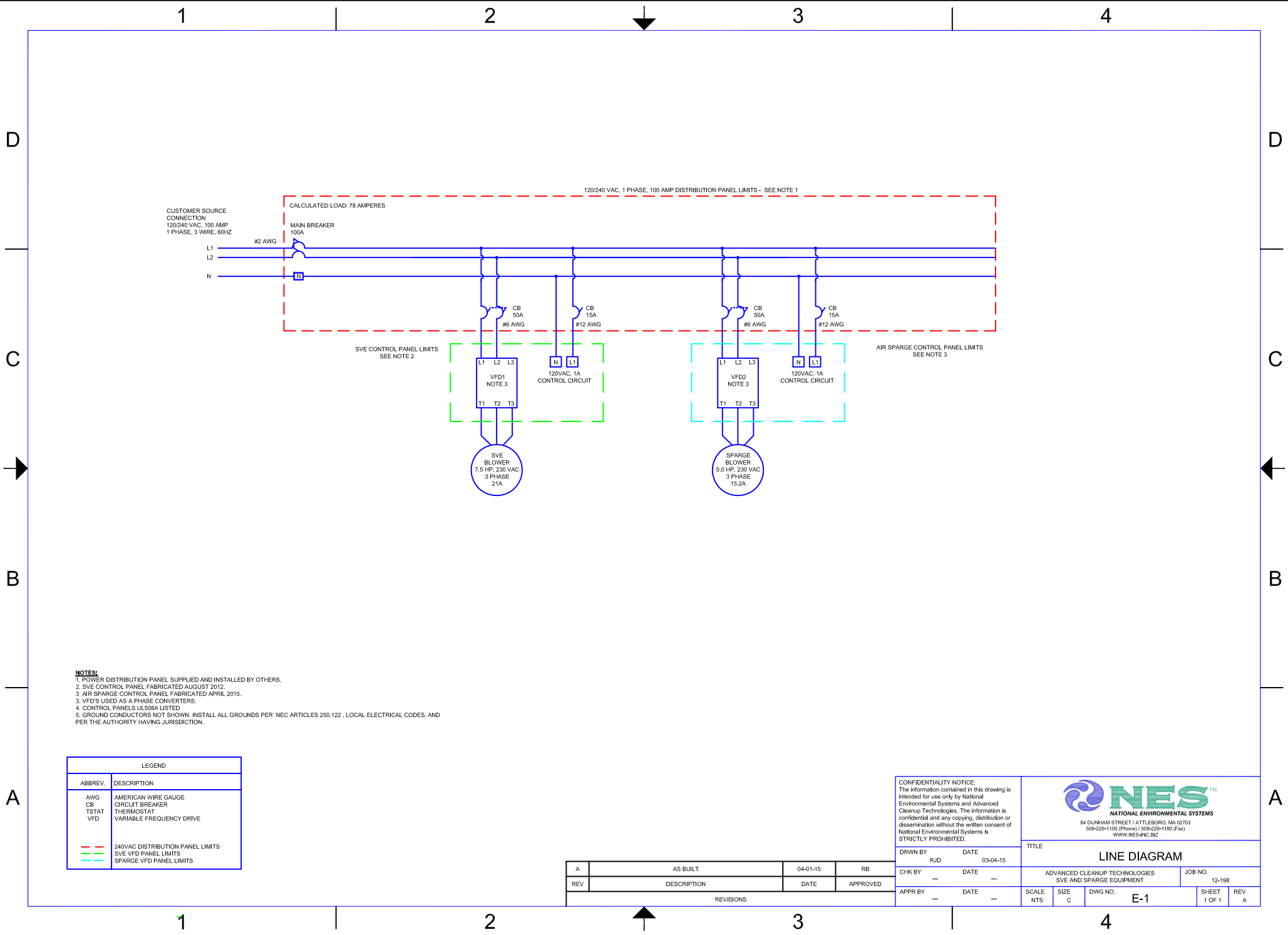
TAG	QUANTITY	ITEM	MODEL	MANUFACTURER
ENCL	1	CONTROL PANEL ENCLOSURE 24 X 24 X 12 - MILD STEEL/GRAY	EN4SD242412GY	HAMMOND
ENCL	1	BACK-PANEL - FITS ENCL. 24 X 24 - STEEL/WHT	EP2424	HAMMOND
ENCL	1	MOUNTING FEET SET OF 4 - ZINC PLATED	EZPMFHD	HAMMOND
VF	1	VENT FAN 105CFM 115VAC 4.7" W/ FILTER GRILL 24 IN CORD	DNFF120BK115	HAMMOND
VF	1	VENT FAN ADJUSTABLE 30-140F BI-METAL TEMP SWITCH N.O.	SKT011419NO	HAMMOND
VF	2	VENT FAN RAINHOOD NEMA 3R	RH20000GY	HAMMOND
VF	2	VENT FAN GRILL / SOLID COVER KIT	RHA20000G	HAMMOND
CB	1	CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	MG24430_	SQUARE D
VFD	1	VFD, 33 AMP RATING	ESV752N02TXB	AC TECH
CR	3	RELAY 1 POLE 24VDC	RV8H-L-D24_	IDEC
CR	4	RELAY 3PDT 120VAC W/INDICATOR LIGHT	RH3B-UL-AC 120V	IDEC
CR	4	RELAY SOCKET FOR RH3B	SH3B- 05	IDEC
CR	2	RH1B-ULDC12V SPDT W/ LIGHT RELAY	RH1B-ULDC12V	IDEC
CR	2	RELAY SOCKET FOR RH1B	SH1B- 05	IDEC
PS	1	POWER SUPPLY, 24VDC, 1.3A, 1PH, 30W	PS5R-C24	IDEC
T	2	TIMER ON-DELAY	RE17RAMU_	SQUARE D
PB	8	LEGEND PLATE HOLDER	ZBZ33-	SQUARE D
LT	5	PILOT LIGHT HEAD, RED	ZB5AV04 3	SQUARE D
LT	5	MOUNTING BASE, 120V RED PROTECTED LED	ZB5AVG 4	SQUARE D
SW	1	PUSH BUTTON OPERATOR NON-ILLUM BLACK	ZB5AA 2	SQUARE D
SW	1	3 POSITION SELECTOR SWITCH ILLUM. GREEN MOMENTARY	ZB5AK1733_	SQUARE D
SW	1	MOUNTING BASE 120V GREEN PROTECTED LED	ZB5AVG3_	SQUARE D
TB	12	TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	NSYTRV22	SQUARE D
TB	2	TERMINAL BLOCK END BARRIERS GRAY	NSYTRAC22	SQUARE D
TB	2	TERMINAL BLOCK END ANCHORS	NSYTRAABV35	SQUARE D
GB	1	LOAD CENTER GROUND BAR 12 TERMINALS	PK15GTA	SQUARE D





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DRWN BY DATE RJD 03-11-15		TITLE <div style="text-align: center; font-size: 1.2em; font-weight: bold;">WIRING DIAGRAM</div>			
CHK BY DATE		ADVANCED CLEANUP TECHNOLOGIES (ACT) AIR SPARGE CONTROL PANEL		JOB NO. <div style="text-align: center;">12-198</div>	
APPR BY DATE		SCALE <div style="text-align: center;">NTS</div>	SIZE <div style="text-align: center;">B</div>	DWG NO. <div style="text-align: center; font-size: 1.5em; font-weight: bold;">I-2</div>	SHEET <div style="text-align: center;">2 OF 3</div>
					REV <div style="text-align: center;">A</div>





D

C

B

A

D

C

B

A

1

2

VFD EXTERIOR

LED SCREEN (4 CH)

KEYPAD

AC TECH SMV SERIES

COLOR = BLUE

LOOSEN TWO PHILLIPS SCREWS AT BOTTOM TO REMOVE LOWER COVER.

TO CLEAR FAULTS

1. CORRECT CONDITION CAUSING FAULT.

2. PRESS STOP TO CLEAR FAULT. IF FAULT CLEARS (I.E. "FAULT: FOLLOWER")

3. CYCLE POWER & STOP/RUN CONTACT (AUTO TO OFF THEN BACK TO AUTO)

VFD INTERIOR

CTRL

LED SCREEN (4 CHAR.)

CONTROL TERMINALS

POWER TERMINALS

ELECTRONIC PROGRAMMING MODULE

CONTAINS VFD PARAMETER SETTINGS ON CHIP.

ALLOWS EASY DRIVE CHANGEOUT.

VFD PARAMETER SETTINGS

AS ADJUSTED/PROGRAMMED BY NES

PARAM. #	PARAMETER NAME AS APPEARS IN MANUAL	SETTINGS			
		VFD1	VFD2	VFD3	VFD4
P108	MOTOR OL(SEE CALC. AT BOTTOM)	45 (%)	N/A	N/A	N/A
P100	CONTROL (START STOP REF SIG)	1 (= TERM STRIP)			
P102	MIN FREQ (FREQUENCY)	30 (Hz)			
P104	ACCEL (RAMP UP TIME)	10 (SEC)			
P110	START	1 (=POWER UP)			
P140	RELAY	4 (=INVERSE FAULT)			
P142	TB14 OUT (NPN OPEN COLL TRANS.)	1 (=RUN)			
P150	TB10A OUT (ANALOG OUTPUT)	2 (=2-10V, FREQ)			
NOTEWORTHY FACTORY DEFAULTS LISTED BELOW:					
P111	STOP METHOD	1 (= COAST)			
P112	ROTATION	0 (= FORWARD ONLY)			
P305	RPM	3600			
SOME PARAMETERS FOR DIAGNOSTICS/MONITORING:		EXAMPLE DISPLAY:			
P508	MOTOR CURRENT	13 (= AMPS)			
P527	OUTPUT FREQUENCY	60 (HZ)			
P540	RUN TIME	102.5 (HOURS)			
MOTOR FULL LOAD CALC.					
	SVE BLOWER FLA =	13			
	VFD MODEL: ESV113NO2TXB MAX OUTPUT:	29			
	OVERLOAD SETTING (IN % OF MAX):	13/29 = 45			

NOTES FOR ABOVE TABLE

1. ALL PARAMETERS NOT LISTED ABOVE
REMAIN AT FACTORY DEFAULT SETTINGS.

2. SEE DRAWINGS FOR VFD AND MOTOR SIZES.

TO PROGRAM VFD (OR ACCESS PARAMETERS):

1. PRESS

M

 DISPLAY GOES TO

P100

USE ARROW BUTTONS TO GET TO DESIRED PARAMETER NUMBER.

2. PRESS

M

 DISPLAY GOES TO

1

PARAMETER SETTING

3. PRESS

Δ

 OR

▽

 TO REVEAL CHOICES OF PARAMETERS
SEE MANUAL FOR AVAILABLE PARAMETER CHOICES.

4. PRESS

M

 TO SAVE PARAMETER CHOICE.
(SCREEN GOES TO STOP).

VFD KEYPAD

CTRL

REMOTE MAN
LOCAL AUTO

HZ RPM
% AMPS
/UNITS

AUTO

FWD

LED SCREEN (4 CHAR.)

REV

1

0

STOP

(MODE)

(REV / FWD)

FOR MANUAL ADJUSTMENT OF MOTOR SPEED (VFD FREQUENCY)

1. PRESS

Δ

 OR

▽

 TO INCREASE OR DECREASE.

2. VFD WILL RETURN TO SETPOINT KEYPAD FREQUENCY WHEN
POWER IS REMOVED AND RESTORED.

COMMON DISPLAYS:

1.)

Stop

 DRIVE STOPPED

2.)

45.0

 RUNNING @ 45.0 Hz

COMMON FAULTS:

1.) F_PF = MOTOR OVERLOADED

2.) F_AF = HIGH TEMPERATURE FAULT

NOTE: PARMAETERS MAY BE RE-ACCESSED UP TO 2 MINUTES FOR CHECKING.
PRESSING PROG WILL BRING BACK LAST ACCESSED PARAMETER.

SEE AC TECH SMV SERIES MANUAL FOR ADDITIONAL INFORMATION.

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DRWN BY

RJD

DATE

03-11-15

CHK BY

DATE

APPR BY

DATE

NES™

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WWW.NES-INC.BIZ

TITLE

VFD SETTINGS

ADVANCED CLEANUP TECHNOLOGIES (ACT)

AIR SPARGE CONTROL PANEL

JOB NO.

12-198

SCALE

NTS

SIZE

B

DWG NO.

E-2

SHEET

1 OF 1

REV

A

1

2

1

2

**TABLE 3
PANEL BILL OF MATERIALS**

REVISION A

APRIL 2015

12-198

AIR SPARGE EQUIPMENT

TAG	QUANTITY	ITEM	MODEL	MANUFACTURER
ENCL	1	CONTROL PANEL ENCLOSURE 24 X 24 X 12 - MILD STEEL/GRAY	EN4SD242412GY	HAMMOND
ENCL	1	BACK-PANEL - FITS ENCL. 24 X 24 - STEEL/WHT	EP2424	HAMMOND
ENCL	1	MOUNTING FEET SET OF 4 - ZINC PLATED	EZPMFHD	HAMMOND
VF	1	VENT FAN 105CFM 115VAC 4.7" W/ FILTER GRILL 24 IN CORD	DNFF120BK115	HAMMOND
VF	1	VENT FAN ADJUSTABLE 30-140F BI-METAL TEMP SWITCH N.O.	SKT011419NO	HAMMOND
VF	2	VENT FAN RAINHOOD NEMA 3R	RH20000GY	HAMMOND
VF	2	VENT FAN GRILL / SOLID COVER KIT	RHA20000G	HAMMOND
CB	1	CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT	MG24430_	SQUARE D
VFD	1	VFD, 33 AMP RATING	ESV752N02TXB	AC TECH
CR	3	RELAY 1 POLE 24VDC	RV8H-L-D24_	IDEC
CR	4	RELAY 3PDT 120VAC W/INDICATOR LIGHT	RH3B-UL-AC 120V	IDEC
CR	4	RELAY SOCKET FOR RH3B	SH3B- 05	IDEC
CR	2	RH1B-ULDC12V SPDT W/ LIGHT RELAY	RH1B-ULDC12V	IDEC
CR	2	RELAY SOCKET FOR RH1B	SH1B- 05	IDEC
PS	1	POWER SUPPLY, 24VDC, 1.3A, 1PH, 30W	PS5R-C24	IDEC
T	2	TIMER ON-DELAY	RE17RAMU_	SQUARE D
PB	8	LEGEND PLATE HOLDER	ZBZ33-	SQUARE D
LT	5	PILOT LIGHT HEAD, RED	ZB5AV04 3	SQUARE D
LT	5	MOUNTING BASE, 120V RED PROTECTED LED	ZB5AVG 4	SQUARE D
SW	1	PUSH BUTTON OPERATOR NON-ILLUM BLACK	ZB5AA 2	SQUARE D
SW	1	3 POSITION SELECTOR SWITCH ILLUM. GREEN MOMENTARY	ZB5AK1733_	SQUARE D
SW	1	MOUNTING BASE 120V GREEN PROTECTED LED	ZB5AVG3_	SQUARE D
TB	12	TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY	NSYTRV22	SQUARE D
TB	2	TERMINAL BLOCK END BARRIERS GRAY	NSYTRAC22	SQUARE D
TB	2	TERMINAL BLOCK END ANCHORS	NSYTRAABV35	SQUARE D
GB	1	LOAD CENTER GROUND BAR 12 TERMINALS	PK15GTA	SQUARE D



SECTION 6 - CONTROL COMPONENTS

CONTROL PANEL ENCLOSURE 24 X 24 X 12 - MILD STEEL/GRAY - HAMMOND EN4SD242412GY

VENT FAN 105CFM 115VAC 4.7" W/ FILTER GRILL 24 IN CORD - HAMMOND DNFF120BK115

VENT FAN ADJUSTABLE 30-140F BI-METAL TEMP SWITCH N.O. - HAMMOND SKT011419NO

VFD, 33 AMP RATING - AC TECH ESV752N02TXB

POWER SUPPLY, 24VDC, 1.3A, 1PH, 30W - IDEC PS5R-C24

TIMER ON-DELAY - SQUARE D RE17RAMU

Type 4 Mild Steel Wallmount Enclosure *Eclipse Series*

Hinge Door with Quarter Turn/Handle



Application

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

Standards

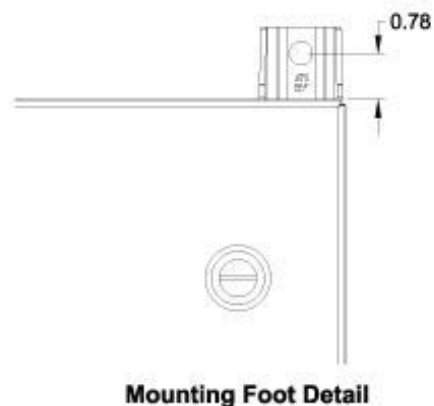
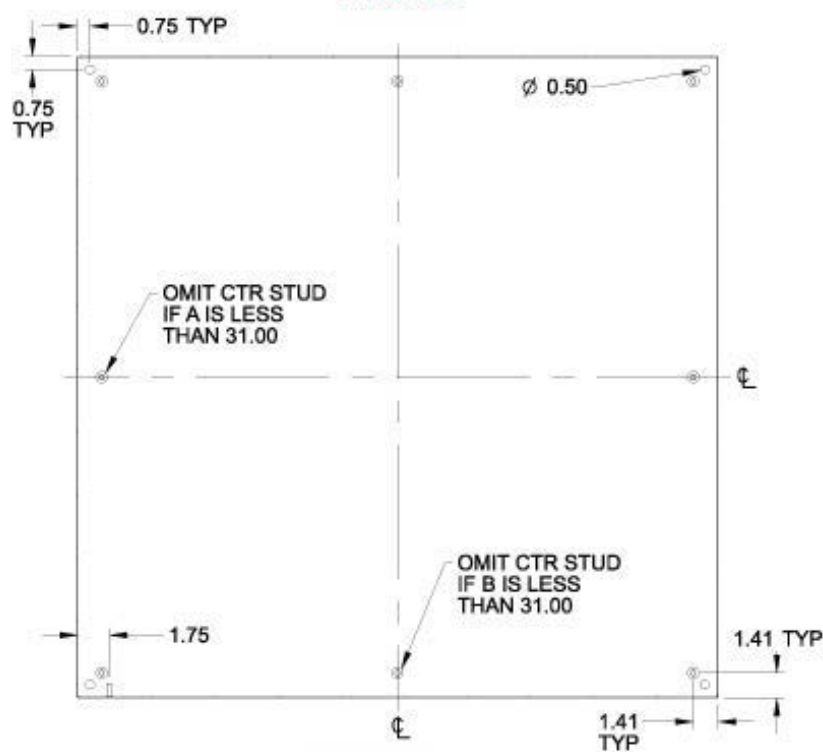
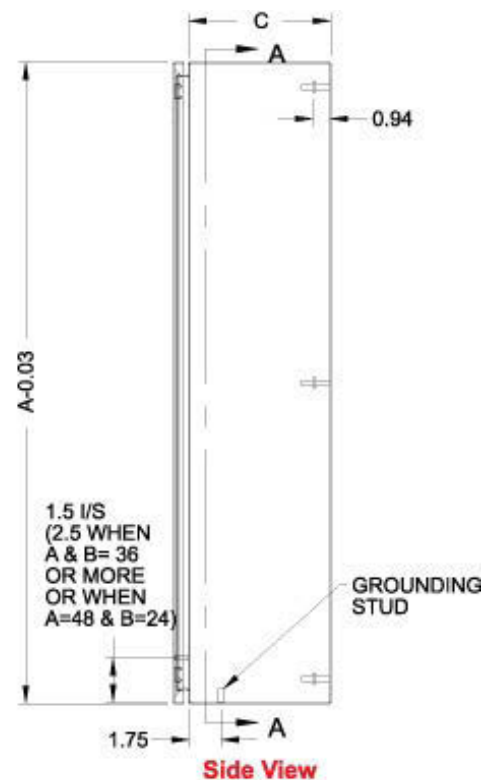
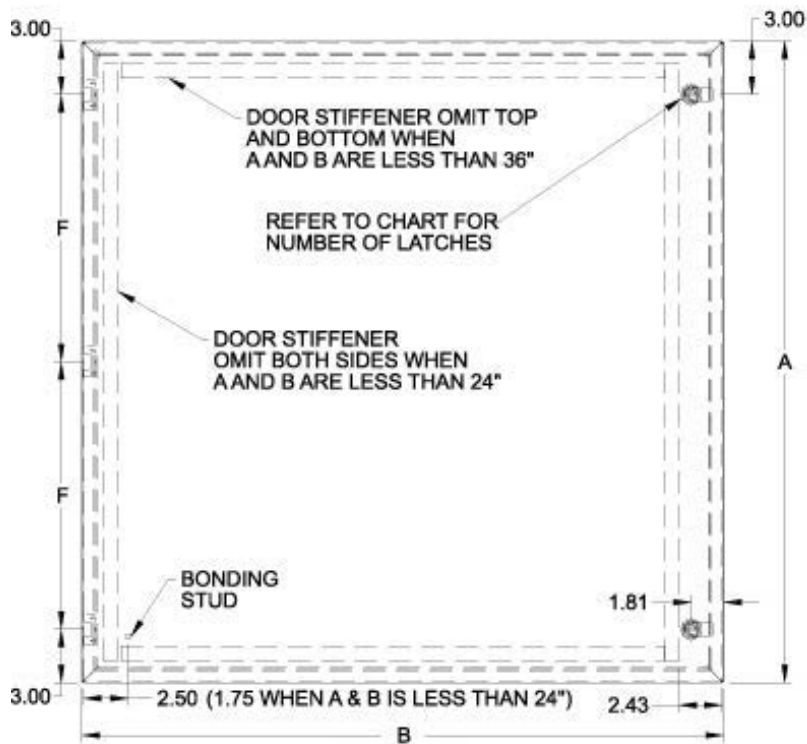
- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
 - NEMA Type 3R, 4, and 12
 - IEC 60529, IP66

Construction

- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

Finish

- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).



Part No. (ANSI 61 Gray)	Part No. (RAL 7035 Light Gray)	Overall Dimensions			Door/Body Gauge	Latches Qty	Type	Opt. Panel Part No.	Panel Size		# Hinges	F	Ship Wt. (lbs)
		A	B	C					D	E			
EN4SD12126GY	EN4SD12126LG	12.00	12.00	6.00	16	1	Qtr Turn	EP1212	10.20	10.20	2	6.00	12
EN4SD12246GY	EN4SD12246LG	12.00	24.00	6.00	16	1	Qtr Turn	EP1224	10.20	22.20	2	18.00	24
EN4SD16126GY	EN4SD16126LG	16.00	12.00	6.00	16	1	Qtr Turn	EP1612	14.20	10.20	2	10.00	16
EN4SD16166GY	EN4SD16166LG	16.00	16.00	6.00	16	1	Qtr Turn	EP1616	14.20	14.20	2	10.00	19
EN4SD16206GY	EN4SD16206LG	16.00	20.00	6.00	16	1	Qtr Turn	EP1620	14.20	18.20	2	10.00	22
EN4SD20126GY	EN4SD20126LG	20.00	12.00	6.00	16	1	Qtr Turn	EP2012	18.20	10.20	2	14.00	20

EN4SD242410GY	EN4SD242410LG	24.00	24.00	10.00	14	2	Qtr. Turn	EP2424	22.20	22.20	2	18.00	45
EN4SD243010GY	EN4SD243010LG	24.00	30.00	10.00	14	2	Qtr. Turn	EP2430	22.20	28.20	2	18.00	53
EN4SD302010GY	EN4SD302010LG	30.00	20.00	10.00	14	2	Qtr. Turn	EP3020	28.20	18.20	3	12.00	47
EN4SD302410GY	EN4SD302410LG	30.00	24.00	10.00	14	2	Qtr. Turn	EP3024	28.20	22.20	3	12.00	53
EN4SD303010GY	EN4SD303010LG	30.00	30.00	10.00	14	2	Qtr. Turn	EP3030	28.20	28.20	3	12.00	75
EN4SD362410GY	EN4SD362410LG	36.00	24.00	10.00	14	2	Qtr. Turn	EP3624	34.20	22.20	3	15.00	70
EN4SD363010GY	EN4SD363010LG	36.00	30.00	10.00	14	2	Qtr. Turn	EP3630	34.20	28.20	3	15.00	84
EN4SD363610GY	EN4SD363610LG	36.00	36.00	10.00	14	2	Qtr. Turn	EP3636	34.20	34.20	3	15.00	100
EN4SD423010GY	EN4SD423010LG	42.00	30.00	10.00	14	1	3-point	EP4230	40.20	28.20	4	12.00	107
EN4SD423610GY	EN4SD423610LG	42.00	36.00	10.00	14	1	3-point	EP4236	40.20	34.20	4	12.00	117
EN4SD482410GY	EN4SD482410LG	48.00	24.00	10.00	14	1	3-point	EP4824	46.20	22.20	4	14.00	95
EN4SD483010GY	EN4SD483010LG	48.00	30.00	10.00	14	1	3-point	EP4830	46.20	28.20	4	14.00	120
EN4SD483610GY	EN4SD483610LG	48.00	36.00	10.00	14	1	3-point	EP4836	46.20	34.20	4	14.00	125
EN4SD603610GY	EN4SD603610LG	60.00	36.00	10.00	14	1	3-point	EP6036	58.20	34.20	4	18.00	150
EN4SD201612GY	EN4SD201612LG	20.00	16.00	12.00	16	1	Qtr Turn	EP2016	18.20	14.20	2	14.00	32
EN4SD202012GY	EN4SD202012LG	20.00	20.00	12.00	16	1	Qtr Turn	EP2020	18.20	18.20	2	14.00	34
EN4SD242012GY	EN4SD242012LG	24.00	20.00	12.00	16	1	Qtr Turn	EP2420	22.20	18.20	2	18.00	38
EN4SD242412GY	EN4SD242412LG	24.00	24.00	12.00	14	2	Qtr Turn	EP2424	22.20	22.20	2	18.00	47
EN4SD302412GY	EN4SD302412LG	30.00	24.00	12.00	14	2	Qtr Turn	EP3024	28.20	22.20	3	12.00	57
EN4SD303012GY	EN4SD303012LG	30.00	30.00	12.00	14	2	Qtr Turn	EP3030	28.20	28.20	3	12.00	80
EN4SD362412GY	EN4SD362412LG	36.00	24.00	12.00	14	2	Qtr Turn	EP3624	34.20	22.20	3	15.00	62
EN4SD363012GY	EN4SD363012LG	36.00	30.00	12.00	14	2	Qtr Turn	EP3630	34.20	28.20	3	15.00	91
EN4SD363612GY	EN4SD363612LG	36.00	36.00	12.00	14	2	Qtr Turn	EP3636	34.20	34.20	3	15.00	104
EN4SD423012GY	EN4SD423012LG	42.00	30.00	12.00	14	1	3-point	EP4230	40.20	28.20	4	12.00	111
EN4SD423612GY	EN4SD423612LG	42.00	36.00	12.00	14	1	3-point	EP4236	40.20	34.20	4	12.00	121
EN4SD482412GY	EN4SD482412LG	48.00	24.00	12.00	14	1	3-point	EP4824	46.20	22.20	4	14.00	98
EN4SD483612GY	EN4SD483612LG	48.00	36.00	12.00	14	1	3-point	EP4836	46.20	34.20	4	14.00	148
EN4SD603612GY	EN4SD603612LG	60.00	36.00	12.00	14	1	3-point	EP6036	58.20	34.20	4	18.00	165
EN4SD723012GY	EN4SD723012LG	72.00	30.00	12.00	14	2	Qtr Turn, 5-point	EP7230	70.20	28.20	5	16.50	190
EN4SD723612GY	EN4SD723612LG	72.00	36.00	12.00	14	2	Qtr Turn, 5-point	EP7236	70.20	34.20	5	16.50	195
EN4SD242016GY	EN4SD242016LG	24.00	20.00	16.00	16	1	Qtr Turn	EP2420	22.20	18.20	2	18.00	52
EN4SD242416GY	EN4SD242416LG	24.00	24.00	16.00	14	2	Qtr Turn	EP2424	22.20	22.20	2	18.00	66
EN4SD302416GY	EN4SD302416LG	30.00	24.00	16.00	14	2	Qtr Turn	EP3024	28.20	22.20	3	12.00	85
EN4SD363016GY	EN4SD363016LG	36.00	30.00	16.00	14	2	Qtr Turn	EP3630	34.20	28.20	3	15.00	102
EN4SD423616GY	EN4SD423616LG	42.00	36.00	16.00	14	1	3-point	EP4236	40.20	34.20	4	12.00	140
EN4SD483616GY	EN4SD483616LG	48.00	36.00	16.00	14	1	3-point	EP4836	46.20	34.20	4	14.00	148
EN4SD603616GY	EN4SD603616LG	60.00	36.00	16.00	14	1	3-point	EP6036	58.20	34.20	4	18.00	200
EN4SD723016GY	EN4SD723016LG	72.00	30.00	16.00	14	2	Qtr Turn, 5-point	EP7230	70.20	28.20	5	16.50	215
EN4SD723616GY	EN4SD723616LG	72.00	36.00	16.00	14	2	Qtr Turn, 5-point	EP7236	70.20	34.20	5	16.50	217
EN4SD242420GY	EN4SD242420LG	24.00	24.00	20.00	14	2	Qtr Turn	EP2424	22.20	22.20	2	18.00	70
EN4SD302420GY	EN4SD302420LG	30.00	24.00	20.00	14	2	Qtr Turn	EP3024	28.20	22.20	3	12.00	82
EN4SD363020GY	EN4SD363020LG	36.00	30.00	20.00	14	2	Qtr Turn	EP3630	34.20	28.20	3	15.00	117

Filter Fan Kits *DNFF Series*

Features



- Kit includes one (1) of the following:
 - Fan
 - Plastic Filter Grill
 - Filter
 - Metal Grill
 - Wire Cord or Leads (see table)
 - Includes Mounting Hardware
- Flame retardant, ABS plastic filter fan grill is molded in a choice of four colors to match our racks & accessories.
 - "BK" (Black)
 - "GY" (ANSI 61 Gray)
 - "LG" (Light Gray - RAL7035)
 - "CG" (Gray/Beige - RAL7032)
- Fan is cooled by incoming air.
- Fan component is UL recognized to UL 507, and cUL recognized or CSA certified to CSA-C22.2 No. 113.

Part No. Black Filter Grill	Part No. ANSI 61 Gray Filter Grill	Part No. Gray/Beige Filter Grill	Part No. Light Gray Filter Grill	VAC	Fan Size	CFM	Cord Length
DNFF080BK115	DNFF080GY115	DNFF080CG115	DNFF080LG115	115	3.15	32	11 Inch leads
DNFF120BK115	DNFF120GY115	DNFF120CG115	DNFF120LG115	115	4.70	105	24 Inch cord
DNFF254BK115	DNFF254GY115	DNFF254CG115	DNFF254LG115	115	10.00	550	24 Inch cord
DNFF080BK230	DNFF080GY230	DNFF080CG230	DNFF080LG230	230	3.15	32	11 Inch leads
DNFF120BK230	DNFF120GY230	DNFF120CG230	DNFF120LG230	230	4.70	105	24 Inch cord
DNFF254BK230	DNFF254GY230	DNFF254CG230	DNFF254LG230	230	10.00	550	24 Inch cord

Data subject to change without notice

Thermostats *SKT Series*



Features

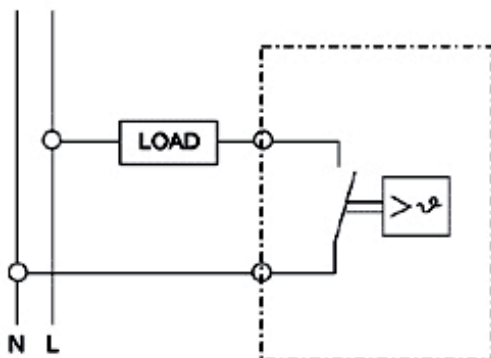
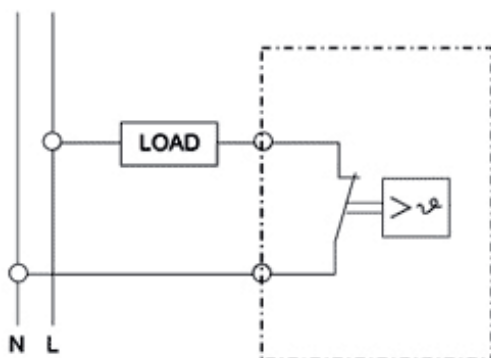
- Designed to provide air temperature control and monitoring in cabinets.
- Thermostat NC (Normally Closed) for the control of heaters and heater fans
- Thermostat NO (Normally Open) for the control of cooling units, or for switching signal transmitters in case of overheating.
- Available in Fahrenheit or Celsius.

NC - Normally Closed (Red)

- Used in conjunction with heaters.
- Contact opens when rising temperatures reach the set point temperature, shutting heater off.

NO - Normally open (Blue)

- Used in conjunction with fans.
- Contact closes when rising temperatures reach the set point temperature, turning fan on.



Part No.	Scale	Contact Type	Dimensions		Switching Capacity	Ship Wt. lbs
			Height x Width x Depth			
SKT011409NC	F°	Normally Closed	2.8 x 1.5 x 1.4		15 A (1) AC 120 V, 10 A (1) AC 250 V	1

Part No.	Scale	Contact Type	Dimensions		Switching Capacity	Ship Wt. lbs
			Height x Width x Depth			
SKT011409NC-C	C°	Normally Closed	2.8 x 1.5 x 1.4		15 A (1) AC 120 V, 10 A (1) AC 250 V	1
SKT011419NO	F°	Normally Open	2.8 x 1.5 x 1.4		15 A (1) AC 120 V, 10 A (1) AC 250 V	1
SKT011419NO-C	C°	Normally Open	2.8 x 1.5 x 1.4		15 A (1) AC 120 V, 10 A (1) AC 250 V	1

Sensor Element:	Thermostatic bi-metal
Switching difference (hysteresis):	+ or - 4°F (+or- 3°K)
Adjustment Range:	30 - 140°F
Noise Suppression:	N (according to VDE 0875)
Connection:	2 pole terminal for AWG 14 (2.5 mm²)
Mounting:	Easily installed by clip mounting on 35 or 38mm DIN rail (included)
Housing:	Flame retardant plastic UL94VO
Color:	Gray (SB)
Protection:	IP20
Approval:	UL Recognized Component, cUL Recognized Component, CE

Data subject to change without notice

SMVector Drive

Flexible, simple, economical



Lenze

SMVector | Our promise

Commitment to Value

The finest product at the best price is serious business. It takes continuous life cycle management to achieve this goal. We are always investigating techniques to improve efficiency and take advantage of the latest microprocessor and power module technology. When we achieve efficiency gains or material cost reductions, we pass those savings on to our customers. This simple philosophy has permitted us to build and maintain a very loyal base of customers.

Commitment to Quality

From product design to manufacture, service and training, quality is at the foundation of Lenze Americas corporate philosophy. A quality product is built of superior materials by highly skilled personnel equipped with state-of-the art instruments. And a quality product is backed by expert training, knowledgeable sales representatives and experienced repair personnel. Continuous life cycle improvement fueled by our pledge to our Customers drives our technology forward. We feel so strongly about quality that each SMVector is backed with a two-year warranty.

Commitment to Innovation

We pride ourselves on delivering products to the market that are designed to meet specific customer needs. Our portfolio of innovative products is broad and covers very simple variable speed applications up through complex motion control. Each product, including the SMVector, is positioned so our customers pay only for the level of technology necessary for their application.

Commitment to Simplicity

One of the cornerstones of our design philosophy is to make our products simple to use. Technology only benefits the user if it can be easily understood and applied. The SMVector's intuitive display and EPM technology dramatically simplifies installation, commissioning and operation for our customers

Commitment to Performance

The SMVector is in a class by itself when it comes to performance. At the heart of the SMV are sophisticated vector algorithms that achieve new heights in torque production and speed control. This technology breakthrough allows our customers to cover a full range of applications from simple speed control through advanced torque and process control with the same product.

Our Promise

At Lenze Americas it is not good enough to deliver part of a promise. Our products deliver the entire package; Value, Quality, Innovation, Simplicity and Performance.

Lenze



Lenze Americas N.A. Headquarters, Uxbridge, MA

SMVector | Features and Benefits:

The SMVector continues our price leadership tradition in the highly competitive AC drive market. Its performance and flexibility make it an attractive solution for a broad range of applications including:

- ▶ Food processing machinery
- ▶ Packaging machinery
- ▶ Material handling/conveying systems
- ▶ HVAC systems

The SMVector makes good its promise of price leadership in delivering unparalleled performance and simplicity. The SMVector is the right choice when you need it all – performance, power, packaging and intuitive programming.



SMV NEMA 4X (IP65)

SMV NEMA 1 (IP31)

Two Year Warranty

Superior Performance

- ▶ Modes of Operation:
 - V/Hz (Constant and Variable)
 - Enhanced V/Hz (Constant and Variable)
 - Vector Speed Control
 - Vector Torque Control
- ▶ Dynamic Torque Response
- ▶ Sophisticated Auto-tuning (Motor Calibration)
- ▶ Impressive Low Speed Operation
- ▶ Sequencer with 16 Programmable Segments

Flexible Power Ranges

- ▶ International Voltages:
 - 120/240V, 1Ø (up to 1.5 Hp)
 - 200/240V, 1/3Ø (up to 3 Hp)
 - 200/240V, 3Ø (up to 20 Hp)
 - 400/480V, 3Ø (up to 60 Hp)
 - 480/600V, 3Ø (up to 60 Hp)

Industrial Grade Packaging

- ▶ NEMA Type 1 (IP31) Enclosure
- ▶ NEMA 4X (IP65) Indoor Only
- ▶ NEMA 4X (IP65) Indoor/Outdoor

Simplicity

- ▶ Intuitive User Interface
- ▶ Electronic Memory Module (EPM)
- ▶ Optional Disconnect Switch (NEMA 4X only)
- ▶ Optional Potentiometer Switch (NEMA 4X only)

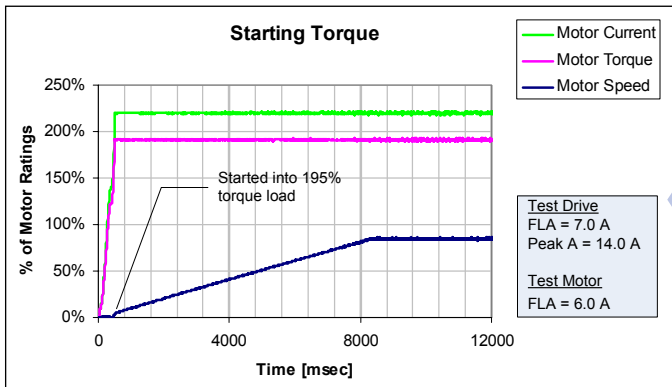
EPM | Just think of it as ... Ever Present Memory



When you need to program or replace a drive, whether it is 1 or 100 drives, the Electronic Programming Module (EPM) gets it done simply, quickly and most important, accurately. There is no hassle of reconfiguring each parameter or resetting the drive to factory or user default settings.

When drive reset is necessary, reset to factory default or customer settings in seconds with the EPM. When the EPM equipped drive is used on a line containing multiple drives with the identical setup, it takes just minutes to program the entire line. And EPMs can be replaced with or without power connected. When a drive must be replaced, the parameter configuration is not lost, simply plug in the pre-programmed EPM. You are good to go with Ever Present Memory.

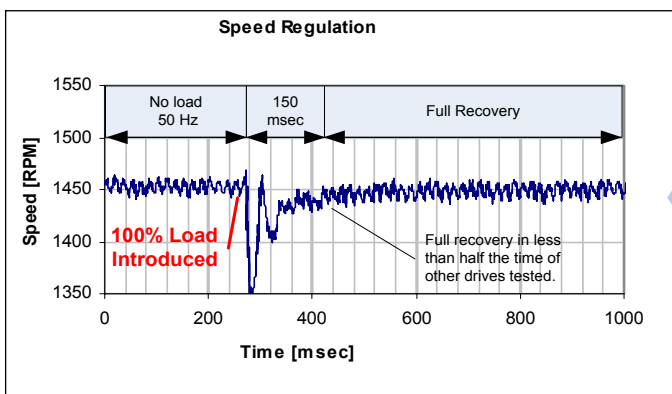
SMVector | Performance



Exceptional Starting Torque

Overpower demanding applications

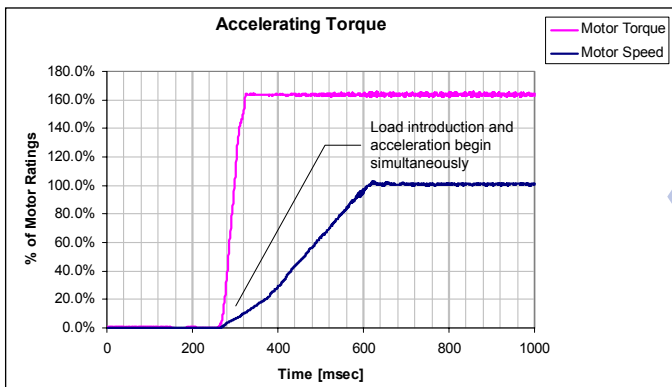
The SMVector is peerless in controlling the motor's ability to convert current into torque. In this example, the SMVector is started into a stiff 195% torque load. Not only does the motor start the load, but it also delivers a full 195% torque while accelerating to 50 Hz in 8 seconds.



Dynamic Speed Regulation

Recovery from 100% shock load in 0.15 seconds

Shock loads are no match for the SMVector. Here an instantaneous 100% load is dealt with in a mere 0.15 seconds. Remarkably, this level of speed regulation is achieved open loop without the benefit of a feedback device.



Quick Acceleration

0 to 100 in 0.33 seconds!

Motors controlled by the SMVector benefit from a sophisticated motor control algorithm that drives motor performance to maximum levels. In this application the the motor is able to drive a 165% torque load while accelerating from 0 to 100% speed in an impressive 0.33 seconds.

The SMV Thrives in Harsh Environments

Plastic Housing/Black Anodized Heatsink

- Light weight and corrosion resistant
- Available for indoor and indoor/outdoor use

Totally Enclosed Non-Ventilating Housing

Compact Enclosures

Optional Potentiometer



Optional Disconnect Switch

- Available on certain models

High Pressure Washdown Version

- Can be ordered without keypad and display

Optional Integrated EMC Filters

- Meets CE regulations

SMV NEMA 4X (IP65)
With Disconnect and Potentiometer

SMVector | Specifications

World Class Control

Modes of Operation

- Open Loop Flux Vector, Speed or Torque Control with/without Auto Tuning
- V/Hz (Constant or Variable)
- Base Frequency Adjustable to Motor Specs
- Enhanced V/Hz with Auto-tuning

Acceleration/Deceleration Profiles

- Two Independent Accel Ramps
- Two Independent Decel Ramps
- Linear, S-Type
- Auxiliary Ramp(or Coast)-to-Stop

Fixed Accel Boost for Improved Starting

500 Hz Output Frequency

High Carrier (PWM Sine-Coded) Frequency

- 4, 6, 8, 10 kHz

Universal Logic Assertion (Selectable)

- Positive or Negative Logic Input
- Digital Reference Available

Braking Functions

- DC Injection Braking
- Optional Dynamic Braking
- Flux Braking w/ Adjustable Flux Level & Decel Time

Speed Commands

- Keypad, Potentiometer
- Jog, 8 Preset Speeds
- Floating Point Control
- Sequencer, 16 Segments
- Voltage: Scalable 0 –10 VDC
- Current: Scalable 4 – 20 mA

Process Control

- PID Modes: Direct and Reverse Acting
- PID Sleep Mode w/ Adjustable Recovery Threshold
- Analog Output (Speed, Load, Torque, kW)
- Network Speed (Baud Rate)
- Terminal and Keypad Status
- Elapsed Run or Power On Time (Hours)

Status Outputs

- Programmable Form "A" Relay Output
- Programmable Open Collector Output
- Scalable 0-10 VDC / 2-10 VDC Analog Output
- 4-20mA w/500 Ohm Total Impedance

Environment

Ambient Temperature

- 10 to 55°C
- Derate 2.5% per °C Above 40°C

Comprehensive Diagnostic Tools

Real Time Monitoring

- 8 Register Fault History
- Software Version
- Drive Network ID
- DC Bus Voltage (V)
- Motor Voltage (V)
- Output Current (%)
- Motor Current (A)
- Motor Torque (%)
- Power (kW)
- Energy Consumption (kWh)
- Heatsink Temperature (°C)
- 0 – 10 VDC Input (User Defined)
- 4 – 20 mA Input (User Defined)
- PID Feedback (User Defined)

Vigilant System Protection

Voltage Monitoring

- Low and High DC Bus V Protection
- Low Line V Compensation

Current Monitoring

- Motor Overload Protection
- Current Limiting Safeguard
- Ground Fault
- Short Circuit Protection

Four ReStarts

- Three Flying and One Auto
- User Enabled

Loss of Follower Management

- Protective Fault
- Go to Preset Speed or Preset Setpoint
- Initiate System Notification

Over Temperature Protection

International Voltages

- +10/-15% Tolerance
- 120/240V, 1Ø
- 200/240V, 1 or 3Ø
- 200/240V, 3Ø
- 400/480V, 3Ø
- 480/600V, 3Ø

Global Standards

- UL GOST
- cUL C-Tick
- CE Low Voltage (EN61800-5-1)
- CE EMC (EN61800-3) with optional EMC filter

Simple Six Button Programming

- Start
- Stop
- Forward/Reverse
- Scroll Up
- Scroll Down
- Enter/Mode

Informative LED Display

Vivid Illumination

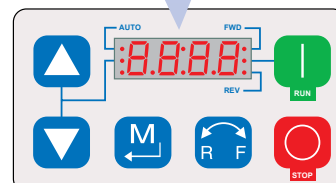
- Easily Read from a Distance

Five Status LEDs

- Run
- Automatic Speed mode
- Manual Speed Mode
- Forward Rotation
- Reverse Rotation

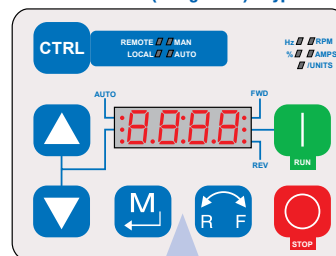
Status Display

- Motor Status
- Fault Management
- Operational Information



NEMA1 (Up to 10HP), NEMA4/4x Keypad

NEMA1 15HP (and greater) Keypad



Additional CTRL Button

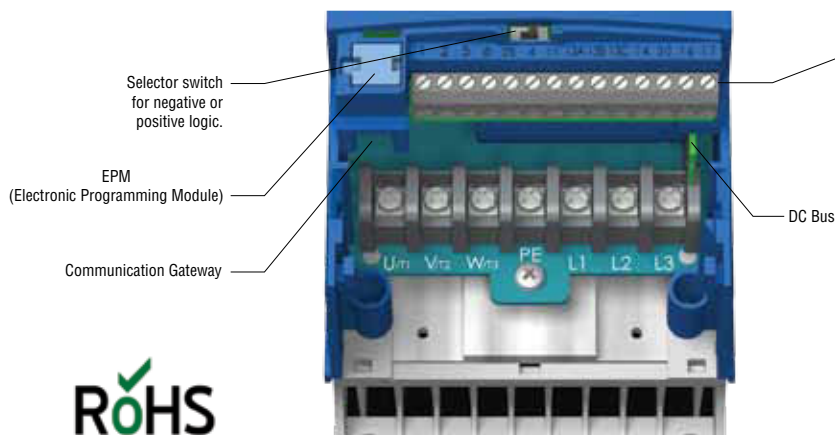
Switch between control modes

- Local-Manual
- Local-Auto
- Remote-Manual
- Remote-Auto

Additional LED Indicators

Define the units being displayed

- Hz
- RPM
- %
- Amps
- /Units



Control Terminals

- Digital Inputs
 - Dedicated Start/Stop
 - (3) Programmable
- Digital Outputs
 - Form "A" Relay
 - Open Collector
- Analog Inputs
 - 0 - 10 VDC
 - 4 - 20 mA
- Analog Outputs
 - 0 - 10 VDC/2 - 10 VDC
- Power Supplies
 - 10 VDC Potentiometer Ref
 - 12 VDC, 20 mA Digital Input Ref or 0VDC Common
 - 12 VDC, 50 mA Supply Common

Additional Control Terminals

(NEMA1, 15HP and greater models)

- 1 Programmable Digital Input
- 1 Common
- RS-485 Modbus Communications
 - TXA
 - TXB

Removable terminal cover and steel conduit plate (not shown).
Easy access for control & power wiring.

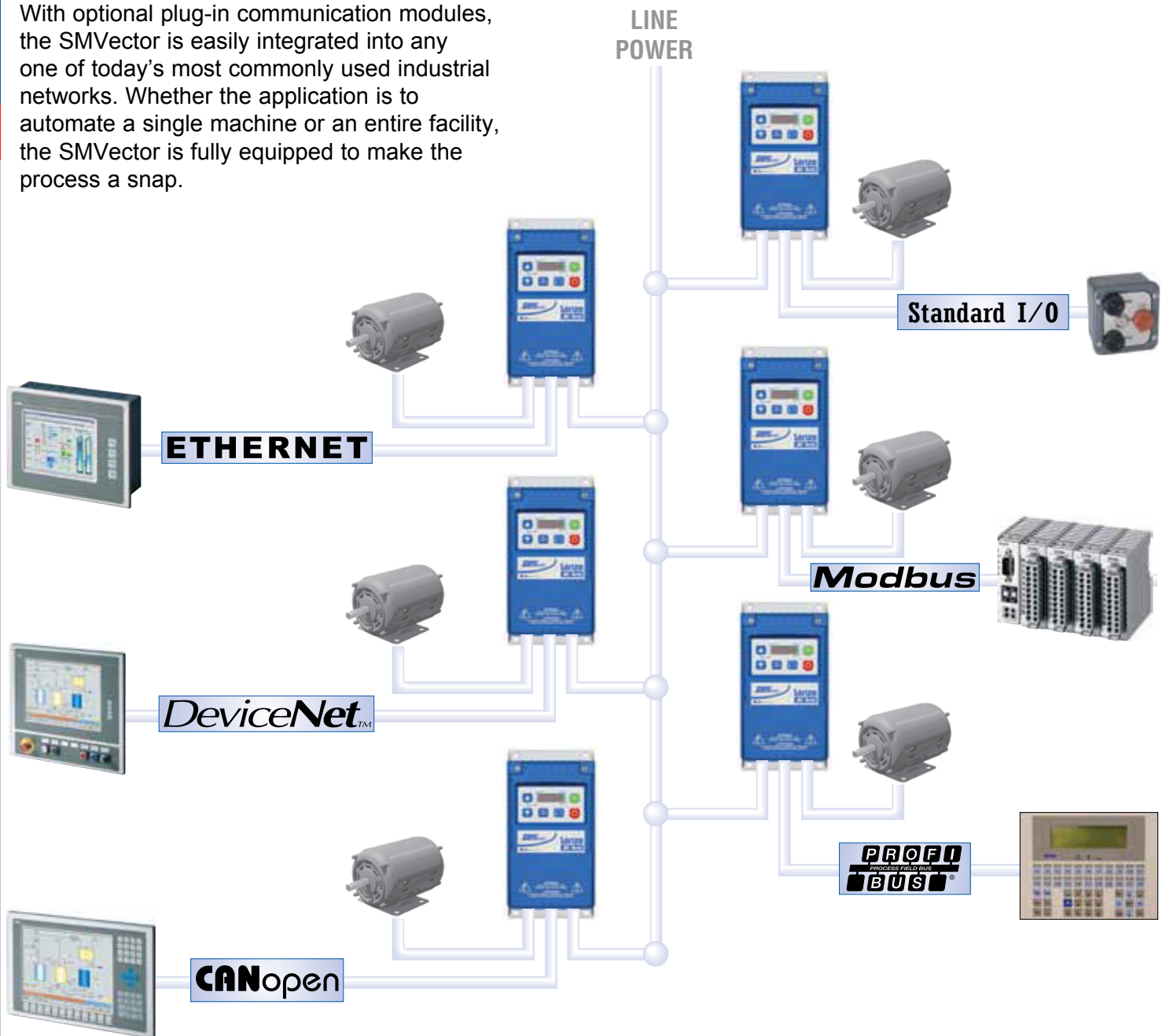
An extra IP21 finger guard ships with every drive.

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SMVector | Connectivity

With optional plug-in communication modules, the SMVector is easily integrated into any one of today's most commonly used industrial networks. Whether the application is to automate a single machine or an entire facility, the SMVector is fully equipped to make the process a snap.



NOTE: Communication options are available in NEMA 1 (IP31) and NEMA 4X (IP65) models.



Communication Module

Setting up a drive in a network has never been so simple. Order the SMVector and your choice of communication module. Simply snap the communication module into the terminal cover and the drive is ready to connect to the network. Or if the SMVector is already installed it can be easily upgraded in the field.

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SMVector | Ratings & Dimensions

120/240V* - 1Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C]/Outdoor[E]		NEMA4X w/Disconnect - Indoor	
Hp	kW	Model	Size	Model	Size	Model	Size
0.33	0.25	ESV251N01SXB	G1	N/A			
0.5	0.37	ESV371N01SXB	G1	ESV371N01SX[C] or [E]	R1	ESV371N01SMC	AA1
1	0.75	ESV751N01SXB	G1	ESV751N01SX[C] or [E]	R1	ESV751N01SMC	AA1
1.5	1.1	ESV112N01SXB	G2	ESV112N01SX[C] or [E]	R2	ESV112N01SMC	AA2

*120/240V models provide 0-230V output even with 120V input applied.

200/240V - 1 or 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C]/Outdoor[E]*		NEMA4X w/Disconnect - Indoor**	
Hp	kW	Model	Size	Model	Size	Model	Size
0.33	0.25	ESV251N02SXB***	G1	N/A			
0.5	0.37	ESV371N02YXB	G1	ESV371N02YX[C] or [E]	R1	ESV371N02YMC	AA1
1	0.75	ESV751N02YXB	G1	ESV751N02YX[C] or [E]	R1	ESV751N02YMC	AA1
1.5	1.1	ESV112N02YXB	G2	ESV112N02YX[C] or [E]	R2	ESV112N02YMC	AA2
2	1.5	ESV152N02YXB	G2	ESV152N02YX[C] or [E]	R2	ESV152N02YMC	AA2
3	2.2	ESV222N02YXB	G2	ESV222N02YX[C] or [E]	S1	ESV222N02YMC	AD1

*Filter versions are also available in 1-phase: Replace the "YX" in the Model Part Number with an "SF".

**Filter versions are also available in 1-phase: Replace the "YM" in the Model Part Number with an "SL".

***Model ESV251N02SXB is single-phase input only.

200/240V - 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]		NEMA4X w/Disconnect - Indoor	
Hp	kW	Model	Size	Model	Size	Model	Size
1.5	1.1	ESV112N02TXB	G2	N/A			
2	1.5	ESV152N02TXB	G2	N/A			
3	2.2	ESV222N02TXB	G2	N/A			
5	4	ESV402N02TXB	G3	ESV402N02TX[C] or [E]	V1	ESV402N02TMC	AC1
7.5	5.5	ESV552N02TXB	H1	ESV552N02TX[D] or [F]	T1	ESV552N02TMD	AB1
10	7.5	ESV752N02TXB	H1	ESV752N02TX[D] or [F]	T1	ESV752N02TMD	AB1
15	11	ESV113N02TXB	J1	ESV113N02TX[D] or [F]	W1	ESV113N02TMD	AF1
20	15	ESV153N02TXB	J1	ESV153N02TX[D] or [F]	W1	ESV153N02TMD	AF1

400/480V - 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]*		NEMA4X w/Disconnect - Indoor**	
Hp	kW	Model	Size	Model	Size	Model	Size
0.5	0.37	ESV371N04TXB	G1	ESV371N04TX[C] or [E]	R1	ESV371N04TMC	AA1
1	0.75	ESV751N04TXB	G1	ESV751N04TX[C] or [E]	R1	ESV751N04TMC	AA1
1.5	1.1	ESV112N04TXB	G2	ESV112N04TX[C] or [E]	R2	ESV112N04TMC	AA2
2	1.5	ESV152N04TXB	G2	ESV152N04TX[C] or [E]	R2	ESV152N04TMC	AA2
3	2.2	ESV222N04TXB	G2	ESV222N04TX[C] or [E]	R2	ESV222N04TMC	AA2
5	4	ESV402N04TXB	G3	ESV402N04TX[C] or [E]	V1	ESV402N04TMC	AC1
7.5	5.5	ESV552N04TXB	H1	ESV552N04TX[C] or [E]	V1	ESV552N04TMC	AC1
10	7.5	ESV752N04TXB	H1	ESV752N04TX[D] or [F]	T1	ESV752N04TMD	AB1
15	11	ESV113N04TXB	J1	ESV113N04TX[D] or [F]	W1	ESV113N04TMD	AE1
20	15	ESV153N04TXB	J1	ESV153N04TX[D] or [F]	W1	ESV153N04TMD	AE1
25	18.5	ESV183N04TXB	J1	ESV183N04TX[D] or [F]	W1	ESV183N04TMD	AF1
30	22	ESV223N04TXB	J1	ESV223N04TX[D] or [F]	X1	ESV223N04TMD	AF1
40	30	ESV303N04TXB	K1	N/A			
50	37.5	ESV373N04TXB	K2	N/A			
60	45	ESV453N04TXB	K3	N/A			

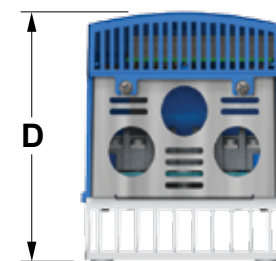
*Filter versions are also available in 1-phase: Replace the "X" in the Model Part Number with an "F".

**Filter versions are also available in 1-phase: Replace the "M" in the Model Part Number with an "L".

600V - 3Ø Input (3Ø Output)

Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]		NEMA4X w/Disconnect - Indoor	
Hp	kW	Model	Size	Model	Size	Model	Size
1	0.75	ESV751N06TXB	G1	ESV751N06TX[C] or [E]	R1	ESV751N06TMC	AA1
2	1.5	ESV152N06TXB	G2	ESV152N06TX[C] or [E]	R2	ESV152N06TMC	AA2
3	2.2	ESV222N06TXB	G2	ESV222N06TX[C] or [E]	R2	ESV222N06TMC	AA2
5	4	ESV402N06TXB	G3	ESV402N06TX[C] or [E]	V1	ESV402N06TMC	AC1
7.5	5.5	ESV552N06TXB	H1	ESV552N06TX[C] or [E]	V1	ESV552N06TMC	AC1
10	7.5	ESV752N06TXB	H1	ESV752N06TX[D] or [F]	T1	ESV752N06TMD	AB1
15	11	ESV113N06TXB	J1	ESV113N06TX[D] or [F]	W1	ESV113N06TMD	AE1
20	15	ESV153N06TXB	J1	ESV153N06TX[D] or [F]	W1	ESV153N06TMD	AE1
25	18.5	ESV183N06TXB	J1	ESV183N06TX[D] or [F]	W1	ESV183N06TMD	AF1
30	22	ESV223N06TXB	J1	ESV223N06TX[D] or [F]	X1	ESV223N06TMD	AF1
40	30	ESV303N06TXB	K1	N/A			
50	37.5	ESV373N06TXB	K2	N/A			
60	45	ESV453N06TXB	K3	N/A			

SMV NEMA 1 (IP31)



Bottom Entry with NEMA 1 Steel Conduit Plate



Bottom Entry with IP31 Finger Guard

Dimensions

	H		W		D	
	in.	mm	in.	mm	in.	mm
G1	7.50	190	3.90	99	4.40	111
G2	7.60	191	3.90	99	5.50	138
G3	7.60	191	3.90	99	5.80	147
H1	9.90	250	5.20	130	6.30	160
J1	12.50	318	7.00	176	8.10	205
K1	14.19	360	8.72	221	10.07	256
K2	17.19	436	8.72	221	10.07	256
K3	20.19	513	8.72	221	10.07	256
R1	8.00	203	6.30	160	4.50	114
R2	8.00	203	6.30	160	6.30	160
S1	8.00	203	7.10	181	6.80	172
T1	10.00	254	8.10	204	8.00	203
V1	10.00	254	9.00	228	8.00	203
W1	14.40	366	9.40	240	9.50	241
X1	18.50	470	9.40	240	9.50	241
AA1	11.00	279	6.30	160	5.40	136
AA2	11.00	279	6.30	160	7.20	182
AB1	13.00	330	8.10	204	8.90	225
AC1	13.00	330	9.00	228	9.00	226
AD1	11.00	279	7.10	181	7.70	194
AE1	14.40	366	9.40	240	10.20	259
AF1	18.50	470	9.40	240	10.20	259

SMV

Frequency Inverter



Operating instructions EN



Lenze

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All information given in this documentation has been carefully selected and tested for compliance with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not accept any responsibility nor liability for damages that may occur. Any necessary corrections will be implemented in subsequent editions.

This document printed in the United States

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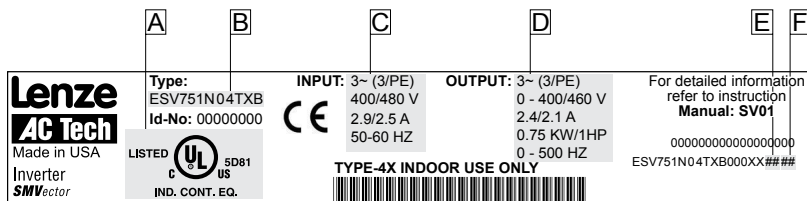


About These Instructions

This documentation applies to the SMV frequency inverter and contains important technical data regarding the installation, operation, and commissioning of the inverter.

These instructions are only valid for SMV frequency inverters with software revision 4.23 or higher for version 4.23 software, the drive nameplate illustrated below would show “42” in the “F” location.

Please read these instructions in their entirety before commissioning the drive.



A	B	C	D	E	F
Certifications	Type	Input Ratings	Output Ratings	Hardware Version	Software Version

Scope of delivery	Important
<ul style="list-style-type: none">1 SMV Inverter with EPM installed (see Section 4.4)1 Operating Instructions manual	<p>After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. Lenze AC Tech does not accept any liability for deficiencies claimed subsequently.</p> <p>Claim:</p> <ul style="list-style-type: none">visible transport damage immediately to the forwarder.visible deficiencies /incompleteness immediately to your Lenze AC Tech representative

Related Documents

The documentation listed herein contains information relevant to the operation of the SMVector frequency inverter. To obtain the latest documentation, visit the Technical Library at <http://www.lenzeamericas.com>.

Document #	Description
CMVINS01	SMVector Communications Module Installation Instruction
CMVMB401	SMVector ModBus RTU over RS485 Communications Reference Guide
CMVLC401	SMVector Locom Communications Reference Guide
CMVCAN01	SMVector CANopen Communications Reference Guide
CMVDVN01	SMVector DeviceNet Communications Reference Guide
CMVETH01	SMVector EtherNet/IP Communications Reference Guide
CMVPFB01	SMVector PROFIBUS Communications Reference Guide
ALSV01	SMVector Additional I/O Module Installation and Operation Manual
DBV01	SMVector Dynamic Braking
PTV01	SMVector Potentiometer Install Instructions
RKV01	SMVector ESZVK1 Remote Keypad
RKVU01	SMVector ESZVXH0 Remote Keypad (for NEMA 1 15-60HP (11-45kW) Drives)



1 Safety Information

General

Some parts of Lenze AC Tech controllers can be electrically live and some surfaces can be hot. Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel and/or damage to equipment.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of variable frequency drives and the application for which it is being used.

Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport, handling, installation or maintenance. Do not touch any electronic components or contacts. This drive contains electrostatically sensitive components, which can easily be damaged by inappropriate handling. Static control precautions must be adhered to during installation, testing, servicing and repairing of this drive and associated options. Component damage may result if proper procedures are not followed.

To ensure proper operation, do not install the drive where it is subjected to adverse environmental conditions such as combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

This drive has been tested by Underwriters Laboratory (UL) and is UL Listed in compliance with the UL508C Safety Standard. This drive must be installed and configured in accordance with both national and international standards. Local codes and regulations take precedence over recommendations provided in this and other Lenze AC Tech documentation.

The SMVector drive is considered a component for integration into a machine or process. It is neither a machine nor a device ready for use in accordance with European directives (reference machinery directive and electromagnetic compatibility directive). It is the responsibility of the end user to ensure that the machine meets the applicable standards.

Electrical Connection

When working on live drive controllers, applicable national safety regulations must be observed. The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, protective earth [PE] connection). While this document does make recommendations in regards to these items, national and local codes must be adhered to.

The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

Application

The drive must not be used as a safety device for machines where there is a risk of personal injury or material damage. Emergency Stops, over-speed protection, acceleration and deceleration limits, etc must be made by other devices to ensure operation under all conditions.

The drive does feature many protection devices that work to protect the drive and the driven equipment by generating a fault and shutting the drive and motor down. Mains power variances can also result in shutdown of the drive. When the fault condition disappears or is cleared, the drive can be configured to automatically restart, it is the responsibility of the user, OEM and/or integrator to ensure that the drive is configured for safe operation.



Safety Information

Explosion Proof Applications

Explosion proof motors that are not rated for inverter use lose their certification when used for variable speed. Due to the many areas of liability that may be encountered when dealing with these applications, the following statement of policy applies:

Lenze AC Tech Corporation inverter products are sold with no warranty of fitness for a particular purpose or warranty of suitability for use with explosion proof motors. Lenze AC Tech Corporation accepts no responsibility for any direct, incidental or consequential loss, cost or damage that may arise through the use of AC inverter products in these applications. The purchaser expressly agrees to assume all risk of any loss, cost or damage that may arise from such application.

Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). The controller may be adapted to your application as described in this documentation.



DANGER!

- After the controller has been disconnected from the supply voltage, live components and power connection must not be touched immediately, since capacitors could be charged. Please observe the corresponding notes on the controller.
- Close all protective covers and doors prior to and during operation.
- Do not cycle input power to the controller more than once every two minutes.
- For SMVector models that are equipped with a Disconnect Switch (11th character in model number is L or M), the Disconnect Switch is intended as a motor service disconnect and does not provide branch circuit protection to the inverter or motor. When servicing the motor, it is necessary to wait 3 minutes after turning this switch to the off position before working on motor power wiring as the inverter stores electrical power. To service the inverter, it is necessary to remove mains ahead of the drive and wait 3 minutes.

Safety Notifications

All safety information given in these Operating Instructions includes a visual icon, a bold signal word and a description.



Signal Word! (characterizes the severity of the danger)

NOTE (describes the danger and informs on how to proceed)

Icon	Signal Word	Meaning	Consequences if ignored
	DANGER!	Warns of hazardous electrical voltage.	Death or severe injuries.
	WARNING!	Warns of potential, very hazardous situations.	Risk of severe injury to personnel and/or damage to equipment.
	WARNING! Hot Surface	Warns of hot surface and risk of burns. Labels may be on or inside the equipment to alert people that surfaces may reach dangerous temperatures.	Risk of severe injury to personnel.
	STOP!	Warns of potential damage to material and equipment.	Damage to the controller/drive or its environment.
	NOTE	Designates a general, useful note.	None. If observed, then using the controller/drive system is made easier.



Harmonics Notification in accordance with EN 61000-3-2, EN 61000-3-12:

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

Directive	Total Power connected to Mains (public supply)	Additional Measures Required for Compliance ⁽²⁾
EN 61000-3-2	< 0.5kW	with mains choke
	0.5 ... 1kW	with active filter
	> 1kW	complies without additional measures
EN 61000-3-12	16 ... 75amp	Additional measures are required for compliance with the standard

(1) For compliance with EMC regulations, the permissible cable lengths may change.

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

Safety Information in accordance with EN 61800-5-1:



DANGER! - Risk of Electric Shock

Capacitors retain charge for approximately 180 seconds after power is removed. Disconnect incoming power and wait at least 3 minutes before touching the drive.

DANGER! - Risque de choc électrique

Les condensateurs restent sous charge pendant environ 180 secondes après une coupure de courant. Couper l'alimentation et patienter pendant au moins 3 minutes avant de toucher l'entraînement.



WARNING!

- This product can cause a d.c. current in the PE conductor. Where a residual current-operated (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM Type B is allowed on the supply side of this product.
- Leakage Current may exceed 3.5mA AC. The minimum size of the PE conductor shall comply with local safety regulations for high leakage current equipment.
- In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.



Safety Information

Safety Information in accordance with UL:

Note for UL approved system with integrated controllers: UL warnings are notes which apply to UL systems.
The documentation contains special information about UL.



- Integral solid state protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. The use of fuses or circuit breakers is the only approved means for branch circuit protection.
- When protected by CC and T Class Fuses, suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, at the maximum voltage rating marked on the drive.
- Additionally suitable when protected by a circuit breaker having an interrupting rating not less than 200,000 rms symmetrical amperes, at the maximum voltage rating marked on the drive. (Excludes ESV113xx2T, ESV153xx2T, ESV113xx4T, ESV153xx4T, ESV183xx4T, ESV223xx4T, ESV303xx4T, ESV113xx6T, ESV153xx6T, ESV183xx6T, ESV223xx6T, and ESV303xx6T).
- Use minimum 75°C copper wire only, except for control circuits.
- For control circuits, use wiring suitable for NEC Class 1 circuits only.
- Torque Requirements (in accordance with UL) are listed in section 3.2.1, Power Connections and in 3.2.3, Control terminals
- Shall be installed in a pollution degree 2 macro-environment.
- NEMA 1 (IP31) models shall be installed in a pollution degree 2 macro-environment.
- All models are suitable for installation in a compartment handling Conditioned Air (i.e., plenum rated).



WARNING!

The opening of branch-circuit protective device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, current carrying parts and other components of the controller should be examined and replaced if damaged.



AVERTISSEMENT!

Le déclenchement du dispositif de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défaut. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur et les remplacer s'ils sont endommagés. En cas de grillage de l'élément traverse par le courant dans un relais de surcharge, le relais tout entier doit être remplacé.



NOTE

Control and communications terminals provide reinforced insulation (i.e. considered SELV or PELV, providing protection in case of direct contact) when the drive is connected to a power system rated up to 300VAC between phase to ground (PE) and the applied voltage on Terminals 16 and 17 is less than 150VAC between phase to ground. Otherwise, control and communications terminals provide basic insulation.



2 Technical Data

2.1 Standards and Application Conditions

Conformity	CE	Low Voltage (2006/95/EC) & EMC (2004/108/EC) Directives
Approvals	UL508C	Underwriters Laboratories -Power Conversion Equipment
Input voltage phase imbalance	≤ 2%	
Supported Power Systems	TT TN	<ul style="list-style-type: none"> For central grounded systems, operation is permitted without restrictions. For corner grounded 400/500V systems, operation is possible but reinforced insulation to control circuits is compromised.
Humidity	≤ 95% non-condensing	
Temperature range	Transport	-25 ... +70°C
	Storage	-20 ... +70°C
	Operation	-10 ... +55°C (with 2.5%/°C current derating above +40°C)
Installation height	0 - 4000m a.m.s.l.	(with 5%/1000 m current derating above 1000m a.m.s.l.)
Vibration resistance	acceleration resistant up to 1.0g	
⚠ Earth leakage current	> 3.5 mA to PE	
Max Permissible Cable Length ⁽¹⁾	≤ 4.0 Hp (3.0 kW)	30 meters shielded, 60 meters un-shielded
	> 5.0 Hp (3.7 kW)	50 meters shielded, 100 meters un-shielded.
Enclosure	IP31/NEMA 1	IP65/NEMA 4X
	NEMA 1 and NEMA 4X model enclosures are plenum rated in accordance with UL 508C and are suitable for installation in a compartment handling conditioned air.	
Protection measures against	Earth fault, phase loss, over voltage, under voltage, motor stalling, over temperature motor overload (125% of FLA), short circuit (SCCR=200kA at rated voltage)	
Compliance with EN 61000-3-2 Requirements ⁽²⁾	< 0.5kW	with mains choke
	0.5 ... 1kW	with active filter
	> 1kW	without additional measures
Compliance with EN 61000-3-12 Requirements ⁽²⁾	16 ... 75amp	Additional measures required for compliance with EN 61000-3-12

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

(1) The stated cable lengths are permissible at default carrier frequencies (refer to parameter P166).

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.



2.2 SMV Type Number Designation

The table herein describes the Type numbering designation for the SMVector Inverter models.

	ESV	152	NO	2	T	X	B
Electrical Products in the SMVector Series							
Power Rating in kW:							
251 = 0.25kW (0.33HP)		113 = 11.0kW (15HP)					
371 = 0.37kW (0.5HP)		153 = 15.0kW (20HP)					
751 = 0.75kW (1HP)		183 = 18.5kW (25HP)					
112 = 1.1kW (1.5HP)		223 = 22.0kW (30HP)					
152 = 1.5kW (2HP)		303 = 30.0kW (40HP)					
222 = 2.2kW (3HP)		373 = 37.5kW (50HP)					
302 = 3.0kW (4HP)		453 = 45.0kW (60HP)					
402 = 4.0kW (5HP)							
552 = 5.5kW (7.5HP)							
752 = 7.5kW (10HP)							
Installed I/O & Communication Module(s):							
C_ = CANopen (Available all models)		The " _ " blank can be:					
D_ = DeviceNet (Available all models)		0 = Standard Keypad					
E_ = Ethernet/IP, (Available all models)							
R_ = RS-485 / ModBus /Lecom (Avail all models)							
P_ = Profibus-DP (Available all models)							
N_ = No Communications installed							
Input Voltage:							
1 = 120 VAC (doubler output) or 240 VAC							
2 = 240 VAC							
4 = 400/480 VAC							
6 = 600 VAC							
Input Phase:							
S = Single Phase Input only							
Y = Single or Three Phase Input							
T = Three Phase Input only							
Input Line Filter							
F = Integral EMC Filter							
L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)							
M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)							
X = No EMC Filter/ No Disconnect Switch							
Enclosure:							
B = NEMA 1/IP31; Indoor only							
C = NEMA 4X/IP65; Indoor only; Convection cooled							
D = NEMA 4X/IP65; Indoor only; Fan cooled							
E = NEMA 4X/IP65; Indoor/Outdoor; Convection cooled							
F = NEMA 4X/IP65; Indoor/Outdoor; Fan cooled							



NOTE

Prior to installation make sure the enclosure is suitable for the end-use environment

Variables that influence enclosure suitability include (but are not limited to) temperature, airborne contaminants, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).



2.3 Ratings

120V / 240VAC Models

Mains = 120V Single Phase (1/N/PE) (90...132V), 240V Single Phase (2/PE) (170...264V); 48...62Hz									
Type	Power		Mains Current		Output Current		Heat Loss (Watts)		
	Hp	kW	120V A	240V A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filtre	N4X/IP65 W/ filtre
ESV251--1S--	0.33	0.25	6.8	3.4	1.7	200	24		
ESV371--1S--	0.5	0.37	9.2	4.6	2.4	200	32	32	
ESV751--1S--	1	0.75	16.6	8.3	4.2	200	52	41	
ESV112--1S--	1.5	1.1	20	10.0	6.0	200	74	74	

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (I_n) rating and is adjustable in parameter P171.

240VAC Models

Mains = 240V Single Phase (2/PE) (170...264V); 48...62Hz								
Type	Power		Mains Current	Output Current		Heat Loss (Watts)		
	Hp	kW	240V A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filtre	N4X/IP65 W/ filtre
ESV251--2S--	0.33	0.25	3.4	1.7	200	20		
ESV371--2S--	0.5	0.37	5.1	2.4	200			30
ESV751--2S--	1	0.75	8.8	4.2	200			42
ESV112--2S--	1.5	1.1	12.0	6.0	200			63
ESV152--2S--	2	1.5	13.3	7.0	200			73
ESV222--2S--	3	2.2	17.1	9.6	200			97

240V Single Phase (2/PE) (170...264V), 240V Three Phase (3/PE) (170...264V); 48...62Hz									
Type	Power		Mains Current		Output Current		Heat Loss (Watts)		
	Hp	kW	1~ (2/PE) A	3~ (3/PE) A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filtre	N4X/IP65 W/ filtre
ESV371--2Y--	0.5	0.37	5.1	2.9	2.4	200	27	26	
ESV751--2Y--	1	0.75	8.8	5.0	4.2	200	41	38	
ESV112--2Y--	1.5	1.1	12.0	6.9	6.0	200	64	59	
ESV152--2Y--	2	1.5	13.3	8.1	7.0	200	75	69	
ESV222--2Y--	3	2.2	17.1	10.8	9.6	200	103	93	

240V Three Phase (3/PE) (170...264V); 48...62Hz								
Type	Power		Mains Current	Output Current		Heat Loss (Watts)		
	Hp	kW	240V A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filtre	N4X/IP65 W/ filtre



Technical Data

ESV112--2T--	1.5	1.1	6.9	6	200	64		
ESV152--2T--	2	1.5	8.1	7	200	75		
ESV222--2T--	3	2.2	10.8	9.6	200	103		
ESV402--2T--	5	4.0	18.6	16.5	200	154	139	
ESV552--2T--	7.5	5.5	26	23	200	225	167	
ESV752--2T--	10	7.5	33	29	200	274	242	
ESV113--2T--	15	11	48	42	180	485	468	
ESV153--2T--	20	15	59	54	180	614	591	

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

400...480VAC Models

400 ... 480V Three Phase (3/PE) (400V: 340...440V), (480V: 340...528V); 48...62Hz											
Type	Power		Mains Current		Output Current				Heat Loss (Watts)		
	Hp	kW	400V A	480V A	Cont (I _n) A		Max I %		N1/IP31	N4X/IP65 No filte	N4X/IP65 W/ filte
					400V	480V	400V	480V			
ESV371--4T--	0.5	0.37	1.7	1.5	1.3	1.1	175	200	23	21	25
ESV751--4T--	1	0.75	2.9	2.5	2.4	2.1	175	200	37	33	37
ESV112--4T--	1.5	1.1	4.2	3.6	3.5	3.0	175	200	48	42	46
ESV152--4T--	2	1.5	4.7	4.1	4.0	3.5	175	200	57	50	54
ESV222--4T--	3	2.2	6.1	5.4	5.5	4.8	175	200	87	78	82
ESV302--4T--	4	3.0	8.3	7.0	7.6	6.3	175	200			95
ESV402--4T--	5	4.0	10.6	9.3	9.4	8.2	175	200	128	103	111
ESV552--4T--	7.5	5.5	14.2	12.4	12.6	11.0	175	200	178	157	165
ESV752--4T--	10	7.5	18.1	15.8	16.1	14.0	175	200	208	190	198
ESV113--4T--	15	11	27	24	24	21	155	180	418	388	398
ESV153--4T--	20	15	35	31	31	27	155	180	493	449	459
ESV183--4T--	25	18.5	44	38	39	34	155	180	645	589	600
ESV223--4T--	30	22	52	45	46	40	155	180	709	637	647
ESV303--4T--	40	30	68	59	60	52	155	180	1020		
ESV373--4T--	50	37.5	85	74	75	65	155	180	1275		
ESV453--4T--	60	45	100	87	88	77	155	180	1530		

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

For 400...480 VAC models, the output current maximum (%) in the 400V column is used when P107 = 0

For 400...480 VAC models, the output current maximum (%) in the 480V column is used when P107 = 1



600VAC Models

600V Three Phase (3/PE) (425...660V); 48...62Hz								
Type	Power		Mains Current	Output Current		Heat Loss (Watts)		
	Hp	kW	A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filte	N4X/IP65 W/ filte
ESV751--6T--	1	0.75	2	1.7	200	37	31	
ESV152--6T--	2	1.5	3.2	2.7	200	51	43	
ESV222--6T--	3	2.2	4.4	3.9	200	68	57	
ESV402--6T--	5	4	6.8	6.1	200	101	67	
ESV552--6T--	7.5	5.5	10.2	9	200	148	116	
ESV752--6T--	10	7.5	12.4	11	200	172	152	
ESV113--6T--	15	11	19.7	17	180	380	356	
ESV153--6T--	20	15	25	22	180	463	431	
ESV183--6T--	25	18.5	31	27	180	560	519	
ESV223--6T--	30	22	36	32	180	640	592	
ESV303--6T--	40	30	47	41	180	930		
ESV373--6T--	50	37.5	59	52	180	1163		
ESV453--6T--	60	45	71	62	180	1395		

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (I_n) rating and is adjustable in parameter P171.



STOP!

- For installations above 1000m a.m.s.l., derate I_n by 5% per 1000m, do not exceed 4000m a.m.s.l.
- Operation above 40°C, derate I_n by 2.5% per °C, do not exceed 55°C.

Output Current (I_n) derating for Carrier Frequency (P166) for NEMA 1 (IP31) Models:

- If P166=2 (8 kHz), derate I_n to 92% of drive rating
- If P166=3 (10 kHz), derate I_n to 84% of drive rating

Output Current (I_n) derating for Carrier Frequency (P166) for NEMA 4X (IP65) Models:

- If P166=1 (6 kHz), derate I_n to 92% of drive rating
- If P166=2 (8 kHz), derate I_n to 84% of drive rating
- If P166=3 (10 kHz), derate I_n to 76% of drive rating



Installation

3 Installation

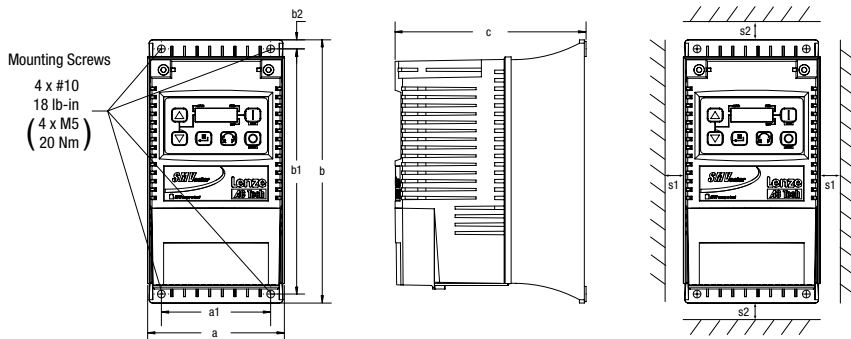
3.1 Dimensions and Mounting



WARNING!

Drives must not be installed where subjected to adverse environmental conditions such as: combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

3.1.1 NEMA 1 (IP31) Models ≤ 30HP (22kW)

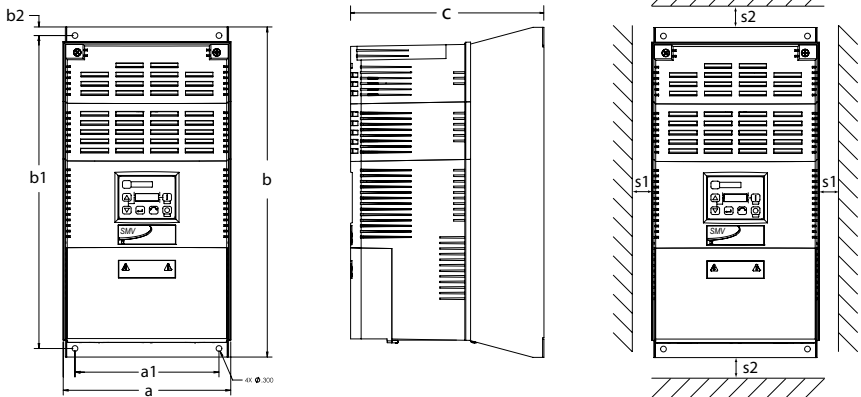


	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
G1	ESV251-----B; ESV371 ESV751-----B	3.90 (99)	3.12 (79)	7.48 (190)	7.00 (178)	0.24 (6)	4.35 (111)	0.6 (15)	2.0 (50)	2.0 (0.9)
G2	ESV112-----B; ESV152-----B ESV222-----B	3.90 (99)	3.12 (79)	7.52 (191)	7.00 (178)	0.26 (7)	5.45 (138)	0.6 (15)	2.0 (50)	2.8 (1.3)
G3	ESV402-----B	3.90 (99)	3.12 (79)	7.52 (191)	7.00 (178)	0.30 (8)	5.80 (147)	0.6 (15)	2.0 (50)	3.2 (1.5)
H1	ESV552-----B; ESV752-----B	5.12 (130)	4.25 (108)	9.83 (250)	9.30 (236)	0.26 (7)	6.30 (160)	0.6 (15)	2.0 (50)	6.0 (2.0)
J1	ESV113-----B; ESV153-----B ESV183-----B; ESV223-----B	6.92 (176)	5.75 (146)	12.50 (318)	11.88 (302)	0.31 (8)	8.09 (205)	0.6 (15)	2.0 (50)	13.55 (6.15)

Conduit Hole Dimensions	Type	N in (mm)	P in (mm)	P1 in (mm)	Q in (mm)	S in (mm)
	G1	1.84 (47)	1.93 (49)	.70 (18)	1.00 (25)	.88 (22)
	G2	1.84 (47)	3.03 (77)	.70 (18)	1.00 (25)	.88 (22)
	G3	1.84 (47)	3.38 (86)	.70 (18)	1.00 (25)	.88 (22)
	H1	2.46 (62)	3.55 (90)	.13 (3)	1.38 (35)	1.13 (29) .88 (22)
	J1	3.32 (84)	4.62 (117)	.73 (19)	1.40 (36)	1.31 (33) .88 (22)



3.1.2 NEMA 1 (IP31) Models > 30HP (22kW)



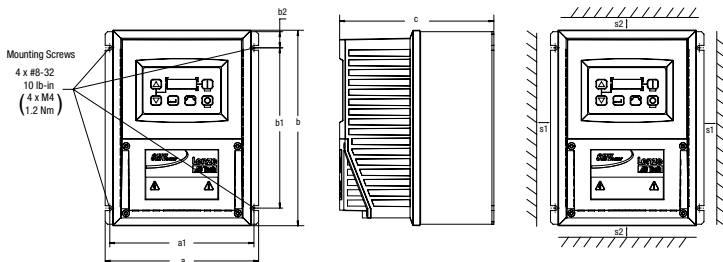
	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
K1	ESV303~4~-B; ESV303~6~-B	8.72 (221)	7.50 (190)	14.19 (360)	13.30 (338)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	24 (10.9)
K2	ESV373~4~-B; ESV373~6~-B	8.72 (221)	7.50 (190)	17.19 (436)	16.30 (414)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	31 (14.1)
K3	ESV453~4~-B ESV453~6~-b	8.72 (221)	7.50 (190)	20.19 (513)	19.30 (490)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	35 (15.9)

Conduit Hole Dimensions	Type	N in (mm)	P in (mm)	P1 in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
	K1	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)
	K2	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)
	K3	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)



Installation

3.1.3 NEMA 4X (IP65) Models



	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
R1	ESV371N01SX ; ESV751N01SX ; ESV371N02YX ; ESV751N02YX ; ESV371N04TX ; ESV751N04TX ; ESV751N06TX ; ESV371N02SF ; ESV751N02SF ; ESV371N04TF ; ESV751N04TF ;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	0.66 (17)	4.47 (114)	2.00 (51)	2.00 (51)	3.6 (1.63)
R2	ESV112N01SX ; ESV112N02YX ; ESV152N02YX ; ESV112N04TX ; ESV152N04TX ; ESV222N04TX ; ESV152N06TX ; ESV222N06TX ; ESV112N02SF ; ESV152N02SF ; ESV112N04TF ; ESV152N04TF ; ESV222N04TF ; ESV302N04TF ;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	0.66 (17)	6.31 (160)	2.00 (51)	2.00 (51)	5.9 (2.68)
S1	ESV222N02YX ; ESV222N02SF ;	7.12 (181)	6.74 (171)	8.00 (203)	6.56 (167)	0.66 (17)	6.77 (172)	2.00 (51)	2.00 (51)	7.1 (3.24)
T1	ESV552N02TX- ; ESV752N02TX- ; ESV752N04TX- ; ESV752N06TX- ; ESV752N04TF- ;	8.04 (204)	7.56 (192)	10.00 (254)	8.04 (204)	0.92 (23)	8.00 (203)	4.00 (102)	4.00 (102)	10.98 (4.98)
V1	ESV402N02TX ; ESV402N04TX ; ESV552N04TX ; ESV402N06TX ; ESV552N06TX ; ESV402N04TF ; ESV552N04TF ;	8.96 (228)	8.48 (215)	10.00 (254)	8.04 (204)	0.92 (23)	8.00 (203)	4.00 (102)	4.00 (102)	11.58 (5.25)
W1	ESV113N02TX- ; ESV153N02TX- ; ESV113N04TX- ; ESV153N04TX- ; ESV113N04TF- ; ESV153N04TF- ; ESV113N06TX- ; ESV153N06TX- ; ESV183N04TX- ; ESV183N04TF- ; ESV183N06TX- ;	9.42 (240)	8.94 (228)	14.50 (368)	12.54 (319)	0.92 (24)	9.45 (241)	4.00 (102)	4.00 (102)	22.0 (10.0)
X1	ESV223N04TX- ; ESV223N04TF- ; ESV223N06TX- ;	9.42 (240)	8.94 (228)	18.5 (470)	16.54 (420)	0.92 (24)	9.45 (241)	4.00 (102)	4.00 (102)	25.5 (11.6)

_ = Last digit of part number:

C = N4X Indoor (convection cooled)

E = N4X In/Outdoor (convection cooled)

~ = Last digit of part number:

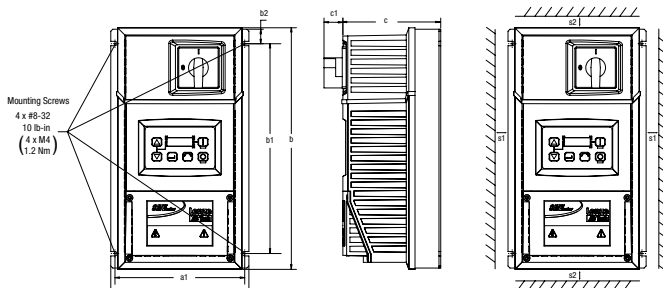
D = N4X Indoor (fan cooled)

F = N4X In/Outdoor (fan cooled)

Conduit Hole Dimensions		Type	N in (mm)	P in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
		R1	3.14 (80)	2.33 (59)	1.50 (38)	.88 (22)	n/a
		R2	3.14 (80)	4.18 (106)	1.50 (38)	.88 (22)	n/a
		S1	3.56 (90)	4.63 (118)	1.50 (38)	.88 (22)	n/a
		T1	4.02 (102)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		V1	4.48 (114)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		W1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)
		X1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)



3.1.4 NEMA 4X (IP65) Models with Disconnect Switch



	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	c1 in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
AA1	ESV371N01SM; ESV371N02YM; ESV371N02SL; ESV371N04TM; ESV371N04TL; ESV371N06TM; ESV751N01SM; ESV751N02YM; ESV751N02SL; ESV751N04TM; ESV751N04TL; ESV751N06TM;	6.28 (160)	5.90 (150)	10.99 (279)	9.54 (242)	0.66 (17)	4.47 (114)	.86 (22)	2.00 (51)	2.00 (51)	4.7 (2.13)
	ESV112N01SM; ESV112N02YM; ESV112N02SL; ESV112N04TM; ESV112N04TL; ESV152N02YM; ESV152N02SL; ESV152N04TM; ESV152N04TL; ESV152N06TM; ESV222N04TM; ESV222N04TL; ESV222N06TM; ESV302N04TL;	6.28 (160)	5.90 (150)	10.99 (279)	9.54 (242)	0.66 (17)	6.31 (160)	.86 (22)	2.00 (51)	2.00 (51)	7.9 (3.58)
	AD1	ESV222N02SL; ESV222N02YM;	7.12 (181)	6.74 (171)	10.99 (279)	9.54 (242)	0.66 (17)	6.77 (172)	.86 (22)	2.00 (51)	9.0 (4.08)
	AB1	ESV552N02TM; ESV752N02TM; ESV752N04TM; ESV752N06TM; ESV752N04TL;	8.04 (204)	7.56 (192)	13.00 (330)	11.04 (280)	0.92 (23)	8.00 (203)	.86 (22)	4.00 (102)	13.9 (6.32)
	AC1	ESV402N02TM; ESV402N04TM; ESV552N04TM; ESV402N06TM; ESV552N06TM; ESV402N04TL; ESV552N04TL;	8.96 (228)	8.48 (215)	13.00 (330)	11.04 (280)	0.92 (23)	8.04 (204)	.86 (22)	4.00 (102)	14.7 (6.66)
	AE1	ESV113N04TM; ESV153N04TM; ESV113N06TM; ESV153N06TM;	9.42 (240)	8.94 (228)	14.50 (368)	12.54 (319)	0.92 (24)	9.45 (241)	0.73 (19)	4.00 (102)	23.0 (10.4)
AF1	ESV113N02TM; ESV153N02TM; ESV113N04TL; ESV153N04TL; ESV183N04TL; ESV223N04TL; ESV183N04TM; ESV223N04TM; ESV183N06TM; ESV223N06TM;	9.42 (240)	8.94 (228)	18.5 (470)	16.54 (420)	0.92 (24)	9.45 (241)	0.73 (19)	4.00 (102)	4.00 (102)	28.5 (12.9)

_ = Last digit of part number: C = N4X Indoor (convection cooled)

~ = Last digit of part number: D = N4X Indoor (fan cooled)

Conduit Hole Dimensions		Type	N in (mm)	P in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
		AA1	3.14 (80)	2.33 (59)	1.50 (38)	.88 (22)	n/a
		AA2	3.14 (80)	4.18 (106)	1.50 (38)	.88 (22)	n/a
		AD1	3.56 (90)	4.63 (118)	1.50 (38)	.88 (22)	n/a
		AB1	4.02 (102)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		AC1	4.48 (114)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		AE1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)
		AF1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)



Installation

3.2 Electrical Installation

Installation After a Long Period of Storage



STOP!

Severe damage to the drive can result if it is operated after a long period of storage or inactivity without reforming the DC bus capacitors.

If input power has not been applied to the drive for a period of time exceeding three years (due to storage, etc), the electrolytic DC bus capacitors within the drive can change internally, resulting in excessive leakage current. This can result in premature failure of the capacitors if the drive is operated after such a long period of inactivity or storage.

In order to reform the capacitors and prepare the drive for operation after a long period of inactivity, apply input power to the drive for 8 hours prior to actually operating the motor.

3.2.1 Power Connections



STOP!

If the kVA rating of the AC supply transformer is greater than 10 times the input kVA rating of the drive(s), an isolation transformer or 2-3% input line reactor must be added to the line side of the drive(s).




DANGER! Hazard of electrical shock!

Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.

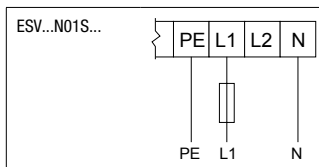


STOP!

- Verify mains voltage before connecting to drive.
- Do not connect mains power to the output terminals (U,V,W)! Severe damage to the drive will result.
- Do not cycle mains power more than once every two minutes. Damage to the drive may result.

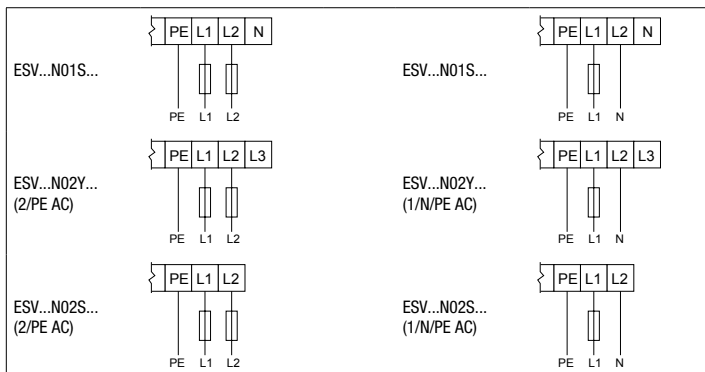
	Mains and Motor Terminations		
	Type	Torque	Strip Length
	<5HP	12 lb-in (1.3 Nm)	5/16 in (8mm)
	ESV552xx2T, ESV752xx2T, ESV113xx4/6, ESV153xx4/6, ESV183xx6, ESV223xx6	16 lb-in (1.8 Nm)	5/16 in (8mm)
	ESV552xx4Txx, ESV752xx4Txx, ESV552xx6Txx, ESV752xx6Txx	12 lb-in (1.3Nm)	0.25 in (6mm)
	ESV113xx2xxx, ESV153xx2xxx, ESV183xx4xxx, ESV223xx4xxx, ESV303xx4xxx	24 lb-in (2.7 Nm)	7/16 in (10mm)
	ESV373xx4xxx, ESV453xx4xxx	27 lb-in (3.05 Nm)	0.75 in (19mm)
Torque: N4X/IP65 Door Screws			
	N4X/IP65	6-7 lb-in (0.67-0.79 Nm)	0.25 in (6mm)

3.2.1.1 Mains Connection to 120VAC Single-Phase Supply

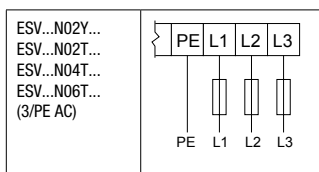




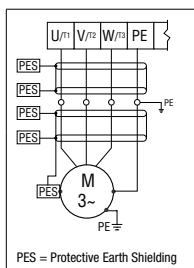
3.2.1.2 Mains Connection to 240VAC Single-Phase Supply



3.2.1.3 Mains Connection to Three-Phase Supply



3.2.1.4 Motor Connection



WARNING!

If the cable connection between the drive and the motor has an in-line contactor or circuit breaker then the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.



WARNING!

Leakage current may exceed 3.5 mA AC. The minimum size of the protective earth (PE) conductor shall comply with local safety regulations for high leakage current equipment.



STOP!

In the case of a Spinning Motor:

To bring free-wheeling loads such as fans to a rest before starting the drive, use the DC injection braking function. Starting a drive into a freewheeling motor creates a direct short-circuit and may result in damage to the drive.

Confirm motor suitability for use with DC injection braking.

Consult parameter P110 for starting / restarting into spinning motors.



Installation

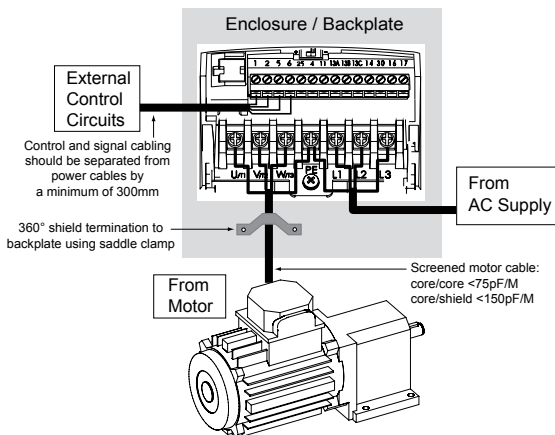
3.2.1.5 Installation Recommendations for EMC Compliance

For compliance with EN 61800-3 or other EMC standards, motor cables, line cables and control or communications cables must be shielded with each shield/screen clamped to the drive chassis. This clamp is typically located at the conduit mounting plate.

The EMC requirements apply to the final installation in its entirety, not to the individual components used. Because every installation is different, the recommended installation should follow these guidelines as a minimum. Additional equipment (such as ferrite core absorbers on power conductors) or alternative practices may be required to meet conformance in some installations.

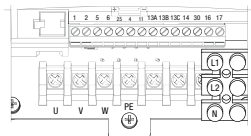
Motor cable should be low capacitance (core/core <75pF/m, core/shield <150pF/m). Filtered drives can meet the class A limits of EN 55011 and EN 61800-3 Category 2 with this type of motor cable up to 10 meters.

NOTE: Refer to Appendix A for recommended cable lengths. Any external line filter should have its chassis connected to the drive chassis by mounting hardware or with the shortest possible wire or braid.

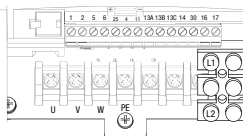


3.2.1.6 NEMA 4X (IP65) Input Terminal Block

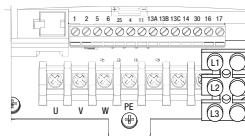
For NEMA 4X (IP65) models with integrated EMC filter and/or integrated line disconnect, the input terminal block is located on the right-hand side of the SMV inverter in the NEMA 4 X (IP65) enclosure. The single and three phase models are illustrated herein. Refer to paragraph 3.2.3 Control Terminals for pin out information.



Single Phase (2/PE) 120/240 VAC models
(ESVxxxN01SMC) with integrated line
disconnect



Single Phase (2/PE) 240 VAC models
with Filter and/or integrated line
disconnect



Three Phase (3/PE) models
with Filter and/or integrated line
disconnect



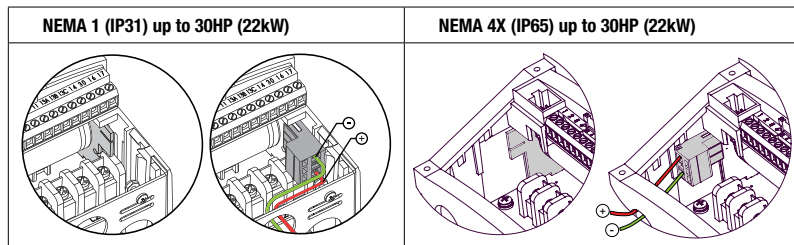
WARNING

Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

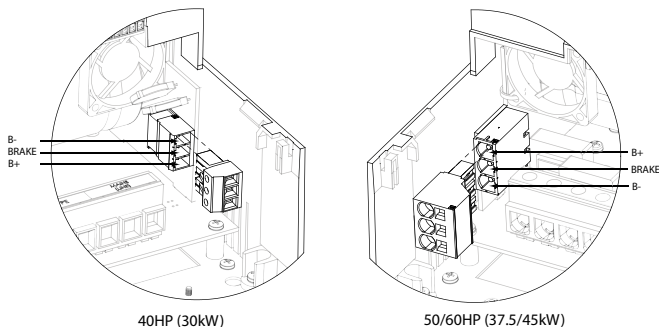


3.2.1.7 Dynamic Brake Connections

For NEMA 1 and NEMA 4X Drives rated up to 30HP (22kW) the Dynamic Brake connections are made as illustrated herein. Refer to the SMV Dynamic Brake Instructions (DBV01) for complete information.



The SMV 40...60Hp (30...45kW) models include a dynamic brake transistor as standard and only require the connection of an external resistor kit for dynamic braking operation. The dynamic brake resistor connections for 40...60 Hp (30...45kW) drives are standard built-in connections as illustrated in the diagram below. In the 40Hp (30kW) model drives, the dynamic brake connector is on the right-hand side of the drive and the terminals from top to bottom are B-, BRAKE and B+. In the 50/60HP (37.5/45 kW) model drives, the dynamic brake connector is on the left-hand side of the drive and the terminals from top to bottom are B+, BRAKE and B-.



External resistor kits must be connected to terminals B+ and BRAKE (no connection to B-). Refer to the table herein for external resistor kit selection. Refer to parameter P189 for enabling the dynamic brake function in the 40...60Hp (30...45kW) models.

400/480 VAC SMV Inverter			Resistor Kit			
Type	Hp	kW	Resistance (Ω)	Power (W)	Catalog #	SAP#
ESV303**4T**	40	30	23.5	1020	841-013	13317724
ESV373**4T**	50	37	17	1400	841-015	13317626
ESV453**4T**	60	45	17	1400	841-015	13317626
600 VAC SMV Inverter			Resistor Kit			
Type	Hp	kW	Resistance (Ω)	Power (W)	Catalog #	SAP#
ESV303**6T**	40	30	35	1070	841-014	13317624
ESV373**6T**	50	37	24	1560	841-016	13317628
ESV453**6T**	60	45	24	1560	841-016	13317628



Installation

3.2.2 Fuses/Cable Cross-Sections



NOTE: Observe local regulations. Local codes may supersede these recommendations

WARNING: Use a FUSE * for 240V drives requiring > 40A protection and for 400/480/600V drives requiring >32A protection.

Type		Recommendations				
		Fuse	Miniature circuit breaker ⁽¹⁾	Fuse ⁽²⁾ or Breaker ⁽³⁾ (N. America)	Input Power Wiring (L1, L2, L3, PE)	
					[mm ²]	[AWG]
120V 1~ (1/N/PE)	ESV251N01SXB	M10 A	C10 A	10 A	1.5	14
	ESV371N01SXB, ESV371N01SX*	M16 A	C16 A	15 A	2.5	14
	ESV751N01SXB, ESV751N01SX*	M25 A	C25 A	25 A	4	10
	ESV112N01SXB, ESV112N01SX*	M32 A	C32 A	30A	4	10
240V 1~ (2/PE)	ESV251N01SXB, ESV251N02SXB, ESV371N01SXB, ESV371N02YXB, ESV371N02SF*	M10 A	C10 A	10 A	1.5	14
	ESV751N01SXB, ESV751N02YXB, ESV751N02SF*	M16 A	C16 A	15 A	2.5	14
	ESV112N02YXB, ESV112N02SFC, ESV112N01SXB, ESV112N01SX*	M20 A	C20 A	20 A	2.5	12
	ESV152N02YXB, ESV152N02SF*	M25 A	C25 A	25 A	2.5	12
	ESV222N02YXB, ESV222N02SF*	M32 A	C32A	30 A	4	10
	ESV371N02YXB, ESV751N02YXB, ESV371N02Y_*, ESV751N02Y_*	M10 A	C10 A	10 A	1.5	14
240V 3~ (3/PE)	ESV112N02YXB, ESV152N02YXB, ESV112N02TXB, ESV152N02TXB, ESV112N02Y_*, ESV152N02Y_*	M16 A	C16 A	12 A	1.5	14
	ESV222N02YXB, ESV222N02TXB, ESV222N02YX*	M20 A	C20 A	20 A	2.5	12
	ESV402N02TXB, ESV402N02T_*	M32 A	C32 A	30 A	4.0	10
	ESV552N02TXB, ESV552N02T_*	M40 A	C40 A	35 A	6.0	8
	ESV752N02TXB, ESV752N02T_*	M50 A	* use Fuse only	45 A *	10	8
	ESV113N02TXB, ESV113N02TX_*, ESV113N02TM_*	M80 A	* use Fuse only	80 A *	16	6
	ESV153N02TXB, ESV153N02TX_*, ESV153N02TM_*	M100 A	* use Fuse only	90 A *	16	4
	ESV371N04TXB, ...ESV222N04TXB, ESV371N04T_*, ...ESV222N04T_*, ESV371N04TF*, ...ESV222N04TF*	M10 A	C10 A	10 A	1.5	14
	ESV302N04T_*	M16 A	C16 A	15 A	2.5	14
	ESV402N04TXB, ESV402N04T_*	M16 A	C16 A	20 A	2.5	14
400V or 480V 3~(3/PE)	ESV552N04TXB, ESV552N04T_*	M20 A	C20 A	20 A	2.5	14
	ESV752N04TXB, ESV752N04T_*	M25 A	C25 A	25 A	4.0	10
	ESV113N04TXB, ESV113N04T_*	M40 A	* use Fuse only	40 A *	4	8
	ESV153N04TXB, ESV153N04T_*	M50 A	* use Fuse only	50 A *	10	8
	ESV183N04TXB, ESV183N04T_*	M63 A	* use Fuse only	70 A *	10	6
	ESV223N04TXB, ESV223N04T_*	M80 A	* use Fuse only	80 A *	16	6
	ESV303N04TXB	M100 A	* use Fuse only	100 A *	25	4
	ESV373N04TXB	M125 A	* use Fuse only	125 A *	35	2
	ESV453N04TXB	M160 A	* use Fuse only	150 A *	35	1
	ESV751N06TXB, ...ESV222N06TXB, ESV751N06T_*, ...ESV222N06T_*	M10 A	C10 A	10 A	1.5	14
600V 3~(3/PE)	ESV402N06TXB, ESV402N06T_*	M16 A	C16 A	12 A	1.5	14
	ESV552N06TXB, ESV552N06T_*	M16 A	C16 A	15 A	2.5	14
	ESV752N06TXB, ESV752N06T_*	M20 A	C20 A	20 A	2.5	12
	ESV113N06TXB, ESV113N06TX_*, ESV113N06TM_*	M32 A	C32 A	30 A	4	10
	ESV153N06TXB, ESV153N06TX_*, ESV153N06TM_*	M40 A	* use Fuse only	40 A *	4	8
	ESV183N06TXB, ESV183N06TX_*, ESV183N06TM_*	M50 A	* use Fuse only	50 A *	6	8
	ESV223N06TXB, ESV223N06TX_*, ESV223N06TM_*	M63 A	* use Fuse only	60 A *	10	8
	ESV303N06TXB	M80 A	* use Fuse only	70 A *	16	6
	ESV373N06TXB	M100 A	* use Fuse only	90 A *	16	4
	ESV453N06TXB	M125 A	* use Fuse only	110 A *	25	2



Notes for Fuse and Cable Table:

- (1) Installations with high fault current due to large supply mains may require a type D circuit breaker.
- (2) UL Class CC or T fast-acting current-limiting type fuses, 200,000 AIC, preferred. Bussman KTK-R, JN or JJS or equivalent.
- (3) Thermomagnetic type breakers preferred.

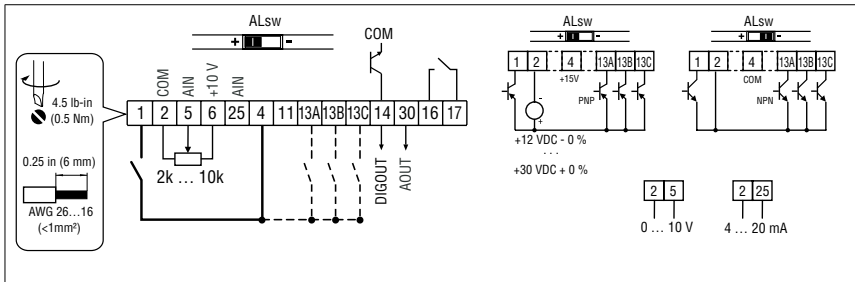
- _ 11th digit of part number: F = Integral EMC Filter
L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
X = No EMC Filter/ No Disconnect Switch
C = N4X Indoor only (convection cooled)
E = N4X Indoor/Outdoor (convection cooled)
D = N4X Indoor only (fan cooled)
F = N4X Indoor/Outdoor (fan cooled)
- * = Last digit of part number:
~ = Last digit of part number:

Observe the following when using Ground Fault Circuit Interrupters (GFCIs):

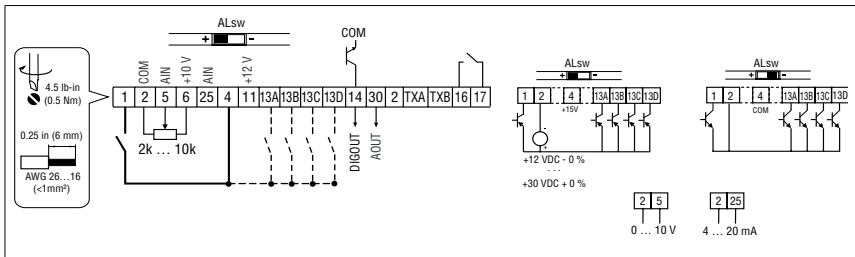
- Installation of GFCI only between supplying mains and controller.
- The GFCI can be activated by:
 - capacitive leakage currents between the cable screens during operation (especially with long, screened motor cables)
 - connecting several controllers to the mains at the same time
 - RFI filters

3.2.3 Control Terminals

Control Terminal Strip for 0.33 - 10 HP (0.25 - 7.5 kW):



Control Terminal Strip for 15HP (11 kW) and Greater Drives:



NOTE

Control and communications terminals provide basic insulation when the drive is connected to a power system rated up to 300V between phase to ground (PE) and the applied voltage on terminals 16 and 17 is less than 250 VAC between phase to phase and ground (PE).



Installation

Control Terminal Strip Descriptions

Terminal	Description	Important
1	Digital Input: Start/Stop	input resistance = 4.3k Ω
2	Analog Common	
5	Analog Input: 0...10 VDC	input resistance: >50 k Ω
6	Internal DC supply for speed pot	+10 VDC, max. 10 mA
25	Analog Input: 4...20 mA	input resistance: 250 Ω
4	Digital Reference/Common	+15 VDC / 0 VDC, depending on assertion level
11	Internal DC supply for external devices	+12 VDC, max. 50 mA
13A	Digital Input: Configurable with P121	input resistance = 4.3k Ω
13B	Digital Input: Configurable with P122	
13C	Digital Input: Configurable with P123	
13D*	Digital Input: Configurable with P124	
14	Digital Output: Configurable with P142, P144	DC 24 V / 50 mA; NPN
30	Analog Output: Configurable with P150...P155	0...10 VDC, max. 20 mA
2*	Analog Common	
TXA*	RS485 TxA	
TXB*	RS485 TxB	
16	Relay output: Configurable with P140, P144	AC 250 V / 3 A
17		DC 24 V / 2 A ... 240 V / 0.22 A, non-inductive

* = Terminal is part of the terminal strip for the 15HP (11kW) and higher models only.

Assertion level of digital inputs

The digital inputs can be configured for active-high or active-low by setting the Assertion Level Switch (ALsw) and P120. If wiring to the drive inputs with dry contacts or with PNP solid state switches, set the switch and P120 to "High" (+). If using NPN devices for inputs, set both to "Low" (-). Active-high (+) is the default setting.

HIGH = +12 ... +30 V

LOW = 0 ... +3 V



NOTE

An **F_AL** fault will occur if the Assertion Level switch (ALsw) position does not match the parameter P120 setting and P100 or any of the digital inputs (P121...P124) is set to a value other than 0.

4 Commissioning











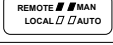
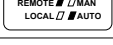
4.1 Local Keypad & Display

SMV Models: 0.33-10HP (0.25-7.5kW)	SMV Models: 15HP (11kW) and greater
4-Character Display	4-Character plus CTRL Display

Display	START BUTTON
	In Local Mode (P100 = 0, 4, 6), this button will start the drive.
	STOP BUTTON
	Stops the drive, regardless of which mode the drive is in. WARNING! When JOG is active, the STOP button will not stop the drive!
	ROTATION
	In Local Mode (P100 = 0, 4, 6), this selects the motor rotation direction: <ul style="list-style-type: none"> - The LED for the present rotation direction (FWD or REV) will be on - Press R/F; the LED for the opposite rotation direction will blink - Press M within 4 seconds to confirm the change - The blinking direction LED will turn on, and the other LED will turn off <p>When rotation direction is changed while the drive is running, the commanded direction LED will blink until the drive is controlling the motor in the selected direction. Rotation is set in P112. When P112 = 0, rotation is forward only. When P112 = 1 rotation is forward and reverse.</p>
	MODE
	Used to enter/exit the Parameter Menu when programming the drive and to enter a changed parameter value.
	UP AND DOWN BUTTONS
	Used for programming and can also be used as a reference for speed, PID setpoint, or torque setpoint. When the ▲ and ▼ buttons are the active reference, the middle LED on the left side of the display will be on.



Commissioning

Display	INDICATING LEDs (on 4-character display)			
	FWD LED: Indicate the present rotation direction is forward. Refer to ROTATION description above.			
	REV LED: Indicate the present rotation direction is reverse. Refer to ROTATION description above.			
	AUTO LED: Indicates that the drive has been put into Auto mode from one of the TB13 inputs (P121...P124 set to 1...7). Indicates that PID mode is active (if PID mode is enabled). Indicates that sequencer mode is active (if sequencer mode is enabled).			
	RUN LED: Indicates that the drive is running.			
	▲ ▼ LED: Indicates that the ▲ ▼ are the active reference.			
	NOTE If the keypad is selected as the auto reference (P121...P124 is 6) and the corresponding TB-13 input is closed, the AUTO LED and ▲ ▼ LEDs will both be on.			
FUNCTIONS THAT FOLLOW ARE APPLICABLE TO SMV DRIVES 15HP (11kW) AND HIGHER				
	CTRL The CTRL pushbutton selects the start and speed reference control sources for the drive. Press  mode button to accept the new control mode selection.			
	CTRL LEDs		START CONTROL	REFERENCE CONTROL
		[LOCAL] [MAN]	Keypad	P101 Settings
		[LOCAL] [AUTO]	Keypad	Terminal 13x Settings
		[REMOTE] [MAN]	Terminal Strip	P101 Settings
		[REMOTE] [AUTO]	Terminal Strip	Terminal 13x Settings
	If P100 = 6 the CTRL button is used to toggle start control between the terminal strip [REMOTE] and the keypad [LOCAL]		- REM/LOC LED indicating the present start control source is ON - Press [CTRL]; the LED for other start control source will blink - Press [M] within 4 sec to confirm the change - Blinking LED will turn ON (the other LED will turn OFF)	
	If P113 = 1 the CTRL button is used to toggle reference control between the TB-13x setup [AUTO] and P101 [MANUAL]		- AUT/MAN LED indicating present reference control is ON - Press [CTRL]; the other reference control will blink - Press [M] within 4 sec to confirm change - Blinking LED will turn ON (the other LED will turn OFF)	
	If P100 = 6 and P113 = 1, it is possible to change the start and reference control sources at the same time			



Display	START CONTROL	
	The REMOTE/LOCAL LEDs indicate the current start control source. If the start control source is a remote keypad or the network, then both LEDs will be OFF.	
	REFERENCE CONTROL	
	The AUTO/MANUAL LEDs indicate the current reference control source.	
	IF P113 = 0 or 2, the AUTO/MANUAL LEDs will match the AUTO LED on the 4-character display. IF P113 = 0 and no AUTO reference has been setup on the terminal strip, the MANUAL LED will turn ON and the AUTO LED will turn OFF.	
	IF P113 = 1, the AUTO/MANUAL LEDS show the commanded reference control source as selected by the [CTRL] button. If the [CTRL] button is used to set the reference control source to AUTO but no AUTO reference has been setup on the terminal strip, reference control will follow P101 but the AUTO LED will remain ON.	
	UNITS LEDs	
	HZ: current display value is in Hz	In Speed mode, if P178 = 0 then HZ LED will be ON. If P178 > 0, the Units LEDs follow the setting of P177 when the drive is in run (non-programming) mode.
	‰: current display value is in ‰	
	RPM: current display value is in RPM	In Torque mode, the HZ LED will be ON when the drive is in run (non-programming) mode.
	AMPS: current display value is in Amps	
	/UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)	
	In Pid mode, the Units LEDs follow the setting of P203 when the drive is in run (non-programming) mode. If P179 > 0, the Units LEDs will show the unit of the diagnostic parameter that is being displayed.	

4.2 Drive Display and Modes of Operation

Speed Mode Display

In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive's output frequency.

PID Mode Display

When the PID mode is enabled and active, the normal run display shows the actual PID setpoint. When PID mode is not active, the display returns to showing the drive's output frequency.

Torque Mode Display

When the drive is operating in Vector Torque mode, the normal run display shows the drive's output frequency.

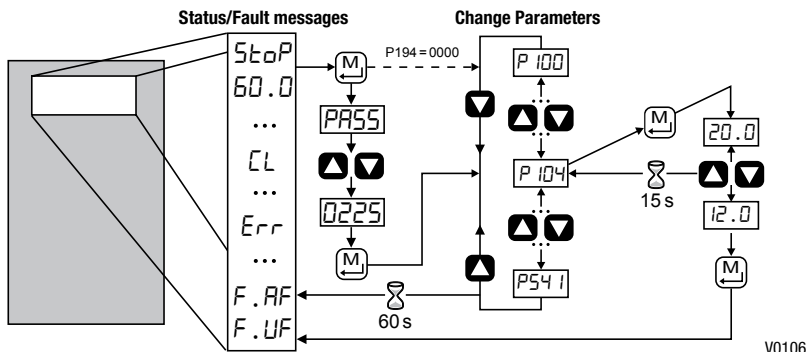
Alternate (Run-Screen) Display

When P179 (Run Screen Display) is set to a value other than 0, one of the diagnostic parameters (P501...P599) is displayed. Example: if P179 is set to 1, then diagnostic parameter P501 (Software version) is displayed. If P179 = 2, then P502 (Drive ID) is displayed.



Commissioning

4.3 Parameter Setting



V0106

4.4 Electronic Programming Module (EPM)

The EPM contains the drives operational memory. Parameter settings are stored in the EPM and setting changes are made to the "User settings" in the EPM.

An optional EPM Programmer (model EEPM1RA) is available that allows:

- An EPM to be copied directly to another EPM.
- An EPM to be copied to the memory of the EPM Programmer.
- Stored files can be modified in the EPM Programmer.
- Stored files can be copied to another EPM.



EPM Module
in SMV Drive

As the EPM Programmer is battery operated, parameter settings can be copied to an EPM and inserted into a drive without power being applied to the drive. This means that the drive will be fully operational with the new settings on the next application of power.



Additionally, when the drives parameter settings are burned into an EPM with the EPM Programmer, the settings are saved in two distinct locations; the "User settings" and the "OEM default settings". While the User settings can be modified in the drive, the OEM settings cannot. Thus, the drive can be reset not only to the "factory" drive default settings (shown in this manual), but can be set to the Original Machine settings as programmed by the OEM.

The user area contents of the EPM are what are copied into the OEM space by the EPM programmer. When parameter modifications are made to the drive and then a copy made via the EPM Programmer, these are the settings that will be available by the OEM selections from P199. The EPM Programmer is the only way to load the OEM area of the EPM.

While the EPM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing EPM will trigger an F_F I fault)





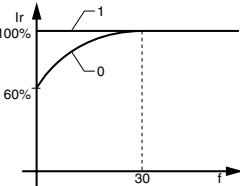
4.5 Parameter Menu

4.5.1 Basic Setup Parameters



Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P100	Start Control Source	0	0 Local Keypad	Use RUN button on front of drive to start
			1 Terminal Strip	Use start/stop circuit wired into the terminal strip. Refer to section 3.2.3
			2 Remote Keypad Only	Use RUN button on optional Remote Keypad to start
			3 Network Only	<ul style="list-style-type: none"> Start command must come from network (Modbus, CANopen, etc) SMV models <15HP (11kW) require optional communication module (refer to the network module documentation). Must also set one of the TB-13 inputs to 9 (Network Enable); see P121...P124
			4 Terminal Strip or Local Keypad	Allows start control to be switched between terminal strip and local keypad using one of the TB-13 inputs. See note below.
			5 Terminal Strip or Remote Keypad	Allows start control to be switched between terminal strip and optional remote keypad using one of the TB-13 inputs. See Note below
			6 CTRL button select	Allows start control to be switched between terminal strip and local keypad using the CTRL button. NOTE: P100 Selection 6 is applicable to SMV 15HP (11kW) and higher models only.
			WARNING! P100 = 0 disables TB-1 as a STOP input! STOP circuitry may be disabled if parameters are reset back to defaults (see P199)	
			NOTE <ul style="list-style-type: none"> P100 = 4, 5: To switch between control sources, one of the TB-13 inputs (P121...P124) must be set to 08 (Control Select); TB-13x OPEN (or not configured): Terminal strip control TB-13x CLOSED: Local (P100 = 4) or Remote (P100 = 5) keypad P100 = 0, 1, 4, 6: Network can take control if P121...P124 = 9 and the corresponding TB-13x input is CLOSED. The STOP button on the front of the drive is always active except in JOG mode. TB-1 is an active STOP input if P100 is set to a value other than 0. An F_{RL} fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and P100 is set to a value other than 0. 	
P101	Standard Reference Source	0	0 Keypad (Local or Remote)	Selects the default speed or torque reference when no Auto Reference is selected using the TB-13 inputs.
			1 0-10 VDC	
			2 4-20 mA	
			3 Preset #1 (P131)	
			4 Preset #2 (P132)	
			5 Preset #3 (P133)	
			6 Network	
			7 Preset Sequence Segment #1 (P710)	Selections 7, 8 & 9 are not valid for PID setpoint or torque reference.
			8 Preset Sequence Segment #2 (P715)	
			9 Preset Sequence Segment #3 (P720)	



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Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 102	Minimum Frequency	0.0	0.0	{Hz}	P103	<ul style="list-style-type: none">P102, P103 are active for all speed referencesWhen using an analog speed reference, also see P160, P161
P 103	Maximum Frequency	60.0	7.5	{Hz}	500	
			NOTE <ul style="list-style-type: none">P103 cannot be set below Minimum Frequency (P102)To set P103 above 120 Hz:<ul style="list-style-type: none">Scroll up to 120 Hz; display shows H.Fr (flashing).Release ▽ button and wait one second.Press ▽ button again to continue increasing P103.			
 WARNING! Consult motor/machine manufacturer before operating above rated frequency. Overspeeding the motor/machine may cause damage to equipment and injury to personnel!						
P 104	Acceleration Time 1	20.0	0.0	{s}	3600	<ul style="list-style-type: none">P104 = time of frequency change from 0 Hz to P167 (base frequency)P105 = time of frequency change from P167 to 0 HzFor S-ramp accel/decel, adjust P106
P 105	Deceleration Time 1	20.0	0.0	{s}	3600	
	EXAMPLE: IF P103 = 120 Hz, P104 = 20.0 s and P167 (base frequency) = 60 Hz; then the rate of frequency change from 0 Hz to 120 Hz = 40.0 s					
P 106	S-Ramp Integration Time	0.0	0.0	{s}	50.0	<ul style="list-style-type: none">P106 = 0.0: Linear accel/decel rampP106 > 0.0: Adjusts S-ramp curve for smoother ramp
P 107 ⁽¹⁾	Line Voltage Selection	1*	0 Low (120, 200, 400, 480VAC) 1 High (120, 240, 480, 600VAC)			* The default setting is 1 for all drives except when using "Reset to 50Hz default settings" (Parameter P199, selection 4) with 480V models. In this case, the default setting is 0.
P 108	Motor Overload	100	30	{%}	100	P108 = $\frac{\text{motor current rating}}{\text{SMV output rating}} \times 100$ Example: if motor = 3amps and SMV = 4amps, then P108 = 75%
				NOTE Do not set above rated motor current as listed on the motor dataplate. The motor thermal overload function of the SMV is UL approved as a motor protection device. Cycling power after an overload fault could result in significantly reducing the motor life.		
P 109	Motor Overload Type	0	0 Speed Compensation			
			1 No Speed Compensation Example: Motor is cooled by forced ventilation as apposed to shaft mounted, self cooling fans.			

(1) Any changes to this parameter will not take effect until the drive is stopped.

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P110	Start Method	0	0 Normal	Drive will automatically start when power is applied.
			1 Start on Power-up	
			2 Start with DC Brake	When start command is applied, drive will apply DC braking according to P174, P175 prior to starting the motor
			3 Auto Restart	Drive will automatically restart after faults, or when power is applied.
			4 Auto Restart with DC Brake	Combines settings 2 and 3
			5 Flying Start/Restart - Type 1	<ul style="list-style-type: none">Drive will automatically restart after faults, or when power is applied.After 3 failed attempts, drive will Auto Restart with DC brake.P110 = 5, 7: Performs speed search, starting at Max Frequency (P103)P110 = 6, 8: Performs speed search, starting at the last output frequency prior to faulting or power lossIf P111 = 0, a flying START is performed when a start command is applied.P110 = 7,8: Utilizes P280/281 to set Max Current Level and Decel Time for restart
			6 Flying Start/Restart - Type 1	
			7 Flying Start /Restart - Type 2 for 2-pole motors requiring a flying restart	
			8 Flying Start/Restart - Type 2 for 2-pole motors requiring a flying restart	
			NOTE <ul style="list-style-type: none">P110 = 0, 2: Start command must be applied at least 2 seconds after power-up; F_{UF} fault will occur if start command is applied too soon.P110 = 1, 3...6: For automatic start/restart, the start source must be the terminal strip and the start command must be present.P110 = 2, 4...6: If P175=999.9, dc braking will be applied for 15s.P110 = 3...6: Drive will attempt 5 restarts; if all restart attempts fail, drive displays LC (fault lockout) and requires manual reset.P110 = 5, 6: If drive cannot catch the spinning motor, drive will trip into F_{rF} fault.P110 = 5, 6: If drive trips into F_{DF} fault, try P110 = 7 or 8.	
 WARNING! Automatic starting/restarting may cause damage to equipment and/or injury to personnel! Automatic starting/restarting should only be used on equipment that is inaccessible to personnel.				
P111	Stop Method	0	0 Coast	Drive's output will shut off immediately upon a stop command, allowing the motor to coast to a stop
			1 Coast with DC Brake	The drive's output will shut off and then the DC Brake will activate (refer to P174, P175)
			2 Ramp	The drive will ramp the motor to a stop according to P105 or P126.
			3 Ramp with DC Brake	The drive will ramp the motor to 0 Hz and then the DC Brake will activate (refer to P174, P175)
P112	Rotation	0	0 Forward Only	If PID mode is enabled, reverse direction is disabled (except for Jog).
			1 Forward and Reverse	



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Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 113	Auto/Manual Control	0	0 Terminal Strip Control	The reference is dictated by the settings and state of the TB-13x terminals. If no AUTO reference has been setup on the terminal strip then reference control is dictated by P101.
			1 Auto/Manual (CTRL button select)	Allows the reference to be switched between auto and manual using the CTRL pushbutton on the drive keypad. If the CTRL pushbutton has selected AUTO reference but no AUTO reference has been setup on the terminal strip, then reference control is dictated by P101.
			2 Manual Control Only	Reference is dictated by P101 regardless of any AUTO source that may be selected by the TB-13x terminals.
			NOTE P113 is applicable to SMV 15HP (11kW) and higher models only.	
P 115	MOP Speed Initialization at Power-Up	0	0 Set to last MOP speed at power up	Output frequency at power-up = last MOP speed
			1 Set to 0.0Hz at power up	Output frequency at power-up = 0Hz
			2 Set to Preset #3 (P133) at power up	Output frequency at power-up = P133

4.5.2 I/O Setup Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 120	Assertion Level	2	1 Low 2 High	P120 and the Assertion Level switch must both match the desired assertion level unless P100, P121...P124 are all set to 0. Otherwise an F.AL fault will occur.
P 121	TB-13A Digital Input	0	0 None 1 AUTO Reference: 0-10 VDC 2 AUTO Reference: 4-20 mA	Disables input For frequency mode, see P160...P161, For PID mode, see P204...P205, For vector torque mode, see P330
P 122	TB-13B Digital Input (Priority > TB13A) Same as TB13A except: 3 = Preset #2 23 = Seq Seg, #2		3 AUTO Reference: Preset #1 * 13D: 3 = Reserved	For frequency mode see P131...P137, For PID mode, see P231...P233, For torque mode see, P331...P333
P 123	TB-13C Digital Input (Priority > TB13B, A) Same as TB13A except: 3 = Preset #3 23 = Seq Seg, #4		4 AUTO Reference: MOP Up 5 AUTO Reference: MOP Down 6 AUTO Reference: Keypad 7 AUTO Reference: Network 8 Control Select	<ul style="list-style-type: none"> Normally open: Close input to increase or decrease speed, PID or torque setpoint. MOP Up is not active while in STOP
P 124	TB-13D* Digital Input (Priority > TB13C, B, A) Same as TB13A except: 3 = Preset #4 23 = Seq Seg, #8		9 Network Enable 10 Reverse Rotation 11 Start Forward 12 Start Reverse 13 Run Forward 14 Run Reverse 15 Jog Forward 16 Jog Reverse 17 Accel/Decel #2 18 DC Brake 19 Auxiliary Ramp to Stop 20 Clear Fault 21 External Fault F_EF 22 Inverse External Fault F_EF 23 AUTO Ref: Sequence Segment #1 24 Start Sequence 25 Step Sequence 26 Suspend Sequence	Use when P100 = 4, 5 to switch between terminal strip control and local or remote keypad control. Required to start the drive through the network. Open = Forward Closed = Reverse Refer to Note for typical circuit Refer to Note for typical circuit Jog Forward speed = P134 Jog Reverse speed = P135 Active even if P112 = 0 Refer to P125, P126 Refer to P174; close input to override P175 Normally closed: Opening input will ramp drive to STOP according to P127, even if P111 is set to Coast (0 or 1). Close to reset fault Normally closed circuit; open to trip Normally open circuit; close to trip Works in Speed Mode only Transition from non-asserted to asserted state
		WARNING Jog overrides all STOP commands! To stop the drive while in Jog mode, the Jog input must be deactivated or a fault condition induced.		
		WARNING If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).		



Commissioning

Code		Possible Settings		IMPORTANT																																																										
No.	Name	Default	Selection																																																											
<div><div><div><div></div></div></div><div><div></div></div></div>	NOTE <ul style="list-style-type: none">When input is activated, settings 1...7 override P101When TB-13A...TB-13D are configured for Auto References other than MOP, TB-13D overrides TB-13C, TB-13C overrides TB-13B and TB-13B overrides TB-13A. Any other Auto Reference will have priority over MOP.Settings 10...14 are only valid in Terminal Strip mode (P100 = 1, 4, 5, 6)If Start/Run/Jog Forward and Start/Run/Jog Reverse are both activated, drive will STOPIf Jog input is activated while drive is running, the drive will enter Jog mode; when Jog input is deactivated, drive will STOPAn F_{RL} fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and any of the digital inputs (P121...P124) are set to a value other than 0.An F_{IL} fault will occur under the following conditions:<ul style="list-style-type: none">TB-13A...TB-13D settings are duplicated (each setting, except 0, 3 and 23, can only be used once)One input is set to "MOP Up" and another is not set to "MOP Down", or vice-versa.One input is set to 10 and another input is set to 11...14.One input is set to 11 or 12 and another input is set for 13 or 14.Typical control circuits are shown below:<ul style="list-style-type: none">If any input is set to 10, 12 or 14, P112 must be set to 1 for Reverse action to function. <div><div><div>Run / Stop with Direction P121 = 10</div><div><div>1413A</div><div><div>STOPFWD</div><div>RUNREV</div></div></div></div><div><div>Start Forward / Start Reverse P121 = 11, P122 = 12</div><div><div>1413A13B</div><div><div>STOPFWD</div><div>RUNREV</div></div></div></div><div><div>Run Forward / Run Reverse P121 = 13, P122 = 14</div><div><div>1413A13B</div><div><div>RUNFWD</div><div>RUNREV</div></div></div></div></div>																																																													
	P 125	Acceleration Time 2	20.0	0.0	{s}	3600	<ul style="list-style-type: none">Selected using TB-13A...TB-13D (P121...P124 = 17)For S-ramp accel/decel, adjust P106																																																							
	P 126	Deceleration Time 2	20.0	0.0	{s}	3600																																																								
	P 127	Deceleration Time for Auxiliary Ramp to Stop	20.0	0.0	{s}	3600	<ul style="list-style-type: none">Selected using TB-13A...TB-13D (P121...P124 = 19).For S-ramp accel/decel, adjust P106Once executed, this ramp time has priority over P105 and P126.																																																							
	P 129	Automatic Accel/Decel rate switch threshold	0.0	0.0	{Hz}	1000	If Actual Frequency < P129 Use Accel/decel time #2 (P125/P126) If Actual Frequency > P129 Use Accel/decel time #1 (P104/P105)																																																							
	P 131	Preset Speed #1	0.0	0.0	{Hz}	500	<table><tr><th>PRESET SPEED</th><th>13A</th><th>13B</th><th>13C</th><th>13D</th></tr><tr><td>1</td><td>X</td><td>--</td><td>--</td><td>--</td></tr><tr><td>2</td><td>--</td><td>X</td><td>--</td><td>--</td></tr><tr><td>3</td><td>--</td><td>--</td><td>X</td><td>--</td></tr><tr><td>4</td><td>X</td><td>X</td><td>--</td><td>--</td></tr><tr><td>4 (alternate)</td><td>--</td><td>--</td><td>--</td><td>X</td></tr><tr><td>5</td><td>X</td><td>--</td><td>X</td><td>--</td></tr><tr><td>6</td><td>--</td><td>X</td><td>X</td><td>--</td></tr><tr><td>7</td><td>X</td><td>X</td><td>X</td><td>--</td></tr><tr><td>8 (alternate)</td><td>--</td><td>X</td><td>--</td><td>X</td></tr><tr><td>8 (alternate)</td><td>--</td><td>--</td><td>X</td><td>X</td></tr></table>	PRESET SPEED	13A	13B	13C	13D	1	X	--	--	--	2	--	X	--	--	3	--	--	X	--	4	X	X	--	--	4 (alternate)	--	--	--	X	5	X	--	X	--	6	--	X	X	--	7	X	X	X	--	8 (alternate)	--	X	--	X	8 (alternate)	--	--	X	X
	PRESET SPEED	13A	13B	13C	13D																																																									
	1	X	--	--	--																																																									
	2	--	X	--	--																																																									
	3	--	--	X	--																																																									
4	X	X	--	--																																																										
4 (alternate)	--	--	--	X																																																										
5	X	--	X	--																																																										
6	--	X	X	--																																																										
7	X	X	X	--																																																										
8 (alternate)	--	X	--	X																																																										
8 (alternate)	--	--	X	X																																																										
P 132	Preset Speed #2	0.0	0.0	{Hz}	500																																																									
P 133	Preset Speed #3	0.0	0.0	{Hz}	500																																																									
P 134	Preset Speed #4	0.0	0.0	{Hz}	500																																																									
P 135	Preset Speed #5	0.0	0.0	{Hz}	500																																																									
P 136	Preset Speed #6	0.0	0.0	{Hz}	500																																																									
P 137	Preset Speed #7	0.0	0.0	{Hz}	500																																																									
P 138	Preset Speed #8	0.0	0.0	{Hz}	500	<ul style="list-style-type: none">Speed setting is used by P15813D available on 15HP (11kW) & higher drives.																																																								



Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 140	Relay Output TB-16, 17	0	0 None	Disables the output
			1 Run	Energizes when the drive is running
			2 Reverse	Energizes when reverse rotation is active
			3 Fault	De-energizes when the drive trips, or power is removed
			4 Inverse Fault	Energizes when the drive trips
			5 Fault Lockout	P110 = 3...6: De-energizes if all restart attempts fail
			6 At Speed	Energizes when output frequency = commanded frequency
			7 Above Preset Speed #6	Energizes when output frequency > P136
			8 Current Limit	Energizes when motor current = P171
			9 Follower Loss (4-20 mA)	Energizes when 4-20 mA signal is < P164
			10 Loss of Load	Energizes when motor load drops below P145; Refer to P146 also
			11 Local Keypad Control Active	
			12 Terminal Strip Control Active	Energizes when the selected source is active for start control
			13 Remote Keypad Control Active	
			14 Network Control Active	
			15 Standard Reference Active	Energizes when P101 reference is active
			16 Auto Reference Active	Energizes when Auto Reference is activated using TB-13 input; refer to P121...P124
			17 Sleep Mode Active	Refer to P240...P242
			18 PID Feedback < Min. Alarm	Energizes when PID feedback signal < P214
			19 Inverse PID Feedback < Min. Alarm	De-energizes when PID feedback signal < P214
			20 PID Feedback > Max Alarm	Energizes when PID feedback signal > P215
			21 Inverse PID Feedback > Max Alarm	De-energizes when PID feedback signal > P215
			22 PID Feedback within Min/Max Alarm range	Energizes when PID feedback signal is within the Min/Max Alarm range; refer to P214, P215
			23 PID Feedback outside Min/Max Alarm range	Energizes when PID feedback signal is outside the Min/Max Alarm range; refer to P214, P215
			24 Reserved	
			25 Network Controlled	SMV models < 15HP (11kW) require an optional communication module (refer to the network module documentation).
			26 Loss of 0-10V Input	Energizes when 0-10V signal is < P158
			27 Sequencer Controlled	State set in individual sequencer segments
			28 Sequencer Active	
			29 Sequencer Suspended	
			30 Sequence Done	End Sequence
			31 Output Frequency = 0.0Hz	Output inactive
P 142	TB-14 Output	0	0...23 (same as P140)	
			24 Dynamic Braking	For use with Dynamic Braking option
			25...31 (same as P140)	



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Code		Possible Settings				IMPORTANT															
No.	Name	Default	Selection																		
P 144	Digital Output Inversion		<table><tr><td>P144</td><td>Invert P142</td><td>Invert P140</td></tr><tr><td>0</td><td>NO</td><td>NO</td></tr><tr><td>1</td><td>NO</td><td>YES</td></tr><tr><td>2</td><td>YES</td><td>NO</td></tr><tr><td>3</td><td>YES</td><td>YES</td></tr></table>				P144	Invert P142	Invert P140	0	NO	NO	1	NO	YES	2	YES	NO	3	YES	YES
			P144	Invert P142	Invert P140																
			0	NO	NO																
			1	NO	YES																
2	YES	NO																			
3	YES	YES																			
	NOTE Inverting P140 or P142 when the parameter is set to NONE (0) will result in the output being energized continuously.																				
	NOTE For SMVector drives rated at 0.33 to 10 HP (0.25 to 7.5 kW), P144 is only available with software versions 3.0 and higher (refer to P501).																				
P 145	Loss of Load Threshold	0	0	{%}	200	P140, P142 = 10: Output will energize if motor load falls below the P145 value longer than the P146 time															
P 146	Loss of Load Delay	0.0	0.0	{s}	240.0																
P 149	Analog Output Offset	0.0	0	{%}	100	Scaled value. Example: P149 = 10%, Scaled variable = freq, P150 = 1, P152 = 60Hz; then TB30 = 0VDC below 6Hz															
P 150	TB-30 Output	0	0 None			2-10 VDC signal can be converted to 4-20 mA with a total circuit impedance of 500 Ω															
			1 0-10 VDC Output Frequency																		
			2 2-10 VDC Output Frequency																		
			3 0-10 VDC Load																		
			4 2-10 VDC Load																		
			5 0-10 VDC Torque																		
			6 2-10 VDC Torque																		
			7 0-10 VDC Power (kW)																		
			8 2-10 VDC Power (kW)																		
			9 Network Controlled			SMV models < 15HP (11kW) require an optional communication module (refer to the network module documentation).															
10 Sequencer Controlled			Value set in individual sequencer segments																		
P 151	Add Analog Input to TB-30 Output	0	<table><tr><td>P151</td><td>Add TB-25 (4-20mA)</td><td>Add TB-5 (0-10VDC)</td></tr><tr><td>0</td><td>NO</td><td>NO</td></tr><tr><td>1</td><td>NO</td><td>YES</td></tr><tr><td>2</td><td>YES</td><td>NO</td></tr><tr><td>3</td><td>YES</td><td>YES</td></tr></table>			P151	Add TB-25 (4-20mA)	Add TB-5 (0-10VDC)	0	NO	NO	1	NO	YES	2	YES	NO	3	YES	YES	This parameter adds the analog input signal(s) to the TB-30 Output signal. EXAMPLE: If a drive is running at 60Hz with P150 set to 1 (0-10VDC Freq) and P152 set to 240.0Hz, the output at TB-30 would be 2.5VDC. If there is a 2.0VDC signal going into TB-5 and P151 is set to 1 (ADD TB-5), the output at TB-30 would become 4.5VDC.
			P151	Add TB-25 (4-20mA)	Add TB-5 (0-10VDC)																
			0	NO	NO																
			1	NO	YES																
			2	YES	NO																
3	YES	YES																			
P 152	TB-30 Scaling: Frequency	60.0	3.0	{Hz}	2000	If P150 = 1 or 2, sets the frequency at which output equals 10 VDC															
P 153	TB-30 Scaling: Load	200	10	{%}	500	If P150 = 3 or 4, sets the Load (as a percent of drive current rating) at which output equals 10 VDC.															
P 154	TB-30 Scaling: Torque	100	10	{%}	1000	If P150 = 5 or 6, sets the Torque (as a percent of motor rated torque) at which output equals 10 VDC															
P 155	TB-30 Scaling: Power (kW)	1.0	0.1	{kW}	200.0	If P150 = 7 or 8, sets the power at which output equals 10 VDC															

4.5.3 Advanced Setup Parameters

Code		Possible Settings			IMPORTANT
No.	Name	Default	Selection		
P 156	Analog Inputs Configuration	0	0 TB5: (0-10 VDC); TB25: (4-20mA) 1 TB5: (0 - 5 VDC); TB25: (4-20mA) 2 TB5: (2 - 10 VDC); TB25: (4-20mA) 4 TB5: (0-10 VDC); TB25: (0-20mA) 5 TB5: (0 - 5 VDC); TB25: (0-20mA) 6 TB5: (2 - 10 VDC); TB25: (0-20mA)		
P 157	TB5 (0-10V) Analog Input Monitoring Action	0	0 No Action 1 If TB5 < P158 - Trip Fault $F_{_}FAU$ 2 If TB5 < P158 - Run Preset #8 3 If TB5 < P158 - Run Preset Seg. #16 4 If TB5 > P158 - Trip Fault $F_{_}FAU$ 5 If TB5 > P158 - Run Preset #8 6 If TB5 > P158 - Run Preset Seg. #16		
			Selects the reaction to a loss of the 0-10V signal at TB5 500ms is the minimum time above/below Monitoring Level (P158) before triggering the drive to trip or run at a preset speed. For P157 = 3 or 6, the accel/decel time is set in P786. NOTE: P157 has priority over P163 and TB-13 presets/auto references (P121-P124)		
P 158	TB5 (0-10V) Analog Input Monitoring Level (ML)	0.0	-10.0 {VDC} 10.0	Negative input voltage is not currently supported.	
P 159	0-10V Analog Input Deadband	0.0	0 {VDC} 10.0	Not active if [-10 to +10 VDC] option is selected.	
P 160	Speed at Minimum Signal	0.0	-999.0 {Hz} 1000	 V0111	
P 161	Speed at Maximum Signal	60.0	-999.0 {Hz} 1000		
			<div></div> NOTE <ul style="list-style-type: none">P160 sets the output frequency at 0% analog inputP161 sets the output frequency at 100% analog inputP160 or P161 < 0.0 Hz: For scaling purposes only; does not indicate opposite direction!P160 > P161: Drive will react inversely to analog input signal		
P 162	Analog Input Filter	0.01	0.00 {s} 10.00	<ul style="list-style-type: none">Adjusts the filter on the analog inputs (TB-5 and TB-25) to reduce the effect of signal noiseThe P162 delay time will affect the response time of diagnostic parameters (P520-P523).	
P 163	TB-25 (4-20mA) Analog Input Monitoring Action	0	0 No Action 1 If TB25 < P164 - Trip Fault $F_{_}FaL$ 2 If TB25 < P164 - Run Preset #7 3 If TB25 < P164 - Run Preset Seg. #15 4 If TB25 ≥ P164 - Trip Fault $F_{_}FaL$ 5 If TB25 ≥ P164 - Run Preset #7 6 If TB25 ≥ P164 - Run Preset Seg. #15		
			<ul style="list-style-type: none">Selects the reaction to a loss of the 4-20 mA signal at TB-25.Signal is considered lost if it falls below the value set in P164Digital outputs can also indicate a loss of 4-20 mA signal; see P140, P142For P163 = 3 or 6, the accel/decel time is set in P781.NOTE: P163 has priority over TB-13 presets/auto references (P121-P124)		



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Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 164	TB-25 (4-20mA) Analog Input Monitoring Level	2.0	0.0	{mA}	20.0	Valid for V/Hz mode only. Set voltage for bus compensation in V/Hz mode <ul style="list-style-type: none">As carrier frequency is increased, motor noise is decreasedObserve derating in section 2.3Automatic shift to 4 kHz at 120% loadNEMA 4X (IP65) Models: Default = 0 (4kHz)NEMA 1 (IP31) Models: Default = 1 (6kHz)
P 165	Base Voltage		15	{V}	1000	
P 166	Carrier Frequency	See Notes	0 4 kHz 1 6 kHz 2 8 kHz 3 10 kHz			
P 167 ⁽¹⁾	Base Frequency	60.0	10.0	{Hz}	1500	
P 168	Fixed Boost		0.0	{%}	40.0	<p>V0112</p>
			NOTE <ul style="list-style-type: none">P167 = rated motor frequency for standard applicationsP165, P168 = default setting depends on drive rating			
P 169	Accel Boost	0.0	0.0	{%}	20.0	Accel Boost is only active during acceleration
P 170	Slip Compensation	0.0	0.0	{%}	40.0	Increase P170 until the motor speed no longer changes between no load and full load conditions.
P 171 ⁽¹⁾	Current Limit	Max I	30	{%}	Max I	<ul style="list-style-type: none">When the limit is reached, the drive displays CL (Current Limit), and either the acceleration time increases or the output frequency decreases.Digital outputs can also indicate when the limit is reached; see P140, P142.Refer to section 2.3 for the maximum output current Max I (%)
P 172	Current Limit Reduction	0	0 Current Limit Reduction Active - Normal response 1 Current Limit Reduction Active - Fast response 2 Current Limit Reduction Disabled - Normal response 3 Current Limit Reduction Disabled - Fast response			In field weakening, the Current Limit is inversely proportional to the speed.
P 173	Decel Override Time	2.0	0.0	{s}	60.0	Maximum time before drive trips into HF fault.
P 174	DC Brake Voltage	0.0	0.0	{%}	50.0	Setting is a percent of the nominal DC bus voltage.

(1) Any changes to this parameter will not take effect until the drive is stopped.

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Code		Possible Settings		IMPORTANT	
No.	Name	Default	Selection		
P 175	DC Brake Time	0.0	0.0 {s} 999.9	NOTE: CONFIRM MOTOR SUITABILITY FOR USE WITH DC BRAKING DC Brake voltage (P174) is applied for the time specified by P175 with the following exceptions: <ul style="list-style-type: none">• If P111=1, 3 and P175=999.9 the brake voltage will be applied continuously until a run or fault condition occurs.• If P110=2, 4...6 and P175=999.9, brake voltage will be applied for 15s• If P121...P124=18 and the corresponding TB-13 input is CLOSED, brake voltage will be applied until the TB-13 input is OPENED or a fault condition occurs.	
P 176	Keypad Setpoint Single Press Increment	0.1	0.1 100.0	Used for run screen setpoint editing only. If P176 >0.1 then scrolling of keypad setpoint is enabled.	
P 177 ⓘ	Speed Units	0	0 Hz	Select the UNITS LED that will be illuminated when the drive is running in speed control mode. For this parameter to be used, P178 must be set to a value other than 0. If P178 is set to 0, the Hz LED will be illuminated regardless of the value set in P177.	
			1 RPM		
			2 %		
			3 /UNITS		
P 178	Display Frequency Multiplier	0.00	0.00 650.00	<ul style="list-style-type: none">• Allows frequency display to be scaled• P178 = 0.00: Scaling disabled• P178 > 0.00: Display = Actual Frequency X P178	
					EXAMPLE If P178 = 29.17 and actual frequency = 60 Hz, then Drive displays 1750 (rpm)
P 179	Run Screen Display	0	0 {Parameter Number} 599	<ul style="list-style-type: none">• 0 = Normal Run Screen, this display depends on mode of operation. Refer to section 4.2.• Other selections choose a diagnostic parameter to display (P501...P599).• Parameters P560 - P564 are selectable if the sequencer is enabled (P700 is not 0). P560-P564 are not visible until P700 is enabled.	
P 180	Oscillation Damping Control	0	0 80	0 = Damping disabled Compensation for resonances within drive	
P 181	Skip frequency 1	0.0	0.0 {Hz} 500	<ul style="list-style-type: none">• Drive will not run in the defined skip range; used to skip over frequencies that cause mechanical vibration• P181 and P182 define the start of the skip ranges• P184 > 0 defines the bandwidth of both ranges.	
P 182	Skip frequency 2	0.0	0.0 {Hz} 500		
P 184	Skip frequency bandwidth	0.0	0.0 {Hz} 10.0		
					NOTE Bandwidth (Hz) = f _s (Hz) + P184 (Hz) f _s = P181 or P182 EXAMPLE: P181 = 18 Hz and P184 = 4 Hz; skip range is from 18 to 22 Hz
P 185	Voltage Midpoint V/Hz characteristic	0	0.0 {V} P165	Valid only when P300 = 0 or 2. Use with P187 to define midpoint on V/Hz curve.	
P 187 ⓘ	Frequency Midpoint V/Hz characteristic	0.0	0.0 {Hz} P167	Valid only when P300 = 0 or 2. Use with P185 to define midpoint on V/Hz curve.	
P 189 ⓘ	Integrated Dynamic Brake	0 Disabled			
		1 Enabled			

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

(3) Parameter applicable to SMV models 40HP (30kW) and higher.



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Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 190	Motor Braking		0 Disabled	Flux brake OFF.
			1 Braking with BUS threshold	When drive is in deceleration and $V_{bus} > V_{deceleration\ freeze}$ (114% of the rated V_{bus}), the flux brake will be turned ON.
			2 Braking always on with deceleration	As long as drive is in deceleration, the flux brake will be ON.
			3 Braking with bus regulator	When drive is in deceleration and $V_{bus} > V_{deceleration\ freeze}$ (114% of the rated V_{bus}), the motor speed will be increased to reduce the bus voltage. Determined by the value in P191, the speed increment = slip speed * P191(%) / 37.
			4 Special	(Consult factory before using)
			WARNING Flux braking can cause heat in the motor. To avoid damage to the motor, use a PTC to protect the motor. If the flux brake is used too frequently, the drive will trip fault "F_PF".	
P 191	Motor Brake Level	0	0 { } 75 (flux braking disabled)	Active when P190 > 0 and drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. NOTE: Over usage of P190 can cause frequent 'overload' trips "F_PF" Not active for P300 = 5 (Torque mode)
P 192	Motor Braking Deceleration Reduction Level	0.0	0 P167 (base freq) Raising the value of P191 reduces the drive deceleration rate during flux braking.	Active when P190 > 0 and P192 > 0.0. Drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. NOTE: Usage of P192 can cause the drive to decelerate faster than settings in P105/P127. Not active for P300 = 5 (Torque mode)
P 194	Password	0	0000 9999	<ul style="list-style-type: none"> Must enter password to access parameters P194 = 0000: Disables password
P 197	Clear Fault History	0	0 No Action 1 Clear Fault History	
P 199	Program Selection		0 Operate from User settings	Refer to Notes 1, 2 and 3 Refer to Note 1 <ul style="list-style-type: none"> Refer to Note 4 Parameters are reset to the defaults listed in this manual. For P199=4, the following exceptions apply: <ul style="list-style-type: none"> P103, P152, P161, P167 = 50.0 Hz P165 = 400V (400/480V drives only) P304 = 50 Hz P305 = 1450 RPM P107 = 0 (480 V drives only)
			1 Operate from OEM settings	
			2 Reset to OEM default settings	
			3 Reset to 60 Hz default settings	
			4 Reset to 50 Hz default settings	
			5 Translate	Refer to Note 5
			WARNING! Modification of P199 can affect drive functionality! STOP and EXTERNAL FAULT circuitry may be disabled! Check P100 and P121...P124	
			NOTE 1 If the EPM does not contain valid OEM settings, a flashing GF will be displayed when P199 is set to 1 or 2. NOTE 2 When P199 is set to 1, the drive operates from the OEM settings stored in the EPM Module and no other parameters can be changed (GF will be displayed if attempted). NOTE 3 Auto Calibration is not possible when operating from OEM Settings. NOTES 4 and 5 - on next page.	



Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P199	Program Selection		<p>NOTE 4 Resetting to 50 and 60 Hz default settings will set the Assertion Level (P120) to "2" (High). P120 may need to be reset for the digital input devices being used. An F_{AL} fault may occur if P120 and the Assertion switch are not set identically.</p> <p>NOTE 5 If an EPM that contains data from a previous compatible software version is installed:</p> <ul style="list-style-type: none"> The drive will operate according to the previous data, but parameters cannot be changed (cE will be displayed if attempted) To update the EPM to the current software version, set P199 = 5. The parameters can now be changed but the EPM is incompatible with previous software revisions. 	

4.5.4 PID Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P200	PID Mode	0	0 Disabled 1 Normal-acting 2 Reverse-acting 3 Normal-acting, Bi-directional 4 Reverse-acting, Bi-directional	<ul style="list-style-type: none"> Normal-acting: As feedback increases, motor speed decreases Reverse-acting: As feedback increases, motor speed increases PID mode is disabled in Vector Torque mode (P300 = 5) Selections 3, 4: If P112=1, PID controller output sets the speed, (range -max freq to +max freq)
			<p>NOTE To activate PID mode, one of the TB-13 inputs (P121...P124) must be used to select the Auto Reference that matches the desired PID setpoint reference. If the selected PID setpoint reference uses the same analog signal as the PID feedback (P201), an F_{AL} fault will occur. Example: The desired PID setpoint reference is the keypad (▲ and ▼). Set TB-13x = 6 (Auto Reference: Keypad):</p> <ul style="list-style-type: none"> TB-13x = closed: PID mode is active TB-13x = open: PID mode is disabled and the drive speed will be controlled by the reference selected in P101. 	
P201	PID Feedback Source	0	0 4-20 mA (TB-25) 1 0-10 VDC (TB-5) 2 Drive Load (P507) 3 Feedback from Network	Must be set to match the PID feedback signal
P202	PID Decimal Point	1	0 PID Display = XXXX 1 PID Display = XXX.X 2 PID Display = XX.XX 3 PID Display = X.XXX 4 PID Display = .XXXX	Applies to P204, P205, P214, P215, P231...P233, P242, P522, P523
P203	PID Units	0	0 % 1 /UNITS 2 AMPS 3 NONE	Select the UNITS LED that will be illuminated when the drive is running in PID control mode
P204	Feedback at Minimum Signal	0.0	-99.9 3100.0	Set to match the range of the feedback signal being used
P205	Feedback at Maximum Signal	100.0	-99.9 3100.0	Example: Feedback signal is 0 - 300 PSI; P204 = 0.0, P205 = 300.0

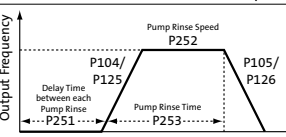
(2) Parameter applicable to SMV models 15HP (11kW) and higher.




Commissioning

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P207	Proportional Gain	5.0	0.0	{%}	1000.0	<div>Used to tune the PID loop:</div> <ul style="list-style-type: none">• Increase P207 until system becomes unstable, then decrease P207 by 10-15%• Next, increase P208 until feedback matches setpoint• If required, increase P209 to compensate for sudden changes in feedback
P208	Integral Gain	0.0	0.0	{s}	20.0	
P209	Derivative Gain	0.0	0.0	{s}	20.0	
			<div></div> <div>NOTE<ul style="list-style-type: none">• Derivative Gain is very sensitive to noise on the feedback signal. Use with care.• Derivative Gain is not normally required in pump and fan applications</div>			
P210	PID Setpoint Ramp	20.0	0.0	{s}	100.0	<ul style="list-style-type: none">• time of setpoint change from P204 to P205 or vice versa.• Used to smooth the transition from one PID setpoint to another, such as when using the Preset PID Setpoints (P231...P233)
P214	Minimum Alarm	0.0	P204		P205	Use with P140, P142 = 18...23
P215	Maximum Alarm	0.0	P204		P205	
P231	Preset PID Setpoint #1	0.0	P204		P205	TB-13A activated; P121 = 3 and P200 = 1 or 2
P232	Preset PID Setpoint #2	0.0	P204		P205	TB-13B activated; P122 = 3 and P200 = 1 or 2
P233	Preset PID Setpoint #3	0.0	P204		P205	TB-13C activated; P123 = 3 and P200 = 1 or 2
P234	Preset PID Setpoint #4	0.0	P204		P205	TB-13D activated; P124 = 3 and P200 = 1 or 2
P240	Sleep Threshold	0.0	0.0	{Hz}	500.0	<ul style="list-style-type: none">• If drive speed < P240 for longer than P241, output frequency = 0.0 Hz; drive display = SLP• P240 = 0.0: Sleep mode is disabled.• P200 = 0...2: Drive will start again when speed command is above P240• P242 > 0.0: Drive will restart when the PID feedback differs from the setpoint by more than the value of P242 or when the PID loop requires a speed above P240.
P241	Sleep Delay	30.0	0.0	{s}	300.0	
P242	Sleep Bandwidth	0.0			B _{max}	
			Where: B _{max} = I(P205 - P204)I			
P243	Feedback Sleep Entry Threshold	0.0	P204		P205	Active only when P244 = 1 or 2
P244	Sleep Entry Mode	0	0 Enter SLEEP if Drive Speed <P240			For time longer than P241
			1 Enter SLEEP if Feedback >P243			For time longer than P241 or same as Sel 0
			2 Enter SLEEP if Feedback <P243			For time longer than P241 or same as Sel 0
P245	Sleep Entry Stop Type	0	0 Coast to Stop			
			1 Ramp to Stop			
			2 Stop with P111 settings			
P246	Feedback Recovery from Sleep Threshold	0.0	P204		P205	Active only when P247 = 1 or 2
P247	Sleep Recovery Mode	0	0 Recovery if Speed Setpoint > P240 or if PID feedback differs from setpoint by more than P242			
			1 Recovery only if Feedback < P246			
			2 Recovery only if Feedback > P246			

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

Code		Possible Settings			IMPORTANT
No.	Name	Default	Selection		
P250	Auto Rinse in Sleep Mode	0	0 Disabled 1 Enabled		Activated in sleep mode only. Sleep Recovery cancels Auto Rinse
P251	Time Delay between Auto Rinses	30.0	0.0 {min}	6553.5	Time delay reset by re/entering sleep mode
P252	Auto Rinse Speed	0.0	-500.0 {Hz}	500.0	If P112 = 1, negative sign = reverse direction
P253	Auto Rinse Time	0.0	0.0 {sec}	6553.5	Does not include time to decel back to speed
<div>Auto Pump Rinse Setup: P250=1 (Enabled) P251=# minutes between each PumpRinse P252=Hz speed of Pump Rinse P253=# seconds Pump Rinse duration</div> <div></div>					
P280	Current Level: Flying Restart Type 2	70.0	0.0 { % }	P171	Maximum current during Type 2 flying restart operation
P281	Decel Time: Flying Restart Type 2	3.0	0.0 {sec}	3600.0	Deceleration rate used during Type 2 flying restart operation

4.5.5 Vector Parameters

Code		Possible Settings		
No.	Name	Default	Selection	IMPORTANT
P300 ⁽¹⁾	Drive Mode	0	0 Constant V/Hz	Constant torque V/Hz control for general applications
			1 Variable V/Hz	
			2 Enhanced Constant V/Hz	For single or multiple motor applications that require better performance than settings 0 or 1, but cannot use Vector mode, due to: <ul style="list-style-type: none">• Missing required motor data• Vector mode causing unstable motor operation
			3 Enhanced Variable V/Hz	
			4 Vector Speed	For single-motor applications requiring higher starting torque and speed regulation
			5 Vector Torque	For single-motor applications requiring torque control independent of speed
				
P302 ⁽¹⁾	Motor Rated Voltage		0 {V} 600	• Default setting = drive rating
P303 ⁽¹⁾	Motor Rated Current		0.1 {A} 500.0	• Set to motor nameplate data

(1) Any changes to this parameter will not take effect until the drive is stopped.



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Code		Possible Settings			IMPORTANT
No.	Name	Default	Selection		
P304 ⁽¹⁾	Motor Rated Frequency	60	0	{Hz} 1000	Set to motor nameplate data
P305 ⁽¹⁾	Motor Rated Speed	1750	300	{RPM} 65000	
P306 ⁽¹⁾	Motor Cosine Phi	0.80	0.40	0.99	
			NOTE If motor cosine phi is not known, use one of the following formulas: cos phi = motor Watts / (motor efficiency X P302 X P303 X 1.732) cos phi = cos [sin ⁻¹ (magnetizing current / motor current)]		
P310 ⁽¹⁾	Motor Stator Resistance		0.00	{Ω} 64.00	<ul style="list-style-type: none">P310, 311 default setting depends on drive ratingWill be automatically programmed by P399Changing these settings can adversely affect performance. Contact factory technical support prior to changing
P311 ⁽¹⁾	Motor Stator Inductance		0.0	{mH} 2000	
P315	Dead Time Compensation Factor	0.0	-50.0	{%} +50.0	<ul style="list-style-type: none">Adjust dead time correction from internal defaultTakes effect when P399 = 3.
P330	Torque Limit	100	0	{%} 400	When P300 = 5, sets the maximum output torque.
P331	Preset Torque Setpoint #1	100	0	{%} 400	TB-13A activated; P121 = 3 and P300 = 5
P332	Preset Torque Setpoint #2	100	0	{%} 400	TB-13B activated; P122 = 3 and P300 = 5
P333	Preset Torque Setpoint #3	100	0	{%} 400	TB-13C activated; P123 = 3 and P300 = 5
P334 ⁽²⁾	Preset Torque Setpoint #4	100	0	{%} 400	TB-13D activated; P124 = 3 and P300 = 5
P340 ⁽¹⁾	Current Loop P Gain	0.25	0.00	16.0	Changing these settings can adversely affect performance. Contact factory technical support prior to changing.
P341 ⁽¹⁾	Current Loop I Gain	65	12	{ms} 9990	
P342 ⁽¹⁾	Speed Loop Adjust	0.0	0.0	{%} 20.0	
P343	Slip Compensation Response Filter	99	90	{ms} 9999	Low pass filter time constant for varying the slip compensation response to changes in the motor current.
P399	Motor Auto-calibration	0	0 Calibration Not Done 1 Standard Calibration Enabled 2 Advanced Calibration Enabled 3 Bypass Calibration, enable operation in vector mode w/o Auto Calibration 4 Standard Calibration Complete 5 Advanced Calibration Complete		<ul style="list-style-type: none">If P300 = 4 or 5, motor calibration must be performed if P399 is not set to 3 (bypass calibration).If P300=2 or 3, motor calibration is recommended.Use option 2 if option 1 failed or in case of non-standard motorsAn alternating CAL / Err will occur if:<ul style="list-style-type: none">- attempt motor calibration with P300 = 0 or 1- motor calibration is attempted before programming motor data
			NOTE: To run the Auto Calibration: <ul style="list-style-type: none">Set P302...P306 according to motor nameplateSet P399 = 1 or 2 (if option 1 failed or in case of non-standard motor)Make sure motor is cold (20° - 25° C)Apply a Start commandDisplay will indicate CAL for about 40 secondsOnce the calibration is complete, the display will indicate Stop; apply another Start command to actually start the motorParameter P399 will now be set to 4 or 5.		

(1) Any changes to this parameter will not take effect until the drive is stopped.

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



4.5.6 Network Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P400	Network Protocol		0 Not Active 1 Remote Keypad 2 Modbus RTU 3 CANopen 4 DeviceNet 5 Ethernet 6 Profibus 7 Lecom-B 8 I/O Module	This parameter setting is based upon the network or I/O module that is installed.
P401	Module Type Installed	0	0 No Module Installed 1 Basic I/O (0x0100, 1.0.0) 2 RS485/Rem. Keypad (0x0200, 2.0.0) 3 CANopen (0x0300, 3.0.0) 11 PROFIBUS (0x1100, 11.0.0) 12 Ethernet (0x1200, 12.0.0)	Module type format: 0xAABC; Drive Display: AA.B.C AA = Module Type B = Major revision C = minor revision
P402	Module Status	0	0 Not Initialized 1 Initialization: Module to EPM 2 Initialization: EPM to Module 3 Online 4 Failed Initialization Error 5 Time-out Error 6 Initialization Failed 7 Initialization Error	Module type mismatch P401 Protocol selection mismatch P400
P403	Module Reset	0	0 No Action 1 Reset parameters to default values	Returns module parameters 401...499 to the default values shown in the manual
P404	Module Timeout Action	3	0 No Fault 1 STOP (see P111) 2 Quick Stop 3 Fault (F _{ntF})	Action to be taken in the event of a Module/Drive Time-out. Time is fixed at 200ms STOP is by the method selected in P111.
P405	Current Network Fault		0 No Fault 1 F.nF1 2 F.nF2 3 F.nF3 4 F.nF4 5 F.nF5 6 F.nF6 7 F.nF7	Netidle Mode Loss of Ethernet I/O connection Network Fault Explicit Message Timeout Overall Network Timeout Overall Explicit Timeout Overall I/O Message Timeout
P406	Proprietary			Manufacturer specific
P407 ... P499		Module Specific Parameters		Refer to the Communications Reference Guide specific to the network or I/O module installed.



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4.5.7 Diagnostic Parameters

Code		Display Range (READ ONLY)		IMPORTANT
No.	Name			
P500	Fault History			<ul style="list-style-type: none"> Displays the last 8 faults Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the F.) Refer to section 5.3
P501	Software Version			Format: x.yz
P502	Drive ID			A flashing display indicates that the Drive ID stored in the EPM does not match the drive model it is plugged into.
P503	Internal Code			Alternating Display: xxx-; -yy
P505	DC Bus Voltage	0	{VDC} 1500	
P506	Motor Voltage	0	{VAC} 1000	
P507	Load	0	{%} 255	Motor load as % of drive's output current rating. Refer to section 2.3.
P508	Motor Current	0.0	{A} 1000	Actual motor current
P509	Torque	0	{%} 500	Torque as % of motor rated torque (vector mode only)
P510	Output Power kW	0.00	{kW} 650.0	
P511	Total kWh	0.0	{kWh} 9999999	Alternating display: xxx-; yyyy when value exceeds 9999
P512	Heatsink Temp	0	{°C} 150	Heatsink temperature
P520	0-10 VDC Input	0.0	{VDC} 10.0	Actual value of signal at TB-5 (See P162)
P521	4-20 mA Input	0.0	{mA} 20.0	Actual value of signal at TB-25 (See P162)
P522	TB-5 Feedback	P204	P205	TB-5 signal value scaled to PID feedback units (See P162)
P523	TB-25 Feedback	P204	P205	TB-25 signal value scaled to PID feedback units (See P162)
P524	Network Feedback	P204	P205	Network signal value scaled to PID feedback units
P525	Analog Output	0	{VDC} 10.0	Refer to P150...P155
P527	Actual Output Frequency	0	{Hz} 500.0	
P528	Network Speed Command	0	{Hz} 500.0	Command speed if (Auto: Network) is selected as the speed source
P530	Terminal and Protection Status			Indicates terminal status using segments of the LED display. (Refer to section 4.5.7.1)
P531	Keypad Status			Indicates keypad button status using segments of the LED display. (Refer to section 4.5.7.2)
P540	Total Run Time	0	{h} 9999999	Alternating display: xxx-; yyyy when value exceeds 9999
P541	Total Power On Time	0	{h} 9999999	
P550	Fault History	1	8	<ul style="list-style-type: none"> Displays the last 8 faults Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the F.) Refer to section 5.3
P551	Fault History Time	0	{h} 999999	Display: "n.hh-" "hhhh" "mm.ss" = fault #, hours, seconds The "hhhh" screen is displayed after hours exceed 999.
P552	Fault History Counter	0	255	Number of sequential occurrences of a fault. For example: 3 external faults occur over a period of time with no other errors occurring. Then P552 will indicate 3, P550 will indicate the error EF and P551 will indicate the time of the first fault occurrence.

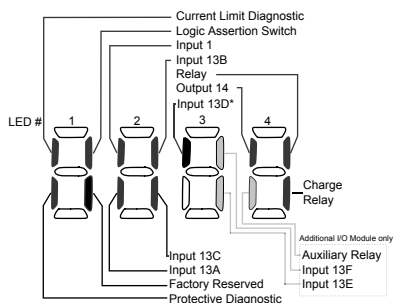
Code		Display Range (READ ONLY)		IMPORTANT
No.	Name			
P560	Sequencer: Currently Active Segment	0	17	
P561	Sequencer: Time since Start of Active Segment	0.0 0	{P708} {P708} 6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P562	Sequencer: Time Remaining in Active Segment	0.0 0	{P708} {P708} 6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P563	Sequencer: Number of cycles since start	0	65535	
P564	Sequencer: Number of cycles remaining	0	65535	
		NOTE: Parameters P560-P564 are visible only when P700 > 0 (i.e. the sequencer is enabled)		

4.5.7.1 Terminal & Protection Status Display

Parameter P530 allows monitoring of the control terminal points and common drive conditions:

An illuminated LED segment indicates:

- the protective circuit is active (LED 1)
- the Logic Assertion Switch is set to High (+)
- input terminal is asserted (LED 2)
- output terminal is energized (LED 4)
- the Charge Relay is not a terminal, this segment will be illuminated when the Charge Relay is energized (LED 4).



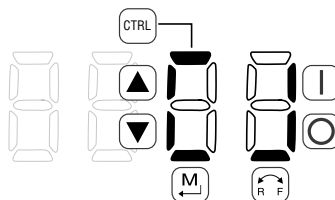
* Input 13D available on 15-60HP (11-45kW) models only

4.5.7.2 Keypad Status Display

Parameter P531 allows monitoring of the keypad pushbuttons:

An illuminated LED segment indicates when the button is depressed.

LED 1 and LED 2 are used to indicate pushbutton presses on a remote keypad that is attached to the drive. LED 3 and LED 4 indicate button presses on the local drive keypad.





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4.5.8 Onboard Communications Parameters 15-60HP (11-45kW)

The P6xx Onboard Communication parameters are applicable to the 15HP (11kW) and higher models only.

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P600	Network Enable	0	0 Disabled 1 Remote Keypad 2 Modbus 7 Lecom	This parameter enables the onboard network communications.
			NOTE: Onboard Communications will be disabled if: - P600 = 0, or - P600 = 1 and P400 = 1, or - P600 = 2 and P400 = 2, 3, 4, 5, 6 or 7 - P600 = 7 and P400 = 2, 3, 4, 5, 6 or 7	If the onboard communications are disabled, the user will not have access to any of the other P6xx parameters.
P610	Network Address	1	1 - 247	Modbus
		1	1 - 99	Lecom
P611	Network Baud Rate	2	0 2400 bps 2 9600 bps 1 4800 bps 3 19200 bps	Modbus
		0	0 9600 bps 1 4800 bps 2 2400 bps 3 1200 bps 4 19200 bps	Lecom
P612	Network Data Format	0	0 8, N, 2 1 8, N, 1 2 8, E, 1 3 8, O, 1	Modbus Only
P620	Network Control Level	0	0 Monitor Only 1 Parameter Programming 2 Programming and Setpoint Control 3 Full Control	Lecom Only
P624	Network Powerup Start Status	0	0 Quick Stop 1 Controller Inhibit	Lecom Only
P625	Network Timeout	10.0	0.0 - 300.0 seconds	Modbus
		50	0 - 65000 milliseconds	Lecom
P626	Network Timeout Action	4	0 No action 1 Stop (P111) 2 Quick Stop 3 Controller Inhibit 4 Trip Fault, F.nF1	Modbus
		0	0 No action 1 Controller Inhibit 2 Quick Stop 3 Trip Fault, F.nF1	Lecom
P627	Network Messages Received		Read-Only: 0 - 9999 NOTE: When the number of messages exceeds 9999, the counter resets and resumes counting from 0.	Valid network messages received

4.5.9 Sequencer Parameters

The P700 Sequencer parameters are listed herein. Refer to section 4.5.7 for P56x Sequencer Diagnostic Parameters. The sequencer function consists of 16 step segments, each individual step segment can have its own ramp time, time spent in individual segment and output frequency entered. The sequencer has 3 different modes to control how the drive moves through each individual step segment: Timer Transition, Step Sequence or Timer and Step Sequence.

P700= 1 (Timer Transition)

Starting at the segment number entered in the "Start Segment" parameter, the drive will automatically move through each of the segments. The time spent in each segment is determined by the values set in the individual "Time in Current Step" parameters.

P700= 2 (Step Sequence)

Starting at the segment number entered in the "Start Segment" parameter the sequencer will only move to the next segment when a rising edge is applied to the highest priority digital input which is programmed to "Step Sequence" selection "24".

P700= 3 (Timer Transition or Step Sequence)

Starting at the segment number entered in the "Start Segment" parameter, the drive will automatically move through each of the segments. The time spent in each segment is determined by the values set in the individual "Time in Current Step" parameters, however if a rising edge is applied to the highest priority digital input which is programmed to "Step Sequence" selection "24" it will force the sequencer to step into the next segment.


NOTE: A value of "0" in the "Time in current step" parameter (ex: P712), will result in the segment being skipped.

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P700	Sequencer Mode	0	0 Disabled 1 Enabled: transition on timer only 2 Enabled: transition on rising edge (P121, 122, 123 = 25 step sequence) 3 Enabled: transition on timer or rising edge	If P700 = 0 and no reference (P121, P101) points to any of the sequence segments, then P701-P799 will not be displayed on the local keypad.
P701	Sequencer: TB13A Trigger Segment	1	1 - 16 TB13A = lowest priority	
P702	Sequencer: TB13B Trigger Segment	1	1 - 16 TB13B: higher priority than TB13A	Asserting TB13B with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P703	Sequencer: TB13C Trigger Segment	1	1 - 16 TB13C: higher priority than TB13B, A	Asserting TB13C with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P704 ⁽²⁾	Sequencer: TB13D Trigger Segment	1	1 - 16 TB13D: higher priority than TB13C, B, A	Asserting TB13D with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P706	Sequencer: Action after Stop/Start transition or Fault Restart	0	0 Restart at beginning of sequence 1 Restart at beginning of current seg 2 Start at beginning of prior segment 3 Start at beginning of next segment	Pointed by TB13x
P707	Sequencer: Number of cycles	1	1 65535	1 = single scan; 65535 = continuous loop

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



Commissioning

Code		Possible Settings				IMPORTANT																																					
No.	Name	Default	Selection																																								
P708	Sequencer: Time units/scaling	0	0	0.1	{sec}	6553.5	Setup units/scaling for all sequencer time related parameters																																				
			1	1	{sec}	65535																																					
			2	1	{min}	65535																																					
			NOTE: P708 rescales the following sequencer related parameters: - Segment Times in current step: P712, P717, P722, P727, P732, P737, P742, P747, P752, P757, P762, P767, P772, P777, P782, P787, P792 - Sequence diagnostic/status: P561, P562																																								
Segment #1																																											
P710	Segment #1 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P711	Segment #1 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P712	Segment #1 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P713	Segment #1 Digital Output State	0	<table><tr><td>Value set in P713</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).				Value set in P713	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P713	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P714	Segment #1 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					
Segment #2																																											
P715	Segment #2 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P716	Segment #2 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P717	Segment #2 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P718	Segment #2 Digital Output State	0	<table><tr><td>Value set in P718</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).				Value set in P718	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P718	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P719	Segment #2 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					

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Code		Possible Settings				IMPORTANT																																				
No.	Name	Default	Selection																																							
Segment #3																																										
P720	Segment #3 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																				
P721	Segment #3 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																					
P722	Segment #3 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																				
P723	Segment #3 Digital Output State	0	<table><tr><td>Value set in P723</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).			Value set in P723	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P723	0	1	2	3	4	5	6	7																																		
Relay (Bit 0)	0	1	0	1	0	1	0	1																																		
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																		
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																		
P724	Segment #3 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																				
Segment #4																																										
P725	Segment #4 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																				
P726	Segment #4 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																					
P727	Segment #4 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																				
P728	Segment #4 Digital Output State	0	<table><tr><td>Value set in P728</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).			Value set in P728	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P728	0	1	2	3	4	5	6	7																																		
Relay (Bit 0)	0	1	0	1	0	1	0	1																																		
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																		
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																		
P729	Segment #4 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																				
Segment #5																																										
P730	Segment #5 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																				
P731	Segment #5 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																					
P732	Segment #5 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																				
P733	Segment #5 Digital Output State	0	<table><tr><td>Value set in P733</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).			Value set in P733	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P733	0	1	2	3	4	5	6	7																																		
Relay (Bit 0)	0	1	0	1	0	1	0	1																																		
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																		
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																		
P734	Segment #5 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																				



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Code		Possible Settings				IMPORTANT																																				
No.	Name	Default	Selection																																							
Segment #6																																										
P735	Segment #6 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																				
P736	Segment #6 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																					
P737	Segment #6 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																				
P738	Segment #6 Digital Output State	0	<table><tr><td>Value set in P738</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).			Value set in P738	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P738	0	1	2	3	4	5	6	7																																		
Relay (Bit 0)	0	1	0	1	0	1	0	1																																		
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																		
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																		
P739	Segment #6 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																				
Segment #7																																										
P740	Segment #7 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																				
P741	Segment #7 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																					
P742	Segment #7 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																				
P743	Segment #7 Digital Output State	0	<table><tr><td>Value set in P743</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).			Value set in P743	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P743	0	1	2	3	4	5	6	7																																		
Relay (Bit 0)	0	1	0	1	0	1	0	1																																		
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																		
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																		
P744	Segment #7 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																				
Segment #8																																										
P745	Segment #8 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																				
P746	Segment #8 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																					
P747	Segment #8 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																				
P748	Segment #8 Digital Output State	0	<table><tr><td>Value set in P748</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).			Value set in P748	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P748	0	1	2	3	4	5	6	7																																		
Relay (Bit 0)	0	1	0	1	0	1	0	1																																		
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																		
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																		
P749	Segment #8 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																				

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Code		Possible Settings				IMPORTANT																																					
No.	Name	Default	Selection																																								
Segment #9																																											
P750	Segment #9 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P751	Segment #9 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P752	Segment #9 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P753	Segment #9 Digital Output State	0	<table><tr><td>Value set in P753</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</p>				Value set in P753	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P753	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P754	Segment #9 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					
Segment #10																																											
P755	Segment #10 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P756	Segment #10 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P757	Segment #10 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P758	Segment #10 Digital Output State	0	<table><tr><td>Value set in P758</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</p>				Value set in P758	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P758	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P759	Segment #10 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					
Segment #11																																											
P760	Segment #11 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P761	Segment #11 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P762	Segment #11 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P763	Segment #11 Digital Output State	0	<table><tr><td>Value set in P763</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</p>				Value set in P763	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P763	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P764	Segment #11 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					



Commissioning

Code		Possible Settings				IMPORTANT																																					
No.	Name	Default	Selection																																								
Segment #12																																											
P765	Segment #12 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P766	Segment #12 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P767	Segment #12 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P768	Segment #12 Digital Output State	0	<table><tr><td>Value set in P768</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).				Value set in P768	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P768	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P769	Segment #12 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					
Segment #13																																											
P770	Segment #13 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P771	Segment #13 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P772	Segment #13 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P773	Segment #13 Digital Output State	0	<table><tr><td>Value set in P773</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).				Value set in P773	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P773	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P774	Segment #13 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					
Segment #14																																											
P775	Segment #14 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																					
P776	Segment #14 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																						
P777	Segment #14 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																					
P778	Segment #14 Digital Output State	0	<table><tr><td>Value set in P778</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).				Value set in P778	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
Value set in P778	0	1	2	3	4	5	6	7																																			
Relay (Bit 0)	0	1	0	1	0	1	0	1																																			
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																			
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																			
P779	Segment #14 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																					


Commissioning



Code	Possible Settings		IMPORTANT																																									
No.	Name	Default								Selection																																		
Segment #15																																												
P780	Segment #15 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																						
P781	Segment #15 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																							
P782	Segment #15 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																						
P783	Segment #15 Digital Output State	0	<table><tr><td>Value set in P783</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <div>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</div>			Value set in P783	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27		
Value set in P783	0	1	2	3	4	5	6	7																																				
Relay (Bit 0)	0	1	0	1	0	1	0	1																																				
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																				
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																				
P784	Segment #15 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																						
Segment #16																																												
P785	Segment #16 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																						
P786	Segment #16 Accel/Decel Time	20.0	0.0	{sec}	3600.0																																							
P787	Segment #16 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0																																						
P788	Segment #16 Digital Output State	0	<table><tr><td>Value set in P788</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <div>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</div>			Value set in P788	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27		
Value set in P788	0	1	2	3	4	5	6	7																																				
Relay (Bit 0)	0	1	0	1	0	1	0	1																																				
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																				
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																				
P789	Segment #16 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10																																						
End Segment																																												
P790	End Segment: Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If P112 = 1, negative sign forces reverse direction																																						
P791	End Segment: Accel/Decel Time	5.0	0.0	{sec}	3600.0																																							
P792	End Segment: Delay before P793, 794 & 795 activation		0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708																																						
P793	End Segment: Digital Output State		<table><tr><td>Value set in P793</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <div>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</div>			Value set in P793	0	1	2	3	4	5	6	7	Relay (Bit 0)	0	1	0	1	0	1	0	1	TB14 (Bit 1)	0	0	1	1	0	0	1	1	I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27		
Value set in P793	0	1	2	3	4	5	6	7																																				
Relay (Bit 0)	0	1	0	1	0	1	0	1																																				
TB14 (Bit 1)	0	0	1	1	0	0	1	1																																				
I/O option Relay (Bit 2)	0	0	0	0	1	1	1	1																																				



Commissioning

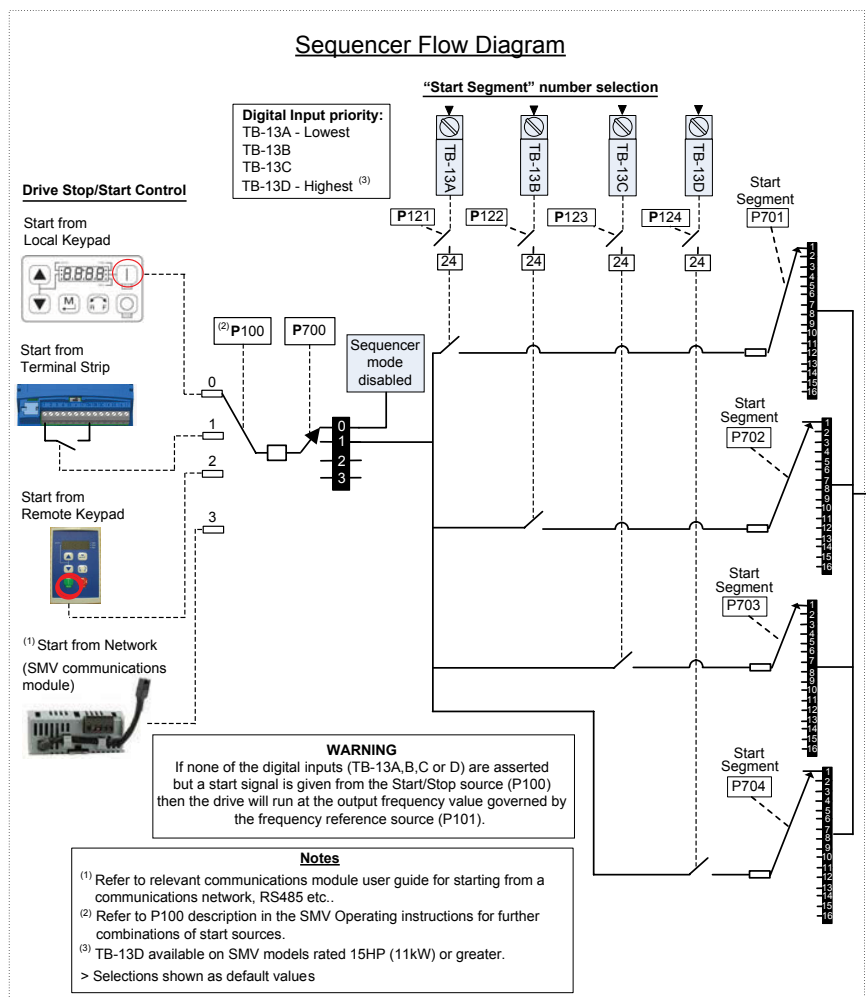
Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P794	End Segment: TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: P150 = 10
P795	End Segment: Drive Action	0	0	Keep Running	Recovery: Toggling the START SEQUENCE will start the cycle from 'end segment Stop' or 'end segment DC Brake'.	
			1	Stop (based on P111)		
			2	Coast to Stop		
			3	Quick Stop (per P127)		
			4	Coast with DC Brake		
			5	Ramp with DC Brake		
			WARNING! If P795 = 0 then toggling the start sequence input will also restart the sequencer cycle but in the interim where TB13X is open the drive will ramp to the standard or specified alternate speed source depending on the drive configuration.			



WARNING

If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

4.5.9.1 Sequencer Flow Diagram Left



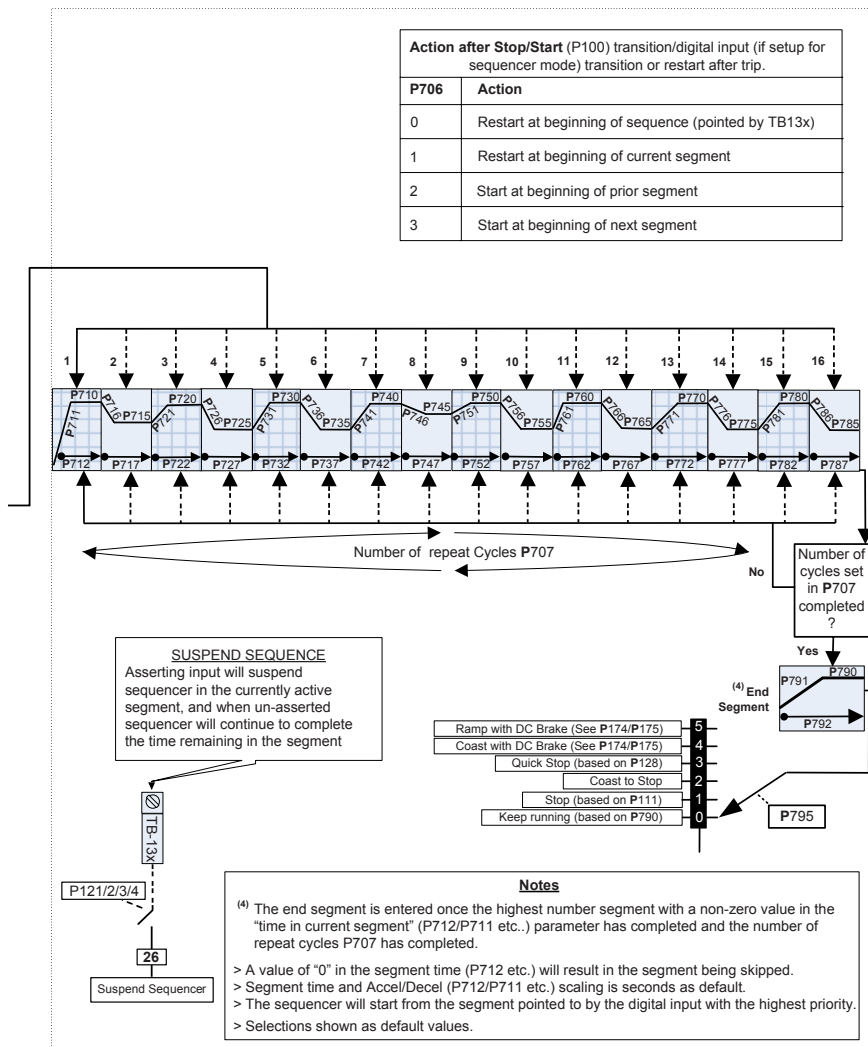
WARNING

If the input defined to “Start Sequence” is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

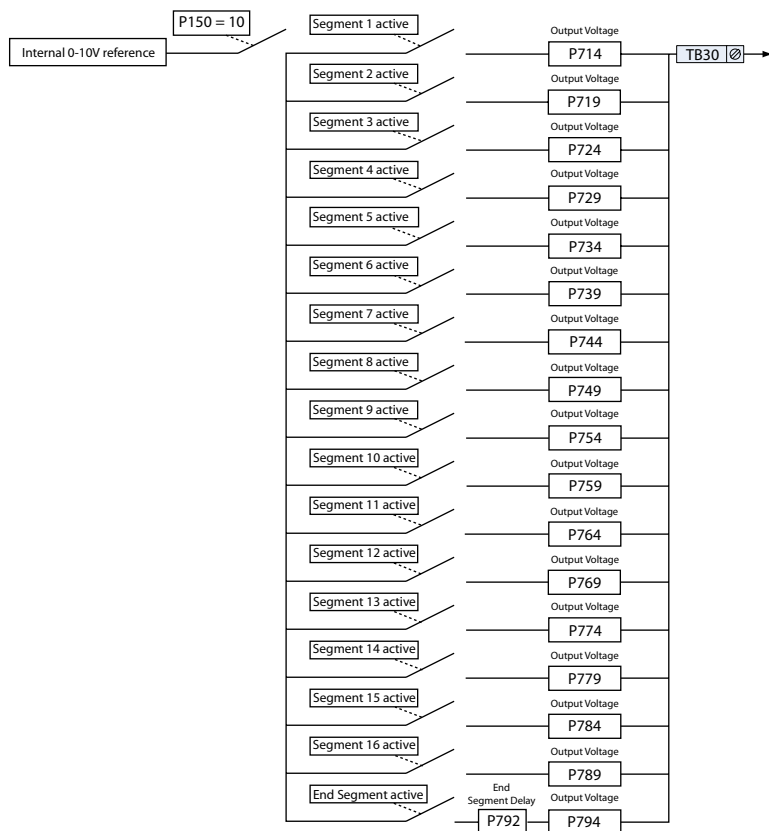


Commissioning

4.5.9.2 Sequencer Flow Diagram Right



4.5.9.3 Sequencer Status



NOTE

On the "End Segment", the output voltage is not present until after the end segment delay P792 has expired. On the other segments the output voltage is present on entry to the segment. The same is true for the digital outputs.

(1) The drive can only be restarted if the error message has been reset.



Troubleshooting and Diagnostics

5 Troubleshooting and Diagnostics

5.1 Status/Warning Messages

Status / Warning	Cause	Remedy
br DC-injection brake active	DC-injection brake activated <ul style="list-style-type: none"> activation of digital input (P121...P124 = 18) automatically (P110 = 2, 4...6) automatically (P111 = 1, 3) 	Deactivate DC-injection brake <ul style="list-style-type: none"> deactivate digital input automatically after P175 time has expired
bF Drive ID warning	The Drive ID (P502) stored on the EPM does not match the drive model.	<ul style="list-style-type: none"> Verify motor data (P302...P306) and perform Auto Calibration. Set drive mode (P300) to 0 or 1 Reset the drive (P199 to 3 or 4) and reprogram.
CAL Motor Auto-calibration active	Refer to P300, P399	Motor Auto-calibration is being performed
cE An EPM that contains valid data from a previous software version has been installed	An attempt was made to change parameter settings	Parameter settings can only be changed after the EPM data is converted to the current version (P199 = 5)
CL Current Limit (P171) reached	Motor overload	<ul style="list-style-type: none"> Increase P171 Verify drive/motor are proper size for application
dEC Decel Override	The drive has stopped decelerating to avoid tripping into HF fault, due to excessive motor regen (2 sec max).	If drive trips into HF fault: <ul style="list-style-type: none"> Increase P105, P126 Install Dynamic Braking option
Err Error	Invalid data was entered, or an invalid command was attempted	
FCL Fast Current Limit	Overload	Verify drive/motor are proper size for application
FSt Flying Restart Attempt after Fault	P110 = 5,6	
GE OEM Settings Operation warning	An attempt was made to change parameter settings while the drive is operating in OEM Settings mode.	In OEM Settings mode (P199 = 1), making changes to parameters is not permitted.
GF OEM Defaults data warning	An attempt was made to use (or reset to) the OEM default settings (P199 = 1 or 2) using an EPM without valid OEM data.	Install an EPM containing valid OEM Defaults data
LC Fault Lockout	The drive attempted 5 restarts after a fault but all attempts were unsuccessful (P110 = 3...6)	<ul style="list-style-type: none"> Drive requires manual reset Check Fault History (P500) and correct fault condition
PdEC PID Deceleration Status	PID setpoint has finished its ramp but the drive is still decelerating to a stop.	
Pi d PID Mode Active	Drive has been put into PID Mode.	Refer to P200
SLP Sleep Mode is active	Refer to P240...P242	
SP Start Pending	The drive has tripped into a fault and will automatically restart (P110 = 3...6)	To disable Auto-Restart, set P110 = 0...2
SPd PID Mode disabled.	Drive has been taken out of PID Mode. Refer to P200.	
StoP Output frequency = 0 Hz (outputs U, V, W inhibited)	Stop has been commanded from the keypad, terminal strip, or network	Apply Start command (Start Control source depends on P100)

(1) The drive can only be restarted if the error message has been reset.



5.2 Drive Configuration Message

When the Mode button is pressed and held, the drive's display will provide a 4-digit code that indicates how the drive is configured. If the drive is in a Stop state when this is done, the display will also indicate which control source commanded the drive to Stop (the two displays will alternate every second).

Configuration Display			
Format = x.y.zz	x = Control Source: L = Local Keypad t = Terminal Strip r = Remote Keypad n = Network	y = Mode: S = Speed mode P = PID mode t = Torque mode C = Sequencer mode	zz = Reference: CP = Keypad ▲ ▼ EU = 0-10 VDC (TB-5) EI = 4-20 mA (TB-25) JG = Jog nt = Network OP = MOP P L...PT = Preset 1...7 Q L...16 = Sequencer Segment
	Example: L.S.CP = Local Keypad Start control, Speed mode, Keypad speed reference t.P.EU = Terminal Strip Start control, PID mode, 0-10 VDC setpoint reference t.C.I2 = Terminal Strip Start control, Sequencer Operation (Speed mode), Segment #12 n.t.P2 = Network Start control, Vector Torque mode, Preset Torque #2 reference n.S.O3 = Network Start control, Speed mode, Speed reference from Sequencer segment #03		
Stop Source Display			
Format = x.StP	L.StP = Stop command came from Local Keypad t.StP = Stop command came from Terminal Strip r.StP = Stop command came from Remote Keypad n.StP = Stop command came from Network		

5.3 Fault Messages

The messages below show how they will appear on the display when the drive trips. When looking at the Fault History (P500), the **F_** will not appear in the fault message.

Fault	Cause	Remedy ⁽¹⁾
F_AF High Temperature fault	Drive is too hot inside	<ul style="list-style-type: none"> Reduce drive load Improve cooling
F_AL Assertion Level fault	<ul style="list-style-type: none"> Assertion Level switch is changed during operation P120 is changed during operation P100 or P121...P124 are set to a value other than 0 and P120 does not match the Assertion Level Switch. 	<ul style="list-style-type: none"> Make sure the Assertion Level switch and P120 are both set for the type of input devices being used, prior to setting P100 or P121...P124. Refer to 3.2.3 and P120.
F_bF Personality fault	Drive Hardware	<ul style="list-style-type: none"> Cycle Power Power down and install EPM with valid data Reset the drive back to defaults (P199 = 3, 4) and then re-program If problem persists, contact factory technical support
F_cF Control fault	An EPM has been installed that is either blank or corrupted	
F_cF Incompatible EPM fault	An EPM has been installed that contains data from an incompatible parameter version	
F_cFt Forced Translation fault	An EPM from an old drive put in new drive causes drive to trip F_cFT fault.	Press [M] (mode button) twice to reset



Troubleshooting and Diagnostics

Fault	Cause	Remedy ⁽¹⁾
F_dbF	Dynamic Braking fault	Dynamic braking resistors are overheating
		<ul style="list-style-type: none"> • Increase active decel time (P105, P126, P127). • Check mains voltage and P107
F_EF	External fault	<ul style="list-style-type: none"> • P121...P124 = 21 and that digital input has been opened. • P121...P124 = 22 and that digital input has been closed.
		<ul style="list-style-type: none"> • Correct the external fault condition • Make sure digital input is set properly for NC or NO circuit
F_F I	EPM fault	EPM missing or defective
		Power down and replace EPM
F_F2 ... F_F I2	Internal faults	Contact factory technical support
F_Fnr	Control Configuration Fault	The drive is setup for REMOTE KEYPAD control (P100=2 or 5) but is not setup to communicate with a remote keypad
		Set P400 = 1, or P600 = 1
	The drive is setup for NETWORK ONLY control (P100=3) but is not setup for network communications	Set P400 or P600 to a valid network communications protocol selection
F_FoL	TB25 (4-20 mA signal) Threshold fault	4-20 mA signal (at TB-25) drops below the value set in P164.
		<ul style="list-style-type: none"> • Check signal/signal wire • Refer to parameters P163 and P164.
F_GF	OEM Defaults data fault	Drive is powered up with P199 = 1 and OEM settings in the EPM are not valid.
		Install an EPM containing valid OEM Defaults data or change P199 to 0.
F_HF	High DC Bus Voltage fault	Mains voltage is too high
		Check mains voltage and P107
		Decel time is too short, or too much regen from motor
		Increase active decel time (P105, P126, P127) or install Dynamic Braking option
F_IL	Digital Input Configuration fault (P121...P124)	More than one digital input set for the same function
		Each setting can only be used once (except settings 0 and 3)
	Only one digital input configured for MOP function (Up, Down)	One input must be set to MOP Up, another must be set to MOP Down
	PID mode is entered with setpoint reference and feedback source set to the same analog signal	Change PID setpoint reference (P121...P124) or feedback source (P201).
	One of the digital inputs (P121...P124) is set to 10 and another is set to 11...14.	Reconfigure digital inputs
	One of the digital inputs (P121...P124) is set to 11 or 12 and another is set to 13 or 14.	
	PID enabled in Vector Torque mode (P200 = 1 or 2 and P300 = 5)	PID cannot be used in Vector Torque mode
F_JF	Remote keypad fault	Remote keypad disconnected
		Check remote keypad connections
F_LF	Low DC Bus Voltage fault	Mains voltage too low
		Check mains voltage
F_n Id	No Motor ID fault	An attempt was made to start the drive in Vector or Enhanced V/Hz mode prior to performing the Motor Auto-calibration
		Refer to parameters P300...P399 for Drive Mode setup and calibration.
F_n tF	Module communication fault	Communication failure between drive and Network Module.
		Check module connections
F_n F I ... F_n F9	Network Faults	Refer to the module documentation. for Causes and Remedies.

Troubleshooting and Diagnostics



Fault		Cause	Remedy ⁽¹⁾
F_DF	Output fault: Transistor fault	Output short circuit	Check motor/motor cable
		Acceleration time too short	Increase P104, P125
		Severe motor overload, due to: <ul style="list-style-type: none"> • Mechanical problem • Drive/motor too small for application 	<ul style="list-style-type: none"> • Check machine / system • Verify drive/motor are proper size for application
		Boost values too high	Decrease P168, P169
		Excessive capacitive charging current of the motor cable	<ul style="list-style-type: none"> • Use shorter motor cables with lower charging current • Use low capacitance motor cables • Install reactor between motor and drive.
		Failed output transistor	Contact factory technical support
F_DF I	Output fault: Ground fault	Grounded motor phase	Check motor and motor cable
		Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current
F_PF	Motor Overload fault	Excessive motor load for too long	<ul style="list-style-type: none"> • Verify proper setting of P108 • Verify drive and motor are proper size for application
F_rF	Flying Restart fault	Controller was unable to synchronize with the motor during restart attempt; (P110 = 5 or 6)	Check motor / load
F_SF	Single-Phase fault	A mains phase has been lost	Check mains voltage
F_UF	Start fault	Start command was present when power was applied (P110 = 0 or 2).	<ul style="list-style-type: none"> • Must wait at least 2 seconds after power-up to apply Start command • Consider alternate starting method (P110).
F_FAU	TB5 (0-10V signal) Threshold fault	0-10V signal (at TB5) drops below the value set in P158.	<ul style="list-style-type: none"> • Check signal/signal wire • Refer to parameters P157 and P158

(1) The drive can only be restarted if the error message has been reset.



Appendix

Appendix A

A.1 Permissible Cable Lengths

The table herein lists the permissible cable lengths for use with an SMV inverter with an internal EMC filter.



NOTE

This table is intended as a reference guideline only; application results may vary. The values in this table are based on testing with commonly available low-capacitance shielded cable and commonly available AC induction motors. Testing is conducted at worst case speeds and loads.

Maximum Permissible Cable Lengths (Meters) for SMV Model with Internal EMC Filters									
Mains	Model	4 kHz Carrier (P166 = 0)		6 kHz Carrier (P166 = 1)		8 kHz Carrier (P166 = 2)		10 kHz Carrier (P166 = 3)	
		Class A	Class B	Class A	Class B	Class A	Class B	Class A	Class B
240 V, 1-phase (2/PE)	ESV251 $\phi\phi$ 2SF ϕ	38	12	35	10	33	5	30	N/A
	ESV371 $\phi\phi$ 2SF ϕ	38	12	35	10	33	5	30	N/A
	ESV751 $\phi\phi$ 2SF ϕ	38	12	35	10	33	5	30	N/A
	ESV112 $\phi\phi$ 2SF ϕ	38	12	35	10	33	5	30	N/A
	ESV152 $\phi\phi$ 2SF ϕ	38	12	35	10	33	5	30	N/A
	ESV222 $\phi\phi$ 2SF ϕ	38	12	35	10	33	5	30	N/A
400/480 V, 3-phase (3/PE)	ESV371 $\phi\phi$ 4TF ϕ	30	4	25	2	20	N/A	10	N/A
	ESV751 $\phi\phi$ 4TF ϕ	30	4	25	2	20	N/A	10	N/A
	ESV112 $\phi\phi$ 4TF ϕ	30	4	25	2	20	N/A	10	N/A
	ESV152 $\phi\phi$ 4TF ϕ	30	4	25	2	20	N/A	10	N/A
	ESV222 $\phi\phi$ 4TF ϕ	30	4	25	2	20	N/A	10	N/A
	ESV302 $\phi\phi$ 4TF ϕ	30	4	25	2	20	N/A	10	N/A
	ESV402 $\phi\phi$ 4TF ϕ	54	5	48	3	42	2	N/A	N/A
	ESV552 $\phi\phi$ 4TF ϕ	54	5	48	3	42	2	N/A	N/A
	ESV752 $\phi\phi$ 4TF ϕ	54	5	48	3	42	2	N/A	N/A

NOTE: The “ $\phi\phi$ ” and “ ϕ ” symbols are place holders in the Model part number that contain different information depending on the specific configuration of the model. Refer to the SMV Type Number Designation table in section 2.2 for more information.



Lenze SMVector 13465100 EDBSV01 EN v18



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Service
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630 Douglas Street
Uxbridge, MA 01569
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 508 278-9100
 508 278-6620
 repair@lenzeamericas.com

Standard Model Key Features



- Wide Power Range: 7.5W-240W
- Universal Input :
 - 7.5W-75W: 85-264V AC/105-370V DC
 - 100W: 100-120V AC/200-240V AC (Selectable) 240-370V DC
 - 120W-240W: 85-264V AC/105-370V AC
- Overcurrent/Overvoltage Protection
- Power Factor Correction (75W, 120W, 240W models)
 - EN61000-3-3
 - EN61000-3-2
- Voltage adjustment $\pm 10\%$
- Spring-up Screw Terminal, IP20 (finger-safe)
- DIN rail or Panel Surface Mount
- Approvals:
 - CE marked
 - UL 508 Listed
 - UL, c-UL
 - TÜV approved
 - EMC Directives:
 - EN50081-2
 - EN50082-2
 - EN61000-6-2
 - LVD EN60950:2000



Standard Power Supplies



7.5 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-A05	5V DC	1.5A
PS5R-A12	12V DC	0.6A
PS5R-A24	24V DC	0.3A



15 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-B05	5V DC	2.5A
PS5R-B12	12V DC	1.2A
PS5R-B24	24V DC	0.6A



30 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-C12	12V DC	2.5A
PS5R-C24	24V DC	1.3A



50 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-D24	24V DC	2.1A



75 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-Q24	24V DC	3.1A



100 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-E24	24V DC	4.2A



120 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-F24	24V DC	5A



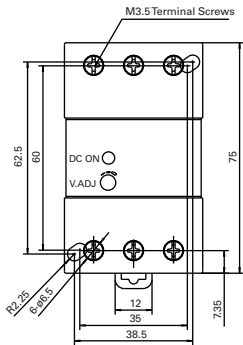
240 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-G24	24V DC	10A

Standard Power Supply Dimensions

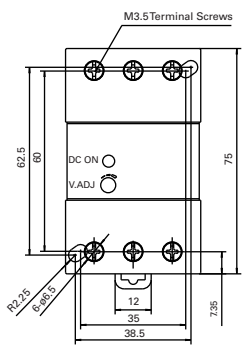
PS5R-A (7.5W)

Height 75.0 mm
Width 45.0 mm
Depth 70.0 mm



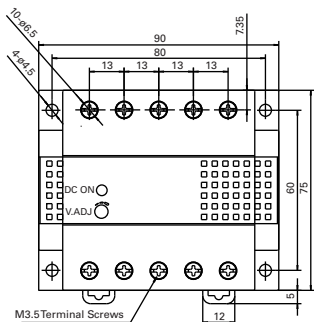
PS5R-B (15W)

Height 75.0 mm
Width 45.0 mm
Depth 95.0 mm



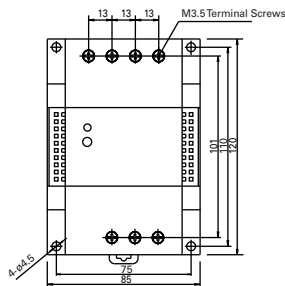
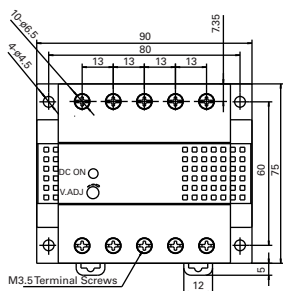
PS5R-C (30W)

Height 75.0 mm
Width 90.0 mm
Depth 95.0 mm



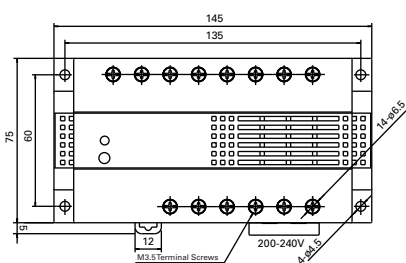
PS5R-D (50W)

Height 75.0 mm
Width 90.0 mm
Depth 95.0 mm



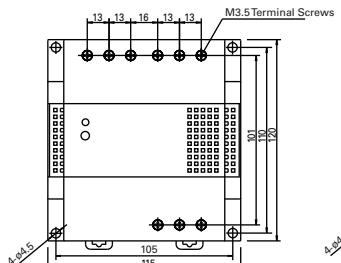
PS5R-Q (75W)

Height 120.0 mm
Width 85.0 mm
Depth 140.0 mm



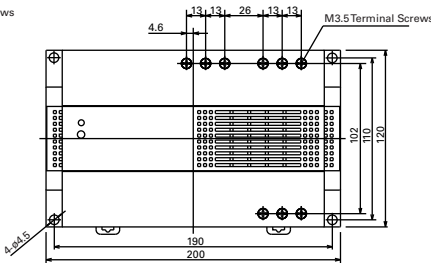
PS5R-E (100W)

Height 75.0 mm
Width 145.0 mm
Depth 95.0 mm



PS5R-F (120W)

Height 120.0 mm
Width 115.0 mm
Depth 140.0 mm



PS5R-G (240W)

Height 120.0mm
Width 200.0mm
Depth 140.0mm

- en**
- 1 T time delay range
 - 2 T time delay setting
 - 3 Function selection
 - 4 LED Indication (Except solid state output)

- de**
- 1 Verzögerungsbereich T
 - 2 Verzögerungseinstellung T
 - 3 Funktionsauswahl
 - 4 LED-Anzeige (außer Halbleiterausgang)

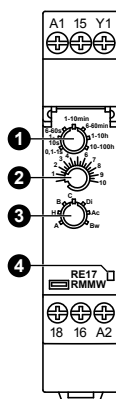
- it**
- 1 Gamma di temporizzazione T
 - 2 Regolazione temporizzazione T
 - 3 Selezione funzione
 - 4 Indicazione LED (eccetto uscita statica)

- fr**
- 1 Gamme de temporisation T
 - 2 Réglage temporisation T
 - 3 Sélection de fonction
 - 4 Voyant (sauf la sortie statique)

- es**
- 1 Gama de temporización T
 - 2 Reglaje temporización T
 - 3 Selección de la función
 - 4 Indicador LED (excepto la salida de estado sólido)

- zh**
- 1 时间范围的确定 T
 - 2 延时时间设定 T
 - 3 功能选择
 - 4 LED 指示 (固态输出除外)

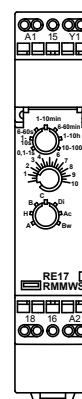
RE17RMMW



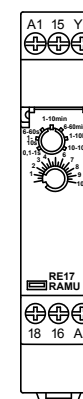
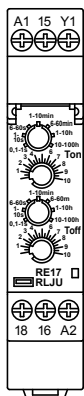
RE17RMXMU



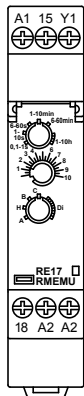
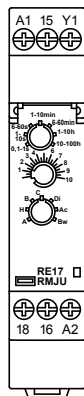
RE17RMMWS



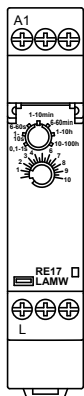
RE17RAMU

RE17RBMU
RE17RCMU
RE17RHMURE17RLJU
RE17RLMU

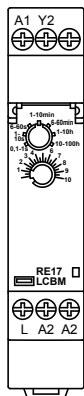
RE17RMEMU

RE17RMJU
RE17RMMU

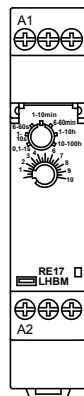
RE17LAMW



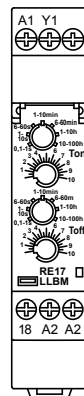
RE17LCBM



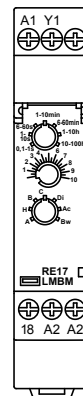
RE17LHBM



RE17LLBM



RE17LMBM



Functions / Fonctions / Funktionen / Funciones / Funzione / 功能

- en**
- U: Supply
R: Relay or solid state output
T: Timing period
C: Control contact
G: Gate
Ta: Adjustable On-delay
Tr: Adjustable Off-delay

Function diagram:

- Relay de-energised
Relay energised
Output open
Output closed

- es**
- U: Alimentación
R: Salida de estado sólido o relé
T: Período de temporización
C: Contacto de control
G: Puerta
Ta: Retardo de conexión ajustable
Tr: Retardo de desconexión ajustable

Diagrama de la función:

- Relé sin alimentación
Relé con alimentación
Salida abierta
Salida cerrada

- fr**
- U: Alimentation
R: Sortie relais ou statique
T: Temporisation
C: Commande
G: Porte (Gate)
Ta: Temporisation travail réglable
Tr: Temporisation repos réglable

Diagramme:

- Relais hors tension
Relais sous tension
Sortie non passante
Sortie passante

- it**
- U: Alimentazione
R: Uscita relé o statica
T: Temporizzazione
C: Comando
G: Porta (Gate)
Ta: Temporizzazione funzionamento regolabile
Tr: Temporizzazione riposo regolabile

Diagramma funzionale:

- Relé non alimentato
Relé alimentato
Uscita aperta
Uscita chiusa

- de**
- U: Spannungsversorgung
R: R: Relais- oder Halbleiterausgang
T: Verzögerung
C: Steuerkontakt
G: Logikgatter
Ta: Einstellbare Ansprechverzögerung
Tr: Einstellbare Rückfallverzögerung

Funktionsdiagramm:

- Relais ohne angelegte Spannung
Relais mit Spannung versorgt
Ausgang geöffnet
Ausgang geschlossen

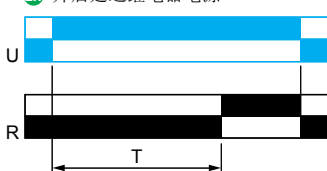
- zh**
- U: 电源
R: 继电器或固态输出
T: 定时时段
C: 控制触点
G: 门
Ta: 可调节接通延迟
Tr: 可调节断开延迟

功能图:

- 继电器已断电
继电器已加电
输出断开
输出闭合

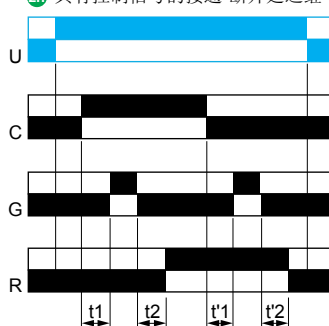
A RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RAMU RE17LAMW
RE17RMEMU RE17LMBM

- en** Power on delay relay
fr Relais temporisé à la mise sous tension
de Ansprechverzögertes Zeitrelais
es Relé de retardo de arranque
it Relé ritardato all'accensione
zh 开启延迟继电器电源



Ac RE17RMMW RE17RMJU RE17LMBM
RE17RMMWS RE17RMMU

- en** On- and off-delay relay with control signal
fr Relais de temporisation travail et repos avec signal de contrôle
de Ansprech- und rückfallverzögertes Zeitrelais mit Steuersignal
es Relé de retardo de conexión y desconexión con señal de control
it Relé ritardato all'inserzione e alla disinserzione con segnale di comando
zh 具有控制信号的接通-断开延迟继电器



$$T = t_1 + t_2 + \dots$$

$$T = t'_1 + t'_2 + \dots$$

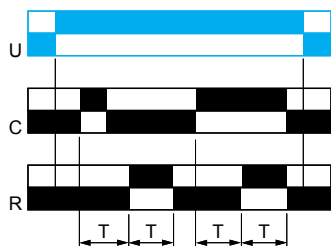
Ad RE17RMXMU

- en** Pulse delayed relay with control signal
fr Relais à impulsion temporisée avec signal de contrôle
de Impulsverzögertes Zeitrelais mit Steuersignal
es Relé de retardo de pulso con señal de control
it Relé a impulso ritardato con segnale di comando
zh 具有控制信号的脉冲延迟继电器

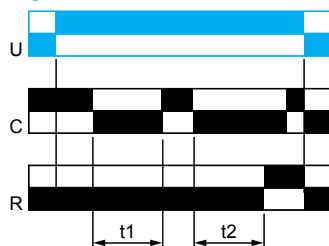


Ah RE17RMXMU

- en Pulse delayed relay (single cycle) with control signal
- fr Relais à impulsion temporisée (un seul cycle) avec signal de contrôle
- de Impulsverzögertes Zeitrelais (einfacher Zyklus) mit Steuersignal
- es Relé de retardo de pulso (ciclo único) con señal de control
- it Relè a impulso ritardato (ciclo singolo) con segnale di comando
- zh 具有控制信号的脉冲延迟继电器 (单循环)

**At** RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RAMU RE17LMBM
RE17RMEMU

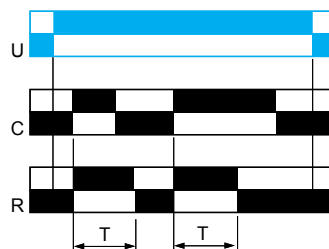
- en Power on delay relay (summation) with control signal
- fr Relais temporisé à la mise sous tension (somme) avec signal de contrôle
- de Ansprechverzögertes Zeitrelais (additiv) mit Steuersignal
- es Relé de retardo de arranque (suma) con señal de control
- it Relè ritardato all'accensione (somma) con segnale di comando
- zh 开启具有控制信号的延迟继电器 (求和) 电源



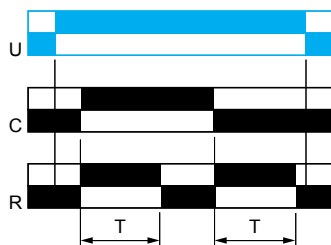
$$T = t_1 + t_2 + \dots$$

B RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RBMU RE17LMBM
RE17RMEMU

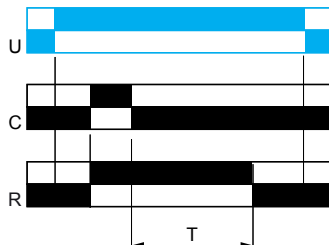
- en Interval relay with control signal
- fr Relais d'intervalle avec signal de contrôle
- de Wischrelais mit Steuersignal
- es Relé de intervalo con señal de control
- it Relè a intervallo con segnale di comando
- zh 具有控制信号的间隔定时继电器

**Bw** RE17RMMW RE17RMMU
RE17RMMWS RE17LMBM
RE17RMJU

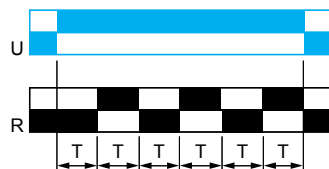
- en Double interval relay with control signal
- fr Relais d'intervalle double avec signal de contrôle
- de Doppeltes Wischrelais mit Steuersignal
- es Relé de intervalo doble con señal de control
- it Relè a doppio intervallo con segnale di comando
- zh 具有控制信号的双间隔定时继电器

**C** RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RCMU RE17LCBM
RE17RMEMU RE17LMBM

- en Off-delay relay with control signal
- fr Relais de temporisation repos avec signal de contrôle
- de Rückfallverzögertes Zeitrelais mit Steuersignal
- es Relé de retardo de desconexión con señal de control
- it Relè ritardato alla disinserzione con segnale di comando
- zh 具有控制信号的断开延迟继电器

**D** RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RMEMU RE17LMBM

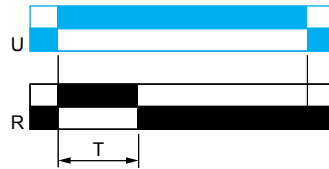
- en Symmetrical flasher relay (starting pulse off)
- fr Relais de clignotant symétrique (impulsion de départ repos)
- de Symmetrisches Blinkrelais (pausebeginnend)
- es Relé señalizador simétrico (pulso inicial desconectado)
- it Relè a intermittenza simmetrica (impulso avvio off)
- zh 对称式闪光继电器 (启动脉冲停止)

**Di** RE17RMMW RE17RMMU
RE17RMMWS RE17LMBM
RE17RMEMU
RE17RMJU

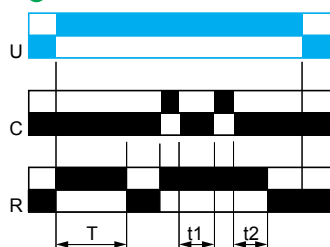
- en Symmetrical flasher relay (starting pulse on)
- fr Relais de clignotant symétrique (impulsion de départ travail)
- de Symmetrisches Blinkrelais (impulsbeginnend)
- es Relé señalizador simétrico (pulso inicial conectado)
- it Relè a intermittenza simmetrica (impulso avvio on)
- zh 对称式闪光继电器 (启动脉冲开启)

**H** RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RHMU RE17LHBM
RE17RMEMU RE17LMBM

- en Interval relay
- fr Relais d'intervalle
- de Wischrelais
- es Relé de intervalo
- it Relè intervallo
- zh 间隔定时继电器

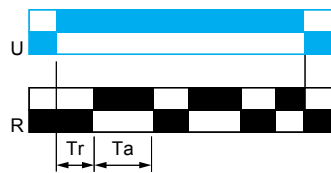
**Ht** RE17RMMW RE17RMJU
RE17RMMWS RE17RMMU
RE17RHMU RE17LMBM
RE17RMEMU

- en Interval relay (summation) with control signal
- fr Relais d'intervalle (somme) avec signal de contrôle
- de Wischrelais (additiv) mit Steuersignal
- es Relé de intervalo (suma) con señal de control
- it Relè a intervallo (somma) con segnale di comando
- zh 具有控制信号的间隔定时继电器 (求和)

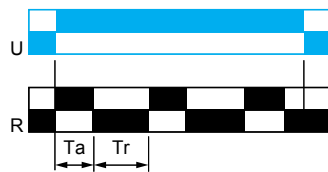


$$T = t_1 + t_2 + \dots$$

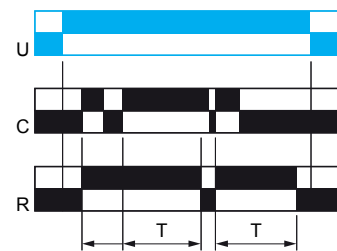
- L** RE17RLJU
RE17RLMU
RE17LLBM
- en Asymmetrical flasher relay (starting pulse off)
 - fr Relais de clignotant asymétrique (impulsion de départ repos)
 - de Asymmetrisches Blinkrelais (pausebeginnend)
 - es Relé señalizador asimétrico (pulso inicial desconectado)
 - it Relè a intermittenza asimmetrica (impulso avvio off)
 - zh 非对称式闪光继电器 (启动脉冲停止)



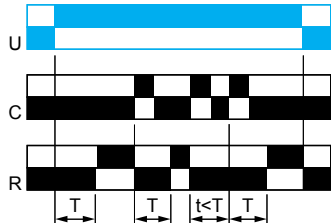
- Li** RE17RLJU
RE17RLMU
RE17LLBM
- en Asymmetrical flasher relay (starting pulse on)
 - fr Relais de clignotant asymétrique (impulsion de départ travail)
 - de Asymmetrisches Blinkrelais (impulsbeginnend)
 - es Relé señalizador asimétrico (pulso inicial conectado)
 - it Relè a intermittenza asimmetrica (impulso avvio on)
 - zh 非对称式闪光继电器 (启动脉冲开启)



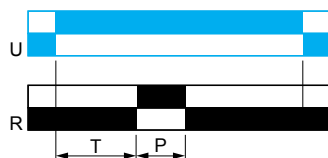
- N** RE17RMXMU
- en Retriggerable interval relay with control signal on
 - fr Relais d'intervalle redéclenchable avec signal de contrôle travail
 - de Nachtriggerbares Wischrelais mit Steuersignal
 - es Relé de intervalo redisparable con señal de control activada
 - it Relè a intervallo ripristinabile all'inizio del segnale di comando
 - zh 开启控制信号的可再触发式间隔定时继电器



- O** RE17RMXMU
- en Retriggerable interval delayed relay with control signal on
 - fr Relais temporisé d'intervalle redéclenchable avec signal de contrôle travail
 - de Nachtriggerbares intervallverzögertes Zeitrelais mit Steuersignal
 - es Relé de retardo de intervalo redisparable con señal de control activada
 - it Relè a intervallo ritardato ripristinabile all'inizio del segnale di comando
 - zh 开启控制信号的可再触发式间隔延迟继电器

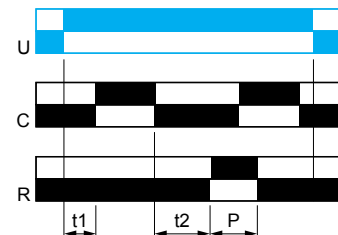


- P** RE17RMXMU
- en Pulse delayed relay with fixed pulse length
 - fr Relais à impulsion temporisée avec longueur d'impulsion fixe
 - de Impulsverzögertes Zeitrelais mit fester Impulslänge
 - es Relé de retardo de pulso con duración fija del pulso
 - it Relè a impulso ritardato con lunghezza impulso fissa
 - zh 具有混合脉冲长度的脉冲延迟继电器



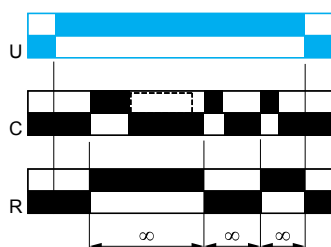
P = 500 ms

- Pt** RE17RMXMU
- en Pulse delayed relay (summation and fixed pulse length) with control signal off
 - fr Relais à impulsion temporisée (somme et longueur d'impulsion fixe) avec signal de contrôle repos
 - de Impulsverzögertes Zeitrelais (additiv und feste Impulslänge) ohne Steuersignal
 - es Relé con retardo de pulso (suma y duración fija de pulso) con señal de control desactivada
 - it Relè a impulso ritardato (somma e lunghezza impulso fissa) senza segnale di comando
 - zh 关闭控制信号的脉冲延迟继电器 (求和和混合脉冲长度)

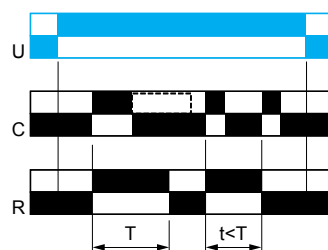


T = t1 + t2 + ...
P = 500 ms

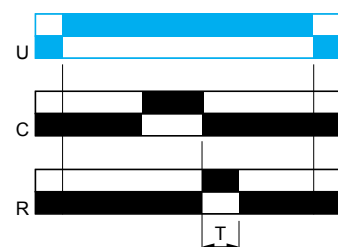
- T** RE17RMXMU
- en Bistable relay with control signal on
 - fr Relais bistable avec signal de contrôle travail
 - de Bistabiles Relais mit Steuersignal
 - es Relé biestable con señal de control activada
 - it Relè bistabile con invio segnale di comando
 - zh 开启控制信号的双稳态继电器

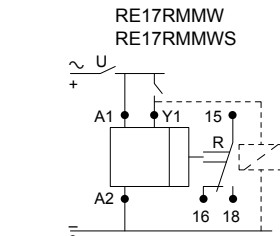
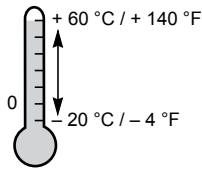


- Tt** RE17RMXMU
- en Retriggerable bistable relay with control signal on
 - fr Relais bistable redéclenchable avec signal de contrôle travail
 - de Nachtriggerbares bistabiles Relais mit Steuersignal
 - es Relé biestable redisparable con señal de control activada
 - it Relè bistabile ripristinabile all'inizio del segnale di comando
 - zh 开启控制信号的可再触发式双稳态继电器

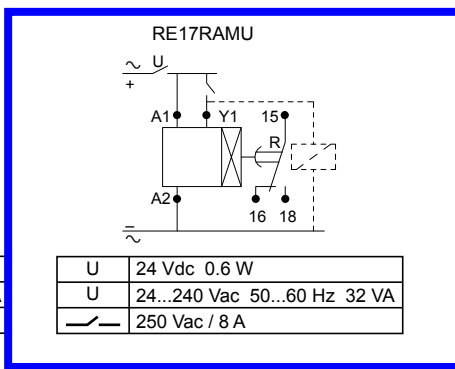


- W** RE17RMXMU
- en Interval relay with control signal off
 - fr Relais d'intervalle avec signal de contrôle repos
 - de Wischrelais ohne Steuersignal
 - es Relé de intervalo con señal de control desactivada
 - it Relè a intervallo senza segnale di comando
 - zh 关闭控制信号的间隔定时继电器

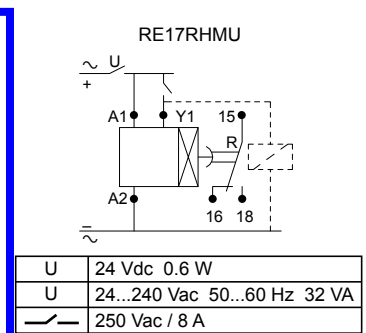




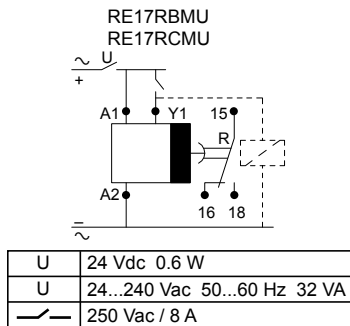
U	12...240 Vdc 1,5 W
U	12...240 Vac 50...60 Hz 3 VA
—	250 Vac / 8 A



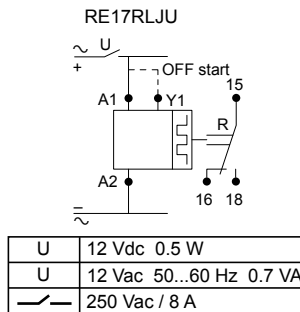
U	24 Vdc 0.6 W
U	24...240 Vac 50...60 Hz 32 VA
—	250 Vac / 8 A



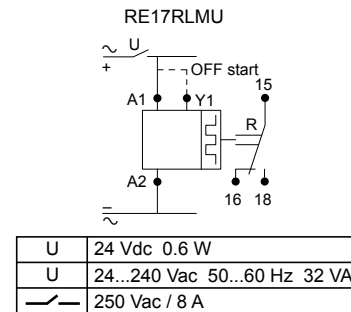
U	24 Vdc 0.6 W
U	24...240 Vac 50...60 Hz 32 VA
—	250 Vac / 8 A



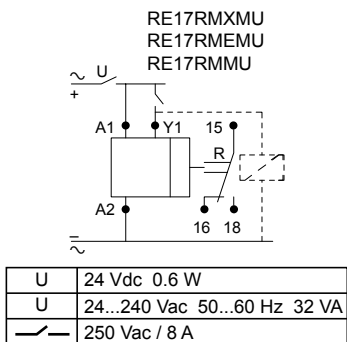
U	24 Vdc 0.6 W
U	24...240 Vac 50...60 Hz 32 VA
—	250 Vac / 8 A



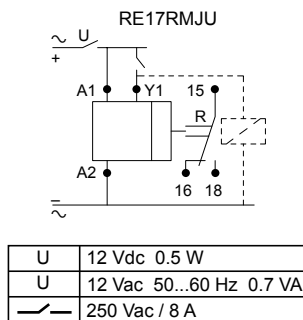
U	12 Vdc 0.5 W
U	12 Vac 50...60 Hz 0.7 VA
—	250 Vac / 8 A



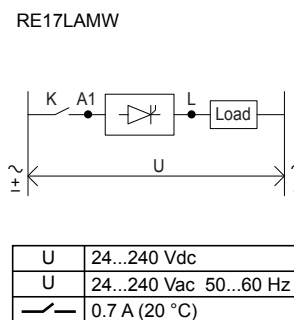
U	24 Vdc 0.6 W
U	24...240 Vac 50...60 Hz 32 VA
—	250 Vac / 8 A



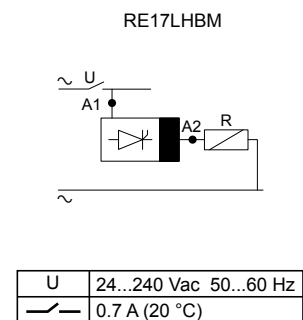
U	24 Vdc 0.6 W
U	24...240 Vac 50...60 Hz 32 VA
—	250 Vac / 8 A



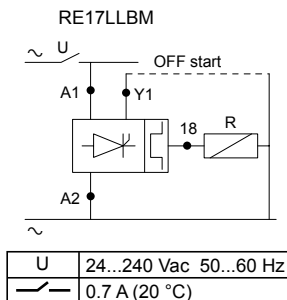
U	12 Vdc 0.5 W
U	12 Vac 50...60 Hz 0.7 VA
—	250 Vac / 8 A



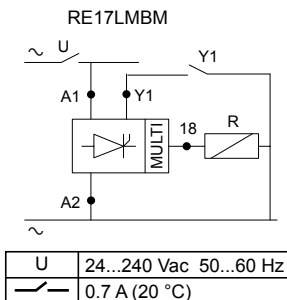
U	24...240 Vdc
U	24...240 Vac 50...60 Hz
—	0.7 A (20 °C)



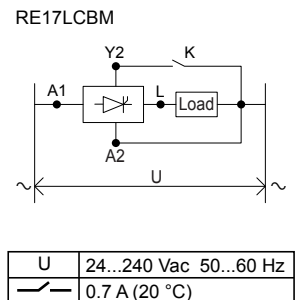
U	24...240 Vac 50...60 Hz
—	0.7 A (20 °C)



U	24...240 Vac 50...60 Hz
—	0.7 A (20 °C)



U	24...240 Vac 50...60 Hz
—	0.7 A (20 °C)



U	24...240 Vac 50...60 Hz
—	0.7 A (20 °C)

Wire sizes and torque / Calibre de fils et couple / Drahtstärken und Anzugsmoment / Tamaños de cable y par de apriete / Sezioni filo e coppia / 电线尺寸和扭矩

All references except RE17RMMWS / Toutes les références sauf RE17RMMWS / Alle Referenzen außer RE17RMMWS / Todas las referencias excepto RE17RMMWS /
Tutti i prodotti eccetto RE17RMMWS / 所有参考 (RE17RMMWS 除外)

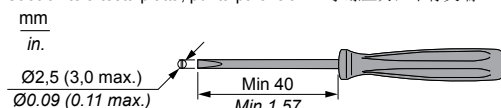
mm in.	6 0.24				
mm ²		0.5...3.33	0.5...2.5	0.2...2.5	0.2...1.5
AWG		20...12	20...14	24...14	24...16

		N•m	0.6...1
Ø 3,5 mm / 0.14 in.		lb-in	5.3...8.8

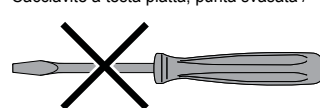
Only for RE17RMMWS (spring terminals) / Uniquement pour RE17RMMWS (bornes à ressort) / Nur für RE17RMMWS (Federklemmen)
Solo RE17RMMWS (terminales de resorte) / Solo per RE17RMMWS (morsetti a molla) / 仅适用于 RE17RMMWS (弹簧端子)

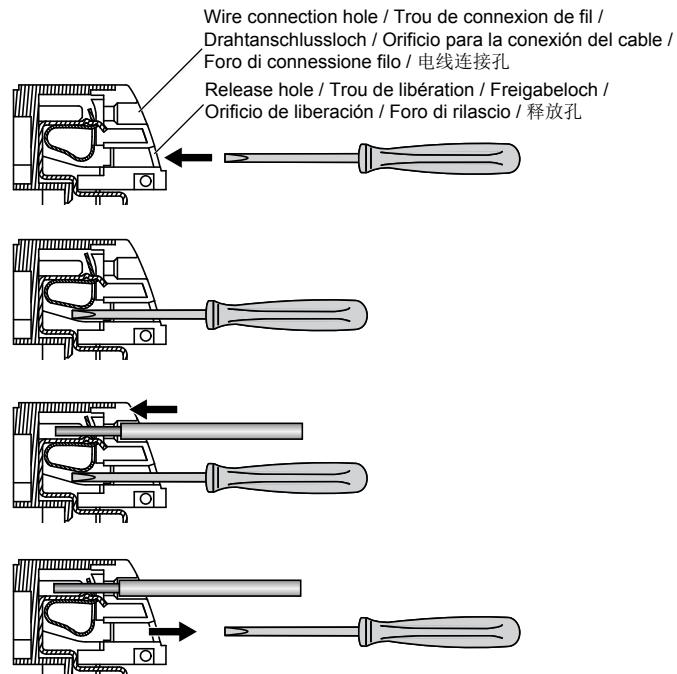
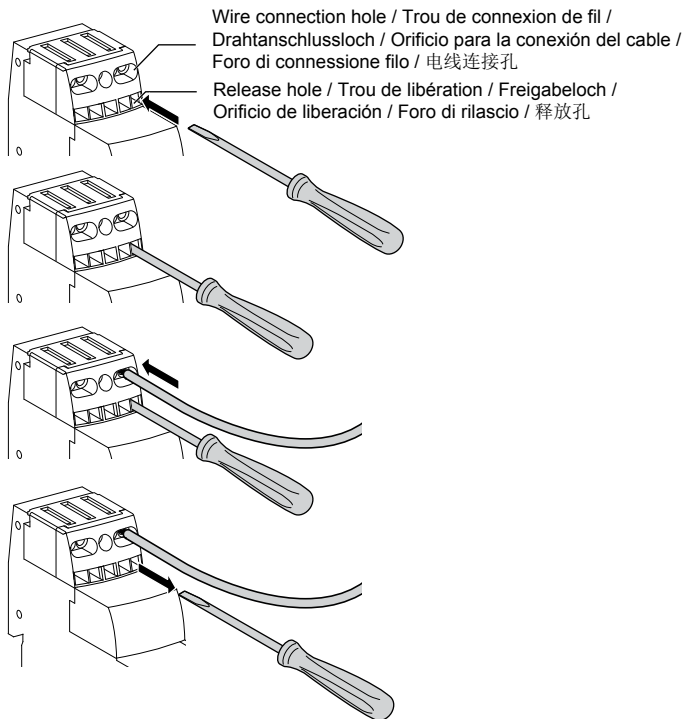
mm in.	8 0.31		
mm ²		0.2...1.5	0.2...1.5
AWG		24...16	24...16

• Flathead screwdriver, Parallel tip / Tournevis plat, pointe parallèle /
Flachkopf-Schraubendreher, parallele Spitze /
Destornillador de cabeza plana, punta paralela /
Cacciavite a testa piatta, punta parallela / 一字螺丝刀, 平行尖端

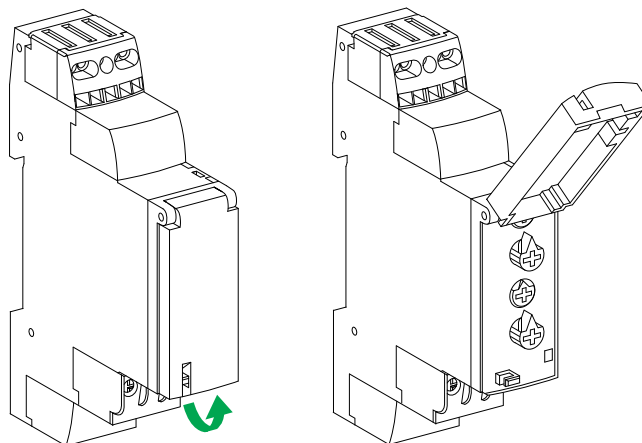


• Flathead screwdriver, Flared tip / Tournevis plat, pointe évasée /
Flachkopf-Schraubendreher, aufgeweitete Spitze /
Destornillador de cabeza plana, punta ancha /
Cacciavite a testa piatta, punta svasata / 一字螺丝刀, 外展尖端

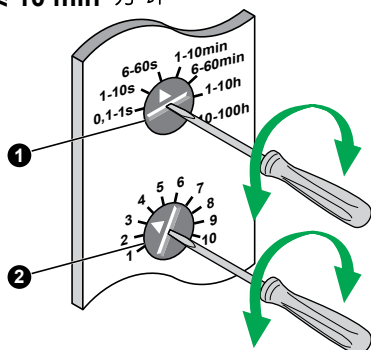




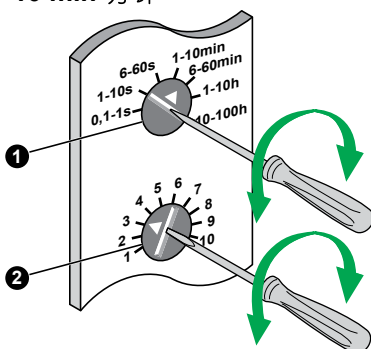
3 Set / Réglez / Einstellung / Regule / Regolate / 设定



$T \leq 10$ min 分钟



$T \geq 10$ min 分钟



Example / Exemple / Biespiel / Ejemplo / Esempio / 例子

	①	➔	②
$T = 60$ s			
$T = 45$ s			

NOT RECOMMENDED /
NON RECOMMANDÉ /
NICHT EMPFOHLEN /
NO RECOMENDADO /
NON CONSIGLIATO /
不建议

Example / Exemple / Biespiel / Ejemplo / Esempio / 例子

	①	➔	②	➔	①
$T = 7$ h 00					

⚠ ⚠ DANGER / DANGER / GEFAHR / PERICOLO / PELIGRO / 危险		
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH <ul style="list-style-type: none"> • Disconnect all power before servicing equipment. • Confirm that the product power supply voltage and its tolerances are compatible with those of the network. <p>Failure to follow these instructions will result in death or serious injury.</p>	RISQUE D'ELECTROCUTION, D'EXPLOSION OU D'ARC ELECTRIQUE <ul style="list-style-type: none"> • Coupez l'alimentation avant de travailler sur cet appareil. • Assurez-vous que la tension d'alimentation du produit, avec ses tolérances, est compatible avec celle du réseau. <p>Le non-respect de cette instruction entraînera la mort ou des blessures graves.</p>	STROMSCHLAG-, EXPLOSIONS- ODER LICHTBOGENGEFAHR <ul style="list-style-type: none"> • Vor dem Arbeiten an dem Gerätessen Stromversorgung abschalten. • Stelle Sie sicher, dass die Versorgungsspannung des Produkts einschließlich Toleranzen mit den Netzbedingungen vereinbar ist. <p>Die Nichtbeachtung dieser Anweisung wird den Tod oderschwere Körpverletzung zur Folge haben.</p>
RISCHIO DI SCOSSA ELETTRICA, DI ESPLOSIONE O DI OFTALMIA DA FLASH <ul style="list-style-type: none"> • Scollegare l'apparecchio dalla presa di corrente prima di qualsiasi intervento. • Assicurarsi che la tensione di alimentazione del prodotto e le relative tolleranze sia compatibile con quelle della rete. <p>La mancata osservanza di questa istruzioni comporta gravi rischi per la vita e l'incolumità personale.</p>	RIESGO DE ELECTROCUCIÓN, EXPLOSIÓN O ARCO ELÉCTRICO <ul style="list-style-type: none"> • Desconecte toda alimentación antes de realizar el servicio. • Asegúrese de que la tensión de alimentación del producto y sus tolerancias son compatibles con las de la red eléctrica. <p>Si no se respetan estas instrucciones, se producirán graves daños corporales o la muerte.</p>	<p>存在电击、爆炸或电弧危险</p> <ul style="list-style-type: none"> • 维修设备前，请断开所有电源连接。 • 确认产品电源电压及其公差兼容于网络的这些参数。 <p>若不遵守这些说明，可能会导致严重的人身伤害甚至死亡。</p>

- (en)** Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.
- (fr)** Les équipements électriques doivent être installés, exploités et entretenus par un personnel qualifié. Schneider Electric décline toute responsabilité quant aux conséquences de l'utilisation de ce matériel.
- (de)** Elektrische Geräte dürfen nur von Fachpersonal installiert, betrieben, gewartet und instand gesetzt werden. Schneider Electric haftet nicht für Schäden, die aufgrund der Verwendung dieses Materials entstehen.
- (es)** Sólo el personal de servicio cualificado podrá instalar, utilizar, reparar y mantener el equipo eléctrico. Schneider Electric no asume las responsabilidades que pudieran surgir como consecuencia de la utilización de este material.
- (it)** Le apparecchiature elettriche devono essere installate, usate e riparate solo da personale qualificato. Schneider Electric non assume nessuna responsabilità per qualunque conseguenza derivante dall'uso di questo materiale.
- (zh)** 电气设备的安装、操作、维修和维护工作仅限于合格人员执行。
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无锡普洛菲斯电子有限公司
江苏省无锡国家高新技术产业开发区发
汉江路20号中国地区客服电话：
+86 400 810 1315

This product must be installed, connected and used in compliance with prevailing standards and/or installation regulations.
As standards, specifications and designs develop from time to time, always ask for confirmation of the information given in this publication.

Waterloo Multilevel Groundwater Monitoring System*

The Waterloo System is used to obtain groundwater samples, hydraulic head measurements and permeability measurements from many discretely isolated zones in a single borehole.

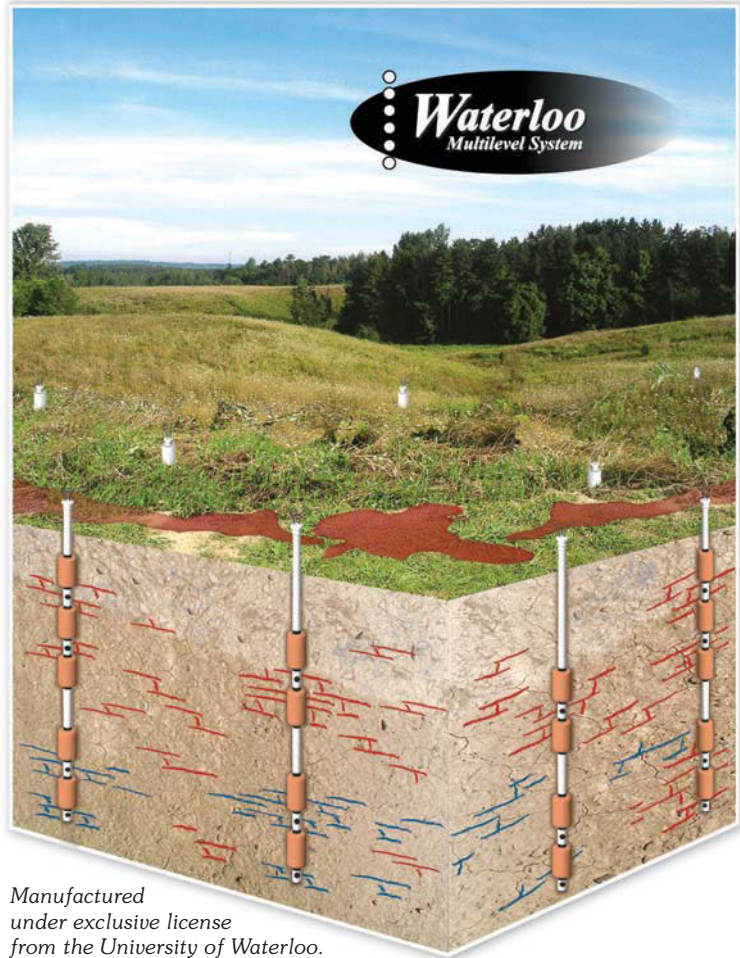
The Waterloo System originated with Dr. John Cherry at the Groundwater Institute of the University of Waterloo in 1984. Ongoing development of the System by Solinst has taken place on a continuous basis since then, with encouragement and suggestions from Dr. Cherry.

Detailed 3-D Data

When a number of Waterloo Systems are used at a site, they allow detailed three-dimensional groundwater information to be obtained at a reasonable cost. Fewer drilled holes are an advantage and monitoring times are reduced.

The simple modular system is customized for the needs of each project. This allows monitoring zones to be placed at desired depths using options suitable for either bedrock, overburden or combination applications and with either permanent or removable systems.

Discrete zone monitoring is the only means of obtaining accurate data for site interpretation and assessments. Transects of multilevels provide the detailed data necessary to calculate mass flux and conservatively assess risk to receptors.



*Manufactured
under exclusive license
from the University of Waterloo.
Canadian Patent #1232836
U.S. Patent #5048605 & International Patents.*



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Advantages

- Detailed 3D data of flow and concentrations
- Data integrity
- Reduced project costs
- Purging and sampling times reduced
- Fewer drilled holes
- Reduced site disturbance
- Variety of monitoring options

Installations

- **Overburden or Bedrock Installations**
 - Allow monitoring of multiple zones in any geologic setting
- **Permanent Waterloo Packers**
 - Excellent in bedrock or cased holes
 - Engineered for permanent seals
- **Removable Hydraulic Packers**
 - Reuse at new zones or locations
 - Easy decommissioning

* Solinst and Levellogger are registered trademarks of Solinst Canada Ltd.

Why Multilevels

Superior quality of data is obtained when monitoring a series of discrete isolated intervals at various depths in a single borehole. The detailed information provided by Multilevels in the form of horizontal and vertical flow, in conjunction with discrete zone sampling for contaminants, is ideal for accurate site assessments.

- **Biases with Long Screened Wells**

- Contaminant mixing over long screens masks vertical variations resulting in underestimating the aerial extent of plumes and diluting the true concentration of contaminants.
- Ambient vertical flow within the well has potential to transmit contaminants to previously isolated zones.

- **Detailed Multilevel Data – Advantages**

- Transects of Multilevels across a groundwater flow path provide the best data to use for Mass Flux calculations. This has proven to be an important tool for site assessments that require realistic estimates of maximum contaminant concentration/risk to receptors.
- Optimize performance of in-situ remediation by using detailed 3-D data from a series of Multilevels. Subsequently, transects can be used to evaluate the success of the chosen remediation option and any improvements.

- **Economics**

- Proven cost reductions for drilling and sediment disposal
- Savings, both in field personnel time and disposal costs, when purge volumes are reduced. The discrete interval that a Multilevel port encompasses allows for smaller purge volumes, rapid responses to level changes and is ideal for low flow sampling techniques.

The Waterloo System

The System uses modular components which form a sealed casing string of various casing lengths, packers, ports, a base plug and a surface manifold. This allows accurate placement of ports at precise monitoring zones.

Monitoring tubes attached to the stem of each port individually connect that monitoring zone to the surface. The standard system is built on 2" (50 mm) Sch. 80 PVC to fit 3"- 4" (75 - 100 mm) boreholes and uses 3 ft. (915 mm) long packers. Stainless steel components, custom packer materials and sizes, Teflon® tubing are available.



Manifold

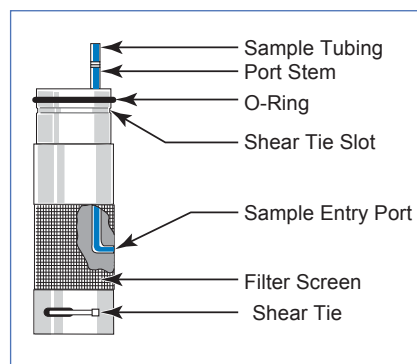


O-Ring Joints with Shear Wire

Ports

Monitoring ports are constructed from 316 stainless steel. Ports are isolated by packers at each desired monitoring zone and are individually connected to the surface manifold with narrow diameter tubing. Thus formation water enters the port, passes into the stem, up into the monitoring tube attached to the stem, to its static level.

A sampling pump or pressure transducer may be dedicated to each monitoring zone by attachment to the port stem. Dual stem ports are available to allow both sampling and hydraulic head measurements from the same port. Alternatively, the monitoring tubes may be left open to allow sampling and hydraulic head measurements with portable equipment. For installations in silty deposits there are special sampling ports with extra screening to prevent silt entry into the port.



Stainless Steel Ports



Joints*

The patented method of joining components of the Waterloo System uses a nylon shear wire and an o-ring. This gives reliable, leakproof joints so that the core of the Waterloo casing string is isolated from external formation waters. Groundwater is only accessible via the port stems and attached monitoring equipment. This water-tight seal also prevents contact between packer inflation water inside the casing and the formation water outside the casing.

Manifolds

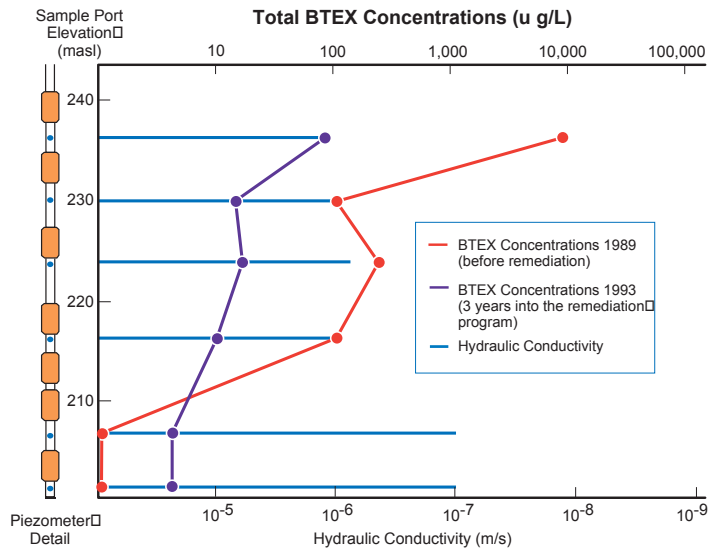
The manifold completes the system at surface. It organizes, identifies, and coordinates the tubes and/or cables from each monitoring zone.

The manifold allows connection to each transducer in turn, and a simple, one-step connection for operation of pumps. When dedicated pumps are selected, it allows individual zones to be purged separately, or purging of many zones simultaneously to reduce field times.

* US Patent 5,255,945 ®Teflon is a registered trade-mark of the DuPont Corp.

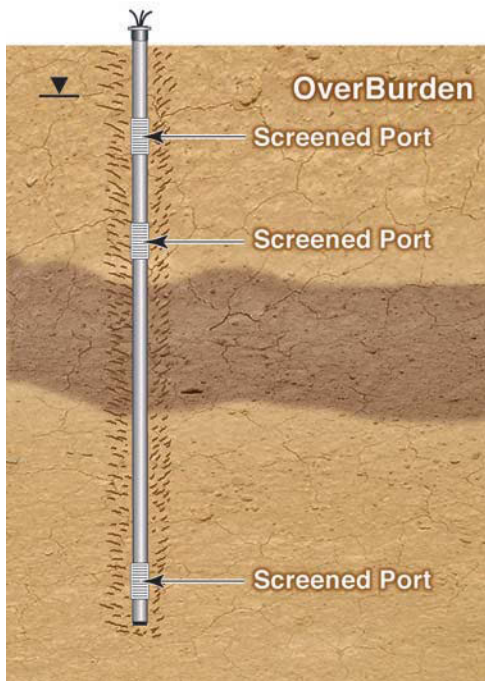
Reliable Data

The effectiveness of the Waterloo System is proven by its ability to accurately and repeatedly obtain pressure and groundwater chemistry data from several distinct zones in a single borehole. The data set below shows a decrease in Total BTEX contamination due to ongoing pump and treat operations at an oil pipeline leak.



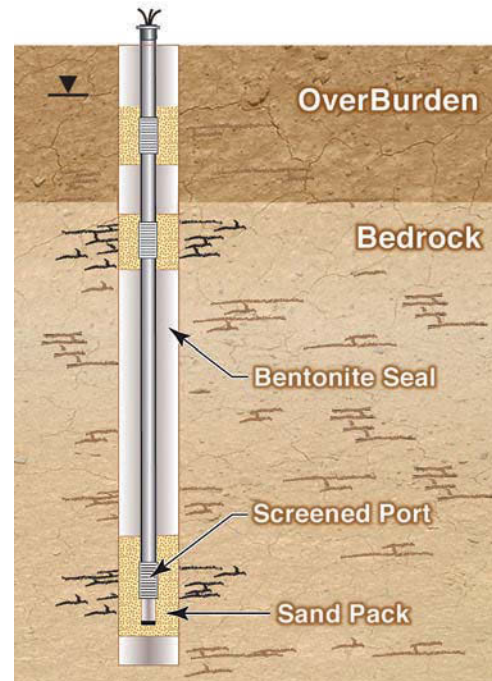
Underground oil pipeline leak assessment. Three 150 ft. (45m) installations. Two point rising head permeability tests were conducted in each interval of the Multilevel System. (See diagram showing contaminant distribution at left.)

Overburden



Direct Burial: Formation Collapse with Screened Ports

Bedrock and/or Overburden



Direct Placement: Sand and Bentonite with Screened Ports

System Flexibility

The Waterloo System is extremely flexible to your design criteria. Each System is customized to suit monitoring needs, site conditions and budget constraints:

- Removable or permanent system
- Bedrock or overburden applications for groundwater or vadose zone monitoring

Packers and ports can be accurately placed to monitor each zone of interest.

Materials

For particular applications specific materials may be chosen. These may include stainless steel casing and packer bodies, and stainless steel, nylon or Teflon® tubing.

Borehole Size

Waterloo or removable packers are designed for use in 3" - 4" boreholes (75 - 100 mm). Systems can be installed in larger boreholes using:

- Placement of sand and bentonite to isolate parts around a Waterloo casing string with no packers.
- 3-4" screen and casing, installed within a larger hole, completed by installing a Waterloo System with packers.

Number of Monitoring Zones/Hole

The maximum number of monitoring zones for a System is determined by the number of tubes and/or cables that will fit inside the casing string. This number is dependent on the monitoring options chosen. Systems can be designed to monitor from 2 to as many as 24 zones.

Standard 2"(50 mm) Waterloo system	
Site Dependent Monitoring Options	# Zones
Dedicated Pumps and Transducers	8
Open Tubes Only (varies with tube size)	15
Dedicated Pumps and Open Tubes	6
Dedicated Pumps Only	12
Dedicated Pressure Transducers Only	24



Using core logs to identify placement of Ports and Packers



Multi-Purge Manifold with Transducers and Dedicated Pumps for four zone monitoring

Monitoring Options

- **Dedicated sampling pumps and/or pressure transducers**

Each monitoring port may be fitted with a dedicated sampling pump and/or pressure transducer. This maximizes the speed with which each data set can be obtained, and avoids the need to decontaminate and repeatedly lower portable devices. The sampling pumps are suitable for sampling many types of contaminants, including VOCs.

Purge volumes are very small. With dedicated pumps all zones can be purged simultaneously. Ports with two stems allows a dedicated pump and a transducer to be placed at exactly the same level.

- **Open tubes**

The most basic version uses open tubes attached to each port. This option allows monitoring with a portable sampler and a narrow diameter Water Level Meter. This provides a very economical and flexible multilevel monitoring device.

- **Mix of open tubes and dedicated equipment**

A third option is to choose a mix of open tubes and dedicated equipment in different zones. This method combines the advantages of less expensive portable equipment for shallower zones (i.e. 100 ft., 30 m) and the more time efficient dedicated equipment for deeper zones.

- **Water level monitoring only**

The System can comprise pressure transducers only, for pressure monitoring in up to 24 discrete zones.

Dedicated Sampling Pumps

Dedicated equipment reduces the time and effort required to obtain data, as equipment is not lowered down the borehole and purge volumes are reduced. It gives significant cost savings and avoids cross contamination.

For long term or frequent sampling Waterloo Systems most commonly use the gas drive, Solinst Double Valve Pumps with stainless steel and Teflon® valves. A pump is connected directly to the stem of each port and dual line polyethylene or Teflon® tubing connects the pump to the wellhead manifold.

Both automatic and manual pump control units are simple to use. They have quick-connect couplings with only a single connection to the manifold required. Samples from all levels are easily and rapidly obtained. Purging from some or all levels simultaneously is accommodated by the multi-purge feature of the manifold.



Collecting a Sample from a Dedicated DVP

Low Flow Purging and Sampling

Purge volumes are very small due to the small annular space and tubing diameters used in the system. Consequently sampling is rapid, even though flows are low, especially with dedicated pumps when all zones can be purged simultaneously.

Dedicated Bladder and Double Valve Pumps, (DVP), as well as a portable DVP are ideal for use when low flow sampling and purging techniques are desired.

Portable Micro Double Valve Pump

The Micro Double Valve Pump (Micro DVP) provides high quality samples, uses coaxial Teflon® tubing, and is small enough to fit in 1/2" (13 mm) ID tubing. The unique combination of flexibility and size make the pump ideal for sampling at depth in small flexible tubes.



*Model 408M
Double Valve
Pump*



*Taking pressure measurements
with Model 404 Geokon Vibrating Wire Readout*

Dedicated Transducers

Dedicated pressure transducers allow rapid and accurate measurement of temperature and total water pressure. Unless static water levels are shallow, transducers are the preferred method of water level measurement, both from an efficiency and an accuracy point of view.

The transducers chosen for use in the Waterloo System are vibrating wire transducers, which are very accurate and rugged. They have superior long term operation with minimal drift over time. They can be read with a manual readout, or with a datalogger which can provide remote, unattended monitoring and telemetry, if desired. Transducers are available with pressure ranges from 50 psi to 500 psi. (7.25 kPa to 72.5 kPa).



Model 102 P1 Water Level Meter



*Dedicated
Sampling Pump
& Transducer*

Portable Monitoring Equipment

Water level measurements can be made in Waterloo ports fitted with an open tube using the narrow, Solinst Model 102, P1 Water Level Meter. It has a weighted, flexible probe, 1/4" OD by 1.5" long (6.35mm x 38 mm).

Sampling may be performed in open tubes using a Mini Inertial Pump, Micro Double Valve Pump, or a Peristaltic Pump.

Designing Your System

The options chosen for each System will be site and application specific.

Each design is dependent on:

- Zones of interest
- Geology of the site
- Monitoring methods preferred
- Cost considerations
- Borehole depth, diameter and type

Refer to the drawings below, then select the type of installation that suits your project. Consider the size and depth of each borehole, and whether casing is to be present. Decide if permanent or temporary Systems are preferred, the number of zones and depth of each zone per System, the monitoring options preferred, and any special materials required.

During development of your plans, the Solinst technical staff will be pleased to help evaluate the options and customize a System that best suits your needs.

Projects

Waterloo Systems have been used to monitor:

- Salt water intrusion
- Industrial cleanups
- Pipeline leaks
- Dam leakage/rehabilitation
- Contaminant identification/cleanup
- DNAPL & LNAPL spill sites
- Waste disposals/landfills
- Soil gas surveys

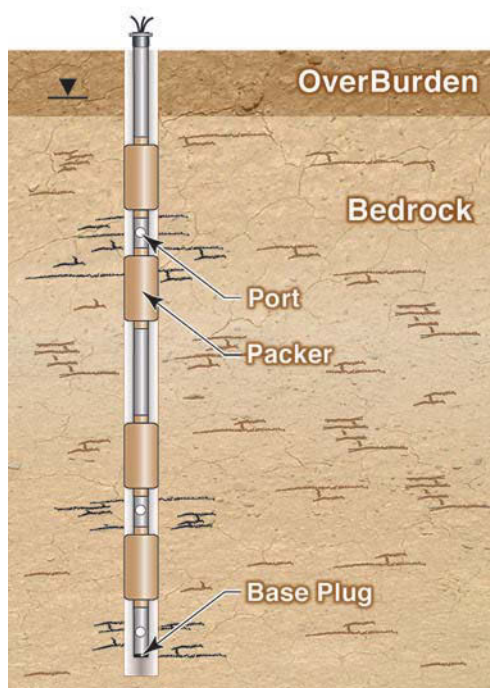
Applications

The Waterloo System has been specified by various industries and consultants for numerous sites across the United States, Canada and overseas. Waterloo Systems have been specified and approved at several sites with Superfund or RCRA designations and in each of the U.S. E.P.A. regions.

The System has been used for:

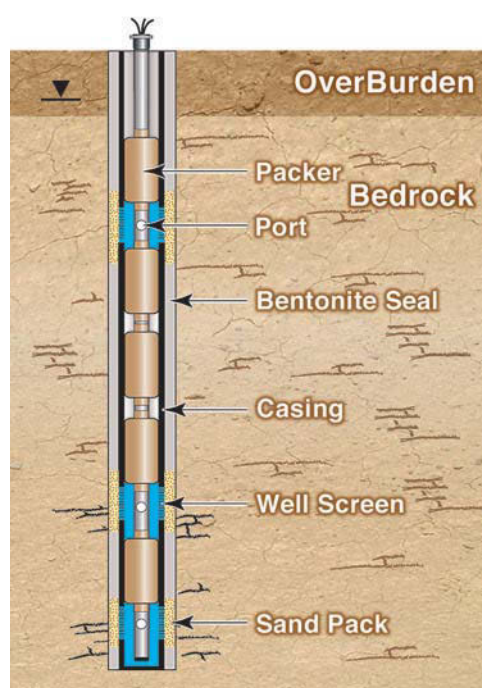
- defining groundwater flow patterns
- performance monitoring of pump and treat systems
- identification and determination of spatial distribution of contaminants
- early warning system/detection of migrating contaminants

Bedrock



Permanent or Removable Packers
in Cored Hole

Bedrock and/or Overburden

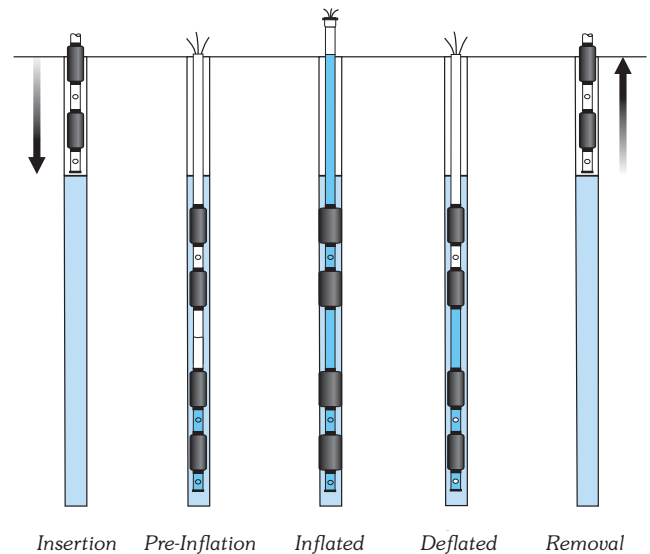
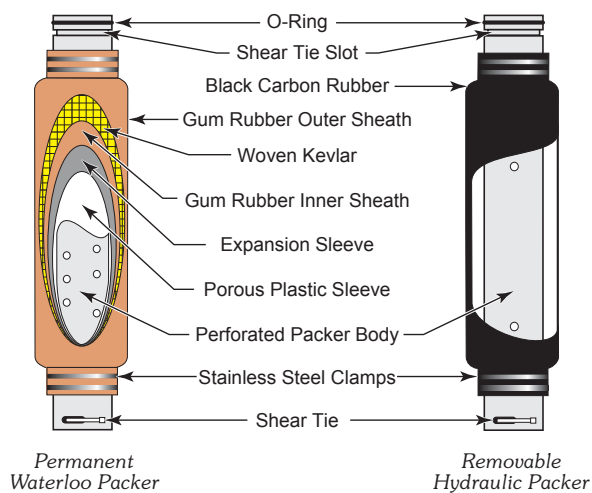


Permanent or Removable Packers
in Casing or Well Screen

Permanent Waterloo Packers

Permanent packers ensure long term integrity of seals in cored bedrock holes and cased wells. They use a water activated expansion sleeve fitted over the perforated packer body. A layer of porous plastic distributes water evenly to the packer expansion material. A Rubber/Kevlar/Rubber sheath envelops the expansion material. The Kevlar layer provides strength to bridge across large fissures. The pliant gum rubber forms an effective seal against the borehole wall.

Water is added to the inside of the sealed casing string after installation. The water passes through the packer body into the expansion sleeve, causing the material to expand. Thus an engineered seal is permanently formed against the borehole wall.



Removable Hydraulic Packers

These packers allow reuse of the system at other zones or new locations. They facilitate system maintenance and borehole decommissioning, simplify grouting of the hole and allow parts of the system to be reused.

Removable packers are made with black carbon rubber and are inflated hydraulically or pneumatically by pressurizing the interior of the Waterloo System casing string. Packers can be constructed to suit various diameters of holes.

Installation within Wellscreen/Casing

A permanent 3" or 4" casing and screen string can be installed by a drilling contractor using typical sand and bentonite placement methods. Then a Waterloo System with either permanent or removable packers can be installed within the screen and casing string, as in a bedrock borehole.

Installs Quickly

Installation of the Waterloo System is quick and easy. Starting with the base plug and lowermost sections, the components are joined together in the order required. As each new port is put into position a new monitoring tube, dedicated pump and/or transducer is connected to it. Successive components are threaded over these tubes, building the casing string, until the System is complete. Typically, installations are completed in a day, using a 3-4 member team. Depending on the depth, a drill rig may be required. Solinst can provide a trained technician to assist with installation.

Overburden Applications

Waterloo Multilevel Systems can be used to monitor multiple zones within unconsolidated formations, as well as in bedrock. There are three methods of System installation:

- Within hollow stem augers or temporary casing. Special screened ports are used and flowing sand formations are allowed to collapse around the System.
- Within hollow stem augers or temporary casing using standard tremie methods to place sand around the ports and bentonite seals in the annular space between the monitoring zones, as the augers or temporary casing is lifted.
- Within a cased and screened well, using packers to seal zones.



Waterloo Systems comprised entirely of stainless steel casing, packers and ports with Teflon-lined tubing were used to monitor contaminant flow in this bedrock application.



Contaminant investigation at a U.S. Air Force Base. Waterloo Systems installed to 700 ft. in overburden using screened and cased wells. Up to 6 zones per hole with dedicated pumps and transducers.



Detailed investigation of PCE delineation in carbonate bedrock. A cost analysis of the 14 Waterloo Systems compared with nested piezometers indicated savings both on the capital costs and on the on-going monitoring.



Landfill site over fractured granite, monitored with five Waterloo Systems. Each System comprised of dedicated Double Valve Pumps and Pressure Transducers in 4-6 intervals to depths of 275 feet (84m). The Multi-Purge Manifold allowed the monitoring of 21 zones to be completed in less than 2 days.



An EPA regulated site in Northeast, USA. This multilevel array allowed a sampling team to purge and sample from 40 monitoring zones across 10 borehole locations in just 4 days. These Waterloo Systems were installed in overburden using preinstalled casing.



750ft. (230m) Waterloo System installation for a deep tunnel assessment study. Three zones monitored with dedicated Double-Valve Pumps and pressure transducers. Picture shows technician obtaining pressure measurements and groundwater samples with portable readout and pump control unit.



An investigation of hydraulic properties beneath a large waste site. Waterloo Multilevel Systems were chosen to allow water quality sampling and to help determine the zones of highest permeability within the aquifer.



A large Midwestern USA research project studying agricultural effects on water quality. 22 Waterloo System installations with 3-4 zones each were installed to depths of 24-60 ft. (7.3-18.3 m) in overburden. Dedicated Double Valve Pumps and Peristaltic Pumps were used.

Appendix E

Quality Assurance Project Plan

**SPIC & SPAN CLEANERS
79-81 PONDFIELD ROAD
BRONXVILLE, NEW YORK
WESTCHESTER COUNTY, NEW YORK**

Quality Assurance Project Plan

NYSDEC VCP Number: C360130

Prepared for:

81 Pondfield Road Company
(partnership in dissolution, winding up)
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Prepared by:

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AUGUST 2019

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Attachment 1 Laboratory Reporting Limits

1.0 PURPOSE AND OBJECTIVES

1.1 Purpose

This Quality Assurance Project Plan (QAPP) has been prepared for site management plan (SMP) activities at the Spic & Span Cleaners Site located at 79-81 Pondfield Road, Bronxville, New York. The QAPP is intended to set Chemical Quality Assurance (CQA) guidelines of reliable data obtained by measurement activities, such that data generated are scientifically valid, defensible, comparable, and of known precision and accuracy.

This QAPP contains a detailed discussion of the chemical quality assurance protocols to be used by field and laboratory personnel, as well as project organization and responsibilities.

Analysis of media samples will be conducted by a laboratory certified in New York State to conduct work under the Environmental Laboratory Approval and Analytical Services Programs (ELAP/ASP) producing Category B deliverables.

This QAPP contains a detailed discussion of the quality assurance and quality control (QA/QC) protocols to be utilized by the consultant and laboratory personnel.

1.2 Definitions

The parameters that will be used to specify data quality objectives, and to evaluate the analytical system performance for all analytical samples are precision, accuracy, representativeness, completeness, and comparability (PARCC). Definitions of these and other key terms used in this QAPP are provided below

- **Accuracy** - the degree of agreement of a measurement with an accepted reference value. Accuracy is generally reported as a percent recovery, and calculated as: $\text{Accuracy} = \text{Measured Value} / \text{Accepted Value} \times 100$

- **Analyte** - the chemical or property for which a sample is analyzed.
- **Comparability** - the expression of information in units and terms consistent with reporting conventions; the collection of data by equivalent means; or the generation of data by the same analytical method. Aqueous samples will be reported as ug/l.
- **Completeness** - the percentage of valid data obtained relative to that which would be expected under normal conditions. Data are judged valid if they meet the stated precision and accuracy goals.
- **Duplicate** - two separate samples taken from the same source by the same person at essentially the same time and under the same conditions that are placed into separate containers for independent analysis. Duplicate samples are intended to assess the effectiveness of equipment decontamination, the precision of sampling efforts, the impacts of ambient environmental conditions on sensitive analyses [e.g., volatile organics analysis (VOA)], and the potential for contaminants attributable to reagents or decontamination fluids. Identifying such potential sources of error is essential to the success of the sampling program and the validity of the environmental data. Each QC sample is described below. As a minimum, each set of ten or fewer field samples will include a trip blank, a duplicate, and one sample collected in a sufficient volume to allow the laboratory to perform a matrix spike.
- **Field Blanks** - field blanks (sometimes referred to as "equipment blanks" or "sampler blanks") are the final analyte-free water rinse from equipment decontamination in the field and are collected at least one during a sampling episode. If analytes pertinent to the project are found in the field blank, the results from the blanks will be used to qualify the levels of analytes in the samples. This qualification is made during data validation. The field blank is analyzed for the same analytes as the sample that has been collected with that equipment.

- **Precision** - a measure of the agreement among individual measurements of the sample property under prescribed similar conditions. Precision is generally reported as Relative Standard Deviation (RSD) or Relative Percent Difference (RPD).

Relative standard deviation is used when three or more measurements are available and is calculated as:

$$\text{RSD} = \text{Standard Deviation} / \text{Arithmetic Mean} \times 100.$$

Relative percent difference is used for duplicate measurements, calculated as:

$$\text{RPD} = ((\text{Value 1} - \text{Value 2}) / \text{Arithmetic Mean}) \times 100.$$

- **Quality Assurance (QA)** - all means taken in the field and inside the laboratory to make certain that all procedures and protocols use the same calibration and standardization procedures for reporting results; also, a program which integrates the quality planning, quality assessment, and quality improvements activities within an organization.
- **Quality Control (QC)** - all the means taken by an analyst to ensure that the total measurement system is calibrated correctly. It is achieved by using reference standards, duplicates, replicates, and sample spikes. In addition, the routine application of procedures designed to ensure that the data produced achieve known limits of precision and accuracy.
- **Replicate** - two aliquots taken from the same sample container and analyzed separately. Where replicates are impossible, as with volatile organics, duplicates must be taken.
- **Representativeness** - degree to which data represent a characteristic of a set of samples. The representativeness of the data is a function of the procedures and caution utilized in collecting and analyzing the samples. The representativeness can be documented by the relative percent difference between separately collected, but otherwise identical sample volumes.

- ***Trip Blanks*** - trip blanks are samples that originate from analyte-free water taken from the laboratory to the Site and returned to the laboratory with the volatile organic samples. One trip blank should accompany each cooler containing volatile organics; it will be stored at the laboratory with the samples, and analyzed with the sample set. Trip blanks are only analyzed for VOCs.

1.3 Data Quality Objectives

1.3.1 Overall Data Quality Objectives

Data Quality Objectives (DQO) are quantitative and qualitative statements specifying the quality of the environmental data necessary to support the decision-making process to guide the site characterization activities and any subsequent actions. DQO define the total uncertainty in the data that is acceptable for each specific activity conducted. This uncertainty includes both sampling error and analytical error. Ideally, the prospect of zero uncertainty is the objective; however, the very processes by which data are collected in the field and analyzed in the laboratory contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty to a minimal level such that it will not hinder the intended use of the data.

To achieve the project DQO, specific data quality parameters such as detection limits, criteria for accuracy and precision, sample representativeness, data comparability and data completeness must be specified. The overall objectives are established such that there is a high degree of confidence in the measurements.

The parameters that will be used to specify data quality objectives and to evaluate the analytical system performance for groundwater samples are PARCC: precision, accuracy, representativeness, completeness, and comparability.

1.3.2 Field Data Quality Objectives

To permit calculation of precision and accuracy for the samples, blind field duplicate, field blanks, trip blanks, and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected, analyzed, and evaluated. Through the submission of field QC samples, the distinction can be made between laboratory problems, sampling technique considerations, sample matrix effects, and laboratory artifacts. To assure sample representativeness, all sample collection will be performed in strict accordance with the procedures set forth in this QAPP.

Precision will be calculated as RPD if there are only two analytical points and percent relative standard deviation (% RSD) if there are more than two analytical points. Blind field duplicate and MS/MSD sample analyses will provide the means to assess precision. The submission of field and trip blanks will provide a check with respect to accuracy and will monitor chemicals that may be introduced during sampling, preservation, handling, shipping, and/or the analytical process. In the event that the blanks are contaminated and/or poor precision is obtained, the associated data will be appropriately qualified.

Representativeness will be assured through the implementation of the SMP of which this QAPP is part. This plan has been designed so that the appropriate numbers of samples of groundwater at each location of interest are obtained for analysis.

Ideally, 100% completeness is the goal. However, it must be recognized that unforeseen issues may result in the generation of some data that may not be acceptable for use. Therefore, a completeness target of 90%, as determined by the total number of usable data points versus the total number of data points measured, will be the realistic goal of this program.

Comparability is defined as the extent to which data from one data set can be compared to similar data sets. Comparability between data sets is often questionable due to issues such as different analytical methods used or inter-laboratory differences. In order that the data generated as part of this project remain comparable to any previously generated data or data to be generated in the future, currently published analytical methods have been identified for the analysis of the collected samples. These methods will be performed by an analytical laboratory with a demonstrated proficiency in the analysis of similar samples by the referenced methods. In addition, samples will be collected using documented procedures to ensure consistency of effort and reproducibility if necessary.

1.3.3 Laboratory Data Quality Objectives

The analytical laboratory will demonstrate analytical precision and accuracy by the analysis of various QC samples (i.e., laboratory duplicates, spike samples, matrix spike duplicates, and laboratory control samples). Relevant precision and accuracy criteria for the analytical parameters related to the SMP are provided in Attachment 1 -Laboratory Reporting Limits and Standard QC Limits. Precision, as well as instrument stability, will also be demonstrated by comparison of calibration response factors from the initial calibration to that of the continuing calibrations. Laboratory accuracy will be evaluated by the addition of surrogate and matrix spike compounds, and will be presented as percent recovery (%R). Precision will be presented as RPD, % RSD, or percent difference (%D), whichever is appropriate for the number and type of QC samples analyzed. Lab blanks are also used to demonstrate accuracy of analyses and possible effects from laboratory artifact contamination.

2.0 QUALITY ASSURANCE/QUALITY CONTROL PROVISIONS

2.1 Equipment Decontamination

To minimize the possible occurrence of cross-contamination, dedicated disposable equipment will be used to collect samples at the Site whenever possible. All non-disposable sampling equipment will be cleaned before each use by washing with solutions in the following order:

1. Phosphate-free detergent wash;
2. Tap water rinse;
3. Air dry; and
4. Wrap in aluminum foil until use.

The tap water may be obtained from any municipal supply system. Sampling equipment will be decontaminated in an area covered by plastic near the sampling location. All spent liquids developed during the decontamination process will be collected for proper disposal in accordance with procedures provided in Section 3.0.

2.2 Field Calibration and Maintenance of Equipment

A maintenance, calibration, and operation program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments. Team members are familiar with the field calibration, operation, and maintenance of the equipment, and will perform the prescribed field operating procedures outlined in the Operation and Field Manuals accompanying the respective instruments. They will keep records of all field instrument calibrations and field checks in the field log books.

If on-Site monitoring equipment should fail, the Project Manager will be contacted immediately. The Project Manager will either provide replacement equipment or have the malfunction repaired immediately.

Field equipment will be maintained through the use of a tracking system. Each piece of equipment will carry a tag which identifies the date of the most recent maintenance, and/or battery charge, and the condition. When equipment is damaged or in need of repair it will be immediately and appropriately flagged for the required maintenance to be performed. This process ensures that only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field will include:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems;
- Protection of equipment from adverse weather conditions;
- Daily inspections of sampling equipment and measurement systems for possible problems such as cracked or clogged lines or tubing or weak batteries;
- Daily checks of instrument calibration; and
- Charge battery packs for equipment that is not in use.

2.3 Sample Preparation, Transportation and Holding

Sample bottles will be labeled with the sample location, identification number, and date and time of sampling prior to being filled with sample. Once filled the sample containers will be immediately capped and placed into an iced cooler for transport to the laboratory to maintain a temperature of 4°C.

Field Chain-of Custody records completed at the time of sample collection will accompany the samples inside the cooler for shipment to the laboratory. These record forms will be sealed in a plastic bag to protect them against moisture. Each cooler will be packed in a manner to prevent damage to sample containers. Temperature blanks will accompany the coolers from the laboratory to the Site and back to the laboratory. Sample coolers will be sealed with nylon strapping tape and the Field Team Leader (FTL) will sign and date a custody seal and place it on the cooler in such a way that any tampering during shipment will be detected.

All coolers will either be driven to or shipped by an overnight courier according to current US DOT regulations and as arranged by the Project Team. Upon receiving the samples, the Sample Custodian at the laboratory will inspect the condition of the samples, compare the information on the sample labels against the field Chain-of-Custody record, assign a laboratory control number, and log the control number into the computer sample inventory system. The Sample Custodian will then store the sample in a secure sample storage cooler maintained at 4°C and maintain custody until the sample is assigned to an analyst for analysis. Custody will be maintained until disposal of the analyzed samples.

The Sample Custodian at the laboratory will note any damaged sample vials, void space within the vials, or discrepancies between the sample label and information on the field Chain-of-Custody record when logging the sample. This information will also be communicated to the FTL or field personnel so proper action can be taken. The Chain-of-Custody form will be signed by both the relinquishing and receiving parties and the reason for transfer indicated each time the sample changes hands.

An internal Chain-of-Custody form will be used by the laboratory to document sample possession from laboratory Sample Custodian to Analysts and final disposition. All Chain-of-Custody information will be supplied with the data packages for inclusion in the document control file.

2.4 Record Keeping

One or more bound books will be maintained for the Site; each book will be consecutively numbered. All sample collection, handling and shipping information will be recorded in the field notebook. Accurate and detailed field notes will be maintained. Decontamination procedures will also be documented in the field notebook. The book(s) will remain with the Site evidence file. Copies will be made for the Project Manager and for the person who made the entries if requested. All entries in the Logbook will be made in ink. Logbook entries will include but not be limited to the following:

First Page:

- Site Name and number;
- Date and time started; and
- Personnel on Site.

Subsequent Pages:

- Detailed description of investigative activities including lithology, physical characteristics, sampling, on-Site meetings, and any problems encountered along with the duration of these activities;
- List of all samples obtained and sample appearance (referenced to field logs if necessary);
- List of personal protection used and documentation procedure; and
- All other pertinent daily activities.

Each New Event Will Contain:

- Date and time started;
- Weather;
- Personnel on-Site;
- Activity information; and
- Initials of note keeper.

*Note: When a mistake is made in the log, it will be crossed out with a single ink line and will be initialed and dated.

Special care will be taken in the description and documentation of sampling procedures. Sampling information to be documented in the field notebook and/or associated forms are as follows:

- Sample #;
- Date and time of sample collected;
- Source of sample;

- Location of sample - document with a Site sketch and/or written description of the sampling location so that accurate re-sampling can be conducted if necessary;
- Sampling equipment;
- Analysis and QA/QC required;
- Field instrument calibration including date of calibration, standards used; and their source, results of calibration and any corrective actions taken;
- Field data;
- Field observations - all significant observations will be documented;
- Sample condition;
- Site conditions;
- Sample shipping procedure, date, time, destination and if legal seals were attached to transport container(s); and
- Comments - Any observation or event that occurred that would be relevant to the site; for example: weather changes and effect on sampling, conversations with the client, public official or private citizen; and instrument calibration, equipment problems, and field changes.

2.5 Analytical Procedures

2.5.1 Aqueous Samples

Analysis of groundwater samples will be conducted by a laboratory certified in New York State to conduct work under the Environmental Laboratory Approval and Analytical Services Programs (ELAP/ASP). Groundwater samples will be analyzed for volatile organic compounds (VOCs), US Environmental Protection Agency (EPA) Method 8260, as specified in Attachment 1.

2.5.2 Laboratory Deliverables

Laboratory deliverables packages will follow the NYS ASP Category B format.

3.0 MANAGEMENT OF INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during the implementation of the groundwater monitoring will include purge water generated during groundwater sampling activities.

The following procedures will be used to manage IDW.

3.1 Investigation Generated Water/Fluid Handling and Disposal.

All water/fluid resulting from well purging before sampling will be collected, handled, and discharged/disposed of pursuant to applicable guidance and regulations.

Water/fluid generated during the groundwater monitoring:

- i. will be containerized upon production and will be subject to the following handling/disposal guidelines:
 - (1) 6 NYCRR Part 364 will not apply to the transport of the containers from the point of generation to a temporary on-Site storage area;
 - (2) the containers will be securely staged, pending appropriate disposal as set forth in subparagraph ii below; and
 - (3) groundwater from several monitoring wells may be combined.

- ii. may be stored on-Site in labeled containers in an area with secondary containment awaiting treatment and/or disposal, in accordance with applicable DEC waste management regulations (e.g., 6 NYCRR Parts 360, 364 and the 370 series) or other provisions approved by DER. The contents of the containers will be:
 - (1) properly treated or disposed of, when any of the following are observed:
 - (A) visual evidence of contamination, consisting of discoloration, sheens, or non-aqueous phase liquid (NAPL);
 - (B) olfactory evidence of contamination; or
 - (C) concentrations of contaminants above groundwater standards at levels of concern are known to be present in the monitoring wells, based on previous sampling of the groundwater; or
 - (2) if none of the conditions described in clause ii.(1) apply, the containerized water may be:
 - (A) recharged to unpaved ground into the same groundwater unit, within or directly adjacent to a source area in a manner which does not result in surface water runoff, with DER approval; and
 - (3) treatment of contaminated water/fluids will be at:
 - (A) a permitted off-Site facility;
- iii. Sediment that settles out during monitoring well development or well purging, provided there is no NAPL present, will be handled and disposed in accordance with paragraphs 1 to 3 above, as appropriate for the location of the well.

4.0 QA/QC REQUIREMENTS FOR FIELD SAMPLES

In accordance with sampling and analysis requirements provided in DER-10, Chapter 2 Sampling, Analysis and Quality Assurance, testing for laboratory characterization of Site media will include provisions to serve as a check on the accuracy and integrity of results. This will entail the collection and analysis of various blanks, duplicates and spiked samples as described below.

Trip Blanks

The trip blank will be used to determine if any cross-contamination occurs between aqueous samples during shipment. The analytical laboratory will supply trip blanks as aliquots of distilled, deionized water that will be sealed in a sample bottle prior to initiation of each day of fieldwork. Glass vials (40 ml) with Teflon lined lids will be used for trip blanks. The sealed trip blank bottles will be placed in a cooler with the empty sample bottles and will be provided to the consultant by the laboratory personnel. Trip blanks are analyzed for VOCs as specified in Attachment 1.

Field Blanks

Field blanks will be collected to evaluate the cleanliness of aqueous sampling equipment, sample bottles, and the potential for cross-contamination of samples due to handling of equipment, sample bottles, and contaminants present in the air. Field blanks will be collected at a frequency of one per decontamination event for each type of sampling equipment.

Field blanks will be collected prior to the occurrence of any analytical field-sampling event by pouring deionized or potable water over a particular piece of sampling equipment and into a sample container. The analytical laboratory will provide field blank water and sample jars with preservatives for the collection of all field blanks. Glass jars will be used for organic blanks. The field blanks as well as the trip blanks will accompany field personnel to the sampling location. The field blanks will be analyzed for the same

analytes as the environmental samples being collected that day and will be shipped with the samples taken.

Field blanks will be taken in accordance with the procedure described below:

- Decontaminate sampler using the procedures specified in the QAPP;
- Pour distilled/deionized water over the sampling equipment and collect the water in the appropriate sample bottles;
- The sample will be immediately placed in a sample cooler and maintained at a temperature of 4°C until receipt by the laboratory; and
- Fill out sample log, labels, and COC forms, and record in field notebook.

Temperature Blanks

The temperature blank will be used to determine the temperature of the samples within the cooler upon arrival at the analytical laboratory. A laboratory-supplied temperature blank will be an aliquot of distilled, deionized water that will be sealed in a sample bottle. The sealed temperature blank bottles will be placed in a cooler with the empty sample bottles and will be delivered to the consultant by the laboratory personnel.

Blind Field Duplicate Samples

Blind field duplicate samples will be collected and analyzed to check laboratory reproducibility of analytical data. Blind field duplicate samples will be collected at a frequency of at least 5% (one out of every 20 samples) of the total number of samples collected to evaluate the precision and reproducibility of the analytical methods. All blind field duplicate samples will be submitted to the analytical laboratory as a normal sample, however will have a fictitious sample identification and fictitious time of sample collection. The blind field duplicate will be cross-referenced to document which actual sample it is a blind field duplicate of in the field notes and on the master sample log.

Matrix Spike/Matrix Spike Duplicate

Additional environmental sample volume will be collected for use as MS/MSD samples at a frequency of at least 5% (one out of every 20 samples) of the total number of samples collected per matrix to evaluate the precision and reproducibility of the analytical methods.

The field sampling quality assurance-sampling program are summarized in Table 4-1.

5.0 DATA MANAGEMENT AND REPORTING PLAN

5.1 Data Use and Management Objectives

Data Use Objectives

The typical data use objectives for this project are:

- Ascertaining if there is a threat to public health or the environment.

Data Management Objectives

The primary objective of proper data management is to ensure and document that all necessary work is conducted in accordance with the project goals and QAPP in an efficient and high quality manner thereby maximizing the confidence in the data in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC). Data management procedures not only include field and laboratory documentation, but also include how the information is handled after the conclusion of field investigation and laboratory analyses are completed. - Data handling procedures include project file management, reporting, usability analysis and use of consistent formats for the presentation of the data.

Project File Specifications

The Project Manager will keep all project information in a central Project File maintained. The Project File will be assigned a unique project number that will be clearly displayed on all project file folders (including electronic files). Electronic files will be maintained in a similarly organized Project File. Both hard copy and electronic Project Files will contain, at a minimum copies or originals of the following key project information:

- All correspondence including letters, transmittals, telephone logs, memoranda, and emails;
- Meeting notes;
- Technical information such as analytical data; field survey results, field notes, field logbooks, and field management forms;
- Project calculations;
- Subcontractor agreements/contracts, and insurance certificates;
- Project-specific health and safety information/records;
- Access agreements;
- Project document output review/approval documentation; and
- Reports: Annual Groundwater Reports.

5.2 Reporting

Field Data

Field data will be recorded and reported by field personnel using appropriate field data documentation materials such as the field logbook, field management forms, and COC forms.

Good field management procedures include following proper chain of custody procedures to track a sample from collection through analysis, making regular and complete entries in the field logbook, and the consistent use and completion of field management forms. Proper completion of these forms and the field logbook are necessary to support the consequent actions that may result from the sample analysis. This documentation will support that the samples were collected and handled properly making the resultant data complete, comparable, and defensible.

5.2.1 Data Validation

Field data generated in accordance with the project-specific scope of work will primarily consist of data associated with groundwater sampling field parameters. This data will be assessed by review of the project documentation to check that the scope of work specified in this QAPP have been correctly implemented and that documentation exists for the specified field instrument calibrations. This documentation will be considered sufficient to provide that proper procedures have been followed during the field investigation.

DUSRs will be prepared to provide a thorough evaluation of analytical data with the primary objective to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use. These reports will be prepared by a qualified party independent of the laboratory performing the analysis and independent from any direct involvement with the project for all samples when Category B data deliverables are provided. All of the laboratory testing that will be conducted during the implementation of the SMP will include Category B deliverables.

5.2.2 Electronic Deliverables

In accordance with DER-10 Section 1.15 electronic deliverables will be utilized to the greatest degree appropriate. The NYSDEC has implemented an Environmental Information Management System (EIMS). The EIMS uses the database software application EQUIS from EarthSoft® Inc. to manage environmental data. Pursuant to 6 NYCRR 375-1.11(a) all data submitted to the DER will be in the DEC-approved Electronic Data Deliverable (EDD) and new data will be submitted on a continuous basis immediately after data validation occurs but not to exceed 90 days after the data has been obtained.

5.3 Data Presentation Formats

Project data will be presented in consistent formats for all Groundwater Monitoring Reports. Specific formats will be tailored to best fit the needs of the data being presented but general specifications are described below.

Data Records

The data record will generally include one or more of the following:

- Unique sample or field measurement code;
- Sampling or field measurement location and sample or measurement type;
- Sampling or field measurement raw data;
- Laboratory analysis ID number;
- Property or component measured; and
- Result of analysis (e.g., concentration).

Tabular Displays

The following data will generally be presented in tabular displays:

- Unsorted (raw) data;
- Results for groundwater samples;
- Data reduction for statistical analysis; and
- Summary data.

6.0 PERFORMANCE AUDITS

6.1 Laboratory Audits

The NYSDOH ELAP CLP certified laboratories that have satisfactorily completed performance audits and performance evaluation samples will be used for all sample analysis. The results of the most recent performance audits and performance evaluations will be made available upon request. The consultant may perform a laboratory audit if warranted.

7.0 CORRECTIVE ACTIONS

The laboratory utilized for this project will meet the specifications for corrective action protocols typical for performing contract laboratory services. Laboratory corrective action may include instrumentation maintenance, methods modification, cross contamination/carry over issues, sample tracking practices, laboratory information management (LIMs), etc.

Prior to mobilization for the field investigation, a meeting may be scheduled by the consultant and the laboratory to discuss general corrective action approach and establish procedures to ensure good and timely communications among all parties during the investigation. New procedures will be put into effect as appropriate.

TABLES

Table 4-1
Analytical Methods/Quality Assurance Summary Table – Aqueous
Samples Spic & Span Cleaners 79-81 Pondfield Road, Bronxville, NY

		Aqueous
Analytical Parameter		VOCs, chlorinated solvent list only
Number of Samples		3
Number of Duplicate Samples (1)		1
Number of Field Blanks (2)		1
Number of Trip Blanks (3)		1
Number of MS/MSD Pairs (4)		1
Analytical Method		SW-846 8260B
Sample Container		40 ml septum top, clear
Sample Preservation		Cool, 4°C, HCL to pH<2
Sample Holding Time		14 days

Note:
MS/MSD - Matrix Spike, Matrix Spike Duplicate.

ATTACHMENT 1
Laboratory Reporting Limits
& Standard QC Limits

Matrix		Aqueous			
Analytical Group		VOCs			
Analytical Method		SW 846-8260C			
Analyte	CAS Number	Name of State/Territory/Tribal: Regulatory Standards/Criteria	Analytical Method Detection Limit	Laboratory Method Reporting Limit	Batch QC %RPD / %R
Methylene chloride	75-09-2	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.169	10	0 / 47 - 159
1,1-Dichloroethane	75-34-3	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.07	10	0 / 52-152
Chloroform	67-66-3	NYSDEC Division of Water TOGS 1.1.1: 7 ug/L	0.111	10	0 / 56-142
Carbon tetrachloride	56-23-5	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.467	10	0 / 19-134
1,2-Dichloropropane	78-87-5	NYSDEC Division of Water TOGS 1.1.1: 1 ug/L	0.095	10	0 / 40-152
Dibromochloromethane	124-48-1	NYSDEC Division of Water TOGS 1.1.1: 50 ug/L	0.174	10	0 / 50-133
1,1,2-Trichloroethane	79-00-5	NYSDEC Division of Water TOGS 1.1.1: 1 ug/L	0.104	10	0 / 62-138
Tetrachloroethene	127-18-4	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.384	10	0 / 46-124
Trichlorofluoromethane	75-69-4	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.141	10	0 / 10-144
1,2-Dichloroethane	107-06-2	NYSDEC Division of Water TOGS 1.1.1: 0.6 ug/L	0.087	10	0 / 48-133
1,1,1-Trichloroethane	71-55-6	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.06	10	0 / 24-129
Bromodichloromethane	75-27-4	NYSDEC Division of Water TOGS 1.1.1: 50 ug/L	0.063	10	0 / 55-138
trans-1,3-Dichloropropene	10061-02-6	NYSDEC Division of Water TOGS 1.1.1: 0.4 ug/L	0.144	10	0 / 61-126
cis-1,3-Dichloropropene	10061-01-5	NYSDEC Division of Water TOGS 1.1.1: 0.4 ug/L	0.105	10	0 / 66-126
1,1,2,2-Tetrachloroethane	79-34-5	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.12	10	0 / 46-164
Chloromethane	74-87-3	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.181	10	0 / 58-142
Vinyl chloride	75-01-4	NYSDEC Division of Water TOGS 1.1.1: 2 ug/L	0.119	10	0 / 61-127
Chloroethane	75-00-3	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.196	10	0 / 58-142
1,1-Dichloroethene	75-35-4	NYSDEC Division of Water TOGS 1.1.1: 0.7 ug/L	0.155	10	0 / 62-131
trans-1,2-Dichloroethene	156-60-5	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.075	10	0 / 64-133
Trichloroethene	79-01-6	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.08	10	0 / 43 - 150
cis-1,2-Dichloroethene	156-59-2	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.149	10	0 / 72-132
Bromochloromethane	74-97-5	NYSDEC Division of Water TOGS 1.1.1: 5 ug/L	0.074	10	0 / 50-200
1,2-Dibromo-3-chloropropane	96-12-8	NYSDEC Division of Water TOGS 1.1.1: 0.04 ug/L	0.178	10	0 / 33-137

Note:

As specified by Pace Analytical.

Appendix F

Site Management Forms

Site Inspection Form

**Spic & Span Cleaners
79-81 Pondfield Road
Bronxville, New York
NYSDEC BCP Number: C360130**

Date: _____

Personnel: _____

Weather: _____

Reporting Period: _____

SSD/SVE/AS

Well

Integrity: _____

SSD/SVE/AS Piping

Integrity: _____

Alarm

Operation: _____

Site Cover

Condition: _____

Miscellaneous

Site Conditions: _____

Site Inspection Form

Spic & Span Cleaners
79-81 Pondfield Road
Bronxville, New York
NYSDEC BCP Number: C360130

Date: _____

Personnel: _____

Weather: _____

Reporting Period: _____

SSD/SVE Vacuum

Well ID	Vacuum ("H ₂ O)	Acceptable	Repair Required?
DP-1			
DP-2			
DP-3			
DP-4			
DP-5 (SVE-1)			
DP-6			

Vacuum Monitoring Point Measurements (*Acceptable Measurement 0.02"H₂O or greater*)

Well ID	Vacuum ("H ₂ O)	Acceptable	Repair Required?
VP-1			
VP-2			
VP-3			
VP-4			
VP-5			
VP-6			

Air Sparge Monitoring Point Measurements

Well ID	Pressure (PSI)	Acceptable	Repair Required?
AS-1			
AS-2			

Notes

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	
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.	
_____	_____
Date	Contractor

Appendix G
Excavation Work Plan

EXCAVATION WORK PLAN (EWP)

Any future intrusive work that will encounter or disturb the remaining contamination will be performed in compliance with this Excavation Work Plan (EWP). Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the site. Based on future changes to State and federal health and safety requirements, and specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted with the notification provided in Section A-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the periodic inspection and certification reports submitted under the Site Management Reporting.

E-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	Contact Information
Janet Brown, Director Regional Bureau C, NYSDEC Division of Environmental Remediation	(518) 402-9662, Janet.Brown@dec.ny.gov
John Miller, NYSDEC Project Manager	(518) 402-9589, john.miller@dec.ny.gov
Jacquelyn Nealon, NYSDOH Project Manager	(518) 402-7860, beei@health.ny.gov

Kelly Lewandowski, P.E., Chief, NYSDEC Site Control Section	(518)402-9553,kelly.lewandowski@dec.ny.gov
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* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix I of the QAPP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

E-2 SOIL SCREENING METHODS

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

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section E-6 and E-7 of this Appendix.

E-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

E-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material. The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

All excavated soils shall be sampled and analyzed in accordance with Table 5.4(e)10 in DER-10. Based on this characterization, soil containing contaminant levels which exceed the lower value of either the commercial use soil cleanup objectives (SCOs) or the protection of groundwater SCOs will be disposed of off-site at a permitted disposal facility selected with DEC concurrence. Disposal manifests, for any soil disposed of off-site, should be included in the PRR

prepared for the site. Soil which meets the SCOs can be used as backfill and be returned into the excavations from which they were generated.

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

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

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

E-5 MATERIALS TRANSPORT OFF-SITE

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

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

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

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

E-6 MATERIALS DISPOSAL OFF-SITE

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

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

facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

E-7 MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

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

E-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the

land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

E-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RAWP, decision document, or Record of Decision]. The existing cover system is comprised of a minimum of 4 inches of concrete slab on grade foundation flooring, front and rear sidewalks and asphalt paved parking lot. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

E-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at <http://www.dec.ny.gov/regulations/67386.html>, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Soil brought to the site for use as cover or backfill must comply with 6 NYCRR 375-6.7(d) and DER-10 Section 5.4(e). The soil will be placed over a demarcation layer (preferably a geotextile fabric) to identify it from native soil. In areas where the soil is exposed, the upper 6 inches shall be of sufficient quality to maintain a vegetation layer.

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

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

E-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

E-12 EXCAVATION CONTINGENCY PLAN

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

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

E-13 COMMUNITY AIR MONITORING PLAN

The CAMP addresses community concerns of possible off-site airborne migration of suspected contaminants that may be encountered on-site during field activities. Continuous air monitoring will be performed for VOCs during all ground intrusive activities such as soil and ground water sampling. All ambient air readings will be recorded and made available for NYSDEC and NYSDOH personnel to review.

E-13.1 Non-Intrusive Activities

Periodic air monitoring will be performed for volatile organic compounds (VOCs) at the perimeter of the work area once every two hours during field activities. If total organic vapor levels exceed 5 ppm above background, work activities will be halted and monitoring continued

under the provisions of a Vapor Emission Response Plan. All readings will be recorded and made available for NYSDEC and NYSDOH personnel to review.

Particulates will not be monitored due to the absence of any field activities likely to generate dust. However, dust suppression techniques utilizing the application of a water mist from a portable spray tank will be employed in the event dust is generated.

E-13.1.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.
- more frequent intervals of monitoring, as directed by the Safety Officer, are conducted.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

E-13.1.2 Major Vapor Emission

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

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

If efforts relating to the above source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect;

- if organic vapor levels are approached 5 ppm above background.

However, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

E-13.1.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

- All emergency Response Contacts as listed in the Health and Safety Plan of the Work Plan will be notified.
- The local police authorities will immediately be contacted by the Safety Officer and advised of the situation.
- Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

E-13.2 Intrusive Activities

Real-time air monitoring, for volatile compounds and particulate levels at the perimeter of the work area will be accomplished as follows:

- Volatile organic compounds must be monitored at the downwind perimeter of the

work area on a continuous basis. If total organic vapor levels exceed 5 ppm above background, work activities will be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. All readings will be recorded and available for State NYSDEC and NYSDOH personnel to review.

- Particulates should be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations. If the downwind particulate level is 150 ug/m^3 greater than the upwind particulate level, then dust suppression techniques will be employed. All readings will be recorded and available for State NYSDEC and NYSDOH personnel to review.

E-13.2.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume.

If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

E-13.2.2 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet

downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities will be halted.

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

If efforts related to the above the emission source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.:

- if organic vapor levels are approached 5 ppm above background.

However, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

E-13.2.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

- All emergency Response Contacts as listed in the Health and Safety Plan of the Work Plan will be notified
- The local police authorities will immediately be contacted by the Safety Officer and advised of the situation.
- Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

If a sensitive receptor, such as a school, day care or residential area is adjacent to the site, a fixed monitoring station should be located at that site perimeter, regardless of wind direction, and discussed in the text.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

E-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

E-15 DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

E-16 OTHER NUISANCES

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

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