APPENDIX 4
QUALITY ASSURANCE PROJECT PLAN/
FIELD ACTIVITIES PLAN

QUALITY ASSURANCE/FIELD ACTIVITIES PROJECT PLAN

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP)/Field Activities Plan (FAP) describes all field-sampling procedures to be followed in accordance with the DER-10, *Technical Guidance for Site Investigation and Remediation* (Issued on May 3, 2010). Environmental Logic (EL) has prepared this document to address proposed field sampling procedures for the Farmingdale Plaza Cleaners Site (DEC Site #: 130107). EL proposes to collect both vapor and ground water samples to monitor the vapor concern on Site. The proposed sampling procedures will assure that all samples will be collected, handled, delivered to the laboratory, and documented properly. The laboratory (Accutest) is in compliance with NYSDOH ELAP and NYSDEC ASP requirements will be followed. Please see Attachment A has been included which details all laboratory QAPP information. The following schedule for sampling procedures will be followed for the various media listed.

Description of Task	Frequency
Indoor Air Sampling/Sub-Slab Soil Gas Sampling	Annually
O&M	Monthly
Ground Water Sampling	Annually
Exhaust Sampling	Quarterly (Influent/Effluent)

2.0 SAMPLE CONTAINERS

Laboratory cleaned sample containers of appropriate size for the analysis from the selected analytical laboratory will be used for sample collection. The type of sample container is based on the matrix to be sampled and the analytical method to be used. The volume of sample is dependent on the laboratory's QAPP. The samples matrices of vapor and ground water are as follows:

Table Q-1

Analysis	Sample Container
Carbon Changeout (TCLP VOCs/metals & flashpoint)	(2oz septum/8oz) unpreserved
Soil Vapor/Indoor Air (TO-15)	6 L or 1L SUMMA Cannister
Groundwater (VOCs, SVOCs, TAL metals)	2 (40mL) HCL preserved septum vials, 1 (250mL) plastic HNO3 preserved, 2 (950L) Amber unpreserved jars

3.0 EQUIPMENT

3.1 Calibration

All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.

The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.

3.2 Vapor Equipment

The following equipment shall be used to evaluate the SVE system:

Table Q-2

Parameter	Instrument
Airflow	Air Velocity meter
Vacuum	Digital Manometer
VOC	PID
Temperature	Thermometer

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) SAMPLES

QA/QC samples are utilized to provide control over the collection of analytical data and subsequent validation, review and interpretation of the data. The following are some of the procedures, which will be utilized to ensure QA/QC. See Attachment A for more information on laboratory details regarding QA/QC samples and parameters.

4.1 Field Blanks

The purpose of the Field Blank is to determine extraneous contamination sources. The Field Blank can also trace the effects of the ambient air during sampling as well as potential cross contamination from sampling equipment. The Field Blank is analyzed for the same parameters as the samples collected.

For the aqueous matrix, the Field Blank is taken at a frequency of one per day. For the non-aqueous matrix, Field Blanks are to be collected at a frequency of 10% of the total samples collected throughout the sampling event, if the sampling event lasts more than one day.

The Field Blank consists of two sets of sample containers. The first set is filled at the laboratory with demonstrated analyte-free water. The water used must be the same as that used in the laboratory where the analyses are performed. The blank water must be received at the Site within one day of its laboratory preparation and must not be held on the Site for more than two (2) days. The second set of containers remains empty until filled in the field. At the Site, in the most contaminated area, the field blank water is passed through clean, decontaminated sampling equipment into the clean, laboratory supplied empty containers. The Field Blank must arrive back at the laboratory within one day of shipment from the Site. While on-site and during shipment, the field blank water and samples must be maintained at 4°C.

Field Blanks are not required when a sample is collected directly into the sample container.

4.2 Trip Blanks

The purpose of the Trip Blank is to detect extraneous sources of contamination such as sample containers, and cross contamination from shipment as well as laboratory reagent water, ambient air, or reagents used in laboratory analyses.

Trip Blanks consist of two 40 ml VO vials, which are filled at the laboratory with demonstrated analyte-free water. The Trip Blank samples are analyzed for volatile organics only when samples are being analyzed for volatile organics. Once laboratory filled, the Trip Blank is transported and handled in the same manner as the collected samples. It must be received in the field within one day of its preparation in the laboratory. The Trip Blank travels on the Site with the empty bottles and returns to the laboratory, unopened, with the samples. One Trip Blank will be analyzed for each shipment of samples, not to exceed two (2) consecutive calendar days and must be maintained at 4°C while on-site and during shipment.

4.3 Duplicates/ Matrix Spike and Matrix Spike Duplicates

As detailed in the DER-10 Appendix 2B, duplicate, MS/MSD samples will be collected at a rate of 1 for every 20 samples of a specific media concurrent with sampling and monitoring activities performed on site. The analysis of the duplicate will be based on the media sampled and the contaminants of concern identified and the analytical method for the media. At least 1 duplicate/MS/MSD will be taken per sampling event.

5.0 DECONTAMINATION OF SAMPLING EQUIPMENT

All sample collection equipment must be decontaminated before and during sampling to maintain the integrity of the sample and avoid cross-contamination between samples. The decontamination can occur either in the laboratory or the field, depending on the sampling procedures being undertaken.

All sample collection devices will be laboratory cleaned, packaged, and dedicated for exclusive use at one sampling location for that day. Extra sampling equipment will be available on-site in the event that a particular device cannot be used.

Soil sample collection devices (such as split spoons, hand trowels) are normally decontaminated in the field between uses. These devices are cleaned at a location remote from contact with any contamination.

The procedure for decontamination of dedicated field sampling equipment, whether the decontamination is conducted in the laboratory or the field will be as follows.

1. Laboratory grade glassware detergent and tap water wash
2. Potable water rinse.
3. Distilled/deionized (ASTM II) water rinse
4. 10% nitric acid rinse (only if samples are to be analyzed for metals).
5. Distilled/deionized rinse (for metals analyses)
6. Acetone rinse (for samples to be analyzed for organic constituents.
7. Total air dry (for organics)
8. Distilled/deionized rinse (for organic analyses)

After this procedure has been completed, the sampling device will be wrapped in cleaned and autoclaved aluminum foil equivalent material. Sampling equipment will remain in the wrapping material until it is used in the field. It will be handled as little as possible prior to use and disposable gloves will be worn at all times when the device is being handled.

Submersible pumps used to evacuate stagnant groundwater in the well casing, will be cleaned and flushed prior to and between each use. This procedure will consist of external laboratory grade detergent wash and tap water rinse, followed by a 15-gallon flush of potable water through the pump. Finally, the exterior of the pump will be rinsed with distilled/deionized water.

Surface pumps (centrifugal and diaphragm) used for well evacuation will be cleaned between well locations only if a check valve is not used. Dedicated polyethylene tubing will be used for each well. The pump and tubing will be placed on clean polyethylene sheeting to avoid contact with ground surface.

Electronic water level indicators and interface probes will be decontaminated before and between each use by wiping with clean paper towels, washing with laboratory grade detergent, rinsing with tap water, and followed by a distilled/deionized water rinse.

6.0 SAMPLING PROCEDURES

This section describes the field sampling methodologies that will be observed by personnel in accordance with regulatory guidelines. Personnel will obtain all samples using clean sampling devices and place the samples in clean sample containers while wearing new nitrile gloves. Table Q-3 describes the samples to be collected for groundwater and vapor.

Table Q-3: Analytical Methods/Quality Assurance Summary Table

matrix	#samples	FB	TB	Analysis	MS/MSD/DUP	Preserve	#/Container	Container	Hold time
Soil Gas	3	NA	NA	TO-15	NA	NA	1	6L	14 days
IA*	3	NA	NA	TO-15	NA	NA	1	1 or 6L	14 days
OA	3	NA	NA	TO-15	NA	NA	1	1 or 6L	14 days
AS	1	NA	NA	TO-15	NA	NA	1	1L	14 days
AE	1	NA	NA	TO-15	NA	NA	1	1L	14 days
GW	14	1	1	VOC +10 Tics	1/1/1	HCL	2	40 mL v	14 days
GW	14	1	1	SVOC +15 Tics	1/1/1	NA	2	950mL	7 days
GW	14	1	1	TAL Metals	1/1/1	HNO_3	1	250mL	6 months

6.1 Vapor Monitoring and Sampling

Prior to the collection of indoor air and soil gas samples, the SVE system will be shut-down for 45 days to permit soil vapor concentrations to stabilize.

6.1.1 Soil Gas and Indoor Air Sampling

Vapor samples will be collected in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York. At the time of the sampling a NYSDOH building questionnaire and chemical inventory will be completed. Samples will be collected from co-located soil gas and indoor air to evaluate the concentration of CVOCs in the soil vapor as proposed on Figure 3a. An ambient sample will also be collected to evaluate background concentrations of outdoor vapor influences. Soil gas samples will be collected using properly evacuated 6L Summa® canisters provided by the analytical laboratory. The Summa canisters are fitted with flow controllers to allow a collection rate of up to 200 milliliters per minute (in order to obtain a 24-hour sample). Soil gas samples will be collected utilizing a hammer drill to create a temporary narrow diameter point to install Teflon tubing two inches below the floor slab that is sealed with clay during the purging process and then backfilled with hydraulic cement after use. Helium is introduced into the shroud as a tracer gas. The Helium-gas detector is used to confirm the presence of the Helium in the shroud after purging 3 tubing volumes at a rate of <200 ml/min using a syringe. The Helium detector is then used to check the sample hole for presence of Helium. If Helium in excess of 10% is detected from the sample port, it is an indication of a leak due to a poor seal and the seal is redone. Indoor air samples are to be left in locations at approximately 3 feet height in open areas. Each sample will be collected and analyzed in accordance with the *Compendium Method TO-15 Determination of VOCs in Air Collected in Specially Prepared Canisters and Analyzing by Gas Chromatography/Mass Spectrometry (GC/MS)*. Vacuum readings shall be collected when opened and 15 minutes after opening to verify correct operation. Chain of Custody requirements shall be maintained in accordance with the technical regulations for vapor samples including logging the required pressures, times, etc. All samples will be sent to an accredited laboratory for analysis.

6.1.2. SVE System Performance Sample Collection

System samples will be collected (quarterly/annually) for effluent/influent from the SVE System ports on a quarterly basis from specified locations on Figure 3b utilizing a 1L Summa Cannister for a 15 minute grab sample when in operation. Sample results will be compared to action levels to evaluate system performance and exceedances reported to the NYSDEC no more than 72 hours after test results are received. Each sample will be collected and analyzed in accordance with the *Compendium Method TO-15 Determination of VOCs in Air Collected in Specially Prepared Canisters and Analyzing by Gas Chromatography/Mass Spectrometry (GC/MS)*. Chain of Custody requirements shall be maintained in accordance with the technical regulations for vapor samples including logging the required pressures, times, etc. Vacuum readings shall be collected when opened and 15 minutes after opening to verify correct operation. All samples will be sent to an accredited laboratory for analysis.

Air emissions from the SVE system are subject to regulations as set forth by DAR-1. Should emissions exceed the Annual Guidance Concentration (AGC) or Short-term Guidance Concentration (SGC) for any given contaminant, actions will be taken immediately to reduce emissions contaminant concentrations to below their respective AGC/SGC. These actions may include, but are not limited to: carbon vessel changeout, adjustment of system operating parameters, implementation of additional remedial controls, system shutdown, or a combination of these actions.

Based upon a nominal system airflow rate of 300 CFM, an actual exhaust stack height of 18-feet, and an actual exhaust stack inner diameter of 3.826-inches, the maximum allowable emission rates per contaminant are as follows:

Contaminant	AGC (ug/M3)	SGC (ug/M3)	MaxAllowable Emission Rate (lbs/hr)
PCE	1	1000	0.01269
TCE	.45	54000	0.00444
1,2 DCE	1900	NA	24.1359

During monthly inspection a PID will be utilized to evaluate influent and effluent at SVE points (ie. SVE 1, 3, 5 and post-carbon exhaust). Should field screening of the effluent (post-carbon) airstream yield a PID reading of 10ppm or greater, NYSDEC should be notified immediately such that a determination to shut down the system pending further evaluation can be made.

6.2 Groundwater Sampling

EL proposes to perform one synoptic round of measurements from all the monitor wells located on Site and to collect groundwater samples from select monitor wells to provide baseline groundwater quality conditions. The monitor wells will be opened and a headspace reading collected with a photoionization detector (PID). After the headspace has been recorded, a Solinst Product Level Interface probe will be used to evaluate the depth to water, and if there is any Light or Dense Non-Aqueous Phase Liquid in the water column. The depth to the bottom of the monitor well will be evaluated through sounding to determine the amount of water in the well prior to purging. The groundwater samples shall be collected using a bladder pump (1.75" O.D.) and 3/8" O.D. Teflon tubing of the correct length based on each individual well construction to purge 3 well volumes. During the purging the groundwater will be checked for water chemistry parameters to evaluate stabilization, such as pH, conductivity, turbidity, temperature, salinity, Dissolved Oxygen, Oxygen Reduction Potential (ORP), etc., in accordance with the EPA *Low Stress (Low Flow Purging and Sampling Procedure For the Collection of Groundwater Samples.* The groundwater samples will be analyzed by a certified laboratory for VOC+10 TICS, SVOC +15 TICS, and TAL metals.

The following monitor wells are proposed to be part of the baseline groundwater sampling event: DEC-MW3, EPA-MW8A (MW-2), WMW-1 (MW-1), EPA-MW-5A &5B, EPA-0S-3A, EPA-MW-1A (MW-6), EPA-MW-1B (MW-5), DEC-MW-6, EPA-MW-4A, MW-22A, MW-22B and MW-34B, providing they are still in a usable condition and accessible. Please see Figure 5 for the Baseline Groundwater Sampling Plan. Also, See Table Q1 and Q3 for more information regarding laboratory information. The data will be evaluated to assess if and how many additional groundwater sampling events will be performed and which wells will be included in the periodic monitoring. For future groundwater sampling events, a scope of work memo will be submitted to the DEC under separate cover which will explain any changes to the groundwater sampling and provide a schedule for future events.

All purge water will be pumped into 55 gal DOT drums, and emplaced on a pad on-site until they can be removed for off-site disposal at a TSDF.

Chain of Custody requirements shall be maintained in accordance with the technical regulations for groundwater samples. All samples will be sent to an accredited laboratory for analysis.

Please see Attachment A and Table Q1 and Q3 which goes over all of the laboratory details for each of the parameters to be analyzed, the preservation method for glass ware, holding times, etc.

6.3 Sample Identification

All sample containers will be marked with indelible ink before sample collection. After collection, the container will be sealed, and a sample label will be attached to the container and covered with clear vinyl tape.

Each sample container must be labeled with the following information.

1. Job Name and Number
2. Sample Number
3. Date and Time
4. Sampler's Name
5. Sample Type and Location
6. Sample Analysis

Sample numbers on the individual jars will be checked against the chain-of-custody form.

6.4 Sample Transportation and Custody

Samples are delivered to a certified laboratory immediately following collection procedures (e.g., at the end of the day). If this is not possible, the samples are maintained at the required temperature in a secure refrigerator at the offices of Environmental Logic (Lawrenceville, New Jersey) to maintain their integrity but will be transmitted to the laboratory and analyzed within the specified holding time as described in Analytical Summary Tables, and Attachment A and Tables Q1 and Q3. These samples are then delivered the following morning to the laboratory. Samples are shipped according to Department of Transportation regulations (49 CFR 173.130).

The chain-of-custody procedure is utilized to document the history of each sample and its handling. Custody records trace a sample from its collection through all transfers of custody until it is transferred to the laboratory. Internal laboratory records then document the custody of the sample through its final deposition.

Standard procedures are employed both in the field and in the laboratory to maintain the integrity of the sample custody. Such procedures include the tagging of all sample containers, the use of custody seals where applicable, the use of chain-of-custody forms and standard schedule, and control and security procedures within the laboratory.

7.0 SAMPLING OBJECTIVES

Field samples are to be collected to monitor CVOC concentrations in the effected media (vapor and groundwater) and to assess if additional remedial measures are necessary, or if cessation of a remediation strategy (ie. shut-down of SVE system) has been achieved.

8.0 DOCUMENTATION

Field notebooks used by personnel will be bound with numbered pages. All pertinent information regarding the Site and the sampling procedures will be documented. Entries made in these notebooks must note the date and time. Information recorded in these notebooks will include:

-name of the individual making the entry;
-date and time of arrival and departure at the Site;
-location of the samples taken;
-the method of collection;
-numbers of samples taken;
-date and time of collection;
-sample identification number(s);
-any field instrument calibration performed and/or instrument readings;
-weather conditions on the day of sampling and any field observations; and,
-any additional and pertinent information concerning special readings for air sampling, summa regulator IDs, purge volume for vapor points, purge device, helium/tracer test results, PID readings, height of sample intake, NYSDOH building questionnaire, chemical inventory etc.

For ground water sampling, the following additional information will be entered into the field book:

-well identification number;
-organic vapors, pH, dissolved oxygen, temperature and conductivity;
-thickness of free product, if present;
-total depth of well;
-estimated water volume in well;
-start and end time of purging;
-total volume purged;

Photo documentation will be made of selected field activities with photo description, time photo was taken, photo location, and direction of photo all to be recorded in the field notebook.

9.0 LABORATORY PERFORMANCE

In accordance with the DER-10, analysis will be conducted by a laboratory (Accutest) that is accredited pursuant to the NYSDOH Environmental Laboratory Accreditation Program (ELAP) for the category of parameters analyzed. Accutest's Quality System Manual (QSM) is provided in

Attachment A. Samples collected by the remedial party will be analyzed by an analytical method included in the most current DEC Analytical Services Protocol (ASP) and method detection levels met. The laboratory is in good standing in the USEPA Contract Laboratory Program. Written laboratory SOPs are on file. The laboratory will adhere to the personnel, certification, and analytical requirements listed in accordance with DER-10. The laboratory will produce data which meet the NYSDEC requirements, and all supporting data will remain on file for five years. The laboratory will provide sample data deliverables via electronic submission (www.dec.ny.gov/chemical/62440.html). For more information regarding the laboratory ability to comply with all the NYSDEC requirements please see Attachment A.

10.0 REPORTING

Subsequent to receiving the results a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method will be incorporated into the environmental report and submission of a Category B deliverable by the accredited laboratory. The resume is included along with the laboratory requirements for preparing the DUSR in Attachment A.

ATTACHMENT A

Lab Manager: [signature]
QA Manager: [signature]
Effective Date: 8/25/17

Title: METALS BY INDUCTIVELYCOUPLED PLASMA ATOMIC EMISSION SPECTROMETRY (ICP) USING SOLIDS STATE ICP

METHOD REFERENCE: SW846 6010D

REVISED SECTIONS: Tables 2 (Plasma view)

1.0 SCOPE AND APPLICATION

1.1 This method is applicable for the determination of metals in water, wipes, sludges, sediments, and soils. Sample matrices are pretreated following SW846 methods for digestion of soil, sediment, sludge, wipe or water samples. Refer to specific digestion SOP's for more information on digestion techniques.

1.2 A variety of metals can be analyzed by ICAP. These include, but are not limited to, Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, S, Se, Si, Ag, Na, Sr, Tl, Sn, Ti, Pd, V, W, Zn, Bi, Li and Zr.

2.0 SUMMARY

2.1 Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods. When analyzing groundwater samples for dissolved constituents, acid digestion is not necessary if the samples are filtered and acid preserved prior to analysis.

2.2 This SOP describes operation of the ICAP 6500 and ICAP 7000 Spectrometer following method SW846 6010D.

2.2.1 This inductively coupled argon plasma optical emission spectrometers (ICP-OES) uses an Echelle optical design and a Charge Injection Device (CID) solid-state detector to provide elemental analysis. Control of the spectrometer is provided by PC based iTEVA software.

2.2.2 In the instrument, samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a spectrometer, and the intensities of the emission lines are monitored the solid state detector.

2.2.3 Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. In one mode of analysis the position used must be as free as possible from spectral interference and must reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. Interferences which cannot be addressed with background correction must be corrected using the appropriate interelement correction factors.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The normal reporting limits for this method have been established at the concentrations listed in Table 1. Reporting limits may vary depending on client needs and lab protocols, but the reporting limits must always be verified with a low check which meets the criteria outlined in this SOP. In addition, the reporting limits must always be greater than the MDL. Refer to the scheduling sheets and check with the metals supervisor for further information.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards.

SPIKE BLANK SAMPLE. Digest and analyze a laboratory control sample (Soil LC) or spike blank with each set of samples.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX SPIKE DUPLICATE: A matrix spike duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the matrix spike duplicate and the matrix spike must be assessed.

$$\frac{(|\text{Matrix Spike Result} - \text{Matrix Spike Duplicate Result}|) \times 100}{(\text{Matrix Spike Result} + \text{Matrix Spike Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs must be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.)

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards must be prepared at the frequency specified in the appropriate section. The calibration standards must be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analysis.

LOW LEVEL CALIBRATION VERIFICATION (CRI or LLCCV). The LLCCV or CRI standard is a check standard containing the elements of interest at (or below) the reporting level for each element.

HIGH STANDARD: The high standard is a check standard containing elements of the interest at the one half level of the instrument linear range. The acceptance criteria are +/-10 of the true value.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

6.0 PRESERVATION & HOLDING TIME

6.1 All water samples must be preserved with nitric acid to a pH of 2 or less. All solid samples must be stored in a refrigerator at 4 degrees C.

6.2 All samples must be analyzed within 6 months of the date of collection.

7.0 INTERFERENCES

7.1 Several types of interferences can cause inaccuracies in trace metals determinations by ICP. These interferences are discussed below.

7.2 Spectral interferences are caused by overlap of a spectral line from another element, unresolved overlap of molecular band spectra, background contribution from continuous or recombination phenomena, and background contribution from stray light from the line emission of high concentration elements. Corrections for these interferences can be made by using interfering element corrections, by choosing an alternate analytical line, and/or by applying background correction points.

7.3 Physical interferences can be caused by changes in sample viscosity or surface tension, by high acid content in a sample, or by high dissolved solids in a sample. These interferences can be reduced by using an internal standard, by making sample dilutions or by analyzing a sample using the method of standard additions.

7.4 Chemical interferences are not pronounced with ICAP due to the high temperature of the plasma, however if they are present, they can be reduced by optimizing the analytical conditions (i.e. power level, torch height, etc.).

8.0 EQUIPMENT AND SUPPLIES

8.1 Currently there are five solid state ICPs available for use in the lab. They are Thermo 6500 and 7000 ICP units. These units have been optimized to obtain low detection limits for a wide range of elements. Since they are solid state systems, different lines may be included for elements to obtain the best analytical results. However, the lines which are normally included in the normal analysis program are shown in Table 2.

8.2 Instrument auto-samplers. For random access during sample analysis.

8.3 Class A volumetric glassware and pipets.

8.3.1 All glassware must be washed with soap and tap water and then soaked in a 10% nitric acid bath for a minimum of 2 hours. It must then be rinsed at least 3 times with deionized water.

8.4 Glass autosampler tubes

8.4.1 Autosampler tubes must be washed with soap and tap water and then soaked in a 10% nitric acid bath for a minimum of 2 hours. They must then be rinsed at least 3 times with deionized water.

8.5 Autopipeters with tips. These must be calibrated and checked as outlined in the autopipeter SOP, EQA004.

9.0 REAGENTS

9.1 All chemicals listed below are reagent grade unless otherwise specified. Deionized water must be used whenever water is required. The expiration date for standards and reagents is the date supplied by the manufacturer or if no expiration date is given, a default of 6 months is used. For acid solutions (nitric, sulfuric, hydrochloric) the expiration date is 2 years from the date of preparation of the solution.

9.2 Hydrochloric acid, trace metals grade.

9.3 Nitric Acid, Baker instra-analyzed or equivalent.

9.4 Standard stock solutions available from Absolute, Inorganic Ventures, CPI, Ultra Scientific or equivalent. Note: All standards must be ICP quality standards.

9.5 Calibration Standards: These can be made up by diluting the stock solutions to the appropriate concentrations. It is recommended that fresh calibration standards must be prepared a minimum of every two weeks. They must be monitored on a daily basis by comparison to an ICV. Standards which are going to be stored for several days must be transferred to FEP fluorocarbon or previously unused polyethylene or polypropylene bottles for long term storage.

9.5.1 Standards must be approximately matrix matched to the samples. For most samples, a 5 percent nitric acid and 5 percent hydrochloric acid will approximate the acid matrix of the sample and limit nebulization problems. If it is known that the samples contain a significantly different acid matrix, then the matrix of the standards must be modified or the samples must be diluted so that they are in a similar matrix to the curve.

9.5.2 Standards must be prepared so that there is minimal spectral interference between analytes.

9.5.3 See Table 10 for the make-up and concentrations of standards and stock solutions being used to calibrate the ICP. The standard curve consists of a blank and 1 non-zero standard at the levels shown in Table 10.

9.6 Calibration/Rinse Blank. The calibration blank is prepared by diluting a mixture of 50 ml of concentrated nitric acid and 50 ml of concentrated hydrochloric acid to a final volume of 1 liter with deionized water.

9.7 Analytical Quality Control Solutions. All of the solutions below are prepared by adding either mixed or single element metals solutions to a solution containing 5 percent nitric acid and 5 percent hydrochloric acid and diluting to a fixed final volume with this acid mixture. All of these solutions must be placed in FEP fluorocarbon or previously unused polyethylene or polypropylene bottles for long term storage.

9.7.1 Initial Calibration Verification solution. This standard solution must be made from a different source than the calibration curve. The values for each element must be near the midpoint of the calibration curve. This solution is used to verify the accuracy of the initial calibration. See Table 4 for suggested ICV concentrations.

9.7.2 Continuing Calibration Verification solution: The metals concentrations for this standard must be at approximately the mid-point of the calibration curve for each element. This standard must be prepared from the same source that is used for the calibration curve. See Table 4 for suggested CCV concentrations.

9.7.3 Interference Element Check Solutions. These solutions must be used on a periodic basis to check the interfering element corrections on the instruments. Note: If interferences from different elements than those listed below are a problem, the interfering element solutions may be modified. Two acceptable solutions are outlined below.

9.7.1.1 ICSA Solution. The ICSA solution contains only the interfering elements. The recommended concentrations are shown below. If the linear ranges on a given instrument are lower than these levels, the concentrations may be set near the top of the linear range for those elements.

Al	500 mg/L
Ca	400 mg/L
Fe	200 mg/L
Mg	500 mg/L

9.7.1.2 ICSAB Solution. The ICSAB solution contains both the interferents and the analytes of interest. The recommended concentrations are shown below. If the linear ranges on a given instrument are lower than these levels, the concentrations may be set near the top of the linear range for those elements

Ag	1.0 mg/L	Zn	1.0 mg/L
Ba	0.50 mg/L	As	1.0 mg/L
Be	0.50 mg/L	Se	1.0 mg/L
Cd	1.0 mg/L	Sb	1.0 mg/L
Co	0.50 mg/L	Tl	1.0 mg/L
Cr	0.50 mg/L	Mo	0.5 mg/L
Cu	0.50 mg/L	Pd	0.5 mg/L
Mn	0.50 mg/L	Al	500 mg/L
Ni	1.0 mg/L	Ca	400 mg/L
Pb	1.0 mg/L	Fe	200 mg/L
V	0.50 mg/L	Mg	500 mg/L
W	0.50 mg/L	Zr	0.50 mg/L
Li	0.50 mg/l	Sr	0.5 mg/l
Bi	0.50 mg/l	Ti	0.5 mg/l
B	0.50 mg/l	S	0.5 mg/l
Sn	0.50 mg/l	Si	0.5 mg/l

9.7.2 CRI Standards (also referred to as LLCCV). The CRI standard must contain the elements of interest at (or below) the reporting limit for each element. The CRI level is at the reporting limit as shown in Table 1. This solution is to be prepared at the reporting limit level for each element. They must be made in the same matrix as the calibration standards. Note: The CRI must be verified at the RL before any dilutions are applied

9.8 Matrix Spike and Spike Blank Solution: The final concentrations suggested for the matrix spike and spike blank solutions are shown in Table 5. Refer to METALS SPIKING SOLUTION AND STANDARDS PREPARATION SOP EMP 202-11 Table 1,1A, and 3 for preparation/concentration and amount of spiking solutions. Appropriate amount of the resulting stock solution is added to the matrix spike and blank spike samples before they are digested.

9.9 Matrix Spike and Spike blank (For aqueous samples and TCLP leachates).

9.9.1 The final concentrations suggested for the matrix spike are shown in Table 5. Spiking solutions, they are prepared by adding either mixed or single element metals solution. Refer to METALS SPIKING SOLUTION AND STANDARDS PREPARATION SOP EMP 202-11 Table 1,1A, and 3 for preparation/concentration and amount of spiking solutions. Resulting stock solution is added to the matrix spike and blank spike samples before they are digested..

9.9.2 The Spike blank sample must be digested and analyzed for every batch of 20 samples or less. The Blank spike prepared by adding either mixed or single element metals solutions to DI water and bringing up to a fixed final volume. For TCLP samples, the blank spike must be made using blank leachate solution rather than DI water. 50 ml of this solution is digested and brought to a final volume of 50 ml.

9.10 Liquid Argon or Argon Gas. Argon is provided by Air Products in the large outdoor tank. No lab monitoring of the tank is normally necessary

9.11 Internal Standard Solution (with matrix modifier). To a 2 liter flask containing approximately 800 ml of DI water, add 40 ml of 10,000 mg/l Cesium solution, 10 ml of 10000 mg/l indium, and 2 ml of 10000 mg/l yttrium. Add 100 ml concentrated nitric acid and 100 ml concentrated hydrochloric acid and bring to a final volume of 2000 ml and mix well. This solution is added to all samples and standards as the instrument is running using a split line on the peristaltic pump.

10.0 PROCEDURE

10.1 General procedure on how to operate the SS Trace is described below. Refer to the Thermo 6500 operation manual for further details.

10.2 Before bringing up the instrument, make sure that the lines, the torch, the nebulizer, and the spray chamber are clean, the dehumidifier is filled with DI water up to the level between Minimum and Maximum, and that there are no leaks in the torch area.

10.3 Turn on the recirculating cooler. Verify that the liquid argon is turned on.

10.4 Set up the pump tubing and engage the peristaltic pump.

10.5 Put a new solution of acid rinse into the rinse reservoir. (Note: the composition of the rinse solution may be periodically changed to minimize sample introduction problems and sample carryover.) If internal standard is being used, make sure that sufficient internal standard solution is prepared.

10.6 Start up the instrument following the sequence shown below.

10.6.1 Double click the **iTEVA Control Center** Icon on desktop. Type ***admin*** in User Name field, and then click OK.

10.6.2 Once the iTEVA Control Center window is opened, click on **Plasma** Icon at status bar area. Then click on **Instrument Status** to check the interlock indicators (torch compartment, purge gas supply, plasma gas supply, water flow and exhaust must be in green; drain flow and busy must be in gray) and the Optics Temperature. (It should be around 38°C.) Click on the Close box.

10.6.3 Click **Plasma On**. After the plasma is on, close the Status window and let the instrument warm to up for 15 to 20 minutes before starting the analysis. New tubing may take an hour to stabilize.

10.7 Torch Alignment and Auto Peak

10.7.1 If the torch has been cleaned, then it has to be realigned after it is replaced

10.7.1.1 Open the method and then click on **Sequence** tab, and then click on List View Icon until you reach rack display.

10.7.1.2 Send probe to the cup which is filled with 2 ppm Zn solution in Autosampler program. eg. Go to S-6 position (you can assign any position in the rack for torch alignment) which is filled with 2 ppm Zn solution.

10.7.1.3 Click on **Analysis** tab and then select **Torch Alignment** from **Instrument** drop down menu. There will be a pop up dialog box present. Click RUN. Then there will be another dialog box pop up (This is a reminder for Torch Alignment Solution (2 ppm Zn)), let the solution to pass through the plasma and click Ok. Now, the instrument is initiating an automated torch alignment. It takes about 7 minutes to complete this step. Progress is indicated in the progress bar.

10.7.1.4 After Torch Alignment is done, click Close. Click on **Sequence** tab and then follow by **List View** Icon.

10.7.1.5 Go to Rinse position at rack display, right click to select Go to rinse and let it rinse for 2 minutes.

10.7.2 Perform Auto Peak.

10.7.2.1 It is recommended that the Auto Peak Adjust procedure be performed monthly or whenever the peak shape has shifted for any element. A standard that contains all of the lines of interest is used and the system automatically makes the appropriate fine adjustment. (CCV solution is used for this process.)

10.7.2.1.1 A shift in peak shape can be defined as when the peak is no longer in the middle of the defined viewing window. The window must be set so that the peak is approximately centered and there is a sufficient area measured so that reproducible, consistent data can be obtained at reporting limit levels. This is done as part of the automatic process, but the window size can be adjusted manually in the method based on the shape of the peak to obtain the best fit for the peak. A wider peak may need a broader integration window for the best analysis. In general, the window should cover at least the top 1/3 of the peak.

10.7.2.2 Click **Sequence** tab and then click on **List View I**con till the rack is displayed.

10.7.2.3 Send the probe to the cup which is filled with CCV solutions using Autosampler program (you can assign any position in the rack which has CCV solution filled for auto peak adjust) then click on **Analysis** tab. All elements' result is showed in the display area. From **Instrument** drop down menu, select **Perform Auto Peak**. There will be a pop up dialog box present. Highlight _All Elements_,then click RUN. Then there will be another dialog box pop up (This is a reminder for Perform Auto Peak Solution), click Ok. Now, the instrument is performing auto peak adjust. It takes about 5 minutes to complete this process. The Auto Peak dialog box will show a green " √" in front of All Elements, which indicates Auto Peak is completed.

10.8 Open the method and start up the run.

10.8.1 Click on **Analyst I**con at the workspace. Go the Method and choose Open from the drop down menu. Select the method with a Revision (usually select the last revision used).

10.8.2 Go to **Method** tab at the bottom of left-hand corner to click on **Automated Output** at the workspace area. Type a filename in Filename field in the data display area (i.e.: SA073107M1: starts with SA, then follow by MM-DD, then M1; M1 indicates the first analytical run for that day, then follow by M2, M3 and so on for the second and third runs).

10.8.3 Click on **Sequence** tab at the bottom of left-hand corner. From **Auto-Session** drop down menu bar, click on **New Autosampler** to create a sequence. This will pop up a dialog box, then click on **New** and fill number of samples (i.e.: 100) in the Number of Samples field and the sample ID (usually leave this field empty) in Sample Name field. Type a sequence name (i.e.: SEQ073107M1: starts with SEQ, then MM-DD-YY, then M1; M1 indicates the first analytical run for that day, then follow by M2, M3 and so on for the second and third runs) in the Sequence Name field. Click OK, then put in "0" on Settle Time between the Sequences box, click OK.

10.8.4 Right click on **Untitled** (CETAC ASX-520 Enviro 5 Named Rack is the rack that currently using) at the workspace area, click on **Auto-Locate ALL** to locate all samples.

10.8.5 Double click on **Untitled** again, then click on the sequence name (i.e.: SEQ073107M1), on the data display area, type the sequence in Sample name column, dilution factor (if needed) in CorrFact column, check the box in front of Check column, and select an appropriate check table.

10.8.6 Once done with creating sequence, go to **Method** drop down menu and save all changes as **Save As**. There will be a Save a Method dialog box present, go to Save

Option to check on "Overwrite Method and bump revision number" box, then click OK.

10.8.7 Go to **Sequence** tab, click on **List View** Icon from tool bar, then click on **Connect Autosampler to PC and Initialize** Icon. (Now, the autosampler tip is up and sits on the top of the rinse cup.)

10.8.8 The sequence includes the calibration and run quality control.

10.8.8.1 Calibrate the instrument as outlined below using the standards shown in Table 3. This calibration procedure is done a minimum of once every 24 hours. The calibration standards may be included in the autosampler program or they may be run separately.

10.8.8.2 Analyze ICV and ICB after the calibration is completed and before any samples are analyzed. An ICB may be run following the ICV, but is not required.

10.8.8.3 For mixed runs (EPA 200.7 and SW846 6010C), the first CCV is designated the ICCV. For samples and quality control, insert the list pointer after a space after the sample. Check with the metals supervisors for additional information on the use of listpointers. In general, listpointer 2 refers to the SW846 6010 method and listpointer 1 refers to EPA 200.7 method.

10.8.8.4 Low Level Calibration Verification (Low checks or LLCCV) Run low checks at reporting limit levels after ICCV and CCB. The low checks are named as CRI (or CRIB for DOD run), CRID and CRIA. The levels for each low check are listed in Table 6, Table 7 and Table 8.

10.8.8.4.1 Muti-level low check solutions must be analyzed for default reporting limits and special client reporting limits.

10.8.8.4.2 Method limits of 80 to 120% are applied to the CRI low check standard.

10.8.8.5 Before analyzing any real samples, an interference check solution must be checked. For all spiked elements, the analyzed results must be within 20 percent of the true results. For unspiked elements, the interfering element solutions must contain **less than** the absolute value of the reporting limit for each element.

10.8.8.6 If the interfering element solution is not within specifications and that element must be reported, then new interfering element correction (IEC) factors will need to be generated following the procedure outlined in Section 11 below. If new IEC's are generated, then the run must be restarted from the ICSA, ICSAB quality control samples and new CCV checks must be run before any samples can be reported.

10.8.8.7 After the initial analytical quality control has been analyzed, the samples and the preparation batch quality control must be analyzed. Each sample analysis must be a minimum of 2 readings using at least a 5 second integration time. For samples containing levels of elements greater than approximately 5 times the reporting limits, the relative standard deviations for the replicates must be less than 5%. If not, reanalyze the sample. Upon reanalysis, the RSDs are acceptable then report the data from the reanalysis. If RSD's are not acceptable on reanalysis, then the results for that element must be evaluated by the data reviewer and footnoted if necessary. In some cases, an additional dilution analysis may be needed. Check with the area supervisor or manager for additional information.

10.8.8.8 Between each sample, flush the nebulizer and solution uptake system with a blank rinse solution for the required period of time to ensure that analyte memory effects are not occurring. A time of 80-120 seconds is recommended for most analyses with the current autosampler set-up.

10.8.8.9 Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth samples during an analysis run, whichever is more frequent, and at the end of the sample run.

10.8.8.10 If the CCV solution is not within 10 percent of the true value, no samples can be reported in the area bracketed by the failing CCV for the failing element. Additionally, for the elements with a CCV greater than 5 times the reporting limit, the relative standard deviation for the replicates must be less than 5 percent.

10.8.8.11 The CCB results must be less than ½ of the reporting limit or limit of quantitation for each desired target analyte. If this criteria is not met, then no samples can be reported in the area bracketed by the failing CCB for the failing element and all samples must be submitted for reanalysis.

10.8.8.11.1 However, if the samples are high relative to the CCB (> 10 X the CCB level) and a higher reporting limit is acceptable for the final end use of the data, then the samples may be evaluated using a higher reporting limit to meet the CCB criteria. This must be clearly documented on the run if a higher reporting limit is applied.

10.8.8.11.2 In addition, at the reviewer's discretion, samples that are < RL may be reported when the CCB is biased high. Analysts must assume that samples bracketed by a failing CCB must be reanalyzed unless instructed otherwise.

10.8.8.11.3 If a CCB fails, if possible, the analyst must stop the run and run a new CCV, CCB pair before proceeding with the analysis of any additional samples.

10.8.8.12 For one sample per preparation batch, or whenever matrix interferences are suspected for a batch of samples, a serial dilution must be prepared. Normally the sample used for the serial dilution is the sample that is used for the matrix spike and matrix spike duplicate. For the serial dilution, a 1:5 dilution must be made on the sample.

10.8.8.13 If the matrix spike or matrix spike duplicate is out of acceptable limits, then it is recommended that post-digest spikes be prepared to determine potential interferences.

10.8.8.14 For any readings that exceed the linear range for a given element, a dilution is required. After a high reading, the sample following the high one must be examined for possible carryover. The verifications may be necessary by rinsing the lines with an acid solution and then rereading the sample. A limit check table may be built into the autosampler file so that samples exceeding the linear range are flagged on the raw data.

10.8.8.15 For the interelement spectral interference corrections to remain valid during sample analysis, the interferent concentration must not exceed its linear range. If the interferent exceeds its linear range or its correction factor is big enough to affect the element of interest even at a lower concentration, sample dilution with reagent blank and reanalysis is required. In these circumstance analyte detection limits are raised. Check with metals supervisor for more information.

10.8.8.16 Anytime that the interference is large relative to the sample, dilution may be required. Check with the metals supervisor for more information.

10.8.8.17 For any readings where the internal standard is outside of the range of 70 to 130% of the internal standard level in the calibration blank, then the sample must be diluted until the internal standard is within that range. See Table 11 for the assigned Internal Standard for each element.

10.8.9 This method does not require the analysis of an interfering element check solution at the end of the run. However, this may be required to meet other method and/or client requirements. Run the ICSA and ICSAB solutions as instructed by the metals lab supervisor or manager or as noted in the program code instructions.

10.8.10 After the instrument is optimized, click **Run Auto-Session** Icon to start the run.

10.8.11 If you need to add or delete samples once the run is started, follow the steps shown below.

10.8.11.1 Adding Samples.

10.8.11.1.1 Click on **Sequence** tab, then click on **List View** Icon at the tool bar. There is the sequence table on the data display area.

10.8.11.1.2 Click on **Add Samples** Icon. This will pop up the dialog box, then fill number of samples that need to add in field. Click OK. By doing this, samples will be added at the end of sequence without a location the rack.

10.8.11.1.3 Go to the added samples, on the to position ID column, assign a number for each sample. This number will be the position in the rack. On the Samplename column, type in sample IDs, fill in Corr Fact (if needed) and Check Table.

10.8.11.1.4 The added samples will be analyzed at the end of the original sequence run order unless you assign them to run under different order.

10.8.11.2 Deleting Samples.

10.8.11.2.1 Click on **Sequence** tab, then click on **List View** Icon under the sequence display area.

10.8.11.2.2 To the sample that need to be deleted, on the to position ID column, change the number to "0". By doing this, that sample will be unlocated in the rack and the autosampler tip will go to the next sample.

10.9 When the analysis is completed export the data to LIMS following the procedure outlined below.

10.9.1 Double click on **ePrint** Icon on desktop. There will be a LEADTOOLS ePRINT dialog box pop up, then click **Finish Jobs** and **OK** boxes.

10.9.2 Double click the **PDF** Icon on desktop, the PDF file will present as Document_#. Right click on that file, select **Rename** to change the file name to an assigned analytical run ID. (i.e.: MA8324). This is the raw data for MA8324.

10.9.3 Drop the raw data to Lims.

10.9.4 By completing above steps, the raw data (i.e.: MA8324) can be pulled up in the Raw Data Search function.

10.9.5 For any Thallium hit found during the data review or analysis, the sample will be rerun to confirm. If the hit is confirmed, check the thallium spectrum of that sample to determine if the hit is caused by the matrix interference or true. If the spectrum indicates any matrix interference then the sample will be rerun on dilutions to bring the thallium result to <RL

10.10 The data must be reviewed in the LIMS as outlined in the inorganic data review SOP, EQA034. Calculations for water samples are done automatically in the LIMS using the equation shown below.

original sample concentration of metal (μg/l) =

$$\frac{\text{(conc. in the digestate (}\mu\text{g/l)) x (final digestate volume (ml))}}{\text{(Initial sample volume (ml))}}$$

10.11 Aft the end of the analysis day, the ICP must be brought down using the following sequence:

10.11.1 Place the autosampler tip in rinse cup and rinse in a mixed solution of 5% nitric acid and 5% hydrochloric acid for 10 minutes and in DI water for 20 minutes. **Note**: A stronger acid may be needed depending on the matrix of the samples that were analyzed.

10.11.2 Turn off the plasma by click on the **Plasma** Icon and click on **Plasma Off**.

10.11.3 Close all iTEVA programs/ windows.

10.11.4 Release the tension on the sample pump platen.

10.11.5 Switch off recirculating chiller.

11.0 PROCEDURE FOR GENERATION OF INTERFERING ELEMENT CORRECTION FACTORS

11.1 All IEC's must be verified and updated a minimum of once every 6 months or whenever instrument conditions change significantly. It is recommended that elements with frequent high concentrations or with large IEC's must be checked more frequently.

11.2 Calculate the IEC correction factors and enter them into the method. Verify that the recalculated sample results are within QC limits. Calculate the correction factor using the equation shown below. This correction factor must be added to the correction factor already in place in the method for a given element.

$$IEC = \frac{\text{Concentration Result of the element with the interference}}{\text{Concentration result of the interfering element}}$$

11.3 Analyze the ICSA/ICSAB solutions and/or SIE solutions and verify that the combined standards are within QC limits. If they are not, make additional changes to the IEC factors and then re-verify both the individual and combined solution values.

11.4 Save and update the method.

11.5 Interfering element correction factors saved as raw data along with the run printouts on a daily basis so that the IEC's for a given run are traceable.

12.0 QC REQUIREMENTS

12.1 This section outlines the minimum QA/QC operations necessary to satisfy the analytical requirements for method SW846 6010D.

12.2 Method Detection Limits (MDLs). MDLs must be established for all analytes, using a solution spiked at approximately 3 to 5 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs must be determined approximately once per year or whenever there is a significant change in the background or instrument response.

12.3 Instrument Detection Limits (IDLs). Instrument Detection Limits (IDLs). It is required that IDL's be completed **ANNUALLY** or after major instrument maintenance or by project specifications. The Instrument Detection Limits (in ug/L) are determined by analyzing 10 replicates of a reagent blank solution. The IDL is defined as 3 times the standard deviation of 10 reps added to the mean of the replicates; as long as it is 0 or positive (Use zero for the mean if the mean is negative.). IDLs shall be determined and reported for each wavelength used in the analysis of the samples.

12.4 Linear Calibration range: The upper limit of the linear calibration ranges is the highest calibration standard.

12.5 Initial Calibration Verification (ICV) and Initial Calibration Blank (ICB). After every new calibration, an ICV must be analyzed. The analysis of the ICV may be followed by the analysis of the ICB, although this is not required by the method.

12.5.1 For the ICV, all elements to be reported must be within 10 percent of the true value and the replicates that exceed 5 times the reporting limit must have a relative standard deviation of less than 5 percent. The ICV must be from a different source than the calibration standards and must be near the mid-point of the calibration curve. If the ICV does not meet criteria, then the problem must be identified and corrected before samples can be run and reported for the element(s) that are outside of criteria. Correction of the problem can be verified by rerunning the check standard and showing that it meets QC criteria.

12.5.2 If an ICB is analyzed, than all elements to be reported must be less than ½ of the RL (LLOQ). If the ICB is outside of criteria, then the problem must be identified and corrected before samples can be run and reported for the element(s) that are outside of criteria. Correction of the problem can be verified by rerunning the check standard and showing that it meets QC criteria. Analysis of a CCB before running any reportable samples can be used to verify that the system meets calibration blank requirements.

12.6 Continuing Calibration Verification (CCV) and Continuing Calibration Blank (CCB). Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run.

12.6.1 For the CCV, all elements to be reported must be within 10 percent of the true value and the replicates that are greater than 5 times the reporting limit must have a relative standard deviation of less than 5 percent. The CCV must be made from the same source as the calibration standards at a concentration near the mid-level of the calibration curve. If an element does not meet the recovery criteria of the CCV (90 to 110%), than no samples can be reported for that element in the area bracketed by the CCV.

12.6.1.1 If the replicate rsd is high, but all replicates are within the recovery limits, then the results can be accepted at the discretion of the reviewer.

12.6.2 For the CCB, all elements to be reported must be less than ½ of the reporting limit (LLOQ). If an element does not meet this criteria then no samples can be reported for that element in the area bracketed by the CCB.

12.7 Interference Check Standard. An interference check standard must be analyzed at the beginning of each analytical run. For all spiked elements, the analyzed results must be within 20 percent of the true values. For unspiked elements, the interfering element solutions must contain less than the absolute value of the reporting limit for each element. If these criteria are not met, then no samples containing the elements in question can be reported in the area bracketed by this QC unless the samples contain no significant interferents.

12.8 Low Level Calibration Verification (CRI, CRIB, CRID, CRIA or LLCCV). These are the low level calibration verification standards containing the elements of interest at (or below) the reporting level for each element. A low level check standard at or below the RL/LOQ must be analyzed at the beginning of each calibration (analysis) batch. The acceptance criterion for these checks is 80 to 120% recovery. If an element does not meet this criterion, then all bracketed samples for that element in the concentration range between the low level calibration verification check and the CCV must be reanalyzed. Samples containing concentrations higher than the CCV may be reported as long as CCV criteria are met. The CRI, CRIB, CRID and CRIA nomenclature is used to address different reporting limits for different methods. CRIB is normally used for the DOD LOQ check.

12.8.1 The low level calibration verification is initially verified by the analysis of at least 7 replicate samples, spiked at the RL/LOQ and processed through all preparation and analysis steps of the method. The mean recovery and relative standard deviation of these samples provide an initial statement on precision and accuracy at the LLOQ. In most cases the mean recovery must be +/- 35% of the true value and RSD must be < 20%. Ongoing quarterly verification is required.

12.8.2 More frequent LCCV checks may be analyzed during the course of the run if system stability at the low end of the calibration is questionable or if the lab wants to ensure that fewer samples will have to be submitted for reanalysis if there is a failed low check at the end of a run.

12.8.3 It is recommended that the LCCV (CRI) check be run bracketing every 4 to 8 hour period of analysis. It may be run as frequently as every 10 samples if the supervisory staff deems that this is necessary.

12.9 Method Blank: The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 sample batch. If the method blank does not contain target analytes at a level that interferes with the project-specific DQOs, then the method blank is considered acceptable.

12.9.2 The default 6010 method limit for the method blank is that is must be less than one half of the reporting limit.

12.9.3 In addition, the blank is considered acceptable if it is less than 10% of the regulatory limit, or less than 10% of the lowest sample concentration for each analyte in a given preparation batch, whichever is greater.

12.9.4 If the method blank does not meet criteria, then it can be reanalyzed along with any associated samples. If it is still unacceptable, then all associated samples must be redigested and reanalyzed along with the other appropriate batch QC samples

12.10 Spike Blank: The laboratory must digest and analyze a spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 sample batch. The laboratory must assess laboratory performance of the spike blank against recovery limits of 80 to 120 percent. In house spike blank limits may also be generated to support these default limits. If the spike blank is outside of the control limits for a given element, all samples must be redigested and reanalyzed for that element.

12.10.2 If solid lab controls are used, then the manufacturer's limits must be applied.

12.11 Matrix Spike: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Recoveries must be assessed against default limits of 75 to 125 percent. In house limits may be generated for this method for informational purposes only. If a matrix spike is out of control, then the results must be flagged with the appropriate footnote and it is recommended that a post-digest spike be analyzed for the out of control element(s). If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and must be footnoted to that effect. Note: Both the matrix spike amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

((Spiked Sample Result - Sample Result) / Amount Spiked) x 100 = matrix spike recovery

12.11.2 If a post-digest spike is required, the sample must be spiked with approximately 2 times the sample level or two times the reporting limits, whichever is greater Limits of 75 to 125 percent are applied.The serial dilution is used to confirm any matrix effects. The post-digest spike recovery must be footnoted on the matrix spike recovery or otherwise noted in the quality control summary report. If the post-spike recoveries are out of the range of 75 to 125%, then the matrix spike results must be footnoted with a comment that the post-digest spike recovery indicates possible matrix interference.

12.12 Matrix Spike Duplicate (MSD) or Matrix Duplicate DUP). The laboratory must digest a matrix spike duplicate or matrix duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (rpd) between the MSD and the MS or between the DUP and the sample must be assessed. The rpd is calculated as shown below. The control limit for the duplicate rpd is method defined as 20%. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of $\pm$ the reporting limit, then the duplicate is considered to be in control. Note: Both the duplicate amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

12.12.2 If a MSD or duplicate is out of control, then the data must be checked carefully to confirm that the high rpd for a given element is not a result of an analytical problem. If an analytical problem is suspected, the MSD or duplicate must be reanalyzed for confirmation. If the initial and reanalysis are in agreement (within 20%), then the high rpd is a result of preparation or sample issues and further analysis of the initial preparation is not required. If the initial and reanalysis are not in agreement due to an analytical problem, then any affected samples in the associated batch must also be reanalyzed for that element.

12.12.3 If more than 50% of the elements in a sample (that have levels of at least 5 times the reporting limit) have a high RPD, then the MSD or duplicate must be redigested for confirmation, unless the sample matrix is such that the non-homogeneity of the sample is visually apparent. If the results confirm, the results from the original MSD or duplicate must be flagged as indicative of possible sample non-homogeneity. If the results do not confirm, then the whole batch must be digested and reanalyzed.

12.12.4 If 50% or less of the elements in a sample (that have levels of at least 5 times the reporting limit) have a high rpd, then the high rpd(s) must be footnoted as indicating possible sample non-homogeneity unless other problems are suspected. If problems are suspected, the reviewer will initiate redigestion and reanalysis of the batch.

12.12.5 The calculations used to calculate RPD are shown below.

$$\frac{(|\text{MS Result - MSD Result}|) \times 100}{(\text{MS Result + MSD Result})/2} = \text{MSD RPD}$$

$$\frac{(|\text{Sample Result - Duplicate Result}|) \times 100}{(\text{Sample Result + Duplicate Result})/2} = \text{Duplicate RPD}$$

12.13 Serial Dilution. A serial dilution is required on a frequency of one in 20 samples. For one sample per preparation batch, or whenever matrix interferences are suspected for a batch of samples, a serial dilution must be prepared. Normally the sample used for the serial dilution is the sample that is used for the matrix spike and matrix spike duplicate. For the serial dilution, a 1:5 dilution must be made on the sample. The results of the 1:5 dilution must agree within 20 percent of the true value as long as the sample is greater than 25 times the reporting limit for that element before dilution and the sample results are within the linear range. If not, an interference effect must be suspected and the serial dilution result for the element with the suspected interference must be footnoted. The serial dilution is calculated as shown below.

$$\frac{100 \times ((\text{Sample result – Serial dilution result}))}{\text{Sample result}} = \text{Serial dilution percent difference}$$

12.14 Post Digestion Spike Addition. Post-digest spikes may also be used to determine potential interferences. Check with the metals supervisor for further information on when a post-digest spike must be performed. Recovery limits of 75 to 125 percent must be used to assess post-digest spikes.

12.15 For TCLP samples, a post-digest spike for any element where the matrix spike recovery is less than 50% and the sample concentration for that element is within 20% of the appropriate regulatory level and not over the regulatory level. If the post-digest spike passes within limits of 75 to 125% recovery, the low recovery will be attributed to a sample matrix effect at digestion and no further analyses will be required. If the post-digest spike fails, then a second post-digest spike will be prepared on a sample dilution. If this spike passes, all samples will be rerun at this dilution level to confirm the sample results. If the post-digest spike fails again on the diluted sample, then Method of Standard Additions (MSA) will be performed for this sample.

12.16 IEC Correction Factor Generation. All interfering element correction factors (IEC's), must be verified and updated a minimum of once every 6 months or whenever instrument conditions change significantly. The result of <2 times RL (LLOQ) is required on IEC.

12.17 Lower Limit of Quantitation check sample (LLQC). The LLQC is a sample at the reporting limit that is taken through the entire preparation and analytical process. This standard must be analyzed when reporting limits are initial established and on an as needed basis after that. The LLQC is equivalent to the LOQ (Limit of quantitation) standard which must be analyzed quarterly for the DOD QSM program. The limits of quantitation are verified when all analytes in the LLQC sample are detected within 20% of their true value. If the limits cannot be verified at the spiked level, then the quantitation limit must be adjusted to a level where verification is successful.

12.18 Calibration Curve. The calibration curve must be prepared daily using a minimum of a calibration blank and one non-zero. The calibration must be verified with LLCCV/CRI and an ICV before any samples can be analyzed. If the curve is not verified as described in section 12.5 or 12.8, then no results can be reported for those elements which did not meet quality control criteria.

12.19 HIGH STANDARD: The high standard is required in run and acceptance criteria are +/-10 of the true value. See HSTD tabel for preparation and true value.

13.0 CALCULATIONS

13.1 For water samples, the following calculations must be used. Refer to the QC section for the calculations to be used for the QC samples.

original sample concentration of metal (µg/l) =

$$\frac{\text{(conc. in the digestate (µg/l)) x (final digestate volume (ml))}}{\text{(Initial sample volume (ml))}}$$

13.2 For soil samples, the following calculations must be used.

concentration of the metal in the dry sample (mg/kg) =

$$\frac{\text{(conc. in the digestate (mg/l) x final digestate volume(L))}}{\text{(sample wt. (kg)) x (\% solids/100)}}$$

14.0 DOCUMENTATION REQUIREMENTS

14.1 If any samples or QC checks require reanalysis, a brief explanation of the reason must be documented in the raw data. All instrument data must be exported to the LIMS system and a copy of the run log must be included in the logbook by the instrument.

14.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed. The Accutest Lot Number must be cross-referenced on the standard vial.

14.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. A copy of any outside maintenance reports must also be kept in the log. In addition to the maintenance, the maintenance log must also contain daily information on such items as the profile intensity. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error and a reason for the correction. The initials of the person and date of correction must appear next to the correction.

14.5 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information must also be verified during this review.

15.0 INSTRUMENT MAINTENANCE

15.1 Recommended periodic maintenance includes the items outlined below.

15.1.1 Change the pump tubing weekly or as needed.

15.1.2 Clean the filter on the recirculating pump approximately once a month and dust off the power supply vents every one to two weeks.

15.1.3 Clean the radial view quartz surface weekly or more often if needed.

15.1.4 Clean the nebulizer, torch, and injector tube every two to four weeks or more often as needed.

15.1.5 Change the sampler tip as needed (every one to two months).

15.1.6 Clean the recirculating pump lines every 3 months or more often if needed.

15.1.7 Clean the slides on the autosampler with methanol and wipe them with a KimWipe saturated with Teflon spray a minimum of once per day.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.
16.2.2 Hazardous aqueous wastes
16.2.3 Chlorinated organic solvents
16.2.4 Non-chlorinated organic solvents
16.2.5 Hazardous solid wastes
16.2.6 Non-hazardous solid wastes

17.0 ADDITIONAL REFERENCES

17.1 Refer to other SOP's for ICP analysis (CLP, and EPA 200.7 for both DW and WW).

	TABLE 1: NORMAL REPORTING LIMITS BY ELEMENT			
ANALYTE	**WATER & WIPE REPROTING LIMIT(μg/l)**	**SOIL REPORTING LIMIT (mg/kg)**	**SOIL REPORTING LIMIT (ug/l)**	**TCLP REPORTING LIMIT**
Aluminum	200	50	500	
Antimony	6	2	20	
Arsenic	3	2	20	0.50
Barium	200	20	200	1.0
Beryllium	1	0.2	2	
Cadmium	3	0.5	5	0.025
Calcium	5000	500	5000	
Chromium	10	1	10	0.05
Cobalt	50	5	50	
Copper	10	2.5	25	
Iron	100	50	500	
Lead	3	2	20	0.50
Magnesium	5000	500	5000	
Manganese	15	1.5	15	
Nickel	10	4.0	40	
Potassium	10000	1000	10000	
Selenium	10	2	20	0.50
Silver	10	0.5	5	0.05
Sodium	10000	1000	10000	
Thallium	2	1	10	
Vanadium	50	5	50	
Zinc	20	5	50	
Boron	100	10	100	
Molybdenu	20	1	10	
Palladium	50	5.0	50	
Sulfur	50	10	100	
Silicon	200	20	200	
Strontium	10	5	50	
Tin	10	10	100	
Titanium	10	1	10	
Tungsten	50	5	50	
Zirconium	10	2	20	
Bismuth	20	2	20	
Lithium	20	5	50	
Phosphorus	50	10	100	

TABLE 2: ANALYTICAL LINES ON THE SSTRACE			
ELEMENT	**WAVELENGTH**	**PLASMA VIEW**	**WAVELENGTH RANGE SELECTION**
Al	396.1	Radial	High
As	189.0	Axial	Low
Ca	317.9	Radial	High
Fe	259.9	Radial	High
Mg	279.0	Radial	High
Mn	257.610	Axial	High
Pb	220.3	Axial	Low
Se	196.0	Axial	Low
Tl	190.8	Axial	Low
V	292.4	Axial	High
Ag	328.0	Axial	High
Ba	455.4	Radial	High
Be	313.0	Radial	High
Cd	228.8	Axial	Low
Co	228.6	Axial	Low
Cr	267.7	Axial	High
Cu	324.7	Axial	High
K	766.4	Radial	High
Na	589.5	Radial	High
Ni	231.6	Axial	Low
Sb	206.8	Axial	Low
Zn	206.2	Axial	Low
B	208.9	Axial	Low
Mo	202.0	Axial	Low
P	177.4	Axial	Low
S	182.0	Axial	Low
Sr	407.7	Radial	High
Sn	189.9	Axial	Low
Ti	334.9	Axial	High
Si	212.4	Axial	Low
W	207.9	Axial	Low
Zr	339.1	Axial	High
Bi	223.0	Axial	Low
Li	670.7	Radial	High

TABLE 3: CALIBRATION STANDARD LEVELS in ug/l		
Element	**STD A (Blank)**	**STD B**
Aluminum	0	80000
Antimony	0	4000
Arsenic	0	4000
Barium	0	4000
Beryllium	0	4000
Cadmium	0	4000
Calcium	0	80000
Chromium	0	4000
Cobalt	0	4000
Copper	0	4000
Iron	0	80000
Lead	0	4000
Magnesium	0	80000
Manganese	0	4000
Nickel	0	4000
Potassium	0	80000
Selenium	0	4000
Silver	0	500
Sodium	0	80000
Thallium	0	4000
Vanadium	0	4000
Zinc	0	4000
Boron	0	4000
Molybdenum	0	4000
Phosphorus	0	4000
Sulfur	0	4000
Silicon	0	**10000**
Strontium	0	4000
Tin	0	4000
Titanium	0	4000
Tungsten	0	4000
Zirconium	0	4000
Bismuth	0	4000
Lithium	0	4000

TABLE 4: ICV, and CCV LEVELS		
Element	**ICV Suggested Level in ug/l**	**CCV Suggested Level in ug/l**
Aluminum	40000	40000
Antimony	2000	2000
Arsenic	2000	2000
Barium	2000	2000
Beryllium	2000	2000
Cadmium	2000	2000
Calcium	40000	40000
Chromium	2000	2000
Cobalt	2000	2000
Copper	2000	2000
Iron	40000	40000
Lead	2000	2000
Magnesium	40000	40000
Manganese	2000	2000
Nickel	2000	2000
Potassium	40000	40000
Selenium	2000	2000
Silver	250	250
Sodium	40000	40000
Thallium	2000	2000
Vanadium	2000	2000
Zinc	2000	2000
Boron	2000	2000
Molybdenum	2000	2000
Phosphorus	2000	2000
Sulfur	2000	2000
Silicon	5000	5000
Strontium	2000	2000
Tin	2000	2000
Titanium	2000	2000
Tungsten	2000	2000
Zirconium	2000	2000
Bismuth	2000	2000
Lithium	2000	2000

TABLE 5: SUGGESTED CONCENTRATIONS OF METALS IN THE MATRIX SPIKE AND SPIKE BLANK FOR AQ, SOIL AND TCLP MATRIX			
ELEMENT	SOILS FINAL CONCENTRATION IN mg/kg	AQUEOUS/SOIL FINAL CONCENTRATION IN µg/l	
Aluminum	2500	25000	
Antimony	200	2000	
Arsenic	200	2000	
Barium	200	2000	
Beryllium	200	2000	
Cadmium	200	2000	
Calcium	2500	25000	
Chromium	200	2000	
Cobalt	200	2000	
Copper	200	2000	
Iron	2500	25000	
Lead	200	2000	
Magnesium	2500	25000	
Manganese	200	2000	
Nickel	200	2000	
Potassium	2500	25000	
Selenium	200	2000	
Silver	25	250	
Sodium	2500	25000	
Thallium	200	2000	
Vanadium	200	2000	
Zinc	200	2000	
Boron	200	2000	
Molybdenum	200	2000	
Phosphorus	200	2000	
Sulfur	200	2000	
Silicon	500	5000	
Strontium	200	2000	
Tin	200	2000	
Titanium	200	2000	
Tungsten	200	2000	
Zirconium	200	2000	
Bismuth	200	2000	
Lithium	200	2000	

TABLE 6: SUGGESTED CONCENTRATIONS OF METALS IN THE QUALITY CONTROL SAMPLE LOW CHECK (CRI or CRIB) SOLUTION

ELEMENT	FINAL CONCENTRATION IN μg/l
Sb	6
As	8
Ba	200
Be	2
Cd	3
Cr	10
Co	50
Cu	10
Pb	3
Mn	15
Ni	10
Se	10
Tl	10
V	50
Zn	20
B	100
Bi	20
Li	20
Mo	20
P	50
Sr	10
S	50
Sn	10
Ti	10
W	50
Zr	10
Ag	5
Si	200
Al	200
Ca	5000
Fe	100
Mg	5000
K	5000
Na	5000

TABLE 7: SUGGESTED CONCENTRATIONS OF METALS IN THE QUALITY CONTROL SAMPLE LOW CHECK (CRID) SOLUTION

Element	Final Concentration in µg/l
Sb	
As	3
Ba	4
Be	1
Cd	1
Cr	2
Co	3
Cu	
Pb	
Mn	3
Ni	4
Se	5
Tl	2
V	2
Zn	10
B	
Bi	
Li	
Mo	
Pd	
Sr	
S	
Sn	
Ti	
W	
Zr	
Ag	
Si	
Al	100
Ca	1000
Fe	
Mg	100
K	2000
Na	1000

TABLE 8: SUGGESTED CONCENTRATIONS OF METALS IN THE QUALITY CONTROL SAMPLE LOW CHECK (CRIA) SOLUTION	
ELEMENT	**FINAL CONCENTRATION IN μg/l**
Sb	20
As	20
Ba	
Be	
Cd	
Cr	
Co	
Cu	
Pb	20
Mn	
Ni	
Se	20
Tl	
V	
Zn	
B	
Bi	
Li	
Mo	
Pd	
Sr	
S	
Sn	
Ti	
W	
Zr	
Ag	
Si	
Al	500
Ca	2000
Fe	500
Mg	2000
K	
Na	

TABLE 9: INTERNAL STANDARDS				
ELEMENTS	**Y 3600**	**Y 3710**	**Y 2243**	**In 2306**
Sb			X	
As			X	
Ba		X		
Be		X		
Cd			X	
Cr	X			
Co				X
Cu	X			
Pb				X
Mn	X			
Ni				X
Se			X	
Tl				X
V	X			
Zn			X	
B			X	
Bi			X	
Li		X		
Mo			X	
P			X	
Sr		X		
S			X	
Sn			X	
Ti	X			
W			X	
Zr	X			
Ag	X			
Si			X	
Al		X		
Ca		X		
Fe		X		
Mg		X		
K		X		
Na		X		

TABLE 10: PREPARATION AND CONCENTRATION OF ICP DAILY CALIBRATION AND INTERNAL STANDARD

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Date	Analyst (Initials)
MA-_________ STDA	None	N/A		N/A	N/A	__% HNO3 __% HCl			0.000	0.000	1000	0.000			
MA-_________ STDA	None	N/A		N/A	N/A	__% HNO3 __% HCl			0.000	0.000	1000	0.000			
MA-_________ STDA	None	N/A		N/A	N/A	__% HNO3 __% HCl			0.000	0.000	1000	0.000			
MA-_________ STDA	None	N/A		N/A	N/A	__% HNO3 __% HCl			0.000	0.000	1000	0.000			
MA-_________ STDA	None	N/A		N/A	N/A	__% HNO3 __% HCl			0.000	0.000	1000	0.000			
MA-___________ - STDB	B,Ba,Be,Cd,Co, Cr3,Cu,Mn,Ni,P, Pb,Se,Sr,TL,V, Zn	Inorganic Ventures	Accutest-13 REV1			__% HNO3 __% HCl			1000	0.80	200	4.00			
	As,Mo,Sb,Sn,Ti, W,Zr	Inorganic Ventures	Accutest-14 REV1						1000	0.80		4.00			
	Ag	In house							125	0.80		0.50			
	Bi								1000	0.80		4.00			
	Li								1000	0.80		4.00			
	S								1000	0.80		4.00			
	Si								1000	2.00		10.00			
	Al.Na,K,Fe,Mg, Ca	Inorganic Ventures	Metals Mix						5000	3.20		80.00			
MA-___________ - IS	Y					__% HNO3 __% HCl			10000	2.00	2000	10.00			
	Cs								10000	40.00		200.00			
	In								10000	10.00		50.00			
MA-___________ - IS	Y					__% HNO3 __% HCl			10000	2.00	2000	10.00			
	Cs								10000	40.00		200.00			
	In								10000	10.00		50.00			

TABLE 11: PREPARATION AND CONCENTRATION OF CCV

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expiration Date	Acid Matrix	Acid Manufacturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Date	Analyst (Initials)
	B,Ba,Be,Cd,Co, Cr3,Cu,Mn,Ni,P, Pb,Se,Sr,TL,V, Zn	Inorganic Ventures	Accutest-13 REV1						1000	2.00		2.00			
	As,Mo,Sb,Sn,Ti, W,Zr	Inorganic Ventures	Accutest-14 REV1						1000	2.00		2.00			
	Ag	In house							125	2.00		0.25			
MA-__________ - CCV	Bi					__% HNO3 __% HCl			1000	2.00	1000	2.00			
	Li								1000	2.00		2.00			
	S								1000	2.00		2.00			
	Si								1000	5.00		5.00			
	Al.Na,K,Fe,Mg, Ca	Inorganic Ventures	Mineral Mix						5000	8.00		40.00			

TABLE 12: PREPARATION AND CONCENTRATION OF ICV

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Exp. Date	Acid Matrix	Acid Manufacturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Analyst (Initials)	Date
MA-___-____ - ICV	Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Se, Tl, Ti, V, Zn		QC-19			____% Nitric ____% HCl			100	10.0	500	2.00			
	Ba		N/A						1000	1.0	500	2.00			
	Ag		N/A						1000	0.125	500	0.25			
	Al		N/A						10000	2.0	500	40.00			
	Na		N/A						10000	2.0	500	40.00			
	K		N/A						10000	2.0	500	40.00			
	Fe		N/A						10000	1.9	500	40.00			
	Mg		N/A						10000	1.9	500	40.00			
	Ca		N/A						10000	1.9	500	40.00			
	Sn		N/A						1000	1.0	500	2.00			
	Sr		N/A						1000	1.0	500	2.00			
	B		N/A						1000	1.0	500	2.00			
	Pd		N/A						1000	1.0	500	2.00			
	Si		N/A						1000	2.5	500	5.00			
	W		N/A						1000	1.0	500	2.00			
	Zr		N/A						1000	1.0	500	2.00			
	S		N/A						1000	1.0	500	2.00			
	Bi		N/A						1000	1.0	500	2.00			
	Li		N/A						1000	1.0	500	2.00			

TABLE 13: PREPARATION AND CONCENTRATION OF ICSA AND ICSAB SOLUTIONS.

ICSA:

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Expira-tion Date	Analyst (Initials)	Date
MA-___-____ - ICSA	Mg		N/A			____% Nitric ____% HCl			10000	50.0	1000	500			
	Al		N/A						10000	50.0	1000	500			
	Ca		N/A						10000	40.0	1000	400			
	Fe		N/A						10000	20.0	1000	200			

ICSAB:

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Expira-tion Date	Analyst (Initials)	Date
MA-___-____ - ICSAB	Ag, Cd, Ni, Pb, Zn		CLP ILMO 3.0 ANALYTES B			____% Nitric ____% HCl			100	10	1000	1.00			
	Ba, Be, Cr, Co, Cu, Mn, V		USE AS IS						50			0.50			
	Al								10000	50.0		500			
	Ca								10000	40.0		400			
	Fe								10000	20.0		200			
	Mg								10000	50.0		500			
	Sb								1000	1.0		1.00			
	As								1000	1.0		1.00			
	Se								1000	1.0		1.00			
	Tl								1000	1.0		1.00			
	Pd								1000	0.5		0.50			
	Mo								1000	0.5		0.50			
	W								1000	0.5		0.50			
	Zr								1000	0.5		0.50			
	S								1000	0.5		0.50			
	Bi								1000	0.5		0.50			
	Li								1000	0.5		0.50			

TABLE 14: PREPARATION AND CONCENTRATION OF HIGH STANDARD

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Date	Analyst (Initials)
MA-__________ - HSTD (Regular)	B,Ba,Be,Cd,Co, Cr3,Cu,Mn,Ni,P, Pb,Se,Sr,TL,V, Zn	Inorganic Ventures	Accutest-13 REV1			__% HNO3 __% HCl			1000	5.00	1000	5.00			
	As,Mo,Sb,Sn,Ti, W,Zr	Inorganic Ventures	Accutest-14 REV1						1000	5.00		5.00			
	Ag	In house							125	5.00		0.625			
	Bi								1000	5.00		5.00			
	Li								1000	5.00		5.00			
	S								10000	5.00		50.00			
	Si								1000	25.00		25.00			

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Date	Analyst (Initials)
MA-__________ - HSTD (Minerals)	Al					__% HNO3 __% HCl			10000	30.00	1000	300.00			
	Mg								10000	30.00		300.00			
	K								10000	15.00		150.000			
	Na								10000	15.00		150.00			
	Ca								10000	15.00		150.00			
	Fe								10000	15.00		150.00			

TABLE 15: PREPARATON AND CONCENTRATION OF CRI SOLUTION

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Expira-tion Date	Analyst (Initials)	Date
	Sb					____% HNO3			6.00			0.006			
	Mo	Inorganic Ventures	ACCUTEST-20A			____% HCl			20.00			0.020			
	Sn								10.00	1.00		0.010			
	Ti								10.00			0.010			
	W								50.00			0.050			
	Zr								10.00			0.010			
	Al								200.00			0.200			
	As								8.00			0.008			
	Ba								200			0.200			
	Be	Inorganic Ventures	ACCUTEST-20B						2.00			0.002			
	B								100.00			0.100			
	Cd								3.00			0.003			
	Ca								5000			5.000			
	Cr								10.0	1.00	1000	0.010			
	Co								50.00			0.050			
	Cu								10.0			0.010			
	Fe								100.0			0.100			
MA-___________ - CRI	Pb								3.0			0.003			
	Mg								5000			5.000			
	Mn								15.0			0.015			
	Ni								10.0			0.010			
	P								50.0			0.050			
	K								5000			5.000			
	Se								10.0			0.010			
	Na								5000.0			5.000			
	Sr								10			0.010			
	TL								10			0.010			
	V								50			0.050			
	Zn								20			0.020			
	Bi	In house	Intermediate						20	1.00		0.020			
	Li	In house	Intermediate						50	1.00		0.05			
	S	In house	Intermediate						50	1.00		0.05			
	Zr	In house	Intermediate						10	1.00		0.01			
	Si								1000	0.20		0.20			
	Ag	In house	Intermediate						10	0.50		0.005			

TABLE 16: PRPPARATION AND CONCENTRATION OF CRIA SOLUTION

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Exp. Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Analyst (Initials)	Date
MA-__________-CRIA						____% HNO3 ____% HCl				1.00	1000				
	Al								500			0.500			
	Fe								500			0.500			
	Mg								2000			2.000			
	Ca								2000			2.000			
	Sb								20			0.020			
	As								20			0.020			
	Pb								20			0.020			
	Se								20			0.020			

TABLE 16A: PREPARATION OF INTERMEDIATE SOLUTION (CRIA1) FOR CRIA

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Exp. Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Exp. Date	Analyst (Initials)	Date
MA-__________-CRIA1						____% HNO3 ____% HCl					100				
	Al								10000	5.00		500.0			
	Fe								10000	5.00		500.0			
	Mg								10000	20.00		2000.0			
	Ca								10000	20.00		2000.0			
	Sb								1000	2.00		20.0			
	As								1000	2.00		20.0			
	Pb								1000	2.00		20.0			
	Se								1000	2.00		20.0			

TABLE 17: PRPPARATION AND CONCENTRATION OF CRID SOLUTION

Standard Name	Elements	Vendor Name	Item Name (for multi-elements)	Stock Lot #	Expira-tion Date	Acid Matrix	Acid Manu-facturer	Acid Lot #	Stock Conc. (mg/l)	Vol. Added (ml)	Total Vol. (ml)	Std Conc. (mg/l)	Expira-tion Date	Analyst (Initials)	Date
	Al					____% HNO3 ____% HCl			100.00			0.100			
	As	Inorganic Ventures	ACCUTEST-21						3.00			0.003			
	BA								4.00	1.00	1000	0.004			
	Be								1.00			0.001			
	Cd								1.00			0.001			
MA-__________ - CRID	Ca								1000.00			1.000			
	Cr								2.00			0.002			
	Co								3.00			0.003			
	Mg								100			0.100			
	Mn								3.00			0.003			
	Ni								4.00			0.004			
	K								2000.00			2.000			
	Se								5			0.005			
	Na								1000.0			1.000			
	TL								2.00			0.002			
	V								2.0			0.002			
	ZN								10.0			0.010			

LAB MANAGER: Wendi Lyons

QA MANAGER: Olga Azarian

EFFECTIVE DATE: 9-12-2017

TITLE: DIGESTION OF NON-POTABLE WATERS FOR ICP OR ICP-MS ANALYSIS.
REFERENCES: SW846 3010A
REVISED SECTION: 10.2

1.0 SCOPE & APPLICATION

1.1 This method is applicable for the digestion of aqueous samples, TCLP extracts, and wastes that contain small amounts of suspended solids. After digestion, the samples can be analyzed by ICP or by ICP-MS. This digestion method is based on SW846 3010A.

2.0 SUMMARY

2.1 Samples for metals analysis are digested on a hot plate or in a digestion block at 90 to 95° C to solubilize the metals before analysis. Nitric and hydrochloric acids are used for digestion.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. See determinative method.

3.2 Method Detection Limit. MDLs must be established using a solution spiked at approximately 3 to 5 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of three replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs must be determined approximately once per year for frequently analyzed parameters.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a batch. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

SPIKE BLANK Digest and analyze a spike blank with each set of samples. A minimum of one spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits must also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses) If the Spike blank is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the spike blank recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent must be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample must be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results must be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and must be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent must be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

MATRIX SPIKE DUPLICATES: Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

$$\frac{(|\text{MS Result} - \text{MSD Result}|) \times 100}{(\text{MS Result} + \text{MSD Result})/2} = \text{MSD RPD}$$

METHOD BLANK: The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs are determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material that containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. All digestions must be done in a hood. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Expose to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemical specified in this method. A reference file of date handling sheets must be made available to all personnel involved in these analyses.

6.0 COLLECTION, PRESERVATION, & HOLDING TIMES

6.1 All samples must be preserved with nitric acid at the time of collection to a pH of < 2.

6.1.1 Samples received without preservation must be preserved following the specifications in the Accutest QSM.

6.1.2 It is recommended that an additional unpreserved aliquot be taken for samples which require total sulfur if significant sulfide is suspected to be present. (The additional of acid may promote loss of sulfide from the sample.) See section 10.2.2 for handling of the sulfur aliquot.

6.2 All samples must be digested and analyzed within 6 months of the time of collection.

7.0 APPARATUS AND MATERIALS

7.1 The apparatus needed for this digestion procedure are listed below. It should be noted that hot plates and beakers with watch glasses may be used in place of the digestion block and digestion tubes.

7.2 Digestion block. Temperature adjustable and designed to hold sample digestion tubes and capable of maintaining temperatures from 90 to 95°C.

7.3 Thermometers, calibrated with NIST traceable thermometers. To be used to monitor digestion temperatures.

7.4 Sample digestion tubes and ribbed watch glasses.

7.4.1 If sample digestion tubes are used to measure initial and final volumes, then they must be calibrated following the procedure outlined in EMP203, the digestion tube calibration SOP.

7.5 Automatic pipeter bottles.

7.6 50 ml volumetric flasks or 50 ml TD volumetric cylinders (Class A).

7.6.1 All glassware must be washed with soap and tap water and then soaked in a 10% nitric acid bath for several hours. It must then be rinsed at least 3 times with distilled, deionized water.

7.7 Glass funnels.

7.8 Whatman #41 filter paper or equivalent.

7.9 Volumetric pipets, class A.

7.10 pH paper.

8.0 STANDARDS & REAGENTS

8.1 All chemicals listed below are reagent grade unless otherwise specified. Deionized water must be used whenever water is required.

8.2 Hydrochloric acid. Baker instra-analyzed or equivalent.

8.3 Nitric Acid. Baker instra-analyzed or equivalent.

8.4 30% Hydrogen peroxide

8.5 Metals Spiking Solutions. All metals spiking solutions must be made up in a solution of 2 % nitric acid following the procedures outlined in the metals standards preparation SOP. This can be purchased as a mixture from outside vendor.

8.6 Hydrogen Peroxide, 30%. (Used only if sulfur is an analyte of interest).

9.0 INTERFERENCES

9.1 Organics in a matrix may cause interferences if the sample is not digested rigorously enough. In addition, high levels of acids in the final digestate may cause interferences in the analysis. Both of these interferences can be avoided by choosing the appropriate digestion method and by bringing the sample to an appropriate final volume. For a discussion of other interferences, refer to specific analytical methods.

10.0 PROCEDURE

10.1 Below is the procedure to be followed for the digestion of aqueous samples prior to ICP or ICP-MS analysis.

10.2 Before starting the analysis, check the initial pH of the sample with pH paper and verify that it is < 2. Below is procedure for the checking pH and preservation of metals samples when pH is NOT <2. Add a small amount of concentrated nitric acid (~2mls) drop wise to the sample and mix. Using a pipet tip, place a small amount of sample on a piece of pH paper or pour directly on the pH paper at the sink to confirm that the pH is < 2. Document the date and time of the pH adjustment and the lot number of the nitric acid used for the preservation on the preservation log. Mark the date and time of preservation on the bottle to ensure that the analysis is not started for 24 hours from the time of preservation

10.2.1 For highly basic or buffered samples, where more than a few drops of acid are required, adjust an aliquot of the sample rather than the whole amount and record the amount of acid used for the adjustment.

10.2.2 Samples for TCLP matrix or leachate spikes will be received unpreserved from the TCLP leaching area. These must be aliquoted, spiked, and preserved on receipt in the metals prep area.

10.2.2.1 For handling leachate oil samples refer to the SOP EMP073.

10.2.3 For some clients, additional documentation of the pH adjustment is necessary. For all samples from Ohio, the pH adjustment must be noted in the case narrative or conformance summary for the samples.

10.3 Measure out 50 ml of each nitric preserved sample into a labeled digestion tube or into a beaker. The sample may be measured by using a graduated cylinder or by using a calibrated digestion tube. Make sure that the sample identification is accurately recorded with the digestion tube/beaker numbers on the sample digestion log. In addition to the samples, a Spike Blank and a Method Blank must be set up with each batch of 20 samples or less. A Matrix Spike and a Matrix Spike Duplicate (or Matrix Duplicate) must be set up with each batch of 20 samples. Matrix Spike Duplicates are normally used unless otherwise specified by client requirements.

Check with the metals supervisor for spiking levels to use for the matrix spikes and the spike blank.

10.3.1 For the method blank, add 50 ml of deionized water to the digestion tube.

10.3.2 For the Blank Spike, add Spike solution to 50 ml of DI water in to the digestion tube. Refer to the metals spiking solution SOP, EMP202.

10.3.3 For the matrix spike and matrix spike duplicates, add the spiking solution directly to the 50 ml of sample in the designated tubes. Refer to the metals spiking solution SOP, EMP202, for information on the preparation and amounts of spiking solution required.

10.3.4 TCLP blank spikes must be prepared using 50 ml of the appropriate TCLPE extraction fluid.

10.3.5 For samples to be tested for sulfur, where sulfide is suspected to be present, measure out 50.0 ml of unpreserved sample into a labeled digestion tube. Add 5.0 ml of 30% hydrogen peroxide and let the samples sit for 30 minutes. Then add concentrated nitric acid drop wise to a pH of <2. Record the lots added. All associated quality control (method blank, spike blank, matrix spike, and matrix spike duplicate) must be treated in the same manner. The spikes must be added before the addition of the hydrogen peroxide and acid. Record these steps on the digestion log.

10.3.5.1 If other metals are to be tested from the treated sample from 10.3.5, then it must sit for 24 hours before continuing the digestion. It is recommended that a nitric acid preserved bottle from the field be used for all other metals digestions.

10.4 Add 1.5 ml of concentrated nitric acid to all quality control and samples.

10.5 Place the labeled tubes into a digestion block and cover with watch glasses. (If using beakers, cover the beakers with watch glasses and place them on a hot plate.) Heat the samples at 90 to 95°C until they come to a gentle reflux and then continue to heat the samples until they are evaporated to near dryness, for example 10 ml or less. After the heating is complete, allow the samples to cool.

10.5.1 Watch glasses may be removed if necessary to allow for faster volume reduction, but must be left on for the maximum time possible to limit contamination.

10.6 Add an additional 1.5 ml of concentrated nitric acid to all quality control and samples. Continue heating the samples at a gentle reflux until the sample is completely digested. (More acid may be added as necessary to complete the digestion.)

10.6.1 Signs of a complete digestion are if the digestate is light in color and/or if the appearance of the sample does not change with continued refluxing.

10.7 Add 5 ml of 1:1 HCl to each sample and reflux for an additional 15 minutes.

10.8 Wash down the beaker walls and watch glass with DI water. Bring the sample to a final volume of 50 ml with deionized water. The sample is now ready for analysis by ICP.

10.8.1 If the sample contains particulate, it can be filtered through Whatman # 41 filter paper (or equivalent) before analysis. If any samples in a batch are filtered, then all of the associated quality control must also be filtered in the same manner.

10.8.2 For ICP-MS analysis, the digestate is normally further diluted at the instrument before analysis (at least by a factor of 2) and the dilution factor must be added to the instrument file.

11.0 QUALITY ASSURANCE

11.1 A sample batch is defined as a maximum of 20 field samples in a preparation batch over a time period of 24 hours. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required every 20 samples.

11.2 For each digestion batch of 20 samples or less a spike blank and a method blank is prepared.

11.3 For every 20 samples, digest a matrix spike/matrix spike duplicate pair instead of a matrix spike/ duplicate pair unless otherwise requested by a client.

11.4 Refer to the analytical methods SOPs for additional information on method quality control.

12.0 DOCUMENTATION

12.1 All digestion information must be entered on a digestion log. The information required includes the sample identification, the initial sample volume, the final sample volume, the initial sample pH, the acids used (including both amount and lot number), the spikes used, and the digestion times and temperatures, and the thermometer identification. Both the corrected and uncorrected temperatures must be recorded. If filtration is done, the filter type and lot must also be recorded.

12.2 The analyst must write additional information such as unusual sample characteristics in the Comments section. All spiking solution information must be entered in the metals spiking solution notebook.

13.0 DATA REVIEW & REPORTING

13.1 The prep analyst is responsible for updating the samples to SCH status in the LIMS system and for entering the prep information into the LIMS. This may be done manually or electronically. When the prep information is in the LIMS, the completed paperwork must be turned into the metals supervisor for review.

13.2 The supervisor or a metals analyst reviews the preparation information and approves the data in the LIMS system.

13.3 The original paperwork is submitted to the report generation department for filing.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT

14.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 14.2.

14.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

14.2.1 Non hazardous aqueous wastes.

14.2.2 Hazardous aqueous wastes.

14.2.3 Chlorinated organic solvents.

14.2.4 Non-chlorinated organic solvents.

14.2.5 Hazardous solid wastes.

14.2.6 Non-hazardous solid wastes.

15.0 ADDITIONAL REFERENCES

15.1 Refer to the ICP and ICPMS analytical SOP's, the spiking procedure SOP (EMP202), and the digestion tube calibration SOP (EMP203).

LAB MANAGER: ______________________

QA MANAGER: Maria Buschke

EFFECTIVE DATE: 1-31-18

TITLE: METHOD 8260C, VOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/ MASS SPECTROMETRY (GC/MS)
REFERENCES:SW846 8260C(Revision 3, August 2006), SW846 8000D(Revision 4, July 2014)
REVISED SECTIONS: 10.2.10.8, 11.5.3, 11.5.5, 11.1, 12.1, Table 2 -Mass Range
REMOVED SECTIONS: 10.4.2.1.1, 11.5.7

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the analytical procedures, which are utilized by Accutest to acquire samples for analysis of volatile organic compounds by gas chromatographic/mass spectrometric (GC/MS) following purge and trap utilizing the internal standard technique. The compounds in Table 1 may be determined by this method. An option has been included for the analysis of 1,4-Dioxane by selected ion monitoring GC/MS (GC/SIM-SIM).

1.2 This analytical method is designed for nearly all types of samples, regardless of water content, including ground water, aqueous sludges, liquors, waste solvents, oily wastes, tars, filter cakes, sediments and soils.

1.3 The applicable concentration range of this method is compound, matrix, and instrument dependent. Volatile water-soluble compounds can be included in this analytical technique. However, for some low-molecular weight halogenated hydrocarbons, aromatics, ketones, nitriles, acetates, acrylates, ethers, and sulfides, quantitation limits are approximately ten times higher because of poor purging efficiency. Determination of some structural isomers (i.e. xylenes) may also be hampered by coelution.

2.0 SUMMARY OF METHOD

2.1 Volatile compounds are introduced into the gas chromatograph by purge-and-trap (Method 5030/5035). Method 5030 may be used directly on ground water samples. Method 5035 is used for low-concentration and medium-concentration soils, sediments, and wastes. Medium concentration samples are preserved and stored in methanol prior to purge-and-trap analysis.

2.2 An inert gas is bubbled through a 5 ml sample contained in a specifically designed purging chamber at ambient temperature. The purgeables are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the purgeables are trapped. After purging is completed, the sorbent column is heated and backflushed with the inert gas to desorb the purgeables onto a gas chromatographic (GC) column.

2.3 The volatile compounds are separated by the temperature programmed GC column and detected using a mass spectrometer, which is used to provide both qualitative and quantitative information.

2.4 The peaks detected are qualitated by comparison to characteristic ions and retention times specific to the known target list of compounds.

2.5 Once identified the compound is quantitated by comparing the response of major (quantitation) ion relative to an internal standard technique with an average response factor generated from a calibration curve.

2.6 Additional unknown peaks with a response > 10 % of the closest internal standard may be processed through a library search with comparison to a database of approximately 75,000 spectra. An estimated concentration is quantitated by assuming a response factor of 1.

2.7 Water soluble volatile organic and other poor purging compounds maybe analyzed using this methodology, however this method is not the method of choice for these compounds and the laboratory's ability to achieve all calibration and quality control criteria for this method cannot be guaranteed. These compounds are noted as (pp) in Table 7.

2.8 The method includes an analytical option for the analysis of 1,4-Dioxane by GC/MS-SIM. The selected ions that are characteristic of the analytes of interest are analyzed using lower concentrations of calibration standards under the same MS conditions. SIM analysis is performed upon client request and is documented in the report.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve and may vary depending on matrix interferences, sample volume or weight and percent moisture. Detected concentrations below this concentration cannot be reported without qualification. See Table 10.

3.1.1 Compounds detected at concentrations between the reporting limit and MDL are quantitated and qualified as "J", estimated value. Program or project specifications may dictate that "J" qualified compounds are not to be reported.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B, revision 2. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

3.2.3 Calculated MDLs may not be feasible in the analysis of samples, particularly in regards to compounds in table 11 and common laboratory solvents (methylene chloride and acetone). In these cases the MDLs may be raised from the calculated value to a maximum of half the LOQ to avoid false positives being reported.

4.0 DEFINITIONS

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. See individual types of Blanks: Method Blank, Instrument Blank, Storage Blank, Cleanup Blank and Sulfur Blank.

4-BROMOFLUOROBENZENE (BFB) - the compound chosen to establish mass spectral instrument performance for volatile (VOA) analyses.

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.

CONTINUING CALIBRATION - analytical standard run every 12 hours to verify the initial calibration of the system.

CONTINUOUS LIQUID-LIQUID EXTRACTION - used herein synonymously with the terms continuous extraction, continuous liquid extraction, and liquid extraction. This extraction technique involves boiling the extraction solvent in a flask and condensing the solvent above the aqueous sample. The condensed solvent drips through the sample, extracting the compounds of interest from the aqueous phase.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass (Es).

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the mass spectrometer to the target compounds.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatiles), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds.

MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this SOP, a sample matrix is either water or soil/sediment. Matrix is <u>not</u> synonymous with phase (liquid or solid).

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs must be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used in this SOP and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105 °C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

PRIMARY QUANTITATION ION - a contract specified ion used to quantitate a target analyte.

REAGENT WATER - water in which an interferant is not observed at or above the minimum detection limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph: a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - As used in this SOP and elsewhere to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RELATIVE RETENTION TIME (RRT) - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

INSTRUMENT BLANK – a system evaluation sample containing lab reagent grade water with internal standards and surrogate standards added. An instrument blank is used to remove and/or evaluate residual carryover from high level standards, spike samples and field samples.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: benzene, carbon tetrachloride, 1,4-dichlorobenzene, 1,2-dichlorethane, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, chloroform, 1,2-dibromoethane, tetrachloroethene, trichloroethene, and vinyl chloride. Primary standards of these toxic compounds must be prepared in a hood. A NIOSH/Mass approved toxic gas respirator must be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks. The use of non-TFE tubing, non-TFE thread sealants, or flow controllers with rubber components in the purging device must be avoided.

6.3 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal into the sample during shipment and storage. A trip blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

6.4 Contamination by carry-over can occur whenever high level and low-level samples are sequentially analyzed.

6.4.1 Whenever an unusually concentrated sample is encountered, it must be followed by an analysis of an instrument blank to check for cross contamination. Refer to Table 11 for compounds that may cause carryover for this method.

6.4.2 It may be necessary to wash the purging device with methanol, rinse it with organic-free water, and then dry the purging device in an oven at 105^0 C. Follow the instrument manual for instructions on cleaning. Document the occurrence in the maintenance log and notify the manager/supervisor.

6.4.2.1 Clean and bake purging tube.

6.4.2.2 Clean or replace purge needle.

6.4.2.3 Clean and bake sample filter or sparge filter.

6.4.2.4 Clean and bake sample loop.

6.4.2.5 Replace trap if necessary.

6.4.2.6 Replace water management module if necessary.

6.4.2.7 Rinse transfer line with methanol. Caution: disconnect the trap before rinsing.

6.4.3 In extreme situations, the entire purge-and trap device may require dismantling and cleaning. Follow the instrument's manual for instructions on disassembly. Document the occurrence in the maintenance log and notify the manager/supervisor. Screening of the samples prior to purge-and-trap GC/MS analysis is highly recommended to prevent contamination of the system. This is especially true for soil and waste samples.

6.4.4 If the contamination has been transferred to gas chromatograph, any of the following approaches may be used to cleanup the instrument.

6.4.4.1 Baking out the column between analyses.

6.4.4.2 Change the injector liner to reduce the potential for cross-contamination.

6.4.4.3 Remove a portion of the analytical column in the case of extreme contamination.

6.4.5 The oven temperature program must include a post-analysis bake out period to ensure that semivolatile hydrocarbons are stripped from the chromatographic column.

6.5 Special precautions must be taken during the analysis to avoid contamination from methylene chloride and other common laboratory solvents.

6.5.1 The sample storage and analytical area must be isolated from all atmospheric sources of methylene chloride or other common solvents.

6.5.2 Laboratory clothing worn by the analyst must be clean and used in designated areas only. Clothing previously exposed to solvent vapors in the organics sample preparation laboratory can contribute to sample contamination.

6.6 Samples with suspected or known permanganate levels should be preserved with ascorbic acid at collection. The purpose of the ascorbic acid is to remove the permanganate which is an oxidizer. There is potential that the analytes of concern will undergo an oxidative transformation which would no longer be representative of the concentrations as the site.

7.0 SAMPLE HANDLING AND PRESERVATION AND HOLDING TIME

7.1 HANDLING and PRESERVATION

7.1.1 Water samples

7.1.1.1 Container - 40 ml glass screw-cap VOA vial with Teflon-faced silicone septum. The 40-ml glass VOA vials are pre-cleaned and certified.

7.1.1.2 Acrolein & Acrylonitrile

7.1.1.2.1 If acrolein and acrylonitrile are to be analyzed, collect 3, 40 mL VO vials of sample unpreserved. Samples for acrolein and acrylonitrile analysis receiving no pH adjustment must be analyzed within 7 days of sampling. All samples must be footnoted stating samples were unpreserved and analyzed within 7 days.

7.1.1.3 Collect all samples in triplicate. Test all samples for residual chlorine using test paper for free and total chlorine. If samples contain residual chlorine, three milligrams of sodium thiosulfate must be added for each 40 ml of water sample.

7.1.1.4 Fill sample bottles to overflowing, but do not flush out the dechlorinating agent. Sample must be taken with care so as to prevent any air or bubbles entering vials creating headspace.

7.1.1.5 Adjust the pH of all samples to ≤ 2 at the time of collection, but after dechlorination, by carefully adding two drops of 1:1 HCl for each 40 ml of sample. Seal the sample bottles, Teflon face down, and mix for one minute. Or VOA vials containing the preservative (HCL) may be used.

Note: Do not mix the sodium thiosulfate with the HCl in the sample bottle prior to sampling.

7.1.1.6 The samples must be protected from light and refrigerated at 0 - ≤ 6 °C from the time of receipt until analysis.

7.1.1.7 An alternate preservative that may be used when suspected or known levels of permanganate exist in a sample is 25 mg of ascorbic acid per 40 ml vial.

7.1.1.7.1 Ascorbic acid is added to remove the permanganate which is an oxidizer.

7.1.1.7.2 Fill the sample bottles to overflowing, but do not flush out the ascorbic acid.

7.1.1.7.3 The samples must be protected from light and refrigerated at 0 - ≤ 6 °C from the time of receipt until analysis.

7.1.2 Soil Samples

7.1.2.1 Refer to the SOP for SW846 Method 5035 for preservation requirement of non-aqueous solids.

7.2 HOLDING TIME

7.2.1 Water Samples.

7.2.1.1 All samples are to be analyzed within 14 days of sampling (HCl preserved for aqueous sample) unless otherwise specified by the contract. The sample preservation deficiency is noted in the analytical run logbook when the analyst checks the pH at the bench. If the pH is not <2, the analyst notifies the supervisor, who then notifies Client Service Dept. A comment is added to the result page and Non-Conformance Summary.

7.2.1.2 Acrolein & Acrylonitrile

7.2.1.2.1 Samples for acrolein and acrylonitrile analysis receiving no pH adjustment must be analyzed within 7 days of sampling.

7.2.2 Soil Samples

7.2.2.1 Refer to the SOP for SW846 Method 5035 for holding time requirement of non-aqueous solids.

7.2.2.2 All samples are analyzed within 14 days of sampling unless otherwise specified.

8.0 APPARATUS AND MATERIALS

8.1 SYRINGE

8.1.1 10, 25, 50, 100, 500 and 5000 μl graduated syringes, manually held (Hamilton/equiv.).

8.1.2 5 ml and 50 ml glass gas tight syringes with Luerlok end, if appropriate for the purging device.

8.2 BALANCE

8.2.1 Analytical balance capable of weighing 0.0001 gram.

8.2.2 Top loading balance capable of weighing 0.1 gram.

8.3 PURGE AND TRAP DEVICES

8.3.1 The autosampler models are used for purging, trapping and desorbing the sample into GC column.

- O.I. Model 4560 sample concentrator with 4551 vial multi-sampler
- O.I. Model 4560 sample concentrator with 4552 Water/Soil multi-sampler

8.3.2 The sample purge vial must be designed to accept 5 ml of sample with a water column at least 3 cm deep.

8.3.3 The auto-sampler is equipped with a heater capable of maintaining the purge chamber at 40 °C to improve purging efficiency. The heater is to be used for low level soil/sediment analysis, but not for water or medium level soil/sediment analysis.

8.3.4 The OI #10 trap is 42 cm with an inside diameter of 0.105 inches. The trap must be packed to contain the following absorbents (3-ring) and must be conditioned at 180 °C for 30 minutes by backflushing with a Helium gas flow at least 20 ml/min before initial use.

- Tenax (2,6-Diphenylene oxide polymer).
- Silica gel.
- Carbon Molecule Sieve (CMS).

8.3.5 The desorber must be capable of rapidly heating the trap to 190^0 C for desorption. Do not exceed 210 ^{0}C during bake-out mode. Alternatively, follow manufacturer's instructions.

8.4 GAS CHROMATOGRAPH/MASS SPECTROMETER SYSTEM

8.4.1 Gas Chromatograph.

8.4.1.1 An analytical system complete with a temperature programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases.

8.4.1.2 The injection port must be suitable for split or splitless with appropriate interface.

8.4.1.3 The narrow bore capillary column is directly coupled to the source for HP-6890 or Agilent 6890 model.

8.4.1.4 The wide bore capillary column is interfaced through a jet separator to the source for HP-5890 model.

8.4.2 Column.

- 75 m x 0.53mm ID x 3 µm film thickness capillary column coated with DB-624 (J&W Scientific), or equivalent. Condition as per manufactures directions.

- 105 m x 0.53mm ID x 3 µm film thickness capillary column coated with HP-VOA, or equivalent. Condition as per manufactures directions.

- 60 m x 0.25mm ID x 1.4 µm film thickness capillary column coated with DB-624 (J&W Scientific), or equivalent. Condition as per manufactures directions.

- 60 m x 0.45mm ID x 1.7 µm film thickness capillary column coated with DB-VRX (J&W Scientific), or equivalent. Condition as per manufactures directions.

8.4.3 Mass Spectrometer.

8.4.3.1 HP5973, HP5970 Agilent 5973, or Agilent 5975 is capable of scanning from 35 to 300 amu every 2 seconds or less, utilizing 70 volt (nominal) electron energy in the electron impact ionization mode.

8.4.3.2 The mass spectrometer must be capable of producing a mass spectrum which meets all the criteria in Table 3 when injecting or purging 50 ng of the GC/MS tuning standard - Bromofluorobenzene (BFB).

8.4.3.3 SIM Mode – Capable of selective ion grouping at specified retention times for increased compound sensitivity (Table 2a).

8.5 DATA SYSTEM

8.5.1 Data Acquisition and Instrument Control (HP Chemstation) **-** A computer system is interfaced to the mass spectrometer, which allows the continuous acquisition and storage on a machine-readable media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.

8.5.2 Data Processing (HP Enviroquant) - The software accommodates searching of GC/MS data file for target analytes which display specific fragmentation patterns. The software also allows integrating the abundance of an EICP between specified time or scan number limits. The data system includes the recent version of the EPA/NBS or NIST98 mass spectral library for qualitative searches of non-target compounds present in the chromatogram. The data system flags all data files that have been edited manually by laboratory personnel.

8.5.3 Off line Magnetic Tape Storage Device (Lagato Networker) - The magnetic tape storage device copies data for long-term, off-line storage.

9.0 REAGENTS AND STANDARDS

9.1 Solvent

9.1.1 Methanol: purge-and-trap grade quality or equivalent. Store separately, away from the other solvents.

9.2 Reagent Water

9.2.1 Reagent water is defined as water in which an interferant is not observed at the method detection limit of the parameters of interest.

9.2.2 Reagent water is generated by either passing tap water through a bed of approximately one pound of activated carbon or by using the water purification system at Accutest that is a series of deionizers and carbon cartridges.

9.3 Stock Standard Solutions

9.3.1 Commercially prepared standards used.

9.3.1.1 EPA Method 524.2 Volatiles (78 components): Absolute (or equivalent) at 200 μg/ml or 2,000 μg/ml concentration.

9.3.1.2 Custom Volatiles Mix A: Restek (or equivalent) at 2,000 μg/ml concentration.

9.3.1.3 Custom Volatiles Mix B: Restek (or equivalent) at 2,000 - 100,000 μg/ml concentration.

9.3.1.4 VOC Gas Mixture: Ultra (or equivalent) contains 200 μg/ml or 2,000 μg/ml of the following compound**s** in methanol.

- Bromomethane
- Chloroethane
- Chloromethane
- Dichlorodifluoromethane
- Trichlorofluoromethane
- Vinyl Chloride

9.3.1.5 Multiple neat compounds.

9.3.1.6 Surrogate standard mixture: Ultra (or equivalent) at a concentration of 2,500 μg/ml each surrogate compound.

- 1,2-Dichloroethane-d_4
- Dibromofluoromethane
- Toluene-d_8
- 4-Bromofluorobenzene

9.3.1.7 Internal standard mixture: Ultra (or equivalent) at a concentration of 2,000 μg/ml for all the compounds except Tert Butyl Alcohol-d_9, which is from Absolute (or equivalent) at a concentration of 50,000 μg/ml. The following five internal standards are used that exhibit similar analytical behavior to the compounds of interest.

- 1,4-Dichlorobenzene-d_4
- 1,4-Difluorobenzene
- Chlorobenzene-d_5
- Pentafluorobenzene
- Tert Butyl Alcohol-d_9

9.3.1.8 1,4-Dioxane Solution for SIM : Ultra (or equivalent) at 100 μg/ml in methanol.

9.3.1.9 Ketones mixture: Acros (or equivalent) neat standards for Acetone, 2-Butanone, 4-methyl-2-pentanone (MIBK), and 2-hexanone prepared at concentrations 300 ug/ml for soil matrix and 400 ug/ml for aqueous matrix.

9.3.2 Unopened stock standard (ampoules) must be stored according to manufacturer's documented holding time and storage temperature recommendations (usually placed on the ampoule).

9.3.3 After opened, stock standards, internal standards, and surrogate solutions must be replaced after 6 months (one month for purgeable gases standard) or sooner if manufacture expiration date come first or comparison with quality control check samples indicates degradation.

9.3.4 Store all stock standards in vials with minimal headspace and Teflon lid liners after open, protect from light, and refrigerate to –10ºC or colder or as recommended by the standard manufacturer.

9.3.5 Return the standards to the freezer as soon as the analyst has completed mixing or diluting the standards to prevent the evaporation of volatile target compounds.

9.4 Internal Standard and Surrogate Solution

9.4.1 Five internal standard and surrogate spiking solutions are prepared in methanol per Table 8.A.

9.4.1.1 25 μg /ml internal standard and surrogate mixture.

9.4.1.2 250 μg /ml internal standard and surrogate mixture.

9.4.1.3 100 μg/ml surrogate mixture.

9.4.1.4 25 μg /ml internal standard mixture.

9.4.1.5 250 μg /ml internal standard mixture.

9.4.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.4.3 Each 5 ml sample, QC sample, and blank undergoing analysis must be spiked with any one of the above spiking solutions (depending upon the type of standards addition modules used), resulting in a concentration of 50 μg/l of each compound.

9.4.4 Prepare fresh internal standard and surrogate spiking solutions every six months, or sooner, if manufacturer's expiration dates come first or if the solution has degraded or evaporated.

9.5 Secondary Dilution Standards

9.5.1 Using stock standard solutions prepare secondary dilution standards in methanol containing the compounds of interest, either singly or mixed together.

9.5.1.1 100 μg /ml V8260 mixture: prepared from 2,000 μg /ml stock solution. (see Table 8-C)

9.5.1.2 100 μg /ml V8260 custom mixture: prepared from 2,000 μg /ml stock solution. (see Table 8-C)

9.5.1.3 100 μg /ml Gas mixture: prepared from 2,000 μg /ml stock solution. (see Table 8-C)

9.5.2 Replace after one month for non-gas mixtures (one week for gas mixtures) or sooner if manufacture expiration date come first or comparison with quality control check samples indicates degradation.

9.5.3 Store all secondary dilution standards in vials with no headspace and Teflon lid liners, protect from light, and refrigerate to – 10°C or colder or according to manufacturer's storage temperature recommendation.

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9.5.4 Return the standards to the freezer as soon as preparation is finished to prevent the evaporation of volatile compounds.

9.6 Aqueous Calibration Standard Solutions

9.6.1 Initial Calibration Standards

9.6.1.1 Prepare a minimum of five aqueous calibration standard solutions containing the surrogate compounds as Table 8-D.1 or 8-D.2.

9.6.1.2 To prepare a calibration standard, add a measured volume of secondary dilution standard solutions and the surrogate spiking solution to an aliquot of reagent water in the flask. Use a micro-syringe and rapidly inject the methanol standard into the expanded area of the filled volumetric flask. Remove the needle as quickly as possible after injection. Bring to volume. Mix by inverting the flask three times only. Discard the contents contained in the neck of the flask.

9.6.1.2.1 1,4-Dioxane for SIM analysis is prepared from primary stock standard (100ppm).

9.6.2 Continuing Calibration Standard

9.6.2.1 A continuing calibration standard at a concentration of 50 μg/l is prepared as the scheme outlined in Table 8-E.

9.6.3 Aqueous standards are not stable and may be stored up to 24 hours if held in Teflon sealed screw-cap vials with zero headspace at 4^0C (± 2^0C). Protect the standards from light. If not so stored, they must be discarded after use, unless they are set up to be purged by an autosampler.

9.6.4 When using an autosampler, standards may be retained up to 12 hours if they are in purge tubes connected via the autosampler to the purge and trap device.

9.7 Second Source Calibration Check Standard (ICV)

9.7.1 Prepare the second source calibration check standards from separate sources of stock standards from the calibration curve following the procedures in Section 9.6. At a minimum, an ICV must be analyzed with every initial calibration.

9.7.2 For 1,4-Dioxane via SIM: Prepare the second source calibration check standard using 5 µl of a 100ppm (Absolute or equivalent) to 10 mL of reagent water which yields a 50 ppb standard.

9.8 4-Bromofluorobenzene (BFB) Standard

9.8.1 Two BFB solutions are prepared in methanol per Table 8-B.

9.8.1.1 25 µg /ml solution for direct injection.

9.8.1.2 250 µg /ml solution for purging.

9.8.2 The solution must be replaced after 6 months or sooner if mass spectrum indicates degradation or if manufacture expiration date comes first.

9.9 Ascorbic Acid

10.0 CALIBRATION

10.1 Daily Maintenance. Routine Daily maintenance must be performed before any tuning, calibration or sample analysis activities are initiated. These include checks of the following items:

<u>Purge and Trap Device:</u>

Clean & bake purge tube
Bake trap and transfer lines
Check or refill internal/surrogate spike solution on SIM/SAM vials
Clean/replace syringe (if necessary)
Change and refill rinse bottle
Empty and rinse waste bottle

<u>GC Oven:</u> (if necessary)

Change septum
Change liner
Clip column, indicated by carbon build-up

10.2 Initial Calibration

10.2.1 The calibration range covered for routine analysis under RCRA, and SIM, employs standards of 0.2, 0.5, 1(specified compounds only), (2)*, 5, 10, 20, 50, 100, 200,(300 or 400)* µg/l. (*instrument dependent). Optionally 4 and 8 ug/l standards may replace the 5 and 10 ug/l standards. A minimum of five standards must be run sequentially. The low calibration standard defines the reporting limit. Lower concentration standards (0.2, 0.5, 1.0 or 2.0 µg/l) may be needed to meet the reporting limit requirements of state specific regulatory programs. Refer to Table 8-D-1 and 8-D-2 for calibration standard preparation.

10.2.2 The surrogates are introduced to the calibration standards automatically by the autosampler. For this calibration option the surrogate linear response is less important, since multiple concentrations of surrogates are not being measured. Instead, the surrogate concentration remains constant throughout and the recovery of this known concentration can easily be attained without demonstrating if the response is linear.

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10.2.2.1 Optional: The surrogates can be added manually. In order to compensate for the difference between the automatic and manual surrogate additions a correction factor must be applied to the amount of surrogate added in Table 8-D. To determine the correction factor divide the surrogate concentration from an automatic injection by the surrogate concentration from a manual injection for each of the surrogates. Average the result for each of the surrogates to determine the correction factor. Finally multiply the correction factor by the appropriate amount of surrogate from Table 8-D and add this amount to the standard.

10.2.3 For water and medium-level soil calibration: Transfer and fill up (no air space) each standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray.

10.2.4 For low-level soil calibration: Transfer 5 ml of each standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray.

10.2.4.1 When calibrating for Method 5035 low-level samples, if the sodium bisulfate option was used, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of each standard into vial otherwise do not add sodium bisulfate. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds. Cap the vial with Teflon septum and place it into O.I sample tray.

10.2.5 The linear range covered by this calibration is the highest concentration standard.

10.2.6 Program the autosampler to add internal standard mixture (and optionally surrogate) to each standard. This results in a concentration of 50 μg/l for each internal standard (and surrogate).

10.2.6.1 For O.I. SIM spiker: Automatically adds 10 μl of 25 μg/ml internal standard solution (Section 9.4.1.4) or Internal Standard/Surrogate solution (Section 9.4.1.1) to each standard.

10.2.6.2 For O.I. SAM spiker: Automatically adds 1 μl of 250 μg/ml internal standard solution (Section 9.4.1.5) or Internal Standard/Surrogate solution Section 9.4.1.2) to each standard.

10.2.7 Analyze the standard solutions using the conditions established in Section 11.0. Whenever the highest concentration standard is analyzed, it is usually followed by the analyses of two reagent water blanks. Further analysis may not proceed until the blank analysis is demonstrated to be free of interferences.

10.2.8 Each analyte is quantitatively determined by internal standard technique using the closest eluting internal standard and the corresponding area of the major ion. See Table 7.

10.2.9 The Response Factor (RF) is defined in Section 13.1. Calculate the mean RF for each target analyte using minimum of five RF values calculated from the initial calibration curve.

10.2.10 For the initial calibration to be valid, the following criteria must be met.

10.2.10.1 The percent relative standard deviation (% RSD) (see Section 13.2) of all target analytes must be less than or equal to 20%.

10.2.10.2 If the average response factor criteria cannot be achieved, and if the problem is associated with one or more of the standards, reanalyze the standards and recalculate the RSD. The instrument logbook must have clear documentation as to what the suspected problem was.

10.2.10.2.1 A calibration standard is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed. Notify the team leader/manager. Document this occurrence in the instrument log.

10.2.10.3 Alternately, if the average response factor criteria cannot be achieved, the calibration range can be narrowed by dropping the low or high point of the curve.

10.2.10.3.1 The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end.

10.2.10.4 If the average response factor criteria still cannot be achieved, employ an alternative calibration linearity model. Specifically, linear regression using a least squares approach may be employed.

10.2.10.4.1 If linear regression is employed select the linear regression calibration option of the mass spectrometer data system. Do not force the regression line through the origin and do not employ 0,0 as a sixth calibration standard.

10.2.10.4.2 The correlation coefficient (r value) must be ≥ 0.99 for each compound to be acceptable.

10.2.10.4.2.1 When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point must be performed by re-fitting the response from the low concentration calibration standard back into the curve.

10.2.10.4.2.2 The recalculated concentration of the low calibration point must be within ± 30% of the standard's true concentration

10.2.10.5 The initial calibration criteria for this method apply to all additional compounds of concern specified by the client.

10.2.10.6 If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit and do not meet the minimum correlation coefficient for the linear calibration option, then the chromatographic system is considered too reactive for the analysis to begin. Perform corrective action and recalibrate if the calibration criteria cannot be achieved.

10.2.10.7 A quadratic calibration model is allowed if the linear regression fails.

10.2.10.7.1 This may only be used for historically poor performing compounds (e.g. ketones).

10.2.10.7.2 A minimum of six calibration points are required. Do not employ 0,0 as a calibration point.

10.2.10.7.3 Quadratic calibration models cannot be used to extend the calibration range.

10.2.10.8 It is recommended that the minimum response factor for the most common target analytes in table 12 must be demonstrated for each individual calibration level as a means to ensure that these compounds are behaving as expected. In addition, meeting the minimum response factor criteria for the lowest calibration standard is critical in establishing and demonstrating the desired sensitivity. Poor purging compounds such as ketones may not meet the recommendations.

10.2.10.9 The relative retention times of each target analyte in each calibration standard must agree within 0.06 relative retention time units.

10.3 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard

10.3.1 The calibration is verified with a calibration check standard at 50 μg/l from an external source (Section 9.7). It must be analyzed immediately following the initial calibration.

10.3.2 The percent difference (% D) (Section 13.3) for this standard must meet the criteria of 30% for all the target compounds.

10.3.2.1 If % D is greater than 30%, reanalyze the second source check. If the criteria cannot be met upon re-injection, re-prepare the second source solution using a fresh ampoule and repeat the process.

10.3.2.2 If the %D criteria cannot be achieved after re-preparation of the second source, prepare a third source and repeat the process. Make fresh calibration standards using one of the two standard sources that match each other and repeat the initial calibration.

10.4 Continuing Calibration Verification Standard(CCV)

10.4.1 A continuing calibration verification standard at a concentration near mid-level of the initial calibration range (50 μg/l) must be acquired every 12 hrs or at the beginning of each analytical batch.

10.4.1.1 For water and medium level soil analysis: Transfer and fill up (no air space) the calibration verification standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray. Analyze as per Section 11.7.

10.4.1.1.1 Vary the concentration of the continuing calibration verification standard on alternate verifications (i.e. every other calibration verification) using an alternative concentration standard. The standard selected must be lower than the midpoint calibration standard.

10.4.1.2 For low-level soil analysis: Transfer 5 ml of the calibration verification standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray. Analyze as per Section 11.7.

10.4.1.2.1 When calibrating for Method 5035 low-level samples, if the sodium bisulfate option was used add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of the calibration verification standard into vial, otherwise do not use sodium bisulfate. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds. Analyze as per Section 11.7.

10.4.1.3 A continuing calibration standard is analyzed whenever the analyst suspects that the analytical system is out of calibration. If the calibration cannot be verified, corrective action is performed to bring the system into control. Analysis may not continue until the system is under control.

10.4.2 For the continuing calibration to be valid, all of the following specified criteria must be met.

10.4.2.1 Each of the most common target analytes in the calibration verification standard must meet the minimum response factors as noted in Table 12. This criterion is particularly important when the common target analytes are also critical project-required compounds. This is the same check that is applied during the initial calibration.

10.4.2.2 All target compounds of interest must be evaluated using a 20%variability criterion. Use percent difference when performing the average response factor model calibration. Use percent drift when calibrating using a regression fit model. If the percent difference or percent drift for a compound is less than or equal to 20%, then the initial calibration for that compound is assumed to be valid.

10.4.2.3 Due to the large numbers of compounds that may be analyzed by this method, some compounds will fail to meet the criteria. If the criterion is not met (i.e., greater than 20% difference or drift) for more than 20% of the compounds included in the initial calibration, then corrective action must be taken prior to the analysis of samples.

10.4.2.4 In cases where compounds fail, they may still be reported as non-detects if it can demonstrated that there was adequate sensitivity to detect the compound at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values.

10.4.2.4.1 Compounds with response factors that exceed the 20% D in the CCV compared to the initial calibration with high bias may only be reported as an estimated value.

10.4.2.4.2 Compounds that do not meet the 20% D in the CCV compared to the initial calibration due to low response factors can only be reported if the low sensitivity of the instrument is still achieved. This sensitivity must be verified by running a low level standard check at the RL. If a positive result for the compound is found then adequate sensitivity has been demonstrated and the run can proceed. Non-detect results for samples may be reported, positive results, if reported, must be done as an estimated value.

10.4.3 If the first continuing calibration verification (CCV) does not meet criteria, a second standard can be analyzed immediately or after the corrective action was performed. If the second CCV fails to meet criteria then corrective actions must be performed. Such as: auto-tuning, routine system cleaning and routine system maintenance. Notify the team leader/manager.

10.4.3.1 If the second CCV trial fails, the lab must demonstrate acceptable performance after corrective action with two consecutive passing calibration verifications (CCVs) OR a new initial calibration. The Instrument Logbook and Maintenance Logbook must have clear documented notations as to what the problem was and what corrective action was implemented.

10.4.3.1.1 If the lab has not verified calibration, samples cannot be analyzed.

10.4.3.1.2 However, in the case where samples are analyzed on the system where the CCV does not meet the criteria the data must be flagged.

10.4.3.1.2.1 The data may be usable if the response for the verification exceed high (high bias) and the associated samples are non-detects.

10.4.3.1.2.2 If the criteria for the CCV is low (low bias), those sample results may be reported only if they exceed a maximum regulatory limit/decision level.

10.4.3.2 If the calibration verification is being performed using an auto sampler for night batch, two (2) vials of standard solution are placed in the device for analysis. The second standard must meet continuing calibration criteria and is used for calibration verification. The second check may be discarded only if there is a purge failure or incorrect spike concentration provided the first calibration standard meets the requirement. In this case, the first calibration standard is used as calibration verification following team leader/manager approval. Document this occurrence on instrument log.

10.4.3.2.1 Both CCVs must be evaluated. If vial 1 fails and vial 2 passes this meets the criteria of 10.4.3 of consecutive and immediate passing CCV.

10.4.3.2.2 If CCV number 2 fails, the analysis cannot continue unless it was determined that there was an isolated mechanical failure.

10.4.4 If any of the internal standard areas change by a factor of two (- 50% to + 100%) or the retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate.

10.4.4.1 Reanalyze the continuing calibration standard. New initial calibration is required if reanalyzed standard continues to fail the internal standard requirements.

10.4.4.2 All samples analyzed while the system was out of control must be reanalyzed following corrective action.

10.5 Corrective Action Maintenance For Failed Tuning and Calibration Procedures

10.5.1 Inability to achieve criteria for instrument tuning or calibration may indicate the need for instrument maintenance. Maintenance may include routine system cleaning and replacement of worn expendables or the need for outside service if the scope of the repair exceeds the capability of the staff.

10.5.2 If maintenance is performed on an instrument, return to control must be demonstrated before analysis can continue. Return to control is demonstrated as follows:

10.5.2.1 Successful instrument tune using PFTBA.

10.5.2.2 Successful tune verification by the analysis of 4-bromofluorobenzene.

10.5.2.3 Successful initial calibration or continuing calibration.

11.0 PROCEDURE

11.1 Instrument conditions.

11.1.1 Recommended instrument conditions are listed in Table 2 and 2a (SIM only). Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification must be approved by team leader/manger.

11.1.2 Optimize GC conditions for analyte separation and sensitivity. Once optimized, use the same GC conditions for the analysis of all standards, blanks, samples, and QC samples.

11.2 Purge and Trap Device conditions.

11.2.1 See Table 2.

11.2.2 Daily Maintenance. Routine Daily maintenance must be performed before any tuning, calibration or sample analysis activities are initiated. These include checks of the following items:

<u>Purge and Trap Device:</u>

- Clean & bake purge tube.
- Bake trap and transfer lines.
- Check or refill internal/surrogate spike solution on SIM/SAM vials.
- Clean/replace syringe (if necessary).
- Change and refill rinse bottle.
- Empty and rinse waste bottle.

11.3 Step 1: Daily GC/MS performance check.

11.3.1 Every 12 hours, either

- Inject 50ng of BFB solution directly on column or
- Purge 50ng/mL of BFB solution onto the GC column.

11.3.2 The GC/MS system must be checked to verify acceptable performance criteria are achieved (see Table 3).

11.3.3 This performance test must be passed before any samples, blanks or standards are analyzed. Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background.

11.3.3.1 Select the scans at the peak apex and one to each side of the apex.

11.3.3.2 Calculate an average of the mass abundances from the three scans.

11.3.3.3 Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peaks and no more than 20 scans prior to the elution of BFB. The background subtraction must be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

11.3.4 If all the criteria are not achieved, the analyst must retune the mass spectrometer with team leader/manager and repeat the test until all criteria are met.

11.3.4.1 Alternatively, an additional scan on each side of the peak apex may be selected and included in the averaging of the mass scans. This will provide a mass spectrum of five averaged scans centered on the peak apex. NOTE: The selection of additional mass scans for tuning may only be performed with supervisory approval on a case by case basis.

11.3.4.2 Note: All subsequent standards, samples, MS/MSDs, BS, and blanks associated with a BFB analysis must use identical mass spectrometer conditions.

11.3.4.3 The injection time of the acceptable tune analysis is considered the start of the 12-hour clock.

11.3.5 The BFB must meet the criteria before sample analysis begins. The BFB and calibration verification standard may be combined into a single standard as long as both tuning and calibration verification acceptance criteria for the project can be met without interferences.

11.4 Step 2 : Daily calibration check

11.4.1 Initial calibration

11.4.1.1 Refer to Section 10.2.

11.4.1.2 An initial calibration must be established (or reestablished) on each instrument:

- Prior to any sample analyses;
- Whenever a new column is installed;
- Whenever instrument adjustments that affect sensitivity are made; and
- Whenever a continuing calibration standard fails to meet the specified acceptance criteria, on the second trial.

11.4.2 Initial Calibration Verification - Second Source Calibration Check Standard

11.4.2.1 This standard is only analyzed when initial calibration provided. Refer to Section 10.3.

11.4.3 Continuing Calibration verification standard

11.4.3.1 Refer to Section 10.4.

11.4.4 The method blank (step 3) cannot be analyzed until the continuing calibration verification meets the criteria.

11.5 Step 3 : Method blank

11.5.1 The acceptable method blank must be analyzed for every 12-hour time period or sooner.

11.5.1.1 Water and medium-level soil samples - Place a 40 ml vial, filled with DI water onto the autosampler.

11.5.1.2 Low-level soil samples without sodium bisulfate - Transfer 5 ml of DI water to a 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray.

11.5.1.2.1 Low-level soil samples with sodium bisulfate (Method 5035) - Add 1g of sodium bisulfate into a 40 ml vial before adding 5 ml of DI water. Cap the vial with a Teflon septum, then place the vial onto the autosampler.

11.5.2 Program the autosampler to add internal standard and surrogate solution to the method blank for a concentration of 50 μg/l for each internal standard and surrogate.

11.5.2.1 For O.I. SIM spiker: Automatically adds 10 μl of 25 μg/ml internal standard and surrogate solution (Section 9.4.1.1) to the method blank.

11.5.2.2 For O.I. SAM spiker: Automatically adds 1 μl of 250 μg/ml internal standard and surrogate solution (Section 9.4.1.2) to the method blank.

11.5.3 No compound can be present above the laboratory's MDL. Common laboratory solvents (i.e. methylene chloride, acetone, hexane) may be present up until the RL. Blanks may contain analyte concentrations greater than acceptance limits if the associated samples in the batch are unaffected (i.e, targets are not present in samples or sample concentrations are $\geq$10x the blank).

11.5.4 Surrogates must meet recovery criteria specified in house limits.

11.5.5 If the method blank does not meet surrogate criteria or contains target analytes above the MDL, then

11.5.5.1 All samples analyzed following an out of control method blank must be reanalyzed if conditions in 11.5.3 are not met.

11.5.5.2 Check for the potential of contamination interference from the following areas. Make sure all items are free contamination.

- the analytical system,
- dust and vapor in the air,
- glassware and
- Reagents.

11.5.5.3 Re-analyze the method blank following the system evaluation. In this situation, the instrument logbook must have clear documented notations as to what the problem was and what corrective action was implemented to enable the second blank to pass.

11.5.5.4 If re-analyzed method blank remains out of control, notify team leader or manager.

11.5.6 If two consecutive method blanks are analyzed during unattended operations, the second analysis must meet criteria for the subsequent sample analysis to be valid. Always report the second method blank. The second analysis can only be discarded because of a purge failure provided that the first blank meets the requirement. In this case, the first blank is reported following team leader/manager approval. Document this occurrence on the instrument log.

11.6 Step 4: Blank spike (BS)

11.6.1 An acceptable blank spike must be analyzed with every analytical batch. The maximum number of samples per analytical batch is twenty.

11.6.2 Spike 50 ml of reagent water with appropriate amount of the standards to prepare a blank spike containing 50 μg/L of each analyte. In situations where lower detection limits are required, a blank spike at 20 μg/L may be prepared. The stock solution for the BS must be from the same source as the initial calibration solution. Refer to Table 8-F for the preparations of the blank spikes.

11.6.2.1 Water and medium-level soil samples - Place a 40 ml vial, filled with DI water onto the autosampler.

11.6.2.2 Low-level soil samples without sodium bisulfate - Aliquot 5 ml of the blank spike into vial and cap with Teflon septum, then place the vial into O.I. sample tray.

11.6.2.2.1 Low-level soil samples with sodium bisulfate for Method 5035 - Add 1g of sodium bisulfate to labeled 40 ml vial before aliquot 5 ml of the blank spike into vial and cap with Teflon septum, then place the vial into O.I. sample tray.

11.6.3 Initiate auto addition of internal standard and surrogate into the syringe per 11.5.2.

11.6.4 Compare the percent recoveries (% R) (see Section 13.5) to the in house limits acceptance criteria. If a blank spike is out of control, all the associated samples must be reanalyzed. The exception is if the blank spike recovery is high and no hits reported in associated samples and QC batch. In that case, the sample results can be reported with footnote (remark) and no further action is required. Or if the blank spike recovery is low and the hits in the samples are above regulatory levels.

11.6.5 Do not analyze samples and MS/MSD (step 5) unless the BS meets acceptance criteria.

11.6.6 The blank spike and matrix spike must be the same source and concentration.

11.7 Step 5: Samples /MS/MSD analysis

11.7.1 All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

11.7.2 Select the sample dilution factor to assure the highest concentration analyte is above the calibration range midpoint, but below the upper limit of the range depend on project requirements. See Table 9 for dilution guideline.

- Utilize FID screen data.
- Utilize acquired sample data.
- Utilize the history program.
- Sample characteristics (appearance, odor).

11.7.3 Water samples.

11.7.3.1 Using <u>O.I.Model 4560 sample concentrator with 4551 or 4552 vial multisampler,</u>

- Place the 40 ml vial in the tray, or
- Load 5ml sample into purge tube if sample volume limited.

11.7.3.2 A matrix spike and matrix spike duplicate are performed by spiking 20ul of the appropriate standards into the 40ml sample vial. If there are not enough vials for this procedure, a matrix spike and a sample duplicate are performed in place of an MS/MSD.

11.7.4 Sediment/ soil sample

11.7.4.1 <u>Low-level soil method</u>

11.7.4.1.1 Collect the sample using the procedures detailed in the SOP for SW846 Method 5035 low - level soil samples.

11.7.4.1.2 Weigh out 5 g of each sample into a labeled, tared vial filled with 5 ml DI water. Add the matrix spike by manually puncturing the septum with a small-gauge needle. Transfer the 40ml vial to the autosampler tray. Stir and heat the sample at the time of analysis.

11.7.4.2 <u>Medium-level soil method</u>

11.7.4.2.1 Collect the sample using the procedures detailed in the SOP for SW846 Method 5035 medium - level soil samples.

11.7.4.2.2 Select a methanol aliquot of appropriate volume (see Table 9) determined via screening and transfer to 40 ml of reagent water.

11.7.8 Program the autosampler to inject the internal standard and surrogate solution into the robotic syringe used to withdraw sample from the 40 ml vial. This addition to 5 ml of sample is equivalent to a concentration of 50 μg/L of each internal standard and surrogate.

11.7.8.1 For O.I. SIM spiker: Automatically adds 10 μl of 25 μg/ml internal standard and surrogate solution (Section 9.4.1.1) to each sample.

11.7.8.2 For O.I. SAM spiker: Automatically adds 1 μl of 250 μg/ml internal standard and surrogate solution (Section 9.4.1.2) to each sample.

11.7.9 Purge the sample for 9 minutes with Helium.

11.7.9.1 Low-level soil sample must be performed at 40 °C while the sample is being agitated with the magnetic stirring bar or other mechanical means.

11.7.9.2 To improve the purging efficiency of water-soluble compounds, aqueous samples may also be purged at 40 °C as long as all calibration standards (for 1,4-Dioxane SIM option, purge temperature is 80°C), samples and QC samples are purged at the same temperature and acceptable method performance is demonstrated.

11.7.10 One sample is randomly selected from each analytical batch of similar matrix types and spiked in duplicate to determine whether the sample matrix contributes bias to the analytical results. A matrix spike and matrix spike duplicate are performed by spiking the sample for a concentration of 50 μg/l or 50 μg/kg based on 5 g dry weight. In situations where lower detection limits are required, a blank spike at lower concentration may be prepared.

11.7.11 Desorb the sample for a maximum of 4 minutes by rapidly heating the trap to 190 °C while backflushing with Helium. Desorb time may require performance optimization between 0.5 and 4.0 minutes as dictated by trap manufacturers specifications or instrument characteristics.

11.7.12 Program the purge and trap system to automatically rinse purge tube at least twice with heated organic-free water (reagent water) between analyses to avoid carryover of target compounds. For samples containing large amounts of water-soluble materials, suspended solids, high-boiling compounds, or high purgeable levels, it may be necessary to wash out the purging device with methanol solution between analyses, rinse it with distilled water.

11.7.13 Bake the trap at least 10 minutes at 210 °C to remove any residual purgeable compounds.

11.7.14 If the initial analysis of the sample or a dilution of the sample has a response for any ion of interest that exceeds the working range of the GC/MS system, the sample must be reanalyzed at a higher dilution.

11.7.14.1 When ions from a compound in the sample saturate the detector, this analysis must be followed by the analysis of reagent water blank. If the blank analysis is not free of interferences, then the system must be decontaminated. Sample analysis may not resume until the blank analysis is demonstrated to be free of interferences.

11.8 Sample dilutions

11.8.1 Using Screening Data to Determine Dilution Factors

11.8.1.1 Dilution for High Concentration Analytes Exceeding The Calibration Range

11.8.1.1.1 The highest concentration target compound detected in the screen data is compared to the highest concentration calibration standard used for determinative volatile organics analysis.

11.8.1.1.1.1 Divide the calibration concentration of the screen concentration by the highest concentration calibration standard.

11.8.1.1.1.2 If the result is >1, sample dilution is considered.

11.8.1.1.2 The result from step 11.8.1.1.1 determines the dilution factor. The dilution factor is targeted to assure that the highest concentration diluted analyte is at the mid-range concentration of the calibration curve for the determinative analysis.

11.8.1.1.3 In all cases a conservative approach to dilution is applied to minimize the increase of detection and reporting limits

11.8.1.2 Dilution for High Concentration Matrix Interferences

11.8.1.2.1 The peak height of the background is compared to the peak height of the later eluting calibration standards from the screening analysis.

11.8.1.2.1.1 A rough estimate of background concentration is calculated by dividing the background peak height by the peak height of the selected screening standard and multiplying by its concentration.

11.8.1.2.2 If the result is >1, sample dilution is considered.

11.8.1.2.3 The result from step 11.8.1.2.1 determines the dilution factor. The dilution factor is targeted to avoid Carry-over contamination between samples and facilitate qualitative and quantitative analysis of target compounds present in the sample.

11.8.1.2.4 In all cases a conservative approach to dilution is applied to minimize the increase of detection and reporting limits

11.8.2 If the concentration of any target compound in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and re-analyzed. Until the diluted sample is in a sealed sample vial, all steps in the dilution procedure must be performed without delay.

11.8.3 Water Samples.

11.8.3.1 Prepare all dilutions of water samples in volumetric flasks or Class A graduated cylinder. Intermediate dilutions may be necessary for extremely large dilutions.

11.8.3.2 Calculate the approximate volume of reagent water, which will be added to the volumetric flask or graduated cylinder, and add slightly less than this quantity to the flask. Refer to Table 9 for dilution guideline.

11.8.3.3 Inject the proper sample aliquot from a syringe into the volumetric flask or graduated cylinder. It is also permissible to pour the sample directly into a graduated cylinder for some dilutions. Dilute the flask to the volume mark with reagent water. Cap the flask and invert the flask three times.

11.8.3.4 Fill a 40 ml sample vial and seal with a Teflon baked silicon septa, load the diluted sample into the autosampler and analyze according to Section 11.7.

11.8.4 Low-level Soil Samples.

11.8.3.1 Screen data is used to determine the appropriate sample preparation procedure for a particular sample, the low-level soil method or the medium-level soil method.

11.8.3.2 If any target compound exceeds the initial calibration range from the analysis of 5 g sample, a smaller sample size must be analyzed. However, the smallest sample size permitted is 0.5 g. If smaller than 0.5 g sample size is needed to prevent any target compounds from exceeding the initial calibration range, the medium level method must be used.

11.9 Data interpretation

11.9.1 Qualitative identification.

11.9.1.1 The targeted compounds shall be identified by analyst with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound.

11.9.1.2 The characteristic ions for target compounds that can be determined are listed in Table 7. Table 4 and Table 5 list the characteristic ions for internal standards and surrogate compounds respectively.

11.9.1.3 The criteria required for a positive identification are listed below.

11.9.1.3.1 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criteria are the RRT of sample component must be within ± 0.06 RRT units of the standard component.

11.9.1.3.2 The relative intensities of these ions must agree within ± 30 % between the daily standard and sample spectra. (Example: For an ion with an abundance of 50 % in the standard spectra, the corresponding sample abundance must be between 20 and 80 %.)

11.9.1.3.2.1 Compounds can have secondary ions outside criteria from co-eluting compounds and/or matrix effect that can contribute to ion abundances. The interference on ion ratios can't always be subtracted out by software programs resulting in qualified compound identification.

11.9.1.3.2.2 Quantitation reports display compounds that have secondary ions outside the ratio criteria with a "#" flag.

11.9.1.3.3 Structural isomers that produce very similar mass spectra must be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 50 % of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

11.9.2 Quantitative analysis

11.9.2.1 Once a target compound has been identified, its concentration (Section 13.4) will be based on the integrated area of the quantitation ion, normally the base peak (Table 7). The compound is quantitated by internal standard technique with an average response factor generated from the initial calibration curve.

11.9.2.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate (see Table 7). This is characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. This secondary ion must also be used to generate new calibration response factors.

11.10 Library search for tentatively identified compounds.

11.10.1 If a library search is requested, the analyst must perform a forward library search of NBS or NIST08 mass spectral library to tentatively identify 15 non-reported compounds.

11.10.2 Guidelines for making tentative identification are listed below.

11.10.2.1 These compounds must have a response greater than 10 % of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).

11.10.2.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.

11.10.2.3 Molecular ions present in the reference spectrum must be present in the sample spectrum.

11.10.2.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) must be present in the sample spectrum.

11.10.2.5 The relative intensities of the major ions must agree within ± 20 %. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must between 30 and 70%).

11.10.2.6 Ions present in the sample spectrum but not in the reference spectrum must be reviewed for possible background contamination or presence of coeluting compounds.

11.10.2.7 Ions present in the reference spectrum but not in the sample spectrum must be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

11.10.2.8 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.

11.10.2.9 The resulting concentration must be reported indicating: (1) that the value is estimate, and (2) which internal standard was used to determine concentration. Quantitation is performed on the nearest internal standard.

11.11 An instrument blank is a system evaluation sample containing lab reagent grade water with internal standards and surrogates. An instrument blank is used to remove and or evaluate residual carryover from high level standards, spike samples and field samples. Since target compound lists have expanded to overlap some volatile and semi-volatile compounds, instrument blanks are necessary to remove carryover contamination.

11.11.1 The compounds that may exhibit carryover for this method are listed in Table 11.

11.11.2 If instrument blanks following a standard or spike sample exhibits carry-over effect, then any samples that show the same carryover profile, after a comparable concentration must be considered suspect and rerun for confirmation. For example, if an instrument blank has 1ppb detected after a 200ppb standard, then any sample following a sample containing 200ppb or above of the same compound must be confirmed for possible carryover.

11.11.3 If an Instrument Blank(s) was run following suspect high concentration samples and it exhibits the same carryover profile after a comparable concentration must be considered suspect and rerun for confirmation.

11.11.4 In some cases, several instrument blanks may have to be run to eliminate contamination from over loaded samples.

11.11.5 The analytical system is considered free of carryover, when no target analytes can be detected above the MDL.

11.12 Selected Ion Monitoring (SIM) Option

11.12.1 Instrument Set-Up: Modify the method for SIM analysis and define ion groups with retention times, ions and dwell times to include base peak ion for the target compounds of interest, surrogates, and internal standards (Table 2a.) Select a mass dwell time of 50 milliseconds for all compounds.

11.12.2 Calibration: Calibrate the mass spectrometer in the selected ion monitoring mode using 9 calibration standards of 0.2, 0.3, 0.4, 1, 2, 5, 10, 20, and 50 ug/l. Spike each standard with the SIM specific internal standard solution at 4ug/ml. Calculate individual response factors and response factor RSDs. The initial calibration must meet the criteria in section 10.2.10.

11.12.3 Initial Calibration Verification. Verify the initial calibration after its completion using a 50 ug/l calibration standard purchased or prepared from a second standards reference materials source. The initial calibration verification must meet the criteria of Section 10.3.

11.12.4 Continuing Calibration Verification. Verify the initial calibration every 12 hours using a 50 ug/l calibration. The continuing calibration verification must meet the criteria of Section 10.4.

11.12.5 Surrogate Standard Calculation. Report surrogate spike accuracy for the surrogates spiked for the full scan GC/MS analysis.

12.0 QUALITY CONTROL

12.1 QC Requirements Summary

BFB	Beginning of the analytical shift and every 12 hours
ICV - Second Source Calibration Check Standard	Following initial calibration
Calibration Verification Standard	Every 12 hours
Method Blank	Every 12 hours
Blank Spike	One per analytical batch*
Matrix Spike	One per analytical batch*
Matrix Spike Duplicate or Sample DUP (depends on sample volume)	One per analytical batch*
Surrogate	Every sample and standard
Internal Standard	Every sample and standard

*The maximum number of samples per analytical batch is twenty.

12.2 Daily GC/MS Performance Check - BFB

12.2.1 Refer to Section 11.3.

12.3 Second Source Calibration Check Standard

12.3.1 Refer to Section 10.3.

12.3.2 Calibration Verification Standard

12.3.3 Refer to Section 10.4.

12.4 Method Blank

12.4.1 Refer to Section 11.5

12.5 Blank Spike

12.5.1 Refer to Section 11.6

12.6 Matrix Spike (MS)/Matrix Spike Duplicate (MSD)

12.6.1 One sample is selected at random from each analytical batch of similar matrix types and spiked in duplicate to check precision and accuracy.

12.6.2 Assess the matrix spike recoveries (Section 13.5) and relative percent difference (RPD) (Section 13.6) against the control limits.

12.6.3 If the matrix spike recoveries do not meet the criteria, check the blank spike recovery to verify that the method is in control. If the blank spike did not meet criteria, the method is out of control for the parameter in question and must be reanalyzed or qualified with an estimate of potential bias. Otherwise, matrix interference is assumed and the data is reportable. No further corrective action is required.

12.7 Surrogates

12.7.1 All standards, blanks, samples, and matrix spikes contain surrogate compounds, which are used to monitor method performance. If the recovery of any surrogate compound does not meet the control limits, the result must be flagged and:

12.7.1.1 The calculation must be checked.

12.7.1.2 The sample must be reanalyzed if the recovery of any one surrogate is out of control limit.

12.7.2 If the sample exhibits matrix interference, defined as excessive signal levels from target or non-target interfering peaks. In this case, reanalysis may not be required following team leader/manager approval.

12.7.3 If surrogate recoveries are acceptable upon reanalysis, the data from the reanalysis is reported. If the reanalysis date did not meet the hold time, then both sets of data must be submitted with the reanalysis reported.

12.7.4 If surrogates are still outside control limits upon reanalysis, then both sets of data must be submitted with the first analysis reported.

12.8 Internal Standard

12.8.1 Retention time for all internal standards must be within ± 30 seconds of the corresponding internal standard in the latest continuing calibration or 50 μg/l standard of initial calibration

12.8.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within 50 to 200 % of the corresponding area in the latest calibration standard (12 hr. time period).

12.8.3 If area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed.

12.8.4 If areas are acceptable upon reanalysis, the reanalysis data is reported.

12.8.5 If areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported.

13.0 CALCULATION

13.1 Response Factor (RF)

$$RF = \frac{As \times Cis}{Ais \times Cs}$$

where:
As = Area of the characteristic ion for the compound being measured.
Ais = Area of the characteristic ion for the specific internal standard.
Cs = Concentration of the compound being measured (ug/l).
Cis = Concentration of the specific internal standard (ug/l).

13.2 Percent Relative Standard Deviation (% RSD)

$$\%RSD = \frac{SD}{RFav} \times 100$$

where:
SD = Standard Deviation
RFav = Average response factor from initial calibration.

13.3 Percent Difference (%D)

$$\%D = \frac{(RFav - RFcv)}{RFav} \times 100$$

where:
RFcv = Response factor from Calibration Verification standard.
RFav = Average response factor from initial calibration.

13.4 Concentration (Conc.)

For water:

$$\text{Conc. } (\mu g/l) = \frac{Ac \times Cis \times Vp}{Ais \times RF \times Vi}$$

For soil/sediment low level (on a dry weight basis):

$$\text{Conc. } (\mu g/kg) = \frac{Ac \times Cis \times Vp}{Ais \times RF \times Ws \times M}$$

For soil/ sediment medium level (on a dry weight basis)

$$\text{Conc. } (\mu g/kg) = \frac{Ac \times Cis \times Vp \times Vt}{Ais \times RF \times Vme \times Ws \times M}$$

Where:
Ac = Area of characteristic ion for compound being measured.
Ais = Area of characteristic ion for internal standard.
Cis = Concentration of internal standard
RF = Response factor of compound being measured(from initial calibration)
Vi = Initial volume of water purged (ml)
Vp = 5 ml (Total Purge Volume)
Vme = Volume of Methanol aliquot
Vt = Ml Solvent + ((100-% solid)/100 x Ws)
Ws = Weight of sample extracted (g).
M = (100 - % moisture in sample) / 100 or % solids / 100

13.5 Percent Recovery (% R)

$$\% R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

13.6 Relative Percent Difference (RPD)

$$RPD = \frac{|MSC - MSDC|}{(1/2)(MSC+MSDC)} \times 100$$

Where:
MSC = Matrix Spike Concentration
MSDC = Matrix Spike Duplicate Concentration

13.7 Linear regression by the internal standard technique.

$$C_s = \left(\frac{\frac{A_s}{A_{is}} - b}{a} \right) \times C_{is}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte
Cis = concentration of the internal standard
b = Intercept
a = slope of the line

$$a = \frac{N\,\Sigma xy - \Sigma x\,\Sigma y}{N\,\Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{\Sigma y - a\,\Sigma x}{N}$$

N = number of points
x = amount of analyte
y = response of instrument

13.8 Correlation Coefficient

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2\,\Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

13.9 Quadratic curve with internal standard technique

$$Cs = \frac{-b \pm \sqrt{b^2 - 4a\left(c - \frac{A_s \times C_{is}}{A_{is}}\right)}}{2a}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte
Cis = concentration of the internal standard
b = Intercept
a = slope of the line

14.0 DOCUMENTATION

14.1 The Analytical Logbook. The logbook must be completed by the analyst daily. Each instrument will have a separate logbook. The daily sequence must be recorded in the logbook by giving a file number to every instrument standard, QC, and samples in appropriate spaces. The files must be never overwritten or skipped intentionally. In case where the file is skipped or overwritten, a thorough explanation must be documented in the notes section. Upon completion, every analytical batch must be reviewed and signed by a supervisor/team lead. Supervisor signature indicates all documentation was performed correctly.

14.1.1 If samples or blank spike require reanalysis, a brief explanation of the reason and corrective action must be documented in the Comments section.
14.1.2 If maintenance was done on the instrument in order to pass the CCV or any other reason, the analyst must document it in the logbook.

14.2 Standards Preparation Logbook must be completed for all standard preparations. All information must be completed; the page must be signed and dated by the appropriate person.

14.2.1 The Accutest lot number must be cross-referenced on the standard vial.

14.3 Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

14.5 Supervisory personnel must review and sign all laboratory logbooks monthly to ensure that information was recorded properly. Additionally, the instrument maintenance logbooks and the accuracy of the recorded information must also be verified and signed off on the first page of the logbook quarterly by a supervisor/team lead.

14.6 Acrolein and Acrylonitrile data reported from a preserved sample must be footnoted: “Results reported from the HCl preserved sample. This reported result can only be used for screening purposes for Acrolein and Acrylonitrile.” Any samples analyzed form an unpreserved vial must be footnoted stating samples were unpreserved and analyzed within 7 days.

15.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

15.2.1 Non hazardous aqueous wastes

15.2.2 Hazardous aqueous wastes

15.2.3 Chlorinated organic solvents

15.2.4 Non-chlorinated organic solvents

15.2.5 Hazardous solid wastes

15.2.6 Non-hazardous solid wastes

Table 1 TARGET COMPOUNDS		
Acetone	1,4-Dichlorobenzene	Methylene Bromide
Acetonitrile	Dichlorodifluoromethane	Methylene Chloride
Acrolein	1,1-Dichloroethane	1-Methylnaphthalene
Acrylonitrile	1,2-Dichloroethane	2-Methylnaphthalene
Allyl Chloride	1,1-Dichloroethene	Naphthalene
Benzene	cis-1,2-Dichloroethene	2-Nitropropane
Benzyl chloride	trans-1,2-Dichloroethene	Pentachloroethane
Bromobenzene	1,2-Dichloropropane	Propionitrile
Bromochloromethane	1,3-Dichloropropane	Propyl Acetate
Bromodichloromethane	2,2-Dichloropropane	n-Propylbenzene
Bromoform	1,1-Dichloropropene	Styrene
Bromomethane	cis-1,3-Dichloropropene	Tert Butyl Alcohol
2-Butanone (MEK)	trans-1,3-Dichloropropene	tert-Amyl Methyl Ether
Butyl Acetate	1,4-Dioxane	tert-Butyl Ethyl Ether
n-Butyl Alcohol	Epichlorohydrin	1,1,1,2-Tetrachloroethane
n-Butylbenzene	Ethyl Acetate	1,1,2,2-Tetrachloroethane
sec-Butylbenzene	Ethyl Ether	Tetrachloroethene
tert-Butylbenzene	Ethyl Methacrylate	Tetrahydrofuran
Carbon Disulfide	Ethylbenzene	Toluene
Carbon Tetrachloride	p-Ethyltoluene	trans-1,4-Dichloro-2-Butene
Chlorobenzene	Freon 113	1,2,3-Trichlorobenzene
Chlorodifluoromethane	Heptane	1,2,4-Trichlorobenzene
Chloroethane	Hexachlorobutadine	1,1,1-Trichloroethane
2-Chloroethyl Vinyl Ether	Hexachloroethane	1,1,2-Trichloroethane
Chloroform	Hexane	Trichloroethene
Chloromethane	2-Hexanone	Trichlorofluoromethane
Chloroprene (2-chloro-1,3-butadiene)	Iodomethane (Methy iodide)	1,2,3-Trichloropropane
o-Chlorotoluene	IsoAmyl Alcohol	1,2,4-Trimethlylbenzene
p-Chlorotoluene	Isobutyl Alcohol	1,3,5-Trimethylbenzene
Cyclohexane	Isopropyl Acetate	2,2,4 Trimethylpentane
Cyclohexanone	Isopropylbenzene	Vinyl Acetate
di-Isobutylene	p-Isopropyltoluene	Vinyl Chloride
di-Isopropyl Ether	Methacrylonitrile	Vinyltoluene
1,2-Dibromo-3-Chloropropane	Methyl Acetate	m,p-Xylene
Dibromochloromethane	3 Methyl-1-Butanol	o-Xylene
1,2-Dibromoethane	Methyl Tert Butyl Ether	Ethanol
Dibromomethane	Methylcyclohexane	Methyl Acrylate
1,2-Dichlorobenzene	Methyl Methacrylate	1-chloro-1,1-difluoroethane
1,3-Dichlorobenzene	4-Methyl-2-pentanone (MIBK)	1,1,1-trifluoroethane
1,1-dichloro-1-fluroethane	2,2-Dichloropropane	1,3-Butadiene
3,3-Dimethyl-1-Butanol	Tert-Butyl Formate	Tert-amyl alcohol
2-methylnaphthalene		

Table 2 RECOMMENDED OPERATING CONDITION	
Gas Chromatograph/ Mass Spectrometer	
Carrier Gas (linear velocity)	Helium at *30 cm/sec
Mass range	35 – 260 amu *
Electron Energy	70 volts (nominal)
Scan time	not to exceed 2 sec. per scan
Injection port temperature	200 - 225 °C
Source temperature	200 - 250 °C
Transfer line temperature	220 - 280 °C
Analyzer temperature	220 - 250 °C
Gas Chromatograph temperature program*	
Initial temperature	*40 °C
Time 1	*3 minutes
Column temperature rate	*8 degrees/min.
Final temperature	*220 °C.- 240 °C
Total run time	*25 – 50 mins
Split ratio	*20:1
Purge and Trap Device	
Purge time	9 min. (at 40 °C for low-level soil) SIM – 6 min @ 80 °C
Desorb**	1 min. at 190 °C
Bake	>10 min. at 210 °C
Transfer line	100 - 130 °C
Valve temperature	approx. transfer line temperature

(*) Parameter modification allowed for performance optimization provided operational and QC criteria is achieved. (must be approved by team leader/manager)

(**) Desorb time may require performance optimum between 0.5 and 4.0 minutes as dictated by trap manufacturers specifications or instrument characteristics

Table 2a SIM Group Parameters		
Group No.	**Retention Time (minutes)**	**Ions**
1	0 – 10.8	58, 65, 66, 88
2	10.8 – 16.0	95, 174, 176, 96,64

Table 3 BFB KEY IONS AND ION ABUNDANCE CRITERIA	
Mass	**Ion Abundance Criteria**
50	15-40% of mass 95
75	30-60% of mass 95
95	Base peak, 100% relative abundance
96	5-9% of mass 95
173	< 2% of mass 174
174	> 50% of mass 95
175	5-9% of mass 174
176	>95% and <101% of mass 174
177	5-9% of mass 176

Table 4 INTERNAL STANDARD QUANTITION IONS	
Internal Standard	**Primary/Secondary Ions**
1,4-Difluorobenzene	114 / 63,88
Chlorobenzene-d5	117 / 82, 119
Pentafluorobenzene	168
1,4-Dichlorobenzene-d4	152 / 115, 150
Tert Butyl Alcohol-d9	65/66
Internal Standard (SIM)	
4-BFB	95/174,176

Table 5 SURROGATE QUANTITION IONS	
Surrogate Compound	**Primary/Secondary Ions**
1,2 Dichloroethane – d_4	102
Dibromofluoromethane	113
Toluene-d8	98
4-Bromofluorobenzene	95 / 174, 176
1,4-dioxane-d8	96, 64

Table 6 - Intentionally removed.

Table 7 Volatile Internal Standards with Corresponding Analytes Assigned for Quantitation

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)	Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Tert Butyl Alcohol-d9	65		Dibromomethane	93	95, 174
Tert Butyl alcohol	59	57	Di-isobutylene	57	
Ethanol	45	46	Epichlorohydrin (pp)	57	57, 49, 62, 51
1,4-Dioxane (pp)	88	58,43,57	Heptane	57	
Pentafluorobenzene	168		Methyl cyclohexane	83	
1,1,1-Trichloroethane	97	99, 61	Methyl methacrylate	100	69, 41, 39
1,1-Dichlorethane	63	65, 83	n-Butanol (pp)	56	41
1,1-Dichloroethene	96	61, 63	Propyl Acetate	43	
2,2-Dichloropropane	77	97	tert Amyl Methyl Ether	73	
2-Butanone (pp)	72	43, 72	Trichloroethene	95	97, 130, 132
Acetone (pp)	58	43	**Chlorobenzene-d5**	117	82,119
Acetonitrile (pp)	41	41, 40, 39	1,1,1,2-Tetrachloroethane	131	133, 119
Acrolein (pp)	56	55,58	1,3-Dichloropropane	76	78
Acrylonitrile (pp)	53	52, 51	Bromoform	173	175, 254
Allyl Chloride	76	41	Butyl Acetate	56	
Bromochloromethane	128	49, 130	Chlorobenzene	112	77, 114
Bromomethane	94	96	Dibromochloromethane	129	127
Carbon disulfide	76	78	Ethylbenzene	91	106
Carbon tetrachloride	117	119	m-Xylene	106	91
Chlorodifluouromethane	51	86	o-Xylene	91	106
Chloroethane	64	66	3,3-Dimethyl-1-Butanol	57	69
Chloroform	83	85	p-Xylene	106	91
Chloromethane	50	52	Styrene	104	78
Chloroprene	53	53, 88, 90, 51	Ethyl methacrylate	69	69, 41, 99, 86, 114
cis-1,2-Dichloroethene	96	61, 98	Toluene	92	91
Cyclohexane	84		**Toluene-d_8 (S)**	98	
Dibromofluoromethane (S)	113		Tetrachloroethene	164	129,131,166
Dichlorodifluoromethane	85	87	Cyclohexanone	55	
1,1-Dichloropropene	75	110, 77	2-Hexanone (pp)	58	43, 57, 100

Table 7 Volatile Internal Standards with Corresponding Analytes Assigned for Quantitation

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)	Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Diethyl ether	74	45, 59	trans-1,3-Dichloropropene	75	77, 39
1,3-Butadiene	54		**1,4 Dichlorobenzene-d4**	152	115,150
Diisopropyl ether	45	102	1,1,2,2-Tetrachloroethane	83	131, 85
Ethyl acetate (pp)	45	43, 88, 61	1,2,3-Trichlorobenzene	180	182, 145
Ethyl tert Butyl Ether	59		1,2,3-Trichloropropane	110	77,75
Hexane	56		1,2,4-Trichlorobenzene	180	182, 145
Isopropyl acetate	87	43	1,2,4-Trimethylbenzene	105	120
Tert-Amyl alcohol	59	73,55	1,2-Dibromo-3-chloropropane(pp)	157	155, 75
Freon 113	151		1,2-Dichlorobenzene	146	111,148
Iodomethane	142	127, 141	1,3,5-Trimethylbenzene	105	120
Isobutyl alcohol (pp)	43	43, 41, 42, 74	1,3-Dichlorobenzene	146	111, 148
Methacrylonitrile (pp)	67	41, 39, 52, 66	1,4-Dichlorobenzene	146	111, 148
Methyl Acetate	43	74	2-Chlorotoluene	126	91
Methylene chloride	84	86, 49	**4-Bromofluorobenzene (S)**	95	174, 176
Methyl-t-butyl ether	73	57	2-methylnaphthalene	142	141,115,143
Propionitrile (ethyl cyanide)(pp)	54	54, 52, 55, 40	Dibromofluoromethane		
Tetrahydrofuran	71	42	4-Chlorotoluene	91	126
trans-1,2-Dichloroethene	96	61, 98	Benzyl chloride	91	91, 126, 65, 128
Trichlorofluoromethane	101	151, 153	Bromobenzene	156	77, 158
Vinyl acetate	86	43	Hexachlorobutadiene	225	223, 227
Vinyl chloride	62	64	Hexachloroethane (pp)	201	166, 199, 203
Methyl Acrylate	85	55	Isopropylbenzene	105	120
Tert-Butyl Formate	59	57, 41	Naphthalene	128	-
1-chloro-1, 1-difluoroethane	65	45,85	n-Butylbenzene	92	91, 134
1,1,1-trifluoroethane	69	69,45	n-Propylbenzene	91	120
1,1-dichloro-1-fluroethane	81	45,61	Pentachloroethane (pp)	167	167,130,132,165,169
2,2-Dichloropropane	77	97,79	p-isopropyltoluene	119	134,91
1,4 Difluorobenzene	114	63, 88	sec-Butylbenzene	105	134
1,1,2-Trichloroethane	83	97, 85	tert-Buytlbenzene	119	91, 134
1,2-Dibromoethane	107	109, 188	trans-1,4-Dichloro-2-butene (pp)	53	88, 75
1,2 Dichloroethane	62	98			
1,2 Dichloropropane	63	112	**(pp) = Poor Purging Efficiency**		
2,2,4 Trimethylpentane	57		(S)=Surrogate		
2-Chloroethyl-vinylether (pp)	63	65, 106			
Dichloroethane-d_4 (S)	65	102			
2-Nitropropane	46	-			
3 Methyl –1 butanol	70	55			
4-Methyl-2-pentanone (pp)	58	43, 85, 100			
Benzene	78	-			
Bromodichloromethane	83	85, 127			
cis-1,3-Dichloropropene	75	77, 39			
Methylcyclohexane	83				

Table 7-1 SIM - Volatile Internal Standards with Corresponding Analytes Assigned for Quantitation		
Analyte	**Primary Characteristic Ion**	**Secondary Characteristic Ion (s)**
4-BFB	95	174, 176
1,4-Dioxane	88	58
1,4-dioxane-d8	96	64

Table 8 STANDARDS PREPARATION
A) Internal standard and Surrogate mixtures:

	a) 25/250 µg/ml	b) 250/2,500 µg/ml
Internal Standard Mixture (2,000 µg/ml)	1.25 ml	1 .25 ml
Tert Butyl Alcohol-d_9 (50,000 µg/ml)	0.5 ml	0.5 ml
Surrogate Mixture (2,500 µg/ml)	1 ml	1 ml
Methanol	97.25 ml	7.25 ml
Total	100 ml	10 ml

- 25/250 µg /ml internal standard and surrogate mixture: The mixture is prepared by measuring 1.25ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), 1 ml of 2,500 µg /ml Method 8260A Surrogate Standard Mixture (Ultra or equivalent) and bringing to 100 ml with methanol.

- 250/2,500 µg /ml internal standard and surrogate mixture: The mixture is prepared by measuring 1.25 ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), 1 ml of 2,500 µg /ml Method 8260A Surrogate Standard Mixture (Ultra or equivalent) and bringing to 10 ml with methanol.

- 100 µg/ml surrogate mixture: The solution is prepared at 100 µg/ml by measuring 0.4 ml of 2,500 µg/ml Method 8260A Surrogate Standard Mixture (Ultra or equivalent) and bringing to 10 ml with methanol.

- 25/250 µg /ml internal standard mixture: The solution is prepared by measuring 1.25 ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), and bringing to 100 ml with methanol.

- 250/2,500 µg /ml internal standard mixture: The solution is prepared by measuring 1.25 ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), and bringing to 10 ml with methanol.

B) Bromofluorobenzene (BFB):

	a) 25 μg/ml	b)) 250 μg/ml
BFB (25,000 μg/ml)	0.1 ml	0.1 ml
Methanol	99.9 ml	9.9 ml
Total	100 ml	10 ml

- 25 μg /ml solution for direct injection: The BFB is prepared at 25 μg /ml by measuring 0.1 ml of 25,000 μg /ml (Absolute Stock or equivalent) and diluting to 100 ml with methanol.
- 250 μg /ml solution for purging: The BFB is prepared at 250 μg /ml by measuring 0.1 ml of 25,000 μg /ml (Absolute Stock or equivalent) and diluting to 10 ml with methanol.

Table 8 STANDARD PREPARATION (Continued)
C) Secondary dilution standards:

2nd Dilution Standards	Stock Solution	Concentration (μg/ml)	Volume Added (μl)	Final Volume in Methanol (ml)	Final Concentration (μg/ml)
V8260 Mixture	EPA Method 524.2 Volatiles	2,000	2,500	50	100
	Acrolein	Neat (90%)	66.2		1,000
	Acrylonitrile*	Neat	25		500+
	Propionitrile**	Neat	58.9		1,000++
	Di-iso Butylene	Neat	7.1		100
	Cyclohexane	Neat	6.5		100
	Cyclohexanone	Neat	52.9		1,000
V8260 Custom Mixture	Custom Volatiles Mix A	2,000	2,500	50	100
	Custom Volatiles Mix B	2,000 -100,000	2,500		100 - 5,000
	Epichlorohydrin	Neat	21.4		500
	Iso-Amyl alcohol	Neat	125		2,000
	2-Chloroethyl vinyl ether	Neat	20.1		500
	Ethyl tert-butyl ether	Neat	6.8		100
	Tert-Amyl methyl ether	Neat	6.56		100
	Benzyl chloride	Neat	4.6		100
Gas Mixture	VOC Gas Mixture	2,000	1,000	20	100
Ketones Mixture (water samples)	Acetone, 2-Butanone, MIBK, 2-Hexanone	Neat	23.5 ml	50	400
Ketones Mixture (soil samples)	Acetone, 2-Butanone, MIBK, 2-Hexanone	Neat	7.6 ml	20	300

- 100 µg /ml V8260 mixture: The mixture is prepared at 100 µg /ml by measuring 2 ml of 2,000 µg /ml EPA Method 524.2 Volatiles stock standard, appropriate amount of some neat compounds, and bringing to 50 ml with methanol.
  * Acrylonitrile = 400 µg /ml (Neat) + 100 µg /ml (EPA Method 524.2 Volatiles)
  ** Propionitrile = 900 µg /ml (Neat) + 100 µg /ml (EPA Method 524.2 Volatiles)

- 100 µg /ml V8260 custom mixture: The mixture is prepared at 100 - 5,000 µg /ml by measuring 2.5ml of 2,000 µg /ml Custom Volatiles Mix A, 2.5 ml of 2,000 - 100,000 µg/ml Custom Volatiles Mix B, appropriate amount of some neat compounds, and bringing to 50 ml with methanol.

- 100 µg /ml gas mixture ***: The mixture is prepared at 100 µg /ml by measuring 1 ml of 2,000 µg /ml stock standard and bring to 20 ml with methanol.
  ******* Gas mixture must be prepared weekly.

Table 8 STANDARD PREPARATION (Continued)

D).1 Initial Calibration Standards: using DI water bring to 50 ml final volume for the 1 -400 ppb standards and 500 ml for the 0.2 and 0.5 ppb standards: All mixtures used must be **secondary dilution** standards at **100 ppm**. Note: Larger volumes may be prepared if needed i.e. if 100 ml final volume is used the volume of the standard added would be doubled.

Standard and Surrogate Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)	Surrogate Mix when added manually (100ppm)	Ketones Mix for soil matrix (300 ppm)	Ketones Mix for water matrix (400 ppm)
0.2 ppb	1.0 µl	1.0 µl	1.0 µl	1.0 µl#	1.0 µl	1.0 µl
0. 5 ppb	2.5 µl	2.5 µl	2.5 µl	2.5 µl#	2.5 µl	2.5 µl
1 ppb	0.5 µl	0.5 µl	0.5 µl	0.5 µl#	0.5 µl	0.5 µl
2 ppb *	1.0 µl	1.0 µl	1.0 µl	1.0 µl#	1.0 µl	1.0 µl
4 ppb *	2.0 µl	2.0 µl	2.0 µl	2.0 µl#	2.0 µl	2.0 µl
5 ppb	2.5 µl	2.5 µl	2.5 µl	2.5 µl#	2.5 µl	2.5 µl
8 ppb *	4.0 µl	4.0 µl	4.0 µl	4.0 µl#	4.0 µl	4.0 µl
10 ppb *	5 µl	5 µl	5 µl	5 µl#	5 µl	5 µl
20 ppb	10 µl	10 µl	10 µl	10 µl#	10 µl	10 µl
50 ppb	25 µl	25 µl	25 µl	25 µl#	25 µl	25 µl
100 ppb	50 µl	50 µl	50 µl	50 µl#	50 µl	50 µl
200 ppb	100 µl	100 µl	100 µl	100 µl#	100 µl	100 µl
300 ppb *	150 µl	150 µl	150 µl	150 µl#	150 µl	150 µl
400 ppb *	200 µl	200 µl	200 µl	200 µl#	200 µl	200 µl

* depending upon the instrument.
\# See Section 10.2.2.1 for correction factor.

- When calibrating for Method 5035 low-level soil samples, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of each standard into vial if applicable. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds.

D).2 Initial Calibration Standards for 1,4-Dioxane using SIM

Standard / Surrogate Concentration (ppb)	1,4-Dioxane Solution (100ppm)	DI Water – Final Volume (ml)
0.4	0.4 µl	100
2	2 µl	100
5	5 µl	100
25	25 µl	100
50	25 µl	50
100	50 µl	50
200	100 µl	50
400	200 µl	50

Table 8 STANDARD PREPARATION (Continued)

E) C**ontinuing Calibration Standard: using DI water bring to 50 ml final volume:** All mixtures used are secondary dilution standards at 100 ppm.

Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)	Ketones Mix for water matrix(400 ppm)	Ketones Mix for soil matrix (300 ppm)
50 ppb	25 µl	25 µl	25 µl	25 µl	25 µl

- When calibrating for Method 5035 low-level soil samples, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of the continuing calibration standard into vial if applicable. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds.

F) **Blank Spike (BS): using DI water bring to 50 ml final volume:** All mixtures used are 100 ppm secondary dilution standards.

Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)	Ketones Mix for water matrix(400 ppm	Ketones Mix for soil matrix (300 ppm)
50 ppb	25 ul	25 ul	25 ul	25 µl	25 µl

For lower detection level required (test code: V8260LL)

Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)	Ketones Mix for water matrix(400 ppm	Ketones Mix for soil matrix (300 ppm)
20 ppb	10 ul	10 ul	10 ul	10 µl	10 µl

- When calibrating for Method 5035 low-level soil samples, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of the blank spike into vial if applicable. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds.

Table 9 GUIDELINE FOR DILUTION PREPARATION
Water Sample

Dilution	Sample amount taken	Final volume A (volumetric)	Take from final volume A	Final volume B (volumetric)
1:2	25 ml	50 ml		
1:5	10 ml	50 ml		
1:10	5 ml	50 ml		
1:20	2.5 ml	50 ml		
1: 25	2 ml	50 ml		
1:50	1 ml	50 ml		
1:100	0.5 ml	50 ml		
1:200	250 μl	50 ml		
1:250	200 μl	50 ml		
1:500	100 μl	50 ml		
1:1000	50 μl	50 ml		
1:2000	25 μl	50 ml		
1:2500	20 μl	50 ml		
1:5000	10 μl	50 ml		
1:10000	0.5 ml	50 ml	0.5 ml	50 ml
1:20000	0.5 ml	50 ml	250 μl	50 ml
1:25000	0.5 ml	50 ml	200 μl	50 ml
1:50000	0.5 ml	50 ml	100 μl	50 ml
1:100000	0.5 ml	50 ml	50 μl	50 ml

Soil-Low level (Non-Encore sample)

Dilution	Sample amount taken	Final volume
1:2	2.5 gram	5 ml
1:5	1 gram	5 ml
1:10	0.5 gram	5 ml

Soil-medium level

Additional Dilution	Sample in Methanol amount taken	Final volume (volumetric)
1:1	1 ml	50 ml
1:2	0.5 ml	50 ml
1:5	200 μl	50 ml
1:10	100 μl	50 ml
1:20	50 μl	50 ml
1: 25	40 μl	50 ml
1:50	20 μl	50 ml
1:100	10 μl	50 ml
1:200	5 μl	50 ml
1:250	4 μl	50 ml
1:500	2 μl	50 ml

Table 10 REPORTING LIMITS

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Chlorodifluoromethane	5	5	Chloroform	1	5
Dichlorodifluoromethane	5	5	Freon 113	5	5
Chloromethane	1	5	Methacrylonitrile	10	10
Vinyl chloride	1	5	Butyl Acetate	5	5
Bromomethane	2	5	1,1,1-Trichloroethane	1	5
Chloroethane	1	5	Heptane	5	5
Trichlorofluoromethane	5	5	n-Propyl acetate	5	5
Ethyl ether	5	5	2-Nitropropane	10	10
Acrolein	50	50	Tetrahydrofuran	10	10
1,1-Dichloroethene	1	5	2-Chloroethyl Vinyl Ether	10	25
Tertiary butyl alcohol	25	25	n-Butyl alcohol	250	250
Acetone	10	10	Cyclohexane	5	5
Methyl acetate	5	5	Carbon Tetrachloride	1	5
Allyl chloride	5	5	1,1-Dichloropropene	5	5
Acetonitrile	100	100	Isopropyl Acetate	5	5
Iodomethane	2	5	Benzene	0.5	0.5
Iso-butyl alcohol	50	50	1,2-Dichloroethane	1	1
Carbon disulfide	2	5	Trichloroethene	1	5
Methylene chloride	2	5	Methyl methacrylate	10	10
Methyl tert butyl ether	1	1	1,2 Dichloropropane	1	5
Trans-1,2-Dichloroethene	1	5	Di-isobutylene	5	5
Di-isopropyl ether	5	5	Dibromomethane	5	5
2-Butanone	10	10	1,4 Dioxane	125	125
1,1-Dichloroethane	1	5	Bromodichloromethane	1	5
Hexane	5	5	cis-1,3-Dichloropropene	1	5
Chloroprene	5	5	4-Methyl-2-pentanone	5	5
Acrylonitrile	50	50	Toluene	1	1
Vinyl acetate	10	10	trans-1,3-Dichloropropene	1	5
Ethyl acetate	5	5	Ethyl methacrylate	10	10
2,2-Dichloropropane	5	5	1,1,2-Trichloroethane	1	5
Cis-1,2-Dichloroethene	1	5	2-Hexanone	5	5
Bromochloromethane	5	5	Cyclohexanone	50	200

Table 10 REPORTING LIMITS (Continued)

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Tetrachloroethene	1	5	4-Chlorotoluene	5	5
1,3-Dichloropropane	5	5	1,3,5-Trimethylbenzene	2	5
Dibromchloromethane	1	5	tert-Butylbenzene	5	5
1,2-Dibromoethane	1	1	1,2,4 Trimethylbenzene	2	5
Chlorobenzene	1	5	sec-Butylbenzene	5	5
1,1,1,2-Tetrachloroethane	5	5	1,3-Dichlorobenzene	1	5
Ethylbenzene	1	1	p-Isopropyltoluene	5	5
M,p-Xylene	1	1	1,4-Dichlorobenzene	1	5
o-Xylene	1	1	1,2-Dichlorobenzene	1	5
Styrene	5	5	n-Butylbenzene	5	5
Bromoform	4	4	1,2-Dibromo-3-choropropane	10	10
Isopropylbenzene	2	5	1,2,4-Trichlorobenzene	2	5
Bromobenzene	5	5	Hexachlorobutadiene	5	5
1,1,2,2-Tetrachloroethane	1	5	Naphthalene	5	5
Trans-1,4-Dichloro-2-butene	5	5	1,2,3-Trichlorobenzene	5	5
1,2,3-Trichloropropane	5	5	Epichlorohydrin	100	100
n-Proplybenzene	5	5	3-Methyl-1-butanol	5	5
2-Chlorotoluene	5	5	Hexachloroethane	5	5
Ethanol	100	200	Methyl Acrylate	5	--
Benzyl Chloride	5	5	Methylcyclohexane	5	5
2,2,4 Trimethylpentane	5	5	1,1,1 trifluoroethane Freon 143a	5	10
1-chloro-1,1-difluoroethane Freon 142b	5	10	1,1-dichloro-1-fluoroethane Freon 141b	5	5
1,3-Butadiene	5	5	3,3-Dimethyl-1-butanol	20	20
1.4-Dioxane (SIM)	2	5	2-methylnaphthalene	5	5
Tert-Butyl Formate	5	5	Tert-amyl alcohol	25	25

Table 11 COMPOUNDS THAT MAY EXHIBIT CARRYOVER

Compound
1,2,4-Trichlorobenzene
Hexachlorobutadiene
Naphthalene
1,2,3-Trichlorobenzene

Table 12 RECOMMENDED MINIMUM RELATIVE RESPONSE FACTOR CRITERIA FOR INITIAL AND CONTINUING CALIBRATION VERIFICATION

Compound	Minimum Response Factor	Typical Response Factor
Dichlorofluoromethane	0.100	0.327
Chloromethane	0.100	0.537
Vinyl chloride	0.100	0.451
Bromomethane	0.100	0.255
Chloroethane	0.100	0.254
Trichlorofuoromethane	0.100	0.426
1,1 Dichloroethene	0.100	0.313
Freon 113	0.100	0.302
Acetone	0.100	0.151
Carbon Disulfide	0.100	1.163
Methyl Acetate	0.100	0.302
Methylene chloride	0.100	0.380
trans-1,2 Dichloroethene	0.100	0.351
cis-1,2 Dichloroethene	0.100	0.376
Methyl tert-butyl Ether	0.100	0.847
1,1 Dichloroethane	0.200	0.655
2-Butanone	0.100	0.216
Chloroform	0.200	0.557
1,1,1 Trichloroethane	0.100	0.442
Cyclohexane	0.100	0.579
Carbon Tetrachloride	0.100	0.353
Benzene	.0.500	1.368
1,2 Dichloroethane	0.100	0.443
Trichloroethene	0.200	0.338
Methylcyclohexane	0.100	0.501
1,2-Dichloropropane	0.100	0.382
Bromodichloromethane	0.200	0.424
cis-1,3-Dichloropropene	0.200	0.537
trans-1,3 - Dichloropropene	0.100	0.515
4-Methyl-2-Pentanone	0.100	0.363
Toluene	0.400	1.577
1,1,2-Trichloroethane	0.100	0.518

Compound	Minimum Response Factor	Typical Response Factor
Tetrachloroethene	0.200	0.606
2-Hexanone	0.100	0.536
Dibromochloromethane	0.100	0.652
1,2 Dibromoethane	0.100	0.634
Chlorobenzene	0.500	1.733
Ethyl benzene	0.100	2.827
m,p-Xylene	0.100	1.080
o-Xylene	0.300	1.073
Styrene	0.300	1.916
Bromoform	0.100	0.413
Isopropylbenzene	0.100	2.271
1,1,2,2-Tetrachloroethane	0.300	0.782
1,3-Dichlorobenzene	0.600	1.408
1,4-Dichlorobenzene	0.500	1.427
1,2-Dichlorobenzene	0.400	1.332
1,2-Dibromom-3-chloropropane	0.050	0.129
1,2,4-Trichlorobenzene	0.200	0.806
1,3-Butadiene	0.100	0.250
3,3-Dimethyl-1-butanol	0.010	0.020
1,4-Dioxane (SIM)	0.010	0.286

LAB MANAGER: ____________________

QA MANAGER: Olga Azaian

EFFECTIVE DATE: 11-1-2017

TITLE: METHOD 8270D, SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)
REFERENCES: SW846 8270D
REVISED SECTIONS: 10.3.2.4.1, 10.3.2.4.2, 12.9.3.2

1.0 SCOPE AND APPLICATION

1.1 The following method describes the analytical procedure that is utilized by Accutest to analyze semivolatile organic compounds in extracts prepared from all types of solid waste matrices, soils, and water samples. Options are incorporated for the analysis of sixteen (16) polyaromatic hydrocarbons (PAH) and other compounds listed in table 8A by selected ion monitoring GC/MS (GC/MS-SIM).

1.2 Table 1 lists the neutral, acidic, and basic organic compounds that can be determined by this method. The applicable concentration range of this method is compound and instrument dependent. Some compounds may require special treatment due to the limitations caused by sample preparation and/or chromatographic problems.

2.0 SUMMARY OF METHOD

2.1 This method is performed in accordance with the following extraction methodologies in SW846: 3510, 3520, 3546, 3550 and 3580.

2.2 The resultant methylene chloride extract is injected into a tuned and calibrated GC/MS system equipped with a fused silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph.

2.3 The peaks detected are identified qualitatively by comparison to characteristic ions and retention times specific to the known target list of compounds.

2.4 Once identified, the compound is quantitated by internal standard techniques with an average response factor generated from the calibration curve.

2.5 Additional unknown peaks with a response greater than 10 % of the closest internal standard may be processed through a library search with comparison to a NIST08 database. An estimated concentration is quantitated by assuming a response factor of 1.

2.6 This method includes analytical options for PAHs and other selected compounds by GC/MS-SIM. The extract is fortified with an additional SIM specific internal standard mix and analyzed using selected ions that are characteristic of the compounds of interest following the analysis of lower concentration calibration standards analyzed under the same MS scan conditions. Qualitative and quantitative identification is conducted using the procedures employed for full scan analysis.

3.0 REPORTING LIMIT & METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at either method detection limit or the lowest concentration standard in the calibration curve, depending on the requirements of different regulatory programs. Detected concentrations below this concentration cannot be reported without qualification. See table 9.

3.1.1 Compounds detected at concentrations between the reporting limit and MDL are quantitated and qualified as “J”, estimated value. Program or project specifications may dictate that “J” qualified compounds are not to be reported.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BATCH - a group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

BLANK - an analytical sample designed to assess specific sources of laboratory contamination.

CONTINUING CALIBRATION - a mid-range calibration check standard run every 12 hours to verify the initial calibration of the system.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass (Es).

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations which cover the working range of the instrument; used to define the linearity and dynamic range of the response of the mass spectrometer to the target compounds.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, and sample extract at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds and must be analytes that are not sample components.

MATRIX - the predominant material of which the sample to be analyzed is composed.

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards, is carried throughout the entire preparatory and analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs must be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PRIMARY QUANTITATION ION - a contract specified ion used to quantitate a target analyte.

REAGENT WATER - water in which no interferant is observed at or above the minimum detection limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - As used to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RELATIVE RETENTION TIME (RRT) - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

RESOLUTION - also termed separation or percent resolution, the separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smaller peak being resolved, multiplied by 100.

INITIAL CALIBRATUION VERIFICATION (SECOND SOURCE CALIBRATION STANDARD) - a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run whenever an initial calibration is performed.

SURROGATES - pure analytes added to every blank, sample, matrix spike, matrix spike duplicate, and standard in known amounts before extraction or other processing; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets is made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected human or mammalian carcinogens: benzo(a)anthracene, benzidine, 3,3'-dichlorobenzidine, benzo(a)pyrene, dibenzo(a,h)anthracene, N-nitrosodimethylamine, and 4,4'-DDT. Prepare primary standards of these toxic compounds in a hood. A NIOSH/Mass approved toxic gas respirator must be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other stages of sample processing. Refer to "The Preparation of Glassware for Extraction of organic contaminants" SOP for practices utilized in the extraction department.

6.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature and diversity of the industrial complex or municipality being sampled.

6.4 To reduce carryover when high-concentration samples are sequentially analyzed, the syringe must be rinsed out between samples with solvent. Whenever an unusually concentrated sample is encountered, it must be followed by the analysis of solvent to check for cross contamination.

7.0 SAMPLE COLLECTION, PRESERVATION, & HOLDING TIMES

7.1 Water samples may be collected in 1-liter glass bottles with Teflon insert in caps. Soil samples may be collected in 250-mL wide-mouth amber glass bottles.

7.1.1 Samples must be taken with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves, thus avoiding possible phthalate contamination.

7.2 The samples must be protected from light and refrigerated at ≤6° C from the time of receipt until extraction and analysis.

7.3 Store the sample extracts at -10 °C in amber vials (protected from light), in sealed vials equipped with unpierced PTFE-lined septa.

7.5 HOLDING TIME

7.5.1 Aqueous samples must be extracted within 7 days of sampling.

7.5.2 Soil, sediments and concentrated waste samples must be extracted within 14 days of sampling.

7.5.3 Extracts must be analyzed within 40 days following extraction.

8.0 APPARATUS & MATERIALS

8.1 GAS CHROMATOGRAPH/MASS SPECTROMETER SYSTEM

8.1.1 Gas Chromatograph. HP-5890, HP-6890, Agilent 6890-N, or Agilent 7890 which includes an analytical system that is complete with a temperature programmable gas chromatograph and all required accessories including syringes, capillary chromatographic columns, and gases.

8.1.1.1 The injection port is designed for split or splitless injection with capillary columns.

8.1.1.2 The capillary column is directly coupled to the source.

8.1.2 Column.

8.1.2.1 30 m x 0.25 mm fused silica (0.25 μm film thickness) DB-5MS or equivalent capillary column. Condition the column as per manufacture's directions.

8.1.3 Mass Spectrometer (HP-5972, HP-5973 or Agilent 5975).

8.1.3.1 Full Scan Mode -Capable of scanning from 35-500 amu every 1 second or less utilizing 70 volt (nominal) electron energy in the electron impact ionization mode.

8.1.3.2 SIM Mode- Capable of selective ion grouping at specified retention times for increased compound sensitivity (table 2a).

8.1.3.3 Capable of producing a mass spectrum which meets all the EPA performance criteria in Table 3 when injecting 50 ng of Decafluorotriphenyl phosphine (DFTPP).

8.2 DATA SYSTEM

8.2.1 Acquisition and Instrument Control: HP Chemstation. A computer system is interfaced to the mass spectrometer that allows the continuous acquisition and storage on machine readable media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.

8.2.2 Data Processing: HP Enviroquant. The software accommodates searching of GC/MS data files for analytes which display specific fragmentation patterns. The software also allows integrating the abundance of an EICP between specified time or scan number limits. The data system includes the NIST08 spectra library for qualitative searches of non-target compounds present in the chromatogram. It flags all data files that have been edited manually by laboratory personnel.

8.2.3 Offline Magnetic Media Storage Device - the magnetic media storage device copies data for long term, offline storage.

8.3 SYRINGE

8.3.1 10 μL graduated, auto sampler (Hamilton or equiv.).

8.3.2 Micro liter syringes, various sizes

9.0 REAGENTS AND STANDARDS

9.1 Solvents - Ultra pure, chromatography grade methylene chloride and acetone.

9.2 Stock Standard Solutions.

9.2.1 Certified, commercially prepared standards, from two separate sources are used.

9.2.1.1 Base Neutrals.

- Base/Neutrals Mix #1 (Absolute: Semivolatile Organics Standard Mix # 1).
- Base/Neutrals Mix #2 (Absolute: Semivolatile Organics Standard Mix # 2).
- PAH Mix (Absolute: Semivolatile Organics Standard Mix # 7).
- PAH Mixture #2 (Ultra).
- PAH Selected Ion Monitoring Mixture
- Benzidines Mix (Absolute: Semivolatile Organics Standard Mix # 6).
- Toxic Substances #2 (Absolute: Semivolatile Organics Standard Mix # 5).
- Pyridines Mixture (Ultra).
- Additional requested compound(s) mix (Absolute).
- Base Neutral Mixture (2nd Source).

Acids

- Phenols Mix (Absolute: Semivolatile Organics Standard Mix # 8).
- Toxic Substances #1(Absolute: Semivolatile Organics Standard Mix # 4).
- Acid Mixture (2nd Source).Internal Standard Mixtures.

9.2.2 Internal Standard Mixtures

9.2.2.1 Ultra (or equivalent) at a concentration of 4,000 μg/mL for each of the following compounds:

Full Scan

- 1,4-Dichlorobenzene-d4
- Naphthalene-d8
- Acenaphthene-d10
- Phenanthrene-d10
- Chrysene-d12
- Perylene-d12

SIM

- 1,2-Dichlorobenzene-d4
- 1-Methylnaphthalene-d10
- Fluorene-d10
- Fluoranthene-d10
- Benzo(a)pyrene-d12
- 1,4-Dioxane-d8 (for Isotopic Dilution analysis of 1,4 Dioxane)

9.2.2.2 The internal standards must permit most of the components of interest in a chromatogram to have retention times of 0.8 - 1.20 relative to one of the internal standards.

9.2.2.3 Each 1 mL sample extract, and standard undergoing analysis must be spiked with 10 μl of the internal standard mixtures, resulting in a concentration of 40 μg/mL of each internal standard for full scan analysis and 4μg/mL for SIM analysis. 2 ug/mL of 1,4-Dioxane-d8 is added during extraction for Isotopic Dilution analysis of 1,4-Dioxane via SIM.

9.2.3 Surrogate Standard Mixture.

9.2.3.1 B/N Surrogate Standard Mix: RESTEK (or equivalent) at a concentration of 5,000 μg/mL each surrogate compound.

- Nitrobenzene-d5.
- 2-Fluorobiphenyl.
- p-Terphenyl-d14.

9.2.3.2 Acid Surrogate Standard Mix: RESTEK (or equivalent) at a concentration of 7,500 μg/mL each surrogate compound.

- Phenol-d5.
- 2-Fluorophenol.
- 2,4,6-Tribromophenol.

9.2.4 DFTPP Tune Stock.

9.2.4.1 Protocol (or equivalent) at a concentration of 2,500 μg/mL for the following compounds.

- Decafluorotriphenylphosphine.
- 4,4'-DDT.
- Benzidine.
- Pentachlorophenol.

9.2.5 Store at -10°C or less when not in use or according to the manufacturer's documented holding time and storage temperature recommendations. Stock standard solutions must be replaced after 1 year or sooner if manufacture's expiration date comes first or comparison with quality control check samples indicates degradation.

9.3 Surrogate Spiking Solutions.

9.3.1 One surrogate spiking solution, containing both base/neutral and acid surrogates at a concentration of 50µg/mL is prepared in extractions. Spike each sample, and blank with 1 mL of solution prior to extraction, for a final concentration of 50 μg/l of each surrogate compound in the extract.

9.3.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.3.3 Store at -10 °C or less or according to the manufacturer's documented storage temperature recommendations. Prepare fresh surrogate spiking solutions every six months, or sooner, if the manufacturer's expiration dates come first or if the solution has degraded or evaporated.

9.4 Intermediate Calibration Standard Solution.

9.4.1 The calibration stock solution is prepared by adding an appropriate amount of each stock and surrogate compounds into a 10 mL volumetric flask. Dilute the solution to the volume with methylene chloride and mix thoroughly. Refer to Table 7A for details.

9.5 Calibration Standards.

9.5.1 Initial Calibration Standards.

9.5.1.1 Calibration standards containing the surrogate compounds must be made by quantitative dilutions of the above intermediate solution. The calibration standards are prepared at a minimum of five concentrations to cover the range of 1 - 100 μg/mL for full scan and 0.02 – 5ug/mL for SIM, depending upon project specific requirements. Suggested levels and preparations are shown in Table 7A and 7B.

9.5.2 Continuing Calibration Verification.

9.5.2.1 The concentration of the mid range standard used for continuing calibration verification is alternated between 25 and 50 μg/mL for full scan and 2.5 and 1.0 for SIM.

9.5.3 Store the calibration standards in a refrigerator at ≤ 6 °C and prepare every 6 months or before the manufacturer's expiration date, whichever is sooner. Standards must be replaced immediately if the analysis of check standards indicates degradation.

9.6 Initial Calibration verification (ICV) -Second source calibration check standard.

9.6.1 The ICV standard is prepared per Table 7E, using the intermediate solutions prepared in Extraction.

9.6.2 The ICV is analyzed after each initial calibration.

9.7 Daily GC/MS Performance Checks.

9.7.1 The solution is prepared at 50 μg/mL by making a 1:50 dilution of DFTPP stock solution (Section 9.2.4) in methylene chloride.

9.8 Matrix Spike Solutions.

9.8.1 The matrix spike solutions for both Base/Neutral and Acid are prepared in Acetone at a concentration of 100 μg/mL for each compound. Prepare the matrix spike, matrix spike duplicate and blank spike by spiking the selected sample and the blank with 1 mL of these solutions for a final concentration of 50 μg/l of each compound.

9.9 All organic new standard solutions are analyzed prior to use to verify the accuracy of the prepared concentration.

9.9.1 The prepared standard solution is analyzed using the determinative (instrumental) technique for the method.

9.9.2 The solution is analyzed following the completion of instrument calibration or a calibration check.

9.9.3 The concentration of the standard solution is determined using the software routines used in determining the acceptability of calibration verification.

9.9.4 The data is evaluated and the percent difference determined. The standard solution is approved for use if all designated compounds are present in the solution and the percent difference is less than the established criteria (±20%).

10.0 CALIBRATION

10.1 Initial Calibration.

10.1.1 The calibration range covered for routine analysis under RCRA employs standards of 1, 2, 5, 10, 25, 50, 80, 100 μg/mL for full scan and 0.01 (bis(2-chloroethyl) ether (BCEE) only) 0.02, 0.05, 0.10, 0.20, 1.0, 2.5, 5.0 µg/mL for SIM. A minimum of five standards must be run sequentially. The reporting limit is established by the concentration of the lowest standard analyzed during the initial calibration. Lower concentration standard may be needed to meet the reporting limit requirements of state specific regulatory program. The linear range covered by this calibration is the highest concentration standard.

10.1.2 A calibration range must be constructed for each surrogate compound. Accordingly, add appropriate amounts of surrogate spiking solutions to the calibration solution to define a range similar to the target compounds.

10.1.3 Aliquot 1 mL of each calibration standard into a 2 mL crimp top vial.

10.1.4 Prior to analysis, add 10 µL of the applicable (Full scan and/or SIM) internal standard solution (Section 9.2.2) to each standard. This results in a concentration of 40 µg/mL (Full scan) and 4ug/mL (SIM) for each internal standard. For 1,4-Dioxane isotope dilution analysis, add 10 µL of 2µg/mL 1,4-Dioxane-d8 prior to extraction of samples.

10.1.5 Analyze the standard solutions using the conditions established in Section 11.0. Each analyte is quantitatively determined by internal standard technique using the closest eluting internal standard and the corresponding area of the major ion. See Table 6. 1,4-Dioxane via SIM is analyzed using Isotope Dilution.

10.1.6 The Response Factor (RF) is defined in Section 13.1. Calculate the mean RF for each target analyte, using minimum of five RF values calculated from the initial calibration curve.

10.1.7 For the initial calibration to be valid, the following criteria must be met.

10.1.7.1 The percent relative standard deviation (% RSD) (see Section 13.2) of all target analytes must be less than or equal to 20%.

10.1.7.2 If the %RSD of any individual compound is $\geq$20%, employ an alternative calibration linearity model. Specifically, linear regression using a least squares approach may be employed.

10.1.7.2.1 If a linear regression is employed, select the linear regression calibration option of the mass spectrometer data system. Do not force the regression line through the origin and do not employ 0,0 as a sixth calibration standard.

10.1.7.2.2 The correlation coefficient (r value) must be $\geq$0.99 for each compound to be acceptable.

10.1.7.2.2.1 When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point must be performed by re-fitting the response from the low concentration calibration standard back into the curve.

10.1.7.2.2.2 The recalculated concentration of the low calibration point must be within ± 30% of the standard's true concentration.

10.1.7.2.3 If quadratic is employed, select the quadratic calibration option of the mass spectrometer data system. Quadratic curves must have 6 points.

10.1.7.2.3.1 The correlation coefficient (r value) must be ≥0.99 for each compound to be acceptable

10.1.7.2.4 If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit and do not meet the minimum correlation coefficient for the linear calibration option, then the chromatographic system is considered too reactive for the analysis to begin. Perform corrective action and recalibrate if the calibration criteria cannot be achieved.

10.1.7.3 It is recommended that the minimum response factor for the most common target analytes in the following table must be demonstrated for each individual calibration level as a means to ensure that these compounds are behaving as expected.

Minimum Response Factor Table for both scan and SIM mode analysis

Semivolatile Compounds	**Minimum Response Factor (RF)**
Benzaldehyde	0.010
Phenol	0.800
Bis (2-chloroethyl) ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2'-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxy)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Hexachlorobutadiene	0.010
Caprolactam	0.010
4-Chloro-3-methylphenol	0.200

2-Methylnaphthalene	0.400
Hexachlorocyclopentadiene	0.050
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethyl phthalate	0.010
2,6-Dinitrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dinitrophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4-Dinitrobenzene	0.200
Diethyl phthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010
4-Chlorophenyl-phenyl ether	0.400
Fluorene	0.900
4-Nitroaniline	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenyl ether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Atrazine	0.010
Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butyl phthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butyl benzyl phthalate	0.010
3,3'-Dichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Bis-(2-ethylhexyl)phthalate	0.010
Di-n-octyl phthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
1,4 Dioxane	0.010
2,3,4,6-Tetrachlorophenol	0.010

10.1.7.3.1 Due to the large number of compounds, some compounds will fail to meet the minimum response factor criteria. They may be used as qualified data or estimated values for screening purposes. Non-detects may be reported if adequate sensitivity has been demonstrated at the applicable lower quantitation limit.

10.1.7.4 The initial calibration criteria for this method apply to all additional compounds of concern specified by the client.

10.1.7.5 The relative retention times of each target analyte in each calibration standard must agree within 0.06 relative retention time units.

10.1.7.6 Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is more than 50% of the average of the two peak heights. Otherwise structural isomers are identified as isomeric pairs. The resolution must be verified on the mid - point concentration of the initial calibration (e.g., benzo(b)flouranthene and benzo(k)fluoranthene). Print the check and keep it on file.

10.2 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard.

10.2.1 The calibration is verified with a calibration check standard at 50 μg/mL (Full scan) or 1 ug/mL (SIM) from a secondary source (Section 9.6). It must be analyzed immediately following the initial calibration.

10.2.2 The percent difference (% D) (Section 13.3) for this standard must meet the criteria of 30% for all the target compounds.

10.2.2.1 If % D is greater than 30%, reanalyze the second source check. If the criteria cannot be met upon re-injection, re-prepare the second source solution using a fresh ampoule and repeat the process.

10.2.2.2 If the %D criteria cannot be achieved after re-preparation of the second source, prepare a third source and repeat the process. Make fresh calibration standards using one of the two standard sources that match each other.

10.3 Continuing Calibration Verification Standard - CCV

10.3.1 A calibration verification standard at close mid-level concentration of the initial calibration range at alternating 25 and 50 ug/mL for full scan and 0.5 ug/mL and 1 ug/mL for SIM must be acquired every 12 hrs.

10.3.1.1 The calibration verification standard selected must be near concentration of the midpoint calibration standard or near the action level for the project specified.

10.3.2 For the continuing calibration to be valid, all of the following specified criteria must be met.

10.3.2.1 Each of the most common target analytes in the calibration verification standard must meet the minimum response factors as noted in the Minimum Response Factor Table in section 10.1.7.3.

10.3.2.2 All target compounds of interest must be evaluated using a 20% D criteria. If the percent difference or percent drift for a compound is less than or equal to 20%, then the initial calibration for that compound is assumed to be valid.

10.3.2.3 Due to the large numbers of compounds that may be analyzed by this method, it is expected that some compounds will fail to meet the 20% D criterion. If the criterion is not met (i.e., greater than 20% difference or drift) for more than 20% of the compounds included in the initial calibration, then corrective action must be taken prior to the analysis of samples.

10.3.2.4 In cases where compounds fail, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to the compound at the applicable quantitation limits. For situation when the failed compound is present, the concentration must be reported as estimated.

10.3.2.4.1 Compounds with response factors that exceed the 20% D in the CCV compared to the initial calibration with high bias may be still reported when as non-detect, or in cases where the failed compound is present, the concentration must be reported as estimated value.

10.3.2.4.2 Compounds that do not meet the 20% D in the CCV compared to the initial calibration due to low response factors can only be reported if the low sensitivity of the instrument is still achieved. This sensitivity must be verified by running a low level standard check at reporting limit. If a positive result for the compound is found then adequate sensitivity has been demonstrated and the run can proceed.

10.3.2.5 The resolution check for structural isomers must be verified for each CCV standard Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 50% of the average of the two peak heights. Otherwise structural isomers are identified as isomeric pairs. Print the check and keep it on file.

10.3.3 If the first continuing calibration verification does not meet criteria, a second standard may be injected after notifying the team leader/manager and checking the system for defects.

10.3.3.1 A continuing calibration check is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed or refer to section 10.3.2.4. In situations where the first check fails to meet the criteria, the instrument logbook must have clear documented notations as to what the problem was and what corrective action was implemented to enable the second check to pass.

10.3.4 If the verification criteria cannot be achieved, a new initial calibration must be performed or refer to section 10.3.2.4.

10.3.5 If any of the internal standard areas change by a factor of two (- 50% to + 100%) or the retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate.

10.3.5.1 Reanalyze the continuing calibration standard. New initial calibration is required if reanalyzed standard continues to fail the internal standard requirements.

10.3.5.2 All samples analyzed while the system was out of control must be reanalyzed following corrective action.

11.0 PROCEDURE

11.1 Instrument Conditions.

11.1.1 Recommended instrument conditions are listed in Table 2 and 2a (SIM only). Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification must be approved by team leader/manger. DFTPP, Standards, QC and samples must all be run under the exact same operating conditions, including EM voltage.

11.2 Daily GC/MS Performance Checks.

11.2.1 Mass Spectrometer Tuning. Every 12-hours, inject 1 µL of 50 ng/µL DFTPP solution directly on to the column.

11.2.2 The GC/MS system must be checked to verify that acceptable performance criteria are achieved (see Table 3).

11.2.3 This performance test must be passed before any sample extracts, blanks or standards are analyzed. Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background.

11.2.3.1 Select the scans at the peak apex and one to each side of the apex.

11.2.3.2 Calculate an average of the mass abundances from the three scans.

11.2.3.3 Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peak and acquired within no more than 20 scans to the elution of DFTPP. The background subtraction must be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

11.2.4 If all the criteria are not achieved, the analyst must retune the mass spectrometer with team leader/manager and repeat the test until all criteria are met.

11.2.4.1 Alternatively, an additional scan on each side of the peak apex may be selected and included in the averaging of the mass scans. This will provide a mass spectrum of five averaged scans centered on the peak apex. NOTE: The selection of additional mass scans for tuning may only be performed with supervisory approval on a case by case basis.

11.2.5 The injection time of the acceptable tune analysis is considered the start of the 12-hour clock.

11.2.6 In order to assess GC column performance and injection port inertness, the DFTPP tune standard also contains appropriate amount of 4,4'-DDT, benzidine and pentachlorophenol.

11.2.7 All subsequent standards, samples, MS/MSDs, and blanks associated with a DFTPP analysis must use the identical mass spectrometer instrument conditions.

11.2.6.1 Injection Port Inertness Check.

11.2.6.1.1 The injection port inertness of the GC portion of the GC/MS is evaluated by the percent breakdown of 4,4'-DDT. DDT is easily degraded in the injection port. Breakdown occurs when the injection port liner is contaminated by high boiling residue from sample injection or when the injector contains metal fittings. Check for degradation problems by injecting a GC/MS tune standard containing 4,4'-DDT every 12 hour, regardless of whether DDT is a target analyte. The degradation of DDT to DDE and DDD must not exceed 20%, in order to proceed with calibration procedures. Refer to Section 13.7 for calculation. Print the check and keep it on file.

11.2.6.2 Column Performance Check.

11.2.6.2.1 The condition of the GC column is evaluated by the tailing of benzidine and pentachlorophenol every 12 hour. Benzidine and pentachlorophenol must be present at their normal responses, with no visible peak tailing, as demonstrated by the peak tailing factors. The tailing factor criteria for benzidine (base-neutral fraction) must be $\leq$ 2 and for pentachlorophenol (acid fraction) must be $\leq$ 2. Print the check daily and keep on file:

11.2.6.3 If degradation is excessive and/or poor chromatography is observed, the injector port may require cleaning. It may also be necessary to break off the first 6-12 in. of the capillary column.

11.3 Initial Calibration

11.3.1 Refer to Section 10.1.

11.4 Initial calibration Verification (ICV) - Second Source Calibration Check

11.4.1 This standard must at least be analyzed when initial calibration provided. Refer to Section 10.2.

11.5 Continuing Calibration Checks

11.5.1 Refer to Section 10.3.

11.6 Sample Analysis.

11.6.1 Allow the sample extract (preparation procedure detailed in SOP EOP001, 003 or 3546) to warm to room temperature. Spike 10 μl of the appropriate internal standard mix (4,000 μg/mL for full scan and 400ug/mL for SIM) into 1 mL of sample extract, just prior to analysis. This is equivalent to a concentration of 40 μg/mL (full scan) and 4ug/mL (SIM) of each internal standard. (1,4-Dioxane-d8 is added prior to extraction for isotopic dilution.)

11.6.2 Inject 1 μL aliquot of the sample extract into the GC/MS system. A split injection technology is used.

11.6.3 If the responses for any of the ions of interest exceed the working range of the GC/MS system, dilute a stored extract if available and reanalyze.

11.6.4 When the extracts are not being used for the analysis, store them at -10°C, protected from light, in sealed vials equipped with unpierced PTFE-lined septa.

11.7 Sample Dilution

11.7.1 Establish dilutions of samples in order for detected targets to fall within the calibration range or to minimize matrix interference.

- Utilize screen data (specific project only).
- Utilize acquired sample data.
- Utilize the history program or approval from client/project.
- Sample characteristics (appearance, odor).

11.7.2 If no lower dilution has been reported, the dilution factor chosen must keep the response of the largest peak for a target analyte in the upper half of the initial calibration range of the instrument.

11.7.3 Preparing Dilutions.

11.7.3.1 Prepare sample dilutions quantitatively. Dilute the sample extract with methylene chloride using logical volume to volume ratios, i.e., 1:5, 1:10, 1:50, etc. Large dilutions may require serial dilutions or the use of a Class A 10 mL volumetric flask.

11.7.3.2 Syringe dilutions. – Calibrated syringes are used to prepare dilutions. Add the appropriate amount of methylene chloride to a clean autosampler vial. Add the proper amount of sample using a calibrated syringe of the appropriate volume for the dilution. Add sufficient internal standard to maintain a concentration of 40ug/mL. Cap the vial and gently shake to disperse the sample through the solvent.

11.7.3.3 Volumetric Flask Dilutions – Large dilutions may require the use of a 10 mL or larger Class A Volumetric flask.

11.8 Establishing Search Criteria for target compounds. Search criteria for each compound listed in the method must be entered into the method quantitation/identification file in the Enviroquant software package. This activity must be performed before attempting qualitative and quantitative analysis on any acquired data file. The search criteria are based on compound retention time and the characteristic ions from the reference mass spectrum. Characteristic ions are defined as the three ions of greatest relative intensity, or any ions over 30% relative intensity, if less than three such ions occur in the reference spectrum. The number of secondary ions displayed for each compound search varies between compounds.

11.8.1 Select the primary ion for the target compound from the characteristic ions in Table 6. If multiple characteristic ions are listed, the first ion is the major (primary) ion. Enter this ion as the search ion. Enter the relative abundance of this ion (100% for base peak ions) and set the relative abundance window at ± 30%.

11.8.1.2 Alternate primary ions may be selected when interferences exist from ion abundance contribution from close eluting compounds.

11.8.2 Enter the remaining ions as secondary ions. Secondary ions are not be used to locate peaks within the search window, but are be used to support the qualitative identification of selected peaks. The number of secondary ions displayed for each compound search varies between compounds depending on the number of ions in the spectra >30% relative abundance.

11.8.3 Set the relative abundance windows for the secondary ions at ± 30%.

11.8.4 Establish the relative retention window for each compound. Because it is a relative retention window the same width window applies to all compounds on the quantitation list. The window must be established at a minimum of 0.06 relative retention time units.

11.9 Data Interpretation.

11.9.1 Executing Qualitative Searches. The target compounds shall be identified by analyst with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound.

11.9.1.1 The search procedure will identify peaks within the search window using the primary ion only. Secondary ions and the relative retention are used to determine “the best match”. If the best match contains secondary ions outside the relative abundance window, they will be flagged with a # sign.

11.9.2 Qualitative Identification. The qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. Compounds are identified when the following criteria are met.

11.9.2.1 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other.

11.9.2.2 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criterion is the RRT of sample component must be within ± 0.06 RRT units of the standard.

11.9.2.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

11.9.2.3.1 If a chromatographic peak exhibits a spectrum containing an ion with relative abundance outside the relative abundance window is selected for reporting, the analyst must annotate the spectra that the compound qualified based on his/her best judgement. This circumstance will most often occur from coeluting compounds with similar ions or background matrix interferences.

11.9.3 Quantitative Analysis.

11.9.3.1 Once a target compound has been identified, its concentration (Section 13.4) will be based on the integrated area of the quantitation ion, normally the base peak (Table 6). The compound is quantitated by internal standard technique with an average response factor generated from the initial calibration curve. 1,4-Dioxane via SIM is analyzed via Isotope Dilution.

11.9.3.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate. This may be characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. The secondary ion must be used to generate a new response factor.

11.10 Library Search for Tentatively Identified Compounds.

11.10.1 If a library search is requested, the analyst must perform a forward library search of the NIST08 mass spectral library to tentatively identify 10 to 15 non-reported compounds (15 for base, 10 for acid, 25 for base/acid fraction).

11.10.2 Guidelines for making tentative identification are listed below.

11.10.2.1 These compounds must have a response greater than 10% of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).

11.10.2.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.

11.10.2.3 Molecular ions present in the reference spectrum must be present in the sample spectrum.

11.10.2.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) must be present in the sample spectrum.

11.10.2.5 The relative intensities of the major ions must agree within ± 20 %. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must between 30 and 70%).

11.10.2.6 Ions present in the sample spectrum but not in the reference spectrum must be reviewed for possible background contamination or presence of coeluting compounds.

11.10.2.7 Ions present in the reference spectrum but not in the sample spectrum must be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

11.10.3 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.

11.10.4 The resulting concentration must be reported indicating: (1) that the value is estimate, and (2) which internal standard was used to determine concentration. Quantitation is performed on the nearest internal standard.

11.10.5 Peaks that are suspected to be aldol-condensation reaction products (i.e., 4-methyl-4-hydroxy-2-pentanone and 4-methyl-3-pentene-2-one) shall be searched and reported but not counted towards the total TIC count.

11.10.6 Any peak naming as “System artifact” (from the column bleedings) or “Internal Standard” (added by lab for other test, like SIM analysis) shall be searched and reported but not counted towards the total TIC count.

11.11 Selected Ion Monitoring (SIM) Option

NOTE: The use of SIM is not allowed by the SCDHEC for samples from South Carolina.

11.11.1 Instrument Set-Up: Modify the method for SIM analysis and define ion groups with retention times, ions and dwell times to include base peak ion for the target compounds of interest, surrogates, and internal standards (Table 2a, Table 8a) Select a mass dwell time of 50 milliseconds for all compounds.

11.11.2 Calibration: Calibrate the mass spectrometer in the selected ion monitoring mode using 7 calibration standards of 0.02, 0.05, 0.10, 0.20, 1.0, 2.5, 5.0 µg/mL. Spike each standard with the SIM specific internal standard solution at 4ug/mL (1,4-Dioxane-d8 is calibrated using 2ug/mL). Calculate individual response factors and response factor RSDs using the procedures and criteria described in Section 10.1.6, 10.1.7.3 and 10.1.7.4.

11.11.3 Initial Calibration Verification. Verify the initial calibration after its completion using a 1.0 µg/mL calibration standard purchased or prepared from a second standards reference materials source. The initial calibration verification must meet the criteria of Section 10.2.2.

11.11.4 Continuing Calibration Verification. Verify the initial calibration every 12 hours using a 1.0 or 2.5 µg/mL calibration. The continuing calibration verification must meet the criteria of Section 10.3.

11.11.5 Sample Extract Analysis: Each extract has been previously spike with the SIM internal standard at 4µg/mL. Analyze the sample extracts for the compounds of interest using the SIM scan parameters employed for the calibration standards.

11.11.6 Surrogate Standard Calculation.. Report surrogate spike accuracy for the surrogates spiked for the full scan GC/MS analysis at 50µg/mL.

12.0 QUALITY CONTROL

12.1 QC Requirements Summary.

Daily GC/MS Performance Checks	Beginning of the analytical shift and every 12 hours
Initial Calibration	Whenever needed.
Second Source Calibration Check	Following initial calibration
Continuing Calibration Verification	Every 12 hours.
Method Blank	One per extraction batch*.
Blank Spike	One per extraction batch*.
Matrix Spike	One per extraction batch*.
Matrix Spike Duplicate	One per extraction batch*.
Surrogate	Every sample extract and standard.
Internal Standard	Every sample extract and standard.

*The maximum number of samples per batch is twenty or per project specification.

12.2 Daily GC/MS Performance Checks.

12.2.1 Refer to Section 11.2.

12.3 Initial Calibration.

12.3.1 Refer to Section 10.1.

12.4 Initial Calibration Verification (ICV) - Second Source Calibration Check.

12.4.1 Refer to Section 10.2.

12.5 Continuing Calibration Verification.

12.5.1 Refer to section 10.3.

12.6 Method blank.

12.6.1 The method blank is either reagent water or anhydrous sodium sulfate (depending on the sample matrix) which must be extracted with each set of 20 or less samples. For a running batch, a new method blank is required for each different extraction day. The method blank is then extracted and carried through all stages of the sample preparation and measurement.

12.6.2 If the method blank contains a target analyte above its MDL, the entire batch must be re-extracted and re-analyzed.

12.6.2.1 A method blank may be acceptable if it is less than 5% (20x) of the sample result for the same analyte.

12.6.3 Surrogate compounds are added to the method blank prior to extraction. If the surrogate accuracy in the method blank does not meet in house criteria, it must be reanalyzed. If the reanalysis confirms the original data, the entire batch must be re-extracted.

12.7 Blank Spike

12.7.1 A blank spike must be extracted with each set of 20 or less samples. For a running batch, a new blank spike is required for each different extraction day. The blank spike consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same volume. It is spiked with the same analytes at the same concentrations as the matrix spike/matrix spike duplicate.

12.7.2 The blank spike recoveries must be assessed using laboratory in house limits.

12.7.3 If a blank spike is out of control, the following corrective actions must be taken and all the associated samples must be re-extracted and reanalyzed. The exception is if the blank spike recovery is high and no hits reported in associated samples and QC batch. In that case, the sample results can be reported with footnote (remark) and no further action is required.

12.7.3.1 Check to be sure that there are no errors in the calculations, or spike solutions. If errors are found, recalculate the data accordingly.

12.7.3.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample batch.

12.7.3.3 If no problem is found, re-extract and reanalyze the sample batch.

12.8 Matrix Spike(MS) / Matrix Spike Duplicate(MSD)

12.8.1 One sample is randomly selected from each extraction batch and spiked in duplicate to assess the performance of the method as applied to a particular matrix and to provide information on the homogeneity of the matrix. Both the MS and MSD are carried through the complete sample preparation, and determinative procedures.

12.8.2 Matrix spikes are prepared by spiking an actual sample at a concentration of 50 μg/l for both base/neutral and acids.

12.8.3 Assess the matrix spike recoveries (% R) (Section 13.5) and relative percent difference (RPD) (Section 13.6) against the in house control limits.

12.8.4 If the matrix spike accuracy of any individual compound is out of control, the accuracy for the compound in the blank spike must be within control. In such case, matrix interference is assumed and the data is reported with footnote (e.g., spike recovery indicates possible matrix interference). No further corrective action is required.

12.9 Surrogates

12.9.1 All standards, blanks, sample extracts, and matrix spikes contain surrogate compounds which are used to monitor the performance of the extraction and analytical system.

12.9.2 The recoveries (Section 13.5) of the surrogates must be evaluated to determine whether or not they fall within surrogate control limits developed by the laboratory annually.

12.9.3 If the recovery of any surrogate compound does not meet the control limits, the calculation must be checked for possible error. The surrogate solution must be checked for degradation. Contamination and instrument performance must also be reviewed.

12.9.3.1 Reanalyze the extract if no calculation errors are detected. If the surrogate recoveries for the reanalyzed extract are in control, report the data from the reanalysis only.

12.9.3.2 If the data from the reanalysis is also out of control, re-extract and reanalyze the sample. The testing of concrete or gravel samples may result in low acid fraction surrogate recovery and re-extraction is not necessary. Surrogates will be properly footnoted in the report to reflect this.

12.9.3.3 If, upon reanalysis, the surrogate recoveries are acceptable, report the reanalysis data. If the holding time has expired prior to the reanalysis, report both the original and reanalysis results and note the holding time problem.

12.9.3.4 If the recovery is again not within limits, the problem is considered to be matrix interference. Submit both data sets with the original analysis being reported.

12.9.4 If the sample exhibits matrix interference, defined as excessive signal where target or non-target responses are greater than the response of the internal standards. In this case, reanalysis may not be required following team leader/manager approval; the surrogates will be qualified as outside the limits due to matrix interference. Alternatively, sample may be reanalyzed on dilution, if the reanalysis is again not within the limit, the sample must be reported with a footnote indicating that there were possible matrix interference.

12.10 Internal Standards.

12.10.1 Retention time for all internal standards must be within ± 30 seconds of the corresponding internal standard in the latest continuing calibration or 50 μg/mL standard of initial calibration.

12.10.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within 50 to 200 % of the corresponding area of the latest calibration standard (12 hr. time period).

12.10.3 If the area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed.

12.10.4 If the areas are acceptable upon reanalysis, the reanalysis data is reported.

12.10.5 If the areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported.

12.11 Refer to Project Specific Bench Notes(MS8270) for additional program or client specific QC Requirements

13.0 CALCULATION

13.1 Response Factor (RF).

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:
A_s = Area of the characteristic ion for the compound being measured.
A_{is} = Area of the characteristic ion for the specific internal standard.
C_s = Concentration of the compound being measured (μg/mL).
C_{is} = Concentration of the specific internal standard (μg/mL).

13.2 Percent Relative Standard Deviation (%RSD).

$$\%RSD = \frac{SD}{RF_{av}} \times 100$$

where:
SD = Standard Deviation.
RF_{av} = Average response factor from initial calibration.

13.3 Percent Difference (%D).

$$\% D = \frac{| RF_{av} - RF_{cv} |}{RF_{av}} X 100$$

where: RF_{cv} = Response factor from Calibration Verification Standard.

13.4 Concentration (Conc.).

13.4.1 <u>for water:</u>

$$\text{Conc. } (\mu g/l) = \frac{A_s \times C_{is} \times V_f \times D \times 1000}{A_{is} \times RF_{av} \times V_i}$$

13.4.2 for soil/sediment (on a dry weight basis):

$$\text{Conc. } (\mu g/kg) = \frac{A_s \times C_{is} \times V_f \times D \times 1000}{A_{is} \times RF_{av} \times W_s \times S}$$

where:
V_f = Final Volume of total extract (mL).
D = Secondary dilution factor.
V_i = Initial volume of water extracted (mL).
W_s = Weight of sample extracted (g).
S = (100 - % moisture in sample) / 100.

13.5 Percent Recovery (%R).

$$\% R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

13.6 Relative Percent Difference (RPD).

$$RPD = \frac{|MSC - SDC|}{(1/2)(MSC+MSDC)} \times 100$$

where:

MSC = Matrix Spike Concentration.
MSDC = Matrix Spike Duplicate Concentration.

13.7 Percent Breakdown.

$$\% \text{ Breakdown for DDT} = \frac{\text{Total DDT degradation peak area}}{\text{Total DDT peak area}} \times 100$$

where:
Total DDT degradation peak area = DDE + DDD
Total DDT peak area = DDT + DDE + DDD.

13.8 Linear regression by the internal standard technique.

$$C_s = \left(\frac{\frac{A_s}{A_{is}} - b}{a}\right) \times C_{is}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte

Cis = concentration of the internal standard
b = Intercept
a = slope of the line

$$a = \frac{N\,\Sigma xy - \Sigma x\,\Sigma y}{N\,\Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{\Sigma y - a\,\Sigma x}{N}$$

N = number of points
x = amount of analyte
y = response of instrument

13.9 Quadratic curve with internal standard technique

$$Cs = \frac{-b \pm \sqrt{b^2 - 4a\left(c - \frac{A_s \times C_{is}}{A_{is}}\right)}}{2a}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte
Cis = concentration of the internal standard
b = Intercept
a = slope of the line

13.10 Correlation Coefficient

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2\,\Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

14.0 DOCUMENTATION

14.1 The Analytical Logbook is a record of the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.

14.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in this log.

14.1.2 Overwriting of data files is never allowed.

14.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed; the page must be signed and dated by the respective person.

14.2.1 The Accutest Lot Number must be cross-referenced on the standard vial.

14.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

14.5 Unused blocks of any form must be X'ed or Z'ed out by the analyst before submitting the data for review.

14.6 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information must also be verified during this review.

15.0 DATA REVIEW AND REPORTING

15.1 Initial and continuing calibration check. Verify that all calibration and continuing calibration criteria have been achieved. If the criteria had not been achieved, corrective action must be performed to bring the system in control before analyzing any samples.

15.1.1 If samples had been analyzed under non-compliant calibration criteria, all sample extracts must be re-analyzed once the system is brought into control.

15.2 Quality Control Data Review. Review all QC data. If QC criteria were not achieved, perform corrective action before proceeding with analysis.

15.2.1 In some situation, corrective action may demand that the entire sample batch be re-extracted and re-analyzed before processing data.

15.3 Chromatogram Review. The chromatogram of each sample is evaluated for target analytes.

15.3.1 Each sample may require the reporting of different target analytes. Review the login to assure that the correct target compounds are identified.

15.3.2 Manual integration of chromatographic peaks must be identified by the analysts. Upon review, the supervisor will initial and date the changes made to the report.

15.4 Transfer to LIMS. Following the initial screen review, transfer the processed data to the LIMS.

15.4.1 Compare the printed values to the original values to verify transfer accuracy.

15.4.2 If transfer errors occurred, the errors must be corrected before the data is re-submitted.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.
16.2.2 Hazardous aqueous wastes
16.2.3 Chlorinated organic solvents
16.2.4 Non-chlorinated organic solvents
16.2.5 Hazardous solid wastes
16.2.6 Non-hazardous solid wastes

Table 1 – Target Compounds by SW846 8270D			
Benzenethiol	4-Bromophenyl phenyl ether	Di-n-octyl phthalate	5-Nitro-o-toluidine
Benzoic Acid	Butyl benzyl phthalate	Diethyl phthalate	Naphthalene
2-Chlorophenol	Benzyl Alcohol	Dimethyl phthalate	Nitrobenzene
4-Chloro-3-methyl phenol	1,1'-Biphenyl	2,3-Dichloroaniline	n-Nitrosodimethylamine
2,4-Dichlorophenol	Butyl Stearate	Decane	4-Nitroquinoline 1-Oxide
2,4-Dimethylphenol	2-Chloronaphthalene	Octadecane	N-Nitroso-di-n-propylamine
2,4-Dinitrophenol	4-Chloroaniline	bis(2-Ethylhexyl)phthalate	N-Nitrosodi-n-butylamine
2,6-Dichlorophenol	Carbazole	Ethyl methanesulfonate	N-Nitrosodiethylamine
4,6-Dinitro-2-methylphenol	Caprolactam	Famphur	N-Nitrosodiphenylamine
Dinoseb	Chlorobenzilate	Fluoranthene	N-Nitrosomethylethylamine
2-Methylphenol	Chrysene	Fluorene	N-Nitrosomorpholine
3&4-Methylphenol	Cumene	Hexachlorobenzene	N-Nitrosopiperidine
2-Nitrophenol	bis(2-Chloroethoxy)methane	Hexachlorobutadiene	N-Nitrosopyrrolidine
4-Nitrophenol	bis(2-Chloroethyl)ether	Hexachlorocyclopentadiene	O,O,O-Triethyl phosphorothioat
Pentachlorophenol	bis(2-Chloroisopropyl)ether	Hexachloroethane	2-Picoline
Phenol	4-Chlorophenyl phenyl ether	Hexachlorophene	Parathion
2,3,4,6-Tetrachlorophenol	1,2-Dichlorobenzene	Hexachloropropene	Pentachloroethane
2,4,5-Trichlorophenol	1,2-Diphenylhydrazine	Indene	Pentachlorobenzene
2,4,6-Trichlorophenol	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene	Pentachloronitrobenzene
2-Acetylaminofluorene	1,4-Dichlorobenzene	Isodrin	Phenacetin
4-Aminobiphenyl	2,4-Dinitrotoluene	Isophorone	Phenanthrene
Acenaphthene	2,6-Dinitrotoluene	Isosafrole	Phorate
Acenaphthylene	3,3'-Dichlorobenzidine	Kepone	Pronamide
Acetophenone	3,3'-Dimethylbenzidine	1-Methylnaphthalene	Pyrene
Aniline	1,4-Dioxane	2-Methylnaphthalene	Pyridine
Anthracene	7,12-Dimethylbenz(a)anthracene	3-Methylcholanthrene	p-Phenylenediamine
Aramite	Dimethylnaphthalenes (total)	4,4'-Methylenebis(2-chloroaniline)	Quinoline
Atrazine	Diallate	Methapyrilene	Safrole
alpha-Terpineol	Dibenz(a,h)acridine	Methyl methanesulfonate	1,2,4,5-Tetrachlorobenzene
A,A-Dimethylphenethylamine	Dibenzo(a,h)anthracene	Methyl parathion	1,2,4-Trichlorobenzene
Benzidine	Dibenzofuran	6-Methyl Chrysene	1,2,3-Trichlorobenzene
Benzaldehyde	Dimethoate	1,4-Naphthoquinone	1,3,5-Trichlorobenzene
Benzo(a)anthracene	Diphenylamine	1-Naphthylamine	Thionazin
Benzo(a)pyrene	Disulfoton	2-Naphthylamine	o-Toluidine
Benzo(b)fluoranthene	m-Dinitrobenzene	2-Nitroaniline	sym-Trinitrobenzene
Benzo(g,h,i)perylene	p-(Dimethylamine) azobenzene	3-Nitroaniline	Tetraethyl dithiopyrophosphate
Benzo(k)fluoranthene	Di-n-butyl phthalate	4-Nitroaniline	

Table 2 – RECOMMENDED OPERATING CONDITIONS: Gas Chromatograph/ Mass Spectrometer	
Injection Type	Splitless
Carrier Gas (linear velocity)	Helium at 30 cm/sec*
Mass range	35-500 AMU
Electron Energy	70 volts (nominal)
Scan time	not to exceed 1 sec. per scan
Injection port temperature	200-300 °C
Source temperature	220-270 °C
Transfer line temperature	250-300 °C
Analyzer temperature	220-250 °C
Gas Chromatograph Temperature Program*	
Initial temperature	40-50 °C*
Time 1	2-4 minutes*
Column temperature rate	8-25 degrees/min*
Final temperature	290-320 °C according to column type*
Total run time	*20-40 minutes*

* Parameter modification allowed for performance optimization as long as QC criteria are achieved.

Table 2a – SIM Group Parameters

Group No.	Retention Time (minutes)	Ions
1	0 – 7.8	150, 64, 93, 82, 152, 99, 63, 128, 112, 42, 95, 88, 58
2	7.8 – 11	150, 128, 225, 142, 172, 152, 129, 223, 141, 171, 122, 127, 227, 115, 170
3	11 – 13.8	172, 152, 166, 182, 334, 266, 176, 153, 165, 330, 284, 264, 174, 154, 77, 332, 286, 268
4	13.8 – 18	266, 179, 202, 122, 268, 212, 203, 284, 178, 213, 244, 286
5	18 – 22	244, 229, 167, 122, 226, 202, 228, 149, 203
6	22 – 34.7	264, 149, 253, 278, 263, 150, 250, 139, 265, 252, 276, 138

Table 3 - DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
51	30-60 of mass 198
68	<2 % of mass 69
70	<2 % of mass 69
127	40-60 % of mass 198
197	<1 % of mass 198
198	Base peak, 100 % relative abundance
199	5-9 % of mass 198
275	10-30 % of mass 198
365	>1 % of mass 198
441	Present but less than mass 443
442	>40 % of mass 198
443	17-23 % of mass 442

Table 4 – INTERNAL STANDARDS	
Internal Standard (Full Scan)	**Prim/Sec. ions**
1,4-Dichlorobenzene-d4	152 / 150, 115
Naphthalene-d8	136 / 68
Acenaphthene-d10	164 / 162, 160
Phenanthrene-d10	188 / 94, 80
Chrysene-d12	240 / 120, 236
Perylene-d12	264 / 260, 265
Internal Standard (SIM)	**Prim/Sec. ions**
1,2-Dichlorobenzene-d4	152/ 150
1-Methylnaphthalene-d10	150/ 152, 122
Fluorene-d10	174/ 176
Fluoranthene-d10	212/ 213
Benzo(a)pyrene- d12	264/ 263, 265
1,4-Dioxane-d8	96/ 64

Table 6 – Full Scan Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation			
1,4-Dichlorobenzene-d4	**Ions**	**Acenaphthene-d10**	**Ions**
Aniline	(93/66,65)	Acenaphthene	(154/153,152)
Benzaldehyde	(105)	Acenaphthylene	(152/151,153)
Benzenethiol	(110)	1-Chloronaphthalene	(162/127,164)
Benzyl alcohol	(108/79,77)	2-Chloronaphthalene	(162/127,164)
Bis(2-chloroethyl)ether	(93/63,95)	4-Chlorophenylphenyl ether	(204/206,141)
Bis (2-chloroisopropyl)ether	121	Dibenzofuran	(168/139)
2-Chlorophenol	(128/64,130)	Diethyl phthalate	(149/177,150)
Cumene	(105,120)	Dimethyl phthalate	(163/149,164)
Decane	(43)	m-Dinitrobenzene	(168)
1,3-Dichlorobenzene	(146/148,111)	2,4-Dinitrophenol	(184/63,154)
1,4-Dichlorobenzene	(146/148,111)	2,4-Dinitrotoluene	(165/63,89)
1,2-Dichlorobenzene	(146/148,111)	2,6-Dinitrotoluene	(165/63,89)
1,4 Dioxane	(88, 58)	Fluorene	(166/165,167)
Ethyl methanesulfonate	(79/109,97)	Hexachlorocyclopentadiene	(295/237,142)
2-Fluorophenol (SURR.)	(112)	1,4 – Naphthoquinone	(158)
Hexachloroethane	(117/201,199)	1- Naphthylamine	(143/115,116)
Indene	(116)	2- Naphthylamine	(143/115,116)
Methyl methanesulfonate	(80/79,64)	2-Nitroaniline	(65/92,138)
2-Methylphenol	(108/107,79)	3-Nitroaniline	(138/108,92)
4-Methylphenol	(108/107,79)	4-Nitroaniline	(138/108,92)
N-Nitrosodiethylamine	(102)	4-Nitrophenol	(139/109,65)
N-Nitrosodimethylamine	(74/42)	5 Nitro-o-toluidine	(152)
N-Nitroso-di-n-propylamine	(70/101,130)	Pentachlorobenzene	(250/252,248)
N-Nitrosomethyethylamine	(42)	Pentachloronitrobenzene	(237/235,272)
N-Nitrosomorpholine	(56)	Phenacetin	(108/109,179)
N-Nitrosoptrrolidine	(41)	Phorate	(75)
O-Toluidine	(106)	Pronamide	(173/175,145)
Petachloroethane	(167)	1,2,4,5-Tetrachlorobenzene	(216/214,218)
Phenol	(94)	2,3,4,6-Tetrachlorphenol	(232/230,131)
Phenol-d5 (SURR.)	(99)	Tetraethyldithiopyrophosphate	(322)
2-Picoline	(93/66,92)	Thioazin	(143)
Pyridine	(79)	2,4,6-Trichlorophenol	(196/198,200)
		2,4,5-Trichlorophenol	(196/198,200)

Table 6 (cont'd) – Full Scan Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation			
Naphthalene-d8	**Ions**	**Phenanthrene-d10**	**Ions**
A,A-Dimethylphenethylamine	(58)	4-Aminobiphenyl	(169/168,170)
Acetophenone	(105/77,51)	Anthracene	(178/176,179)
Benzoic acid	(184/92,185)	Atrazine	(58)
Bis(2-chloroethoxy)methane	(93/95,123)	4-Bromophenyl phenyl ether	(248/250,141)
Caprolactam	(55)	Carbazole	(167)
4-Chloroaniline	(127)	Diallate	(86)
4-Chloro-methylphenol	(107/144)	Dimethoate	(87)
2,3 Dichloroaniline	(161)	Di-n-Butyl phthalate	(149/150)
2,4-Dichlorophenol	(162/164,98)	4,6-Dinitro-2-methylphenol	(198/51,105)
2,6-Dichlorophenol	(162/164,98)	Dinoseb	(211)
Dimethylnaphthalene	(156)	Diphenylamine	(169/168,167)
2,4-Dimethylphenol	(122/107)	1,2-Diphenylhydrazine	(77/105)
a,a-Dimethyl-phenethylamine	(58/91,42)	Disulfoton	(88)
Hexachlorobutadiene	(225/223,227)	Fluoranthene	(202/101,203)
Hexachloroprene	(213)	2-Fluorobiphenyl (SURR)	(172)
Isophorone	(82/95,138)	Hexachlorobenzene	(284/142,249)
Isosafrole	(127)	Isodrin	(193)
1-Methylnaphthalene	(142)	Methapyriline	(58)
2-Methylnaphthalene	(142/141)	Methyl Parathion	(125)
Naphthalene	(128/129,127)	N-Nitrosodiphenylamine	(169/168,167)
Nitrobenzene	(77/123,65)	4-Nitroquinoline 1-oxide	(190)
Nitrobenzene-d5 (SURR.)	(82)	Octadecane	(57)
N-Nitroso-di-n-butylamine	(84/57/41)	Parathion	(109)
2-Nitrophenol	(139/109,65)	Pentachlorophenol	(266/264,268)
Quinoline	(129)	Phenanthrene	(178/179,176)
N-Nitrosopiperidine	(42/114,55)	Pronamide	(173)
p-Phenylenediamine	(108)	sym- Trinitrobenzene	(213)
O,O,O-Triethylphosphorthioat	(198)	2,4,6 Tribromophenol (SURR)	(330)
Safrole	(162)		
alpha –Terpineol	(128)	**Perylene-d12**	**Ions**
1,2,3-Trichlorobenzene	(180/182,145)	Benzo(b)fluoranthene	(252/125)
1,2,4-Trichlorobenzene	(180/182,145)	Benzo(k)fluoranthene	(252/125)
1,3,5-Trichlorobenzene	(180/182,145)	Benzo(g.h.i)perylene	(276/138,277)
		Benzo(a)pyrene	(252/253,125)
Chrysene-d12	**Ions**	Dibenz(a,j)acridine	(279/280)
2 –Acetylaminofluorene	(181)	Dibenz(a,h)anthracene	(278/139,279)
Aramite	(194)	7,12-Dimethylbenz(a)anthracene	(256/241,257)
Benzidine	(184)	Di-n-Octyl Phthalate	(149)
Benzo(a)anthracene	(228/229/226)	Hexachlorophene	(196)
Bis(2-ethylhexyl)phthalate	(149/167,279)	Indeno(1,2,3-d)pyrene	(276)
Butylbenzyl phthalate	(149/91)	3-Methylchloanthrene	(268/253)
Chlorobenzilate	(251)		
Chrysene	(228/226,229)		
3,3'-Dichlorobenzidine	(252/254,126)		
p-Dimethylaminoazobenzene	(120/225,77)		
3,3 Dimethylbenzidine	(212)		
Famphur	(218)		
Kepone	(272)		
Methyl Chrysene	(242)		
Pyrene	(202/200,203)		
Terphenyl-d14 (SURR.)	(244)		

Table 6a – SIM Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation			
1,4-Dichlorobenzene-d4	**Ions**	**Fluoranthene-d10**	**Ions**
2-Fluorophenol (Surr)	(112)	Fluoranthene	202, 101, 203
Phenol-d5 (Surr)	(99)	Pyrene	202, 203

Bis-(2-chloro-ethyl)ether	93, 63, 95	Terphenyl-d14 (Surr)	(244)
Nitrobenzene-d5 (Surr)	(82)	Benzo(a)anthracene	228, 229, 226
		Chrysene	228, 226, 229
1-Methylnaphthalene-d10	**Ions**	Bis(2-ethylhexylphthalate	149, 167, 279
1,4-Dioxane	88, 58		
Naphthalene	128, 129, 127		
Hexachlorobutadiene	225, 223, 227	**Benzo(a) pyrene-d12**	**Ions**
2-Methyl Naphthalene	142, 141, 115	Di-n-octyl phthalate	149, 150, 43
2-Fluorobiphenyl (Surr)	(172)	Benzo(b)fluoranthene	252, 253
		Benzo(k)fluoranthene	252, 125
Fluorene-d10	**Ions**	Benzo(a)pyrene	252, 253, 125
Acenaphthylene	152, 151, 153	Indeno(1,2,3-cd)pyrene	276, 277, 138
Acenaphthene	153, 152, 154	Dibenzo(a,h)anthracene	278, 139, 279
Fluorene	166, 165, 167	Benzo(g,h,i)perylene	276, 138, 277
1,2-Diphenylhydrazine	77, 105, 182		
2,4,6-Tribromophenol (Surr)	(330)	**1,4-Dioxane-d8**	**Ions**
Hexachlorobenzene	284, 286	**1,4-Dioxane**	**88, 58**
Pentachlorophenol	266, 264		
Phenanthrene	178, 179, 176		
Anthracene	178, 176, 179		

Table 7 STANDARD PREPARATION

Table 7A – Intermediate Calibration Standard Solution				
Stock Solution	**Stock Conc., μg/mL**	**Volume Added, μl**	**Final Vol. in $MeCl_2$, mL**	**Final Conc. μg/mL**
Semivolatile Standard Mix # 1	2,000	500	10	100
Semivolatile Standard Mix # 2	2,000	500	10	100
Semivolatile Standard Mix # 4	2,000	500	10	100
Semivolatile Standard Mix # 5	2,000	500	10	100
Semivolatile Standard Mix # 6	2,000	500	10	100
Semivolatile Standard Mix # 7	2,000	500	10	100
PAH Mixture #2	2,000	500	10	100
Semivolatile Standard Mix # 8	2,000	500	10	100
Additional Requested Compound(s) Mix	2,000	500	10	100
Pyridines Mixture	2,000	500	10	100
1,2,3-Trichlorobenzene	1,000	1,000	10	100
1,3,5-Trichlorobenzene	1,000	1,000	10	100
Butyl Stearate	10,000	200	10	200
Pentachlorophenol	1,000	1,000	10	100
B/N Surrogate Standard Mix	5,000	200	10	100
Acid Surrogate Standard Mix	7,500	134	10	100.5

Table 7B – Intermediate Calibration Standard Solution -SIM				
Stock Solution	**Stock Conc., µg/mL**	**Volume Added, µl**	**Final Vol. in $MeCl_2$, mL**	**Final Conc. µg/mL**
Semivolatile Standard Mix # 1	2,000	50	10	10
Semivolatile Standard Mix # 2	2,000	50	10	10
Toxic #2	2,000	50	10	10
PAH Mixture #2	2,000	50	10	10
Semivolatile Standard Mix # 8 (Acids)	2,000	250	10	50
1-Methynaphthalene	1,000	100	10	10
B/N Surrogate Standard Mix	5,000	100	10	50
Acid Surrogate Standard Mix (Full Scan)	7500	67	10	50

Table 7C – Initial Calibration Standards Prep Scheme

Standard Solution	Intermediate Conc., µg/mL	Intermediate added, µl Full Scan	Final Volume in $MeCl_2$, mL	Final Conc., µg/mL – Full Scan
STD 1	100	1,000	1	100
STD 2	100	800	1	80
STD 3	100	500	1	50
STD 4	100	250	1	25
STD 5	100/10 (SIM)	100	1	10
STD 6	100	50	1	5
STD 7	100	20	1	2
STD8	100	10	1	1

Table 7D Initial Preparation Standards Prep Scheme - SIM				
Standard Solution	**Intermediate Conc., µg/mL**	**Intermediate added, µl SIM**	**Final Volume in $MeCl_2$, mL**	**Final Conc., µg/mL – SIM Scan**
STD 1	10/50	500	1	5 BN / 25 Acids
STD 2	10/50	250	1	2.5 BN / 12.5 Ac
STD 3	10/50	100	1	1 BN / 5 Acids
STD 4	1	200	1	0.2 BN / 1 Acids
STD 5	1	100	1	0.1 BN / 0.5 Acids
STD7	0.1	500	1	0.05 BN / 0.25 AC
STD 6	0.1	200	1	0.02 BN / 0.1 AC

Table 7E– ICV -Second Source Calibration Check Standard				
Intermediate	**Intermediate Conc., µg/mL**	**Volume Used, µl (Full/SIM)**	**Final Volume in Acetone, mL**	**Final Conc., µg/mL (Full/SIM)**
Base Neutrals Mixture	100	500/ 50	1	50/ 5
Acid Mixture	100	500/ 50	1	50/ 5

Table 8a –Selected Ion Monitoring: Masses and Dwell Times

Compound	Mass Ion (m/z)	Dwell Time (ms)
Acenaphthene	153, 152, 154	50
Acenaphthylene	152, 151, 153	50
Anthracene	178, 176, 179	50
Benzo(a)anthracene	228, 229, 226	50
Benzo(a)pyrene	252, 253, 125	50
Benzo(b)fluoranthene	252, 253	50
Benzo(g,h,i)perylene	276, 138, 277	50
Benzo(k)fluoranthene	252, 125	50
Chrysene	228, 226, 229	50
Dibenzo(a,h)anthracene	278, 139, 279	50
Fluoranthene	202, 101, 203	50
Fluorene	166, 165, 167	50
Indeno(1,2,3-cd)pyrene	276, 277, 138	50
Naphthalene	128, 129, 127	50
Phenanthrene	178, 179, 176	50
Pyrene	202, 203	50
2-Methyl Naphthalene	142, 141, 115	50
Bis-(2-chloro-ethyl)ether	93, 63, 95	50
Pentachlorophenol	266, 264	50
Hexachlorobutadiene	225, 223, 227	50
1,2-Diphenylhydrazine	77, 105, 182	50
Bis(2-ethylhexyl)phthalate	149, 167, 279	50
Di-n-octyl phthalate	149, 150, 43	50
Hexachlorobenzene	284, 286	50
2-Fluorophenol	112, 64, 63	50
Phenol-d5	99, 42	50
Nitrobenzene-d5	82, 128	50
2-Fluorobiphenyl	172, 171, 170	50
2,4,6-Tribromophenol	330, 332, 334	50
1,4 Dioxane	88, 58	50
4,6-dinitro-2-methylphenol	198, 51,105	50
Terphenyl-d14	244, 122	50

Table 9 REPORTING LIMITS

Compound	Water	Soil	Compound	Water	Soil
	μg/l	μg/kg		μg/l	μg/kg
Benzoic Acid	20	667	Chlorobenzilate	5	167
2-Chlorophenol	5	167	Chrysene	1	33
4-Chloro-3-methylphenol	5	167	bis(2-Chloroethoxy)methane	2	67
2,4-Dichlorophenol	5	167	bis(2-Chloroethyl)ether	2	67
2,4-Dimethlyphenol	5	167	Bis(2-Chloroisopropyl)ether	2	67
2,4-Dinitrophenol	20	667	4-Chlorophenyl phenyl ether	2	67
4,6-Dinitro-o-cresol	20	667	1,2-Dichlorobenzene	2	67
Dinoseb	5	167	1,3-Dichlorobenzene	2	67
2-Methylphenol	2	67	1,4-Dichlorobenzene	2	67
4-Methylphenol	2	67	2,4-Dinitrotoluene	2	67
2-Nitrophenol	5	167	2,6-Dinitrotoluene	2	67
4-Nitrophenol	10	333	3,3'-Dichlorobenzidine	5	167
Pentachlorophenol	10	333	3,3'-Dimethylbenzidine	5	167
Phenol	2	67	7,12-Dimethylbenz(a)anthracene	5	167
2,3,4,6-Tetrachlorophenol	5	167	Diallate	5	167
2,4,5-Trichlorophenol	5	167	Dibenzo(a,h)anthracene	1	33
2,4,6-Trichlorophenol	5	167	Dibenzofuran	2	67
2-Acetylaminofluorene	5	167	Dimethoate	5	167
4-Aminobiphenyl	5	167	Diphenylamine	5	167
Acenaphthene	1	33	Disulfuton	5	167
Acenaphthylene	1	33	m-Dinitrobenzene	5	167
Acetophenone	5	167	p-(Dimethylamine)azobenzene	5	167
Aniline	2	67	Di-n-butyl phthalate	2	67
Anthracene	1	33	Di-n-octyl phthalate	2	67
Aramite	5	167	Diethyl phthalate	2	67
A,A-Dimethylphenethylamine	5	167	Dimethyl phthalate	2	67
Benzo(a)anthracene	1	33	bis(2-Ethylhexyl)phthalate	2	67
Benzo(a)pyrene	1	33	Ethyl methansulfonate	5	167
Benzo(b)fluoranthene	1	33	Famphur	30	1000
Benzo(g,h,i)perylene	1	33	Fluoranthene	1	33
Benzo (k)fluoranthene	1	33	Fluorene	1	33
4-Bromophenyl phenyl ether	2	67	Hexachlorobenzene	2	67
Butyl benzyl phthalate	2	67	Hexachlorobutadiene	1	33
Benzyl Alcohol	2	67	Hexachlorocyclopentadiene	20	667
2-Chloronaphthalene	2	67	Hexachloroethane	5	167
4-Chloroaniline	5	167	Hexachlorophene	50	1700
Carbazole	1	67	Hexachloropropene	5	167

Table 9 (Cont'd)

Compound	Water	Soil	Compound	Water	Soil
	μg/l	μg/kg		μg/l	μg/kg
Indeno(1,2,3-cd)pyrene	1	33	N-Nitrosomethylethylamine	5	167
Isodrin	5	167	N-Nitrosomorpholine	5	167
Isophorone	2	67	N-Nitrosopiperidine	5	167
Isosafrole	5	167	N-Nitrosopyrrolidine	5	167
Kepone	30	1000	O,O,O Triethylphosphorothioat	5	167
2-Methylnaphthalene	2	667	2-Picoline	5	167
3-Methylcholanthene	5	167	Parathion	5	167
Methapyrilene	5	167	Pentachlorobenzene	5	167
Methyl Methanesulfonate	5	167	Pentachloroethane	5	167
Methyl Parathion	5	167	Pentachloronitrobenzene	5	167
1,4 Naphthoquinone	5	167	Phenacetin	5	167
1-Naphthylamine	5	167	Phenanthrene	1	33
2-Naphthylamine	5	167	Phorate	5	167
2-Nitroaniline	5	167	Pronamide	5	167
3-Nitroaniline	5	167	Pyrene	1	33
4-Nitroaniline	5	167	Pyridine	2	67
5-Nitro-o-toluidine	5	167	p-Phenylenediamine	5	167
Naphthalene	1	33	Safrole	5	167
Nitrobenzene	2	67	1,2,4,5 Tetrachlorobenzene	5	167
n-Nitrosodimethylamine	2	67	1,2,4-Trichlorobenzene	2	67
4-Nitroquinoline-1-Oxide	10	333	Thionazin	5	167
N-Nitroso-di-n-propylamine	2	67	o-Toluidine	5	167
N-Nitrosodi-n-butylamine	5	167	sym-Trinitrobenzene	5	167
N-Nitrosodiethylamine	5	167	Tetraethyl dithiopyrophosphate	5	167
N-Nitrosodiphenylamine	5	167	Quinoline	5	167
Benzenethiol	20	667	Indene	5	167
1,4-Dioxane	1	33			

Table 10 Selected Ion Monitoring Reporting Limits

Compound	Water	Soil	Compound	Water	Soil
	μg/l	μg/kg		μg/l	μg/kg
Pentachlorophenol	0.3	17	Fluoranthene	0.1	3.3
Acenaphthene	0.1	3.3	Fluorene	0.1	3.3
Acenaphthylene	0.1	3.3	Hexachlorobenzene	0.02	3.3
Anthracene	0.1	3.3	Hexachlorobutadiene	0.1	3.3
Benzo(a)anthracene	0.1	3.3	Indeno(1,2,3-cd)pyrene	0.1	3.3
Benzo(a)pyrene	0.1	3.3	2-Methylnaphthalene	0.1	3.3
Benzo(b)fluoranthene	0.1	3.3	Naphthalene	0.1	3.3
Benzo(g,h,i)perylene	0.1	3.3	Phenanthrene	0.1	3.3
Benzo (k)fluoranthene	0.1	3.3	Pyrene	0.1	3.3
Chrysene	0.1	3.3	bis(2-Chloroethyl)ether	0.2	6.6
Dibenzo(a,h)anthracene	0.1	3.3	Bis (2-ethylhexyl) phthalate	0.2	6.6
1,2-Diphenylhydrazine	0.2	6.6	Di-n-octyl phthalate	0.2	6.6
4,6-dinitro-2-methylphenol	0.5	16.7	1,4 Dioxane	0.1	3.3

SGS ACCUTEST

LAB MANAGER: Samuel Scholz

QA MANAGER: [signature]

EFFECTIVE DATE: 12/27/2016

TITLE: EXTRACTION OF SEMIVOLATILE ORGANICS FROM SOLIDS BY SONICATION (BASE, NEUTRAL, ACID ORGANICS; PESTICIDES, POLYCHLORINATED BIPHENYLS, DIESEL RANGE ORGANICS)

METHOD REFERENCE: SW-846, METHOD 3550C (REV 3. FEBRUARY, 2007)

REVISED SECTIONS: SOP Format, 8.19, 10.3.18.2.2, 10.4.17.2.1, 10.3.17.1, 10.3.18.1.1, 10.3.18.1.3, 10.3.18.2, 10.3.18.5, 10.3.7.1, 10.3.7.2, 10.4.6.1, 10.4.6.2, 10.5.7.1, 10.6.7.1

1.0 SCOPE AND APPLICATION

1.1 This method describes the extraction procedure of semi-volatile organic compounds in various soils sources for analysis by gas chromatography (GC) or gas chromatography/mass spectrometry (GC/MS).

2.0 SUMMARY

2.1 An aliquot of solid sample such as soils, sludges, and wastes, is extracted with an organic solvent (methylene chloride) utilizing the ultrasonic process. Wipe samples are extracted in their entirety, without weighing. The extract is concentrated and/or solvent exchanged for instrumental analysis techniques using SW-846 Methods 8081B, 8082A, 8270D, and 8015C.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 See determinative method.

4.0 DEFINITIONS

BATCH - A group of samples and associated quality control samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples.

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. Types of Blanks may include: Method Blank, Instrument Blank, Storage Blank, and Leachate Blank.

BLANK SPIKE (BS) - An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

CLASS A GLASSWARE - Volumetric laboratory glass that has been manufactured, calibrated and certified to established ASTM volume standards. Under normal laboratory conditions, Class A glassware does not require volume calibration or verification.

EXTRACTION – The process of removing a desired compound from a matrix using chemical or mechanical procedures. The process is used to isolate and concentrate targeted constituents for instrumental analysis.

GAS LIQUID CHROMATOGRAPHY (GC) - An instrumental procedure used to separate mixtures of organic compounds based on polarity or boiling point. The technique employs long capillary columns containing a high molecular weight organic polymer to effect the separation.

HOLDING TIME - The maximum time that samples may be held prior to preparation and/or analysis and still are considered valid.

KUDERNA DANISH (K-D) – A three-stage glass solvent concentration device consisting of a large volume receiving flask (250 or 500mL), a small volume receiver and a three-ball air cooled condenser (Snyder column). This device is used to evaporate large volumes of solvent used for organic extractions to increase the concentration of the analyte in the solvent.

MATRIX - The predominant material of which a sample is composed. For the purpose of this method, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX SPIKE (MS) - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

METHOD BLANK (MB) - an analytical control consisting of all reagents, internal standards, and surrogate standards that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background, and reagent contamination.

REAGENT WATER – Purified water in which an interferant is not observed at or above the minimum reporting limit of the parameters of interest.

SURROGATE - An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

ULTRASONIC – High frequency sound waves that increase molecular vibration of molecules absorbed to surfaces of solid materials. The process can readily mobilize adsorbed organics from solids into organic solvents.

WATER BATH – A waterbath equipped with an evaporation collection system. The system collects the extraction solvent which is then disposed via the appropriate waste stream.

WIPE – An inert fabric of known area used to swab the surface of a contaminated area for the purpose of removing the contamination from the surface for chemical analysis.

5.0 HEALTH AND SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual and Accutest Safety Policy, which includes the use of safety glasses and lab coats. Handle all acids, which are corrosive with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, treat each chemical as a potential health hazard. Reduce exposure to these reagents to the lowest possible level. The laboratory is responsible for maintaining a current file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets is available to all personnel involved in these analyses.

6.0 INTERFERENCES

6.1 Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or interferences to sample analysis. Demonstrate that these materials are free from interferences under the conditions of the analysis by analyzing method blanks.

6.2 Interferences co-extracted from the samples will vary considerably from source to source. If interferences prevent the analysis of an extracted sample, further cleanup of the sample extract may be necessary.

6.3 Phthalate esters contaminate many products commonly used in the laboratory. Avoid plastics in particular because they contain phthalates, used as plasticizers, which can leach from these materials. Practice sound, consistent materials control to avoid phthalate contamination, which may occur at any time.

6.4 Soap residue (e.g. sodium dodecyl sulfate), which results in a basic pH on glassware surfaces, may cause degradation of certain analytes. Specifically, Aldrin, Heptachlor, and most organophosphorus pesticides will degrade in this situation. This occurs in glassware that is difficult to rinse. Carefully hand-rinse these items to avoid this problem.

7.0 COLLECTION, PRESERVATION AND HOLDING TIMES

7.1 Collect solid samples in 8-32oz. glass jars.

7.2 Collect wipe samples in 4-8oz. widemouth glass jars.

7.3 Minimum 10-12g for DRO, 15-17g for Pest/PCB/EPH, 30-33g for ABN of solid samples is required for an extraction. Additional sample volume may be necessary for any samples used for matrix duplicates and matrix spikes.

7.4 The samples must be protected from light and refrigerated at <6° C from the time of receipt until extraction and analysis.

7.5 Extract samples within 14 days of sampling and analyze the extract within 40 days of the extraction.

8.0 APPARATUS AND MATERIALS

8.1 Widemouth Glass Bottle- 150mL or 250mL

8.2 Cotton fabric cloth wipe 5cm^2, pre washed with hexane

8.3 Stainless Steel Spoon or Wooden Spatula

8.4 Top Loading balance, capable of weighing to 0.01g

8.5 Class A Volumetric Flasks: 1mL, 5mL, 10mL, 100mL volumes

8.6 One (1) mL volumetric pipettes or pre-calibrated 1mL syringes

8.7 Sonicator/sonic disrupter- 300 watt output minimum with soundproof casing and ¾-horn

8.8 Drying column – used for removing aqueous fraction from organic fraction. Composed of glass funnel (large or small) containing glass wool or filter paper and sodium sulfate

8.9 Waterbath with solvent evaporation collection system- large volume concentrator capable of capturing evaporated solvent. Composed of waterbath, chiller, and solvent collector

8.10 Porous Boiling Chips or Glass Beads

8.11 Kuderna-Danish sample collection setup- for waterbath with solvent evaporation collection system. Composed of Kuderna-Danish flask (500mL or 250mL), receiver (10mL, Class A calibration), and retaining clip

8.12 Snyder Column- three ball

8.13 Buchi Concentrator System- solvent concentrator capable of capturing evaporated solvent. Composed of Syncore Unit, Vacuum Pump, Chiller, & Recirculating Pump

8.14 Buchi tube, Class A- for Buchi concentrator system.

8.15 N-VAP Concentrator- small volume concentrator. Composed of waterbath and Nitrogen gas blow down apparatus.

8.16 2mL graduated amber glass vial and associated PTFE lined cap (screw top or crimp)

8.17 Refrigerator & Freezer- for sample and backup storage

8.18 10 ml graduated cylinder.

8.19 Vortex Mixer

9.0 REAGENTS

9.1 Reagent water - deionized and carbon filtered water prepared to ASTM Type II specifications.

9.2 Solvents - reagent grade for trace organic analysis. Each solvent lot must be checked for interferences prior to use. Refer to SOP EOP013 for the procedure regarding solvent lot approval.

9.2.1 Methylene Chloride

9.2.2 Hexane

9.2.3 Acetone

9.3 Solutions- generated from reagent grade for trace organic analysis solvents listed above or shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.

9.3.1 1:1 Methylene Chloride:Acetone- Mix equal parts Methylene Chloride and Acetone.

9.3.2 2:1 Hexane:Acetone- Mix two parts Hexane with one part Acetone.

9.3.3 Sulfuric acid (1:1)- purchase as a commercially prepared solution (50% v/v). Alternatively prepare a 50% solution from equal parts concentrated sulfuric acid and reagent water

9.4 Sodium sulfate - granular anhydrous, refer to EOP029-01 for preparation instructions.

9.5 Nitrogen Gas – High Purity Grade.

9.6 Surrogate and Matrix Spiking Solutions. See the analytical SOP for target compound specifications. See the extraction SOP for target compound amounts. Refer to the most current version of Form: OP026 for details on Standard and Spike preparation.

Note: Unopened stock solutions must be stored according to the manufacturers documented holding time and storage temperature recommendations. After opening, stock standards must be replaced after 6 months or sooner if manufacturer's expiration date comes first or comparison with quality control check samples indicate degradation.

10.0 PROCEDURE

10.1 Assemble all needed apparatuses and rinse prior to use.

10.1.1 Drying Column Preparation

10.1.1.1 Prepare a drying column by adding approximately 15-20g of baked sodium sulfate into a funnel lined with glass wool or filter paper.

10.1.2 Kuderna-Danish Sample Collection Setup Preparation

10.1.2.1 Rinse assembled Kuderna-Danish flask and receiver with 5-10mL of methylene chloride. Discard methylene chloride into chlorinated solvent waste.

10.1.2.2 Place a drying column on top of K-D flask to complete Kuderna-Danish Sample Collection Setup.

10.1.3 Snyder Column Preparation

10.1.3.1 Pass approximately 3-5mL of methylene chloride from top to bottom of Snyder Column and on the joints to rinse and prime. Collect excess methylene chloride and discard into chlorinated solvent waste.

10.1.4 Buchi Tube Sample Collection Setup Preparation

10.1.4.1 Prepare previously washed and baked dry Buchi Tubes by adding 5-10mL of DCM and shaking/swirling until all inner surfaces have come in contact with the DCM. Discard methylene chloride by pouring off into chlorinated solvent waste container.

10.1.4.1.1 If water is present, rinse with 5-10mL of acetone prior to methylene chloride prep.

10.1.4.1.2 Hexane rinse, if needed, may also be performed after the methylene chloride rinse.

10.1.4.2 Place a drying column on top of Buchi tube to complete Buchi Tube Sample Collection Setup.

10.2 Turn on all equipment, check for proper operating conditions, and allow to reach operating temperatures prior to use.

10.2.1 Sonicator/sonic disrupter, 300 watt output minimum, with soundproof casing.

10.2.1.1 Inspect control unit and sonication horn(s) for damage. If any damage is noted, notify team lead, supervisor, or manager.

10.2.1.2 Check that the power setting is between 6 and 8, pulse energy, and 50% pulse cycle. DO NOT EXCEED A POWER SETTING OF 8. Set for 3 minutes per sonication cycle. If unsure how to set or confirm, ask for assistance from team lead, supervisor, or manager. The sonicator must be tuned to manufacturer's specifications prior to each use. Document tuning activities in the tuning logbook. Note: Some models do not require manual tuning.

10.2.1.3 Confirm correct horn is attached and all wires are in good working order. If any damage is noted, notify team lead, supervisor, or manager.

10.2.1.4 Test to ensure sonicator will turn on. If unit will not turn on, notify team lead, supervisor, or manager.

10.2.2 Waterbath with Evaporation Collection System. System is composed of 2 parts: Waterbath and Condensation System (Chiller and Condensers). Each part will need to be checked prior to use.

10.2.2.1 Chiller

10.2.2.1.1 Check coolant level in chiller and top-up as needed.

10.2.2.1.2 Turn on chiller. Temperature of coolant should show up on digital display, and flowmeter will register rate of coolant flow in gallons per minute (gpm).

10.2.2.1.3 Check coolant lines for leaks. If any are noted, turn off chiller and notify team lead, supervisor, or manager.

10.2.2.1.4 Adjust flow rate of chiller to exceed flow rate listed on chiller operating parameter card.

10.2.2.1.5 Monitor coolant temperature and ensure it falls below the maximum chiller temperature listed on chiller operating parameter card. If it will not fall below maximum temperature, notify team lead, supervisor, or manager.

10.2.2.1.6 Continue to monitor coolant temperature throughout use. At any point of operation, if chiller temperature exceeds listed maximum, remove all samples and suspend use of the associated waterbath(s) until temperature falls below maximum. If it doesn't fall below maximum temperature, notify team lead, supervisor, or manager.

10.2.2.2 Waterbath

10.2.2.2.1 Check water level in waterbath. If water level is below ¾" of sample holding deck, top up with water.

10.2.2.2.2 Turn on waterbath. If waterbath will not turn on, notify team lead, supervisor, or manager.

10.2.2.2.3 Temperature of water in waterbath should show up on digital display. Check and adjust to ensure temperature is set to 75.0±5.0°C. Water set point temperature is never allowed to exceed 75.0°C. Water temperature is never allowed to exceed 80.0°C. Calibration of waterbath temperature occurs on a quarterly basis. Check calibration date- if expired, do not use. If waterbath will not turn on or out of calibration, notify team lead, supervisor, or manager.

10.2.2.2.4 Continue to monitor water temperature throughout use to ensure heating elements are operating normally and maintain water set point temperature. If waterbath does not maintain the water set point temperature, notify team lead, supervisor, or manager.

10.2.3 Buchi Concentrator System. System is composed of 2 parts: Buchi and Condensation System (Chiller and Condenser). Each part will need to be checked prior to use.

10.2.3.1 Refer to OP030 for proper Buchi Concentrator System Start-up instructions.

10.2.3.2 If any issues, notify a team lead, supervisor, or manager.

10.2.4 N-VAP Concentrator. System is composed of 2 parts: Waterbath and Nitrogen Flow System. Each part will need to be checked prior to use.

10.2.4.1 Waterbath

10.2.4.1.1 Check water level in waterbath. If water level is below ¾” of top, top up with water.

10.2.4.1.2 Turn on waterbath. If waterbath will not turn on, notify team lead, supervisor, or manager.

10.2.4.1.3 Digital Display Waterbath. Temperature of water in waterbath should show up on digital display. Check and adjust to ensure temperature is set to 35.0±2.0°C. Water set point temperature is never allowed to exceed 37.0°C. If waterbath will not turn on, notify team lead, supervisor, or manager.

10.2.4.1.4 Manual Knob Waterbath. Temperature of water in waterbath will need to be manually calibrated and proper setting noted. Check and adjust to ensure temperature is set to 35.0±2.0°C. Water temperature is never allowed to exceed 37.0°C. If waterbath will not turn on or maintain proper temperature, notify team lead, supervisor, or manager.

10.2.4.1.5 Continue to monitor water temperature throughout use to ensure heating elements are operating normally and maintain water set point temperature. If waterbath does not maintain the water set point temperature, notify team lead, supervisor, or manager.

10.2.4.2 Nitrogen Flow System

10.2.4.2.1 Turn on flow of Nitrogen to system. Check to assure the incoming pressure does not exceed 30 pounds per square inch (psi) on pressure gauge.

10.2.4.2.2 Adjust flow rate to 10 liters per minute (lpm) on flow rotometer.

10.2.4.2.3 Check to ensure all needles are in good working order and clean.

10.2.4.2.4 If any issues, notify team lead, supervisor, or manager.

10.3 PESTICIDES BY SW846 METHOD 8081, PCBs BY SW846 METHOD 8082 (SONICATION, WATER BATH, BUCHI CONCENTRATOR, & N-VAP).

10.3.1 Confirm all samples present and delivered, listed on the LIMS batch sheet, and listed on preparation log. If any discrepancies, check with schedulers, team leads, supervisors, or managers.

10.3.2 If no discrepancies, document custody of samples in Internal Chain program and change status of batch to “ASN” reflecting the initiation of extraction in LIMS.

10.3.3 Label all apparatuses with the correct sample identification. Sample labels may transfer from one apparatus to the next.

10.3.4 For all sample types EXCEPT wipes, follow the procedure below.

10.3.4.1 Weigh out two aliquots of minimum 15 grams to approximately 17 grams of Ottawa Sand into two separate tared, widemouth glass jars. One for a method blank and one for a blank spike.

10.3.4.2 Mix sample thoroughly and weigh out minimum 15 grams to approximately 17 grams of wet weight sample into a tared, widemouth jar. Record the weight to the nearest 0.1g bottle number, if decanting performed, and sample description in the logbook.

Note: Sonication technique is designed to address samples which contain rocks, metal shavings, have a gasoline or oil odor, sludges, pure carbon (charcoal, activated carbon, etc), or low density (fabric, aerated soils, rubbers) . Pure Oils and Aqueous Samples are not appropriate for this extraction method. Check with the team leads, supervisors, or managers for further instructions.

10.3.4.3 Quality Control sample. For each batch, one sample will have two additional aliquots of minimum 15 grams to approximately 17 grams of wet weight sample weighed out into two separate tared, widemouth glass jars. One for Matrix Spike and one for Matrix Spike Duplicate.

10.3.5 Perform the addition of drying agent, spiking, surrogating, and solvent addition steps rapidly to avoid loss of the more volatile compounds.

10.3.6 Add up to 60g of anhydrous sodium sulfate to each sample and mix to form a free flowing texture (sandy).

10.3.7 Spiking & Surrogating. For proper execution protocols refer to EOP027.

10.3.7.1 Spiking Amounts. The test being requested will dictate the spike that will need to be added. Using a calibrated 1mL syringe, add spike to blank spike, matrix spike, and matrix spike duplicate (if present).

10.3.7.1.1 For Pesticide add 1mL of pesticide target compound spike.

10.3.7.1.2 For PCB add 1mL of PCB target compound spike.

10.3.7.1.3 For samples testing for both Pesticide and PCB (known as "shared batch"), two separate sets of quality control samples must be prepared. One for Pesticides and one for PCBs.

Note: Check the expiration date for all spiking materials to verify that the solution is valid. Do not use expired solutions for spiking.

Note: Other special spikes maybe needed. Check the special spike section of the logbook for additional information.

10.3.7.2 Surrogate Amounts. Add 1mL of the pesticide/PCB surrogate (labeled as "TCMX" on surrogate bottle) using a calibrated 1mL syringe to all samples, blanks, and spikes.

Note: Check the expiration date for all surrogating materials to verify that the solution is valid. Do not use expired solutions for surrogating.

Note: Other special surrogates maybe needed. Check the logbook for additional information.

10.3.8 Add 100mL of 1:1 methylene chloride:acetone to each sample under the hood. Alternately, 50mL of methylene chloride and 50mL of acetone can be added individually.

10.3.9 Place the tip of a ¾-inch disruptor horn about ½-inch below the solvent surface but above the sample. Sonicate each sample for three minutes at 50% duty cycle, power output of 6 - 8 and on pulse mode. DO NOT EXCEED A POWER SETTING OF 8. Very active mixing of the sample and the solvent must occur when the ultrasonic pulse is activated. The analyst must observe such mixing at some point during the extraction process. Check with your team leads, supervisors or managers on how to make adjustments.

10.3.10 Collect the methylene chloride layer by passing through the drying column into the assembled Kuderna-Danish.

10.3.11 Add a second 100mL volume of methylene chloride/acetone to sample and repeat the extraction procedure described in Section 10.3.8 to 10.3.9. Perform a third extraction in the same manner.

Note: Additional sodium sulfate may be added as needed to prevent trace amounts of aqueous fraction present in methylene chloride layer from passing through.

Important: Do not allow the sodium sulfate to become dry between solvent extracts.

10.3.12 Once the three extraction/collection steps are completed, perform a final rinse of the drying column with approximately 10mL of methylene chloride. Allow the methylene chloride to drain through until dripping stops.

10.3.13 Remove drying column and discard sodium sulfate, glass wool or filter paper into solid sulfate waste.

10.3.14 Add in boiling chip and Snyder column. The sample is now ready to be concentrated.

10.3.15 Sample Concentration Procedure. Document the procedure in the extraction logbook.

10.3.15.1 Water Bath with Evaporation Collection System

Note: Fill in waterbath information, chiller information, and flow rates once samples have been loaded.

Note: If a sample ruptures into the waterbath, immediately close the hood, allow the boiling action of the water to subside, fumes to dissipate, and notify a team lead, supervisor, or manager. Do not attempt glassware removal or cleanup by yourself.

10.3.15.1.1 Position K-D flask in the waterbath. Immersing the 10mL concentrator tube into the waterbath. Concentrate samples to about 5-7mL.

10.3.15.1.2 Allow the K-D flask, receiver, and Snyder column to cool. During this process, approximately 1mL of methylene chloride will recondense and flow down the side of the K-D flask removing most of the extract remaining in the flask and joints.

10.3.15.1.3 Remove Snyder column and slowly add 0.5-1mL of methylene chloride to the tilted K-D flask while rotate the flask. This is a final rinse of the flask and joint. Tilt upright to allow the methylene chloride to drain into the receiver.

10.3.16 Solvent Exchange. A solvent exchange to hexane is required for Pest/PCB samples.

10.3.16.1 Add 50mL of hexane to K-D and swirl to contact all surfaces.

10.3.16.2 Transfer sample by pouring from K-D setup into Buchi tube.

10.3.16.3 Buchi Concentrator System

Note: In logbook, fill in Buchi concentrator information, chiller information, and flow rates in logbook once samples have been loaded.

10.3.16.3.1 Load Buchi tubes into Buchi Concentrator. Use yellow plugs to close any Buchi tube slots that are not being used.

10.3.16.3.2 Select program “Pest/PCB Hexane X”, and press “Start” on the vacuum controller. Turn rotation knob until digital display reads 250 rotations per minute. The extract is concentrated to approximately 1mL.

10.3.16.3.3 Once program is finished, press “Stop” on vacuum controller and turn rotation knob to 0 rotations per minute.

10.3.16.3.4 Unload Buchi tubes from Buchi Concentrator and allow to cool.

10.3.17 Final volume adjustment. Samples may require further concentration or addition to reach proper volumes.

10.3.17.1 For Methods 8081, 8082, and “Shared Batches”, final volume is 10mL. For 8081 Low Level (“8081 LL”) and 8082 Low Level (“8082 LL), final volume is 1mL. If samples will not concentrate to final volumes or change states (i.e. liquid to gel), notify team lead, supervisors, and managers for further instructions. These may require a modified sample amount, alternate concentration technique, and comments to be added.

10.3.17.2 N-VAP Concentration Method. Immerse the nipple of the Buchi tube in the waterbath of the N-VAP. Direct a gentle stream of nitrogen gas onto the extract by adjusting height of needle until small dimple appears on surface. Evaporate the solvent until the desired volume is reached. Occasionally rinse the side-walls of the concentrator tubes with methylene chloride during the evaporation step.

10.3.18 Vialing and Cleanup

10.3.18.1 Sample Vial Labeling

10.3.18.1.1 For 8081 Low Level (“8081 LL”) and 8082 Low Level (“8082 LL), sample, label one 2mL graduated amber vials with Sample number and Batch number. No backup vial is created for this test.

10.3.18.1.2 For 8081 and 8082 not including “Shared Batch” sample. Label two 2mL graduated amber vials with Sample number and Batch number. One for analysis and one for backup.

10.3.18.1.3 “Shared Batch” Low Level is not possible for soil samples. This is due to the cleanup procedure (EOP3665 Sulfuric Acid Cleanup and EOP3620 Florisil Cleanup) requiring sample volume of 1mL for each cleanup.

10.3.18.1.4 For “Shared Batch” sample. Label three 2mL graduated amber vials with Sample number and Batch number. One for PCB analysis, one for pesticide analysis and one for backup.

10.3.18.2 Bring sample to final volume. Top up and vial each sample individually. This prevents evaporation of solvent and concentration of sample.

10.3.18.2.1 For 8081 LL and 8082 LL, final volume is 1mL.

10.3.18.2.2 For Methods 8081, 8082, and "Shared Batch", bring final volume to 10mL by adding an additional 9 mL of Hexane using a graduated cylinder. Mix using the vortex mixer for 10 seconds minimum.

10.3.18.3 Vialing Backup. For 8081, 8082, and "Shared Batch", vial 2mL into 2mL amber vial as a backup and do not add copper. Pesticide and PCB backup samples are vialed prior to appropriate cleanup.

10.3.18.4 Cleanups. Sample extract will require further cleanups prior to final vialing.

10.3.18.4.1 Sulfuric Acid Cleanup (For PCB analysis using SW8082)- Follow EOP3665.

10.3.18.4.2 Florisil Cleanup (For Pesticide analysis using SW8081)- Follow EOP3620.

10.3.18.4.3 For "Shared Batch", a portion of the final volume of 10mL will be used for Sulfuric Acid Cleanup and a separate portion used for Florisil Cleanup.

10.3.18.5 Vialing Sample

Note: For vialing PCB sample destined for analysis, utilize the sulfuric acid cleanup extract. Final volume for 8082 and "Shared Batch" is 10mL. Final volume for 8082 LL is 1mL.

Note: For vialing Pesticide sample destined for analysis, utilize the florisil cleanup extract. Final volume for 8081 and "Shared Batch" is 10mL. Final volume for 8081 LL is 1mL.

10.3.18.5.1 For 8081, 8081 LL, 8082, and 8082 LL not including "Shared Batch" sample, place 1mL of extract into 2mL amber vial and copper cleanup following EOP011.

10.3.18.5.2 For "Shared Batch", vial two separate 1mL aliquots of extract into 2mL amber vials and copper cleanup both following EOP011. One for Pesticide and one for PCB.

10.3.18.6 Discard unvialed remainder of the extract into hexane wastes.

10.3.18.7 Protect the extracts from light and store them in the designated refrigerator at 4°C.

10.3.19 Upon completion of extraction and vialing, account for all samples by matching to logbook entry and confirm the following information is complete and present. This information must be noted in real-time and not after completion.

10.3.19.1 Method. Start date and time, stop date and time, and method used
10.3.19.2 Sample. Matrix type and weights
10.3.19.3 Extract. Colors, final volumes, and cleanup procedures
10.3.19.4 Reagent. Reagents used, lot numbers, and volumes used
10.3.19.5 Spikes and surrogates. Lot numbers, concentration, and volumes used
10.3.19.6 Equipment. Equipment used, flow rates, and temperatures.
10.3.19.7 Personnel. Document all personnel that have assisted in the extraction of the batch by having that person initial the logbook. **Note:** It is not permissible under any circumstances to have another person initial for another person or take credit for work not performed.

10.3.20 In LIMS program, update status of samples to "DONE", using associated batch number, date of extraction, department, select samples being updated using "X", and saving changes. Document completion of sample extraction in Internal Chain program by changing status of batch to "OPEXT".

10.3.21 Present samples and logbook to team leads, supervisors, or managers for final review.

10.3.22 Deliver samples for analysis. Protocols and expectations for delivery are dictated by analytical department and are expected to be adhered to.

10.4 PCB WIPES BY SW846 METHOD 8082 (SONICATION, WATER BATH, BUCHI CONCENTRATOR & N-VAP).

10.4.1 Confirm all samples present and delivered, listed on the LIMS batch sheet, and listed on preparation log. If any discrepancies, check with schedulers, team leads, supervisors, or managers.

10.4.2 If no discrepancies, document custody of samples in Internal Chain program and change status of batch to "ASN" reflecting the initiation of extraction in LIMS.

10.4.3 Label all apparatuses with the correct sample identification. Sample labels may transfer from one apparatus to the next.

10.4.4 For WIPES, follow the procedure below.

10.4.4.1 Wipe samples are extracted directly in sample jars. Weighing and sodium sulfate addition is not necessary. Record the bottle number and sample description in the logbook.

10.4.4.2 Three blank wipes are transferred into three separate widemouth glass jars. One for a method blank, one for a blank spike, and one blank spike duplicate.

10.4.4.3 Quality Control sample. Blank Spike Duplicate serves as the quality control sample. Matrix Spike and Matrix Spike Duplicate are not possible as each wipe is an individual sampling cycle and homogenization of the wipe cannot be assured.

10.4.5 Perform the spiking, surrogating, and solvent addition steps rapidly to avoid loss of the more volatile compounds.

10.4.6 Spiking & Surrogating. For proper execution protocols refer to EOP027.

10.4.6.1 Spiking Amounts. The test being requested will dictate the spike that will need to be added. Using a calibrated 1mL syringe, add spike to blank spike and blank spike duplicate.

10.4.6.1.1 Add 1mL of PCB target compound spike.

Note: Check the expiration date for all spiking materials to verify that the solution is valid. Do not use expired solutions for spiking.

Note: Other special spikes maybe needed. Check the special spike section of the logbook for additional information.

10.4.6.2 Surrogate Amounts. Add 1mL of the pesticide/PCB surrogate (labeled as “TCMX” on surrogate bottle) using a calibrated 1mL syringe to all samples, blanks, and spikes.

Note: Check the expiration date for all surrogating materials to verify that the solution is valid. Do not use expired solutions for surrogating.

Note: Other special surrogates maybe needed. Check the logbook for additional information.

10.4.7 Add 100mL of 1:1 methylene chloride:acetone to each sample under the hood. Alternately, 50mL of methylene chloride and 50mL of acetone can be added individually.

10.4.8 Place the tip of a ¾-inch disruptor horn about ½-inch below the solvent surface but above the sample. Sonicate each sample for three minutes at 50% duty cycle, power output of 6 - 8, and on pulse mode. DO NOT EXCEED A POWER SETTING OF 8. Very active mixing of the sample and the solvent must occur when the ultrasonic pulse is activated. The analyst must observe such mixing at some point during the extraction process.. Check with your supervisor on how to make adjustments.

10.4.9 Collect the methylene chloride layer by passing through the drying column into the assembled Kuderna-Danish.

Note: Additional sodium sulfate may be added as needed to prevent trace amounts of aqueous fraction present in methylene chloride layer from passing through.

Important: Do not allow the sodium sulfate to become dry between solvent extracts.

10.4.10 Add a second 100mL volume of methylene chloride:acetone to sample and repeat the extraction procedure described in Section 10.4.8 to 10.4.9. Perform a third extraction in the same manner.

10.4.11 Once the three extraction/collection steps are completed, perform a final rinse of the drying column with approximately 10mL of methylene chloride. Allow the methylene chloride to drain through until dripping stops.

10.4.12 Remove drying column and discard sodium sulfate, glass wool or filter paper into solid sulfate waste.

10.4.13 Add in boiling chip and Snyder column. The sample is now ready to be concentrated.

10.4.14 Sample Concentration Procedure. Document the procedure in the extraction logbook.

10.4.14.1 Water Bath with Evaporation Collection System

Note: Fill in waterbath information, chiller information, and flow rates once samples have been loaded.

Note: If a sample ruptures into the waterbath, immediately close the hood, allow the boiling action of the water to subside, fumes to dissipate, and notify a team lead, supervisor, or manager. Do not attempt glassware removal or cleanup by yourself.

10.4.14.1.1 Position K-D flask in the waterbath. Immersing the 10mL concentrator tube into the waterbath. Concentrate samples to about 5-7mL.

10.4.14.1.2 Allow the K-D flask, receiver, and Snyder column to cool. During this process, approximately 1mL of methylene chloride will recondense and flow down the side of the K-D flask removing most of the extract remaining in the flask and joints.

10.4.14.1.3 Remove Snyder column and slowly add 0.5-1mL of methylene chloride to the tilted K-D flask while rotate the flask. This is a final rinse of the flask and joint. Tilt upright to allow the methylene chloride to drain into the receiver.

10.4.15 Solvent Exchange. A solvent exchange to hexane is required for Pest/PCB samples.

10.4.15.1 Add 50mL of hexane into K-D setup and swirl to contact all surfaces.

10.4.15.2 Transfer sample by pouring from K-D setup into Buchi tube.

10.4.15.3 Buchi Concentrator System

Note: Fill in Buchi concentrator information, chiller information, and flow rates once samples have been loaded.

10.4.15.3.1 Load Buchi tubes into Buchi Concentrator. Use yellow plugs to close any Buchi tube slots that are not being used.

10.4.15.3.2 Select program “Pest/PCB Hexane X”, and press “Start” on the vacuum controller. Turn rotation knob until digital display reads 250 rotations per minute. The extract is concentrated to approximately 1mL.

10.4.15.3.3 Once program is finished, press “Stop” on vacuum controller and turn rotation knob to 0 rotations per minute.

10.4.15.3.4 Unload Buchi tubes from Buchi Concentrator and allow to cool.

10.4.16 Final volume adjustment. Samples may require further concentration or addition to reach proper volumes.

10.4.16.1 For Methods 8082 Wipe, final volume is 10mL. If samples will not concentrate to final volumes or change states (i.e. liquid to gel), notify team lead, supervisors, and managers for further instructions. These may require a modified sample amount, alternate concentration technique, and comments to be added.

10.4.16.2 N-VAP Concentration Method. Immerse the nipple of the Buchi tube in the waterbath of the N-VAP. Direct a gentle stream of nitrogen gas onto the extract by adjusting height of needle until small dimple appears on surface. Evaporate the solvent until the desired volume is reached. Occasionally rinse the side-walls of the concentrator tubes with methylene chloride during the evaporation step.

10.4.17 Vialing

10.4.17.1 Sample Vial Labeling

10.4.17.1.1 For Method 8082 Wipe sample. Label two 2mL graduated amber vials with Sample number and Batch number. One for analysis and one for backup.

10.4.17.2 Bring sample to final volume.

10.4.17.2.1 For Method 8082 Wipe, bring final volume to 10mL by adding an additional 9 ml of Hexane using a graduated cylinder. Mix using the vortex mixer for 10 seconds minimum.

10.4.17.3 Vialing Backup. For Method 8082 Wipe, vial 2mL of extract into 2mL amber vial as a backup and do not add copper. Backup samples for PCB are vialed prior to appropriate cleanup.

10.4.17.4 Cleanups. Sample extract will require further cleanups prior to final vialing.

10.4.17.4.1 Sulfuric Acid Cleanup (For PCB analysis using SW8082)- Follow EOP3665.

10.4.17.5 Vialing Sample

10.4.17.5.1 For 8082 Wipe sample, place 1mL of extract into 2mL amber vial and copper cleanup following EOP011.

10.4.17.6 Discard unvialed remainder of the extract into hexane wastes.

10.4.17.7 Protect the extracts from light and store them in the designated refrigerator at 4°C.

10.4.17.8 Upon completion of extraction and vialing, account for all samples by matching to logbook entry and confirm the following information is complete and present. This information must be noted in real-time and not after completion.

10.4.17.8.1 Method. Start date and time, stop date and time, and method used
10.4.17.8.2 Sample. Matrix type and weights
10.4.17.8.3 Extract. Colors, final volumes, and cleanup procedures
10.4.17.8.4 Reagent. Reagents used, lot numbers, and volumes used
10.4.17.8.5 Spikes and surrogates. Lot numbers, concentration, and volumes used
10.4.17.8.6 Equipment. Equipment used, flow rates, and temperatures.
10.4.17.8.7 Personnel. Document all personnel that have assisted in the extraction of the batch by having that person initial the logbook.

Note: It is not permissible under any circumstances to have another person initial for another person or take credit for work not performed.

10.4.18 In LIMS program, update status of samples to “DONE”, using associated batch number, date of extraction, department, select samples being updated using “X”, and saving changes. Document completion of sample extraction in Internal Chain program by changing status of batch to “OPEXT”.

10.4.19 Present samples and logbook to team leads, supervisors, or managers for final review.

10.4.20 Deliver samples for analysis. Protocols and expectations for delivery are dictated by analytical department and are expected to be adhered to.

10.5 ACID-BASE NEUTRALS BY SW846 8270 (SONICATION, WATER BATH, & N-VAP).

10.5.1 Confirm all samples present and delivered, listed on the LIMS batch sheet, and listed on preparation log. If any discrepancies, check with schedulers, team leads, supervisors, or managers.

10.5.2 If no discrepancies, document custody of samples in Internal Chain program and change status of batch to “ASN” reflecting the initiation of extraction in LIMS.

10.5.3 Label all apparatuses with the correct sample identification. Sample labels may transfer from one apparatus to the next.

10.5.4 For all sample types, follow the procedure below.

10.5.4.1 Weigh out two aliquots of minimum 30g to approximately 33g of Ottawa Sand into two separate tared, widemouth glass jars. One for a method blank and one for a blank spike.

10.5.4.2 Mix sample thoroughly and weigh minimum 30g to approximately 33g of wet weight sample into a tared, widemouth jar. Record the weight to the nearest 0.1g bottle number, if decanting performed, and sample description in the logbook.

Note: Sonicator technique is designed to address samples which contain rocks, metal shavings, have a gasoline or oil odor, sludges, pure carbon (charcoal, activated carbon, etc), or low density (fabric, aerated soils, rubbers). Pure Oils and Aqueous Samples are not appropriate for this extraction method. Check with the team leads, supervisors, or managers for further instructions.

10.5.4.3 Quality Control sample. For each batch, one sample will have two additional aliquots of minimum 30g to approximately 33g of wet weight sample weighed out into two separate tared, widemouth glass jars. One for Matrix Spike and one for Matrix Spike Duplicate.

10.5.5 Perform the addition of drying agent, spiking, surrogating, and solvent addition steps rapidly to avoid loss of the more volatile compounds.

10.5.6 Add up to 60g of anhydrous sodium sulfate to each sample and mix to form a free flowing texture (sandy).

10.5.7 Spiking & Surrogating. For proper execution protocols refer to EOP027.

10.5.7.1 Spiking Amounts. The test being requested will dictate the spike that will need to be added. Using a calibrated 1mL syringe, add spike to blank spike, matrix spike, and matrix spike duplicate (if present).

10.5.7.1.1 For Base-Neutral (“BN”) add 1.0mL of each of the base neutral target compound spikes: BN1, BN2, & Analine.

10.5.7.1.2 For Acid (“A”) add 1.0mL of the acid target compound spike.

10.5.7.1.3 For Acid Base-Neutral (“ABN”) add 1.0mL each of the Base-Neutral (BN1, BN2, Aniline) and Acid target compound spikes.

10.5.7.1.4 For SIM ("BS12SIM"), add 0.1 mL of acid target compound spike and 1.0mL of Base-Neutral SIM ("BSIM") target compound spike.

Note: Check the expiration date for all spiking materials to verify that the solution is valid. Do not use expired solutions for spiking.

Note: Other special spikes maybe needed. Check the special spike section of the logbook for additional information.

10.5.7.2 Surrogate Amounts. Add 1.0mL of the acid-base neutral surrogate using a calibrated 1mL syringe to all samples, blanks, and spikes.

Note: Check the expiration date for all surrogating materials to verify that the solution is valid. Do not use expired solutions for surrogating.

Note: Other special surrogates maybe needed. Check the logbook for additional information.

10.5.8 Add 100 mL of 1:1 methylene chloride:acetone to each sample under the hood. Alternately, 50mL of methylene chloride and 50mL of acetone can be added individually.

10.5.9 Place the tip of a ¾-inch disruptor horn about ½-inch below the solvent surface but above the sample. Sonicate each sample for three minutes at 50% duty cycle, power output of 6 - 8, and on pulse mode. DO NOT EXCEED A POWER SETTING OF 8.Very active mixing of the sample and the solvent must occur when the ultrasonic pulse is activated. The analyst must observe such mixing at some point during the extraction process. Check with your supervisor on how to make adjustments.

10.5.10 Collect the methylene chloride layer by passing through the drying column into the assembled Kuderna-Danish.

Note: Additional sodium sulfate may be added as needed to prevent trace amounts of aqueous fraction present in methylene chloride layer from passing through.

Important: Do not allow the sodium sulfate to become dry between solvent extracts.

10.5.11 Add a second 100mL volume of methylene chloride:acetone to sample and repeat the extraction procedure described in Section 10.5.8 to 10.5.10. Perform a third extraction in the same manner.

10.5.12 Once the three extraction/collection steps are completed, perform a final rinse of the drying column with approximately 10mL of methylene chloride. Allow the methylene chloride to drain through until dripping stops.

10.5.13 Remove drying column and discard sodium sulfate, glass wool or filter paper into solid sulfate waste.

10.5.14 Add in boiling chip and Snyder column. The sample is now ready to be concentrated.

10.5.15 Sample Concentration Procedure. Document the procedure in the extraction logbook.

10.5.15.1 Water Bath with Evaporation Collection System

Note: Fill in waterbath information, chiller information, and flow rates once samples have been loaded.

Note: If a sample ruptures into the waterbath, immediately close the hood, allow the boiling action of the water to subside, fumes to dissipate, and notify a team lead, supervisor, or manager. Do not attempt glassware removal or cleanup by yourself.

10.5.15.1.1 Position K-D flask in the waterbath. Immersing the 10mL concentrator tube into the waterbath. Concentrate samples to about 5-7mL.

10.5.15.1.2 Allow the K-D flask, receiver, and Snyder column to cool. During this process, approximately 1mL of methylene chloride will recondense and flow down the side of the K-D flask removing most of the extract remaining in the flask and joints.

10.5.15.1.3 Remove Snyder column and slowly add 0.5-1mL of methylene chloride to the tilted K-D flask while rotate the flask. This is a final rinse of the flask and joint. Tilt upright to allow the methylene chloride to drain into the receiver.

10.5.15.1.4 Disassemble the K-D flask from the receiver.

10.5.16 Final volume adjustment. Samples may require further concentration or addition to reach proper volumes.

10.5.16.1 For Methods 8270 and SIM, final volume is 1mL. If samples will not concentrate to final volumes or change states (i.e. liquid to gel), notify team lead, supervisors, and managers for further instructions. These may require a modified sample amount, alternate concentration technique, and comments to be added.

10.5.16.2 N-VAP Concentration Method. Immerse the nipple of the receiver in the waterbath of the N-VAP. Direct a gentle stream of nitrogen gas onto the extract by adjusting height of needle until small dimple appears on surface. Evaporate the solvent until the desired volume is reached. Occasionally rinse the side-walls of the concentrator tubes with methylene chloride during the evaporation step.

10.5.17 Vialing

10.5.17.1 For each sample, label a 2mL graduated amber vial with Sample number and Batch number. No backup vial is created for this test.

10.5.17.2 Bring final volume to 1mL with methylene chloride in receiver and mix with a Pasteur pipet. Transfer all sample extract to the vial.

10.5.17.3 Adjust the vial volume to 1mL with methylene chloride.

10.5.17.4 Protect the extracts from light and store them in the designated freezer at -10°C.

10.5.18 Upon completion of extraction and vialing, account for all samples by matching to logbook entry and confirm the following information is complete and present. This information must be noted in real-time and not after completion.

10.5.18.1 Method. Start date and time, stop date and time, and method used
10.5.18.2 Sample. Matrix type and weights
10.5.18.3 Extract. Colors, final volumes, and cleanup procedures
10.5.18.4 Reagent. Reagents used, lot numbers, and volumes used
10.5.18.5 Spikes and surrogates. Lot numbers, concentration, and volumes used
10.5.18.6 Equipment. Equipment used, flow rates, and temperatures.
10.5.18.7 Personnel. Document all personnel that have assisted in the extraction of the batch by having that person initial the logbook. **Note:** It is not permissible under any circumstances to have another person initial for another person or take credit for work not performed.

10.5.19 In LIMS program, update status of samples to “DONE”, using associated batch number, date of extraction, department, select samples being updated using “X”, and saving changes. Document completion of sample extraction in Internal Chain program by changing status of batch to “OPEXT”.

10.5.20 Present samples and logbook to team leads, supervisors, or managers for final review.

10.5.21 Deliver samples for analysis. Protocols and expectations for delivery are dictated by analytical department and are expected to be adhered to.

10.6 DRO - DIESEL RANGE ORGANICS FOR METHOD SW846-8015 (SONICATION, WATER BATH, & N-VAP).

10.6.1 Confirm all samples present and delivered, listed on the LIMS batch sheet, and listed on preparation log. If any discrepancies, check with schedulers, team leads, supervisors, or managers.

10.6.2 If no discrepancies, document custody of samples in Internal Chain program and change status of batch to "ASN" reflecting the initiation of extraction in LIMS.

10.6.3 Label all apparatuses with the correct sample identification. Sample labels may transfer from one apparatus to the next.

10.6.4 For all sample types, follow the procedure below.

10.6.4.1 Weigh out two aliquots of minimum 10g to approximately 12g of Ottawa Sand into two separate tared, widemouth glass jars. One for a method blank and one for a blank spike.

10.6.4.2 Mix sample thoroughly and weigh out minimum 10g to approximately 12g of wet weight sample into a tared, widemouth jar. Record the weight to the nearest 0.1g bottle number, if decanting performed, and sample description in the logbook.

Note: Sonicator technique is designed to address samples which contain rocks, metal shavings, have a gasoline or oil odor, sludges, pure carbon (charcoal, activated carbon, etc), or low density (fabric, aerated soils, rubbers). Pure Oils and Aqueous Samples are not appropriate for this extraction method. Check with the team leads, supervisors, or managers for further instructions.

10.6.4.3 Quality Control sample. For each batch, one sample will have two additional aliquots minimum 10g to approximately 12g of wet weight sample weighed out into two separate tared, widemouth glass jars. One for Matrix Spike and one for Matrix Spike Duplicate.

10.6.5 Perform the addition of drying agent, spiking, surrogating, and solvent addition steps rapidly to avoid loss of the more volatile compounds.

10.6.6 Add up to 20g of anhydrous sodium sulfate to each sample and mix to form a free flowing texture (sandy).

10.6.7 Spiking & Surrogating. For proper execution protocols refer to EOP027.

10.6.7.1 Spiking Amounts. The test being requested will dictate the spike that will need to be added. Using a calibrated 1mL syringe, add spike to blank spike, matrix spike, and matrix spike duplicate (if present).

10.6.7.1.1 Add 1mL of the DRO target compound spike to the samples selected for matrix spikes.

Note: Check the expiration date for all spiking materials to verify that the solution is valid. Do not use expired solutions for spiking.

10.6.7.2 Surrogate Amounts. Add 1mL of the DRO surrogate using a calibrated 1mL syringe to all samples, blanks, and spikes.

Note: Check the expiration date for all surrogating materials to verify that the solution is valid. Do not use expired solutions for surrogating.

10.6.8 Add 100mL of 1:1 methylene chloride:acetone to each sample under the hood. Alternately, 50mL of methylene chloride and 50mL of acetone can be added individually.

10.6.9 Place the tip of a ¾-inch disruptor horn about ½-inch below the solvent surface but above the sample. Sonicate each sample for three minutes at 50% duty cycle, power output of 6 - 8, and on pulse mode. DO NOT EXCEED A POWER SETTING OF 8. Very active mixing of the sample and the solvent must occur when the ultrasonic pulse is activated. The analyst must observe such mixing at some point during the extraction process Check with your supervisor on how to make adjustments.

10.6.10 Collect the methylene chloride layer by passing through the drying column into the assembled Kuderna-Danish.

Note: Additional sodium sulfate may be added as needed to prevent trace amounts of aqueous fraction present in methylene chloride layer from passing through.

Important: Do not allow the sodium sulfate to become dry between solvent extracts.

10.6.11 Add a second 100mL volume of methylene chloride:acetone to sample and repeat the extraction procedure described in Section 10.6.8 to 10.6.9. Perform a third extraction in the same manner.

10.6.12 Once the three extraction/collection steps are completed, perform a final rinse of the drying column with approximately 10mL of methylene chloride. Allow the methylene chloride to drain through until dripping stops.

10.6.13 Remove drying column and discard sodium sulfate, glass wool or filter paper into solid sulfate waste.

10.6.14 Add in boiling chip and Snyder column. The sample is now ready to be concentrated.

10.6.15 Sample Concentration Procedure. Document the procedure in the extraction logbook.

10.6.15.1 Water Bath with Evaporation Collection System

Note: Fill in waterbath information, chiller information, and flow rates once samples have been loaded.

Note: If a sample ruptures into the waterbath, immediately close the hood, allow the boiling action of the water to subside, fumes to dissipate, and notify a team lead, supervisor, or manager. Do not attempt glassware removal or cleanup by yourself

10.6.15.1.1 Position K-D flask in the waterbath. Immersing the 10mL concentrator tube into the waterbath. Concentrate samples to about 5-7mL.

10.6.15.1.2 Allow the K-D flask, receiver, and Snyder column to cool. During this process, approximately 1mL of methylene chloride will recondense and flow down the side of the K-D flask removing most of the extract remaining in the flask and joints.

10.6.15.1.3 Remove Snyder column and slowly add 0.5-1mL of methylene chloride to the tilted K-D flask while rotate the flask. This is a final rinse of the flask and joint. Tilt upright to allow the methylene chloride to drain into the receiver.

10.6.15.1.4 Disassemble the K-D flask from the receiver.

10.6.16 Final volume adjustment. Samples may require further concentration or addition to reach proper volumes.

10.6.16.1 For Methods 8015, final volume is 1mL. If samples will not concentrate to final volumes or change states (i.e. liquid to gel), notify team lead, supervisors, and managers for further instructions. These may require a modified sample amount, alternate concentration technique, and comments to be added.

10.6.16.2 N-VAP Concentration Method. Immerse the nipple of the receiver in the waterbath of the N-VAP. Direct a gentle stream of nitrogen gas onto the extract by adjusting height of needle until small dimple appears on surface. Evaporate the solvent until the desired volume is reached. Occasionally rinse the side-walls of the concentrator tubes with methylene chloride during the evaporation step.

10.6.17 Vialing

10.6.17.1 For each sample, label a 2mL graduated amber vial with Sample number and Batch number. No backup vial is created for this test.

10.6.17.2 Bring final volume to 1mL with methylene chloride in receiver and mix with a Pasteur pipet. Transfer all sample extract to the vial.

10.6.17.3 Adjust the vial volume to 1mL with methylene chloride.

10.6.17.4 Protect the extracts from light and store them in the designated refrigerator at 4°C.

10.6.18 Upon completion of extraction and vialing, account for all samples by matching to logbook entry and confirm the following information is complete and present. This information must be noted in real-time and not after completion.

10.6.18.1 Method. Start date and time, stop date and time, and method used
10.6.18.2 Sample. Matrix type and weights
10.6.18.3 Extract. Colors, final volumes, and cleanup procedures
10.6.18.4 Reagent. Reagents used, lot numbers, and volumes used
10.6.18.5 Spikes and surrogates. Lot numbers, concentration, and volumes used
10.6.18.6 Equipment. Equipment used, flow rates, and temperatures.
10.6.18.7 Personnel. Document all personnel that have assisted in the extraction of the batch by having that person initial the logbook.
Note: It is not permissible under any circumstances to have another person initial for another person or take credit for work not performed.

10.6.19 In LIMS program, update status of samples to “DONE”, using associated batch number, date of extraction, department, select samples being updated using “X”, and saving changes. Document completion of sample extraction in Internal Chain program by changing status of batch to “OPEXT”.

10.6.20 Present samples and logbook to team leads, supervisors, or managers for final review.

10.6.21 Deliver samples for analysis. Protocols and expectations for delivery are dictated by analytical department and are expected to be adhered to.

11.0 CALCULATIONS

11.1 Not applicable.

12.0 QC REQUIREMENTS

12.1 Extract a method blank and blank spike at a rate of one per day or every twenty (20) samples, whichever is more frequent.

12.2 A matrix spike / matrix spike duplicate (MS/MSD) is required per every 20 samples.

12.3 For pest/PCBs a separate BSP and MS/MSD set are needed if the sample requires PCBs, Toxaphene and/or chlordane. Therefore, if a sample is to be extracted for pesticides and PCBs, 2 sets of BS, MS, and MSD are needed.

12.4 Refer to Project Specific Bench Notes (GC8081, GC8082, MS8270) for additional program or client specific QC requirements.

12.5 Perform solvent checks for each new solvent lot to verify the absence of interferences. See SOP EOP013.

13.0 DOCUMENTATION

13.1 All sample preparation activities and related information must be documented in the respective extraction logbook. Complete all information required for the extraction summary logbook.

13.1.1 Errors must be stricken with a single line, initialed and dated. The correct information must be written adjacent to the erroneous information.

13.1.2 The individual with custody responsibility must sign the extraction log.

13.1.3 The individuals involved in the processing of the batch must initial in the appropriate respective locations.

13.1.4 All spikes, surrogates, reagents, solutions, and applicable manufacturer and lot information must be filled in the appropriate respective locations.

13.1.5 All equipment, equipment identifiers, and the operating parameters at time of use must be filled in the appropriate respective locations.

13.1.6 The logbooks and/or e-logs must be reviewed and initialed by a team leader or supervisor. The approved page is copied and given to the Report Generation Dept.

13.2 Sample custody must be updated according to proper Chain of Custody protocols.

13.3 All standards preparation must be documented in the standards preparation logbook.

13.4 Equipment maintenance logs must be maintained.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT

14.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 14.2.

14.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

14.2.1 Non hazardous aqueous wastes

14.2.2 Hazardous aqueous wastes

14.2.3 Chlorinated organic solvents

14.2.4 Non-chlorinated organic solvents

14.2.5 Hazardous solid wastes

14.2.6 Non-hazardous solid waste

SGS Accutest NJ Normal Reporting Limits for Soil and Non-potable Water Matrices for 2018

(Soil values will be adjusted up for percent solids.)

TEST	Method 200.7/6010 waters - normal RL in ug/l - ICP	Method 200.7/6010 waters - NJ RL in ug/l - ICP	Method 6010 waters - pooled MDL for SS ICP's in ug/l	Method 200.7 waters - pooled MDL for SS ICP's in ug/l	Method 6010 soils - normal RL in mg/kg - ICP	Method 6010 soils - pooled MDL for SS ICP's in mg/kg	TEST
Al	200.0		33.00	32.43	50.0	5.218	Al
Sb	6.0		4.30	3.00	2.0	0.374	Sb
As	8.0	3.000	2.73	2.57	2.0	0.254	As
Ba	200.0		1.25	1.01	20.0	0.174	Ba
Be	1.0		0.40	0.31	0.2	0.049	Be
Cd	3.0		0.70	0.69	0.5	0.057	Cd
Ca	5000.0		28.84	47.78	500.0	42.106	Ca
Cr	10.0		0.85	1.55	1.0	0.178	Cr
Co	50.0		0.72	0.70	5.0	0.070	Co
Cu	10.0		3.22	6.48	2.5	0.396	Cu
Fe	100.0		32.20	20.11	50.0	4.573	Fe
Pb	3.0		2.63	2.58	2.0	0.344	Pb
Mg	5000.0		63.92	58.66	500.0	13.320	Mg
Mn	15.0		0.42	0.78	1.5	0.087	Mn
Mo	20.0		1.39	5.68	2.0	0.153	Mo
Ni	10.0		1.34	0.91	4.0	0.246	Ni
K	10000.0		232.60	290.12	1000.0	30.410	K
Se	10.0		6.63	7.24	2.0	0.645	Se
Si	200.0		44.98	31.81		2.554	Si
Ag	10.0		3.13	2.97	0.5	0.289	Ag
Na	10000.0		128.54	168.82	1000.0	13.606	Na
Ti	10.0		1.84	1.27	1.0	0.267	Ti
V	50.0		1.28	0.95	5.0	0.088	V
Zn	20.0		4.00	2.18	5.0	3.814	Zn
Hg			0.2000	0.0692	0.0330	0.0112	Hg

SGS 2018 Metals RL/MDLs

SGS Accutest NJ Normal Reporting Limits for Soil and Non-potable Water Matrices for 2018

(Soil values will be adjusted up for percent solids.)

Quality Systems Manual

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Document Control Number: ____76____

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Laboratory Director

Nancy F. Cole
Signature

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Quality Assurance Manager

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Signature

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Introduction

The SGS North America Inc. (hereafter referred to as SGS) Quality Assurance System, detailed in this plan, has been designed to meet the quality program requirements of the National Environmental Laboratory Accreditation Program (NELAP), ISO 17025, the Department of Defense Environmental Laboratory Approval Program (DOD ELAP) and other National environmental monitoring programs. The plan establishes the framework for documenting the requirements of the quality processes regularly practiced by the Laboratory. The Quality Assurance (QA) Director is responsible for changes to the Quality Assurance Program, which is appended to the Quality System Manual (QSM) during the annual program review. The plan is also reviewed annually for compliance purposes by the Vice President (VP) for the Environment, Health & Safety (EHS) division of SGS North America Inc. and by the Laboratory Director, and edited if necessary. Changes that are incorporated into the plan are itemized in a summary of changes following the introduction. Plan changes are communicated to the general staff in a meeting conducted by the QA Director following the plan's approval.

The SGS plan is supported by standard operating procedures (SOPs), which provide specific operational instructions on the execution of each quality element and assure that compliance with the requirements of the plan are achieved. SGS employees are responsible for knowing the requirements of the SOPs and applying them in the daily execution of their duties. These documents are updated as changes occur and the staff is trained to apply the changes.

At SGS, we believe that satisfying client requirements and providing a product that meets or exceeds the standards of the industry is the key to a good business relationship. However, client satisfaction cannot be guaranteed unless there is a system that assures the product consistently meets its design requirements and is adequately documented to assure that all procedural steps are executed, properly documented and traceable.

This plan has been designed to assure that this goal is consistently achieved and the SGS product withstands the rigors of scrutiny that are routinely applied to analytical data and the processes that support its generation.

Summary of Changes

Section	Page(s)	Description
Title Page	1	Update legal name to SGS North America Inc.
Introduction	2	Update legal name to SGS North America Inc.
Organization	8	Update QA organization chart

Table of Contents

1.0 QUALITY POLICY

1.1 ***SGS Mission***:

SGS provides analytical services to commercial and government clients in support of environmental monitoring and remedial activities as requested. The Laboratory's mission is dedicated to providing reliable data that satisfies client's requirements as explained in the following:

"Provide easy access, high quality, analytical support to commercial and government clients which meets or exceeds data quality objectives and provides them with the data needed to satisfy regulatory requirements and/or make confident decisions on the effectiveness of remedial activities."

These services are provided impartially and are not influenced by undue commercial or financial pressures which might impact the staff's technical judgment. Consequently, SGS does not engage in activities that endanger the trust in our independent judgment and integrity in relation to the testing activities performed.

1.2 ***Policy Statement***:

The management and staff of SGS share the responsibility for product quality and the commitment to the continual improvement of the quality system. Accordingly, SGS's quality assurance program is designed to assure that all processes and procedures, which are components of environmental data production, meet established industry requirements, are adequately documented from a procedural and data traceability perspective, and are consistently executed by the staff. It also assures that analytical data of known quality, meeting the quality objectives of the analytical method in use and the data user's requirements, is consistently produced in the laboratory. This assurance enables the data user to make rational, confident, cost-effective decisions on the assessment and resolution of environmental issues.

The laboratory Quality System also provides the management staff with data quality and operational feedback information. This enables them to determine if the laboratory is achieving the established quality and operational standards, which are dictated by the client or established by regulation. The information provided to management, through the QA program, is used to assess operational performance from a quality perspective and to perform corrective action as necessary.

All employees of SGS participating in environmental testing receive quality system training and are responsible for knowing and complying with the system requirements. The entire staff shares SGS's commitment to good professional practice.

Chris Gudz

Vice President EHS	12/8/17 Date

2.0 ORGANIZATION

2.1 ***Organizational Entity***. SGS - Dayton is the New Jersey division of SGS North America Inc., which is part of the multi-national SGS S.A., based in Geneva, Switzerland. The facility is located in Dayton, New Jersey where it has conducted business since 1987. Satellite laboratories are maintained in Marlborough, Massachusetts; Orlando, Florida; Houston, Texas; Wheat Ridge, Colorado; and Scott, Louisiana.

2.2 ***Management Responsibilities***

Requirement: Each laboratory facility has an established chain of command. The duties and responsibilities of the management staff are linked to the Operations Council and the Chief Executive Officer of SGS S.A. who establishes the agenda for all company activities.

Managing Director. Oversees all business operations for the SGS network in North America. Reports to the Chief Operating Officer for SGS North America Inc.

Vice President EHS. Primary responsibility for all operations and business activities. Delegates authority to laboratory directors, general managers, and the quality assurance director to conduct day to day operations and execute quality assurance duties. Reports to the Managing Director of North America.

Laboratory Director. Executes day to day responsibility for laboratory operations including technical aspects of production activities and associated logistical procedures. Reports directly to the VP EHS.

Quality Assurance Director. Design, oversight, and facilitation responsibility for all quality system elements identified in the quality program. Reports directly to the VP EHS.

Technical Directors (Organics/Inorganic). Responsible for day to day operations and activities of the organics and inorganics laboratories including scheduling, production and data quality. Report directly to the Laboratory Director.

Quality Assurance Manager. Responsible for ensuring that the management system related to Quality is implemented and followed at all times. Reports directly to the QA Director.

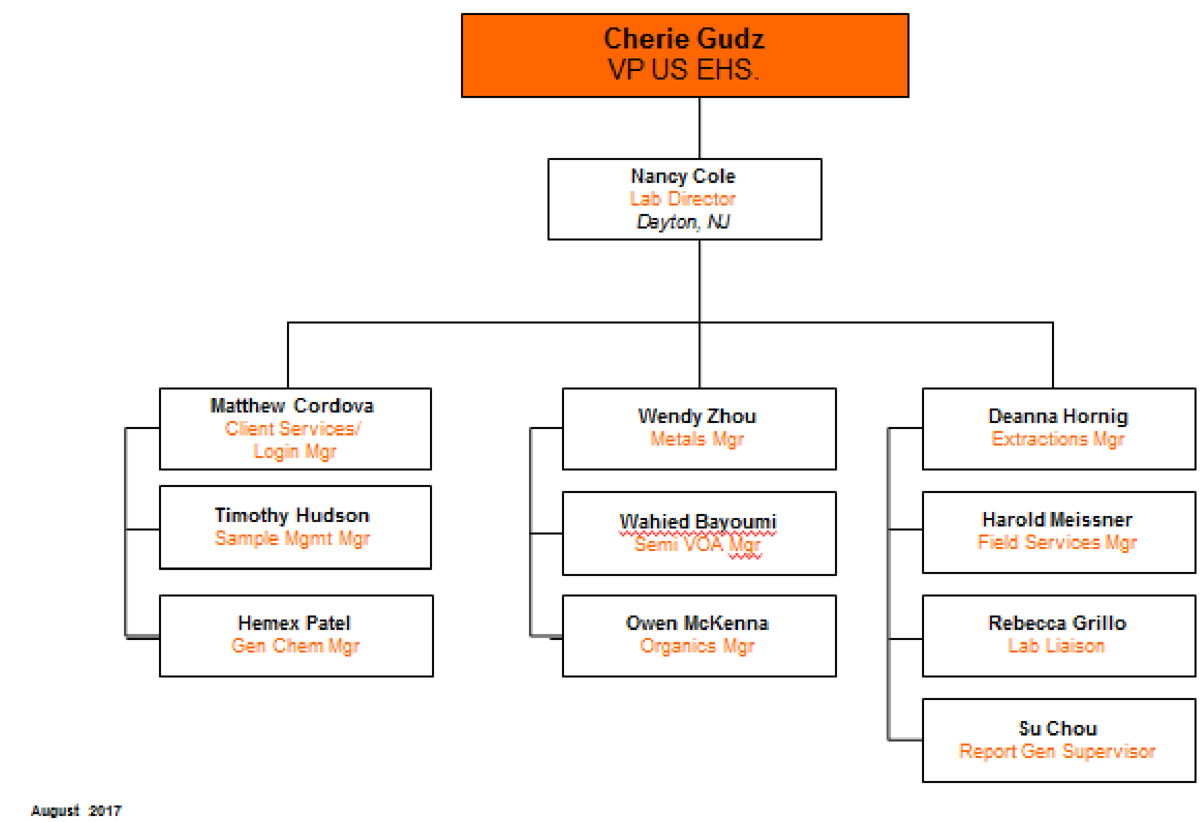
Department Managers. Execute day to day responsibility for specific laboratory areas including technical aspects of production activities and associated logistical procedures. Report directly to the Laboratory Director.

Section Supervisors. Execute day to day responsibility for specific laboratory units including technical aspects of production activities and associated logistical procedures. Report directly to the respective Department Manager.

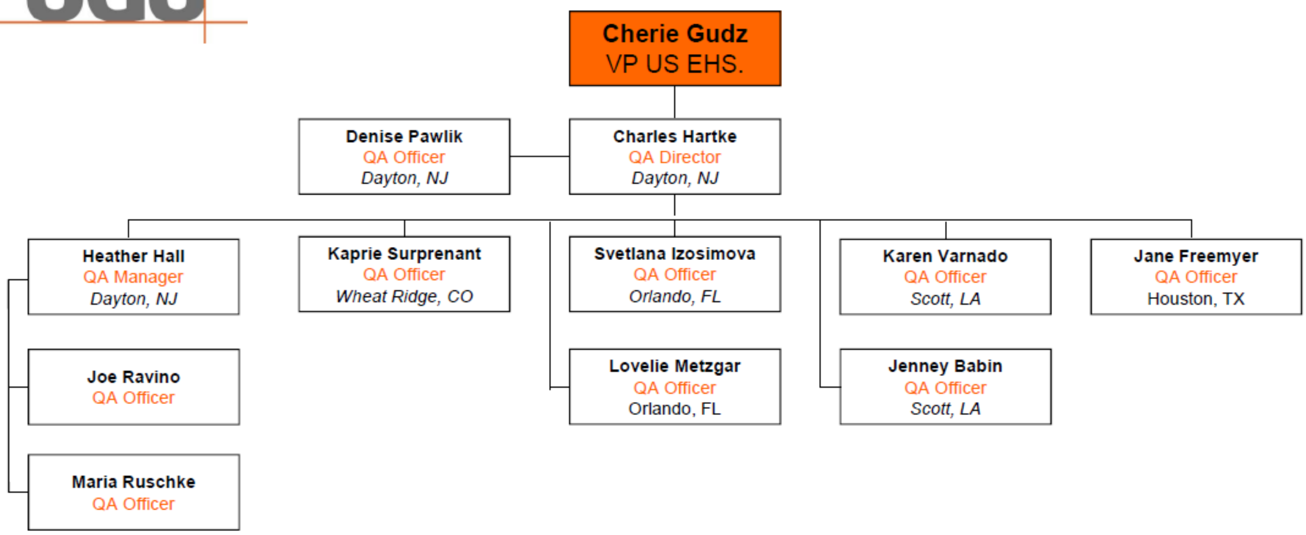
2.3 *Organization Chart*

The hierarchy of the Company's operational control and oversight is illustrated in the SGS Organization Chart. Appointed deputies are listed in Form QA073. In the event that the technical director or quality assurance manager are absent from their respective position for a period of time exceeding fifteen (15) consecutive calendar days. If this absence exceeds thirty-five (35) consecutive calendar days, the laboratory shall notify the New Jersey Department of Environmental Protection (NJDEP)-Office of Quality Assurance and the Department of Defense Environmental Laboratory Accreditation Program (DOD ELAP) accrediting body (ANAB) in writing.

Dayton Laboratory Management Team



SGS EHS Quality Assurance Team



December 2017

3.0 QUALITY RESPONSIBILITIES OF THE MANAGEMENT TEAM

3.1 ***Requirement***: Each member of the management team has a defined responsibility for the Quality System. System implementation and operation is designated as an operational management responsibility. System design and implementation is designated as a Quality Assurance Responsibility.

Vice President EHS. Primarily responsible for process improvements to all business aspects of the company.

Laboratory Director. Responsible for implementing and operating the Quality System in all laboratory areas. Responsible for the design and implementation of corrective action for defective processes. Has the authority to delegate Quality System implementation responsibilities.

Quality Assurance Director. Responsible for design, implementation support, training, and monitoring of the quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if quality issues warrant immediate action. Monitors implemented corrective actions for compliance.

Technical Directors. Responsible for overseeing the technical aspects of the quality assurance system as they are integrated into method applications and employed to assess analytical control on a daily basis. The Technical Directors review and acknowledge the technical feasibility of proposed quality assurance systems involving technical applications of applied methodology.

Department Managers. Responsible for applying the requirements of the Quality System in their section and assuring subordinate supervisors and staff apply all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Section Supervisors & Team Leaders. Responsible for applying the requirements of the Quality System to their operation and assuring the staff applies all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Quality Assurance Manager. Responsible for management of the Quality department and oversight of all Quality Assurance and Quality Control aspects at the Dayton location. Evaluates data objectively and performs assessments without outside influences. Empowered with the authority to halt production if quality issues warrant immediate action. Monitors implemented corrective actions for compliance. Serves as the primary backup in the absence of the Quality Assurance Director.

Quality Assurance Officers. Responsible for design support, implementation support, training, and monitoring support for the quality system. Conducts audits and product reviews to identify product, process, or operational defects using statistical monitoring tools. Provides support for implemented corrective actions for compliance.

Bench Analysts. Responsible for applying the requirements of the Quality System to the analyses they perform, evaluating QC data and initiating corrective action for quality control deficiencies within their control. Implements global corrective action as directed by superiors.

3.2 ***Data Integrity Policy***: The SGS's Data Integrity Policy reflects a comprehensive, systematic approach for assuring that data produced by the laboratory accurately reflects the outcome of the tests performed on field samples and has been produced in a bias free environment by ethical professionals. The policy includes a commitment to technical ethics, staff training in ethics and data integrity, an individual attestation to data integrity and procedures for evaluating data integrity. Senior management assumes the responsibility for assuring compliance with all technical ethics elements and operation of all data integrity procedures. The staff is responsible for compliance with the ethical code of conduct and for practicing data integrity procedures.

The SGS Data Integrity Policy is as follows:

"SGS is committed to producing data that meets the data integrity requirements of the environmental regulatory community. This commitment is demonstrated through the application of a comprehensive data integrity program that includes ethics and data integrity training, data integrity evaluation procedures, staff participation and management oversight. Adherence to the specifications of the program assures that data provided to our clients is of the highest possible integrity and can be used for decision making processes with high confidence."

Data Integrity Responsibilities

Management. Senior management retains oversight responsibility for the data integrity program and retains ultimate responsibility for execution of the data integrity program elements. Senior management is responsible for providing the resources required to conduct ethics training and operate data integrity evaluation procedures. They also include responsibility for creating an environment of trust among the staff and being the lead advocate for promoting the data integrity policy and the importance of technical ethics. The QA Director is the designated ethics officer for the Laboratory. Additionally, SGS Group has an Integrity Hotline (ph: +1 888 475 6847 or compliance@sgs.com) accessible 24/7 which staff and clients may use to contact SGS's Chief Compliance Officer in Geneva.

Staff. The staff is responsible for adhering to the company ethics policy as they perform their duties and responsibilities associated with sample analysis and reporting. By executing this responsibility, data produced by SGS retains its high integrity characteristics and withstands the rigors of all data integrity checks.

The staff is also responsible for adhering to all laboratory requirements pertaining to manual data edits, data transcription and data traceability. These include the application of approved manual peak integration and documentation procedures. It also includes establishing traceability for all manual results calculations and data edits.

Ethics Statement. The SGS ethics statement reflects the standards that are expected for businesses that provide environmental services to regulated entities and regulatory agencies on a commercial basis. The Ethics Statement is comprised of key elements that are essential to organizations that perform chemical analysis for a fee. As such, it focuses on elements related to personal, technical and business activities.

SGS provides analytical chemistry services on environmental matters to the regulated community. The data the company produces provides the foundation for determining the risk presented by a chemical pollutant to human health and the environment. The environmental industry is dependent upon the accurate portrayal of environmental chemistry data. This process is reliant upon a high level of scientific and personal ethics.

It is essential to the Company that each employee understands the ethical and quality standards required to work in this industry. Accordingly, SGS has adopted a code of ethics, which each employee is expected to adhere to as follows:

- Perform chemical and microbiological analysis using acceptable scientific practices and principles.
- Perform tasks in an honest, principled and incorruptible manner inspiring peers & subordinates.
- Maintain professional integrity as an individual.
- Provide services in a confidential, honest, and forthright manner.
- Produce results that are accurate and defensible.
- Report data without any consideration of self-interest.
- Comply with all pertinent laws and regulations associated with assigned tasks and responsibilities.

Data Integrity Procedures. Four key elements comprise the SGS data integrity system. Procedures have been implemented for conducting data integrity training and for documenting that employees conform to the SGS Data Integrity and Ethics policy.

The data integrity program consists of routine data integrity evaluation and documentation procedures to periodically monitor and document data integrity. These procedures are documented as SOPs. SOPs are approved and reviewed annually following the procedures employed for all SGS SOPs. Documentation associated with data integrity evaluations is maintained on file and is available for review.

Data Integrity Training. SGS employees receive technical ethics training during new employee orientation. Employees are also required to refresh their ethical conduct agreement annually, which verifies their understanding of SGS ethics policy and their ethical responsibilities. A brochure summarizing the details of the SGS Data Integrity Policy is distributed to all employees with the Ethical Conduct Agreement. The refreshed agreement is appended to each individual's training file.

The training focuses on the reasons for technical ethics training, explains the impact of data fraud on human health and the environment, and illustrates the consequences of criminal fraud on businesses and individual careers. SGS ethics policy and code of ethics are reviewed and explained for each new employee.

Training on data integrity procedures are conducted by individual departments for groups involved in data operations. These include procedures for manual chromatographic peak integration, traceability for manual calculations and data transcription.

Data Integrity Training Documentation. Records of all data integrity training are maintained in individual training folders. Attendance at all training sessions is documented and maintained in the training archive.

SGS Data Integrity and Ethical Conduct Agreement. All employees are required to sign a Data Integrity and Ethical Conduct Agreement annually. This document is archived in individual training files, which are retained for duration of employment.

The Data Integrity and Ethical Conduct Agreement are as follows**:**

I. *I understand the high ethical standards required of me with regard to the duties I perform and the data I report in connection with my employment at SGS.*

II. *I have received formal instruction on the code of ethics that has been adapted by SGS during my orientation and agree to comply with these requirements.*

III. *I have received formal instruction on the elements of SGS Data Integrity Policy and have been informed of the following specific procedures:*

   a. *Formal procedures for the confidential reporting of data integrity issues are available, which can be used by any employee,*

b. *A data integrity investigation is conducted when data issues are identified that may negatively impact data integrity.*

c. *Routine data integrity monitoring is conducted on sample data, which may include an evaluation of the data I produce,*

IV. *I have read the brochure detailing SGS Data Integrity and Ethics Program as required.*

V. *I am aware that data fraud is a punishable crime that may include fines and/or imprisonment upon conviction.*

VI. *I also agree to the following:*

a. *I shall not intentionally report data values, which are not the actual values observed or measured.*

b. *I shall not intentionally modify data values unless the modification can be technically justified through a measurable analytical process.*

c. *I shall not intentionally report dates and times of data analysis that are not the true and actual times the data analysis was conducted.*

d. *I shall not condone any accidental or intentional reporting of inauthentic data by other employees and immediately report its occurrence to my superiors.*

e. *I shall immediately report any accidental reporting of inauthentic data by myself to my superiors.*

Data Integrity Monitoring. Documented procedures are employed for performing data integrity monitoring. These include regular data review procedures by supervisory and management staff (Section 12.7), supervisory review and approval of manual integrations and periodic reviews of GALP audit trails from the LIMS and all computer controlled analysis.

Data Review. All data produced by the laboratory undergoes at least two levels of review the final review must be performed by a manager, supervisor or designated reviewer. Detected data anomalies that appear to be related to data integrity issues are isolated for further investigation. The investigation is conducted following the procedures described in this section.

Manual Peak Integration Review and Approval. Routine data review procedures for all chromatographic processes includes a review of all manual chromatographic peak integrations. This review is performed by the management staff and consists of a review of the machine integration compared to the manual integration. Manual integrations, which have been performed in accordance with SGS manual peak integration procedures, are approved for further processing and release. Identification of samples and analytes in which manual integration had been necessary may be recorded in a report case narrative specific to a particular client and project requirement.

Manual integrations which are not performed to SGS specifications are set aside for corrective action, which may include analyst retraining or further investigation as necessary.

Data Integrity Review. Data integrity audits are comprehensive data package audits that include a review of raw data, process logbooks, processed data reports and GALP audit trails from individual instruments and LIMS. GALP audit trails, which record all electronic data activities, are available for the majority of computerized methodology and the laboratory information management system (LIMS). These audit trails are periodically reviewed to determine if interventions performed by technical staff constitute an appropriate action. The review is performed on a recently completed job and may include interviews with the staff who performed the analysis. Findings indicative of inappropriate interventions or data integrity issues are investigated to determine the cause and the extent of the anomaly.

Confidential Reporting of Data Integrity Issues. Data integrity concerns may be raised by any individual to their supervisor. Employees with data integrity concerns should always discuss those concerns with their immediate supervisors as a first step unless the employee is concerned with the confidentiality of disclosing data integrity issues or is uncomfortable discussing the issue with their immediate supervisors. The supervisor makes an initial assessment of the situation to determine if the concern is related to a data integrity violation. Those issues that appear to be violations are documented by the supervisor and referred to the QA Director for investigation.

Documented procedures for the confidential reporting of data integrity issues in the laboratory are part of the data integrity policy. These procedures assure that laboratory staff can privately discuss ethical issues or report items of ethical concern without fears of repercussions with senior staff.

Employees with data integrity concerns that they consider to be confidential are directed to the Corporate Human Resources Manager in Dayton, New Jersey. The HR Manager acts as a conduit to arrange a private discussion between the employee and the Corporate QA Director or a local QA Officer.

During the employee - QA discussion, the QA representative evaluates the situation presented by the employee to determine if the issue is a data integrity concern or a legitimate practice. If the practice is legitimate, the QA representative clarifies the process for the employee to assure understanding. If the situation appears to be a data integrity concern, the QA representative initiates a Data Integrity Investigation following the procedures specified in SOP EQA059.

Data Integrity Investigations. Follow-up investigations are conducted for all reported instances of ethical concern related to data integrity. Investigations are performed in a confidential manner by senior management according to a documented procedure. The outcome of the investigation is documented and reported to the company Vice President EHS who has the ultimate responsibility for determining the final course of action in the matter. Investigation documentation includes corrective action records, client notification information and disciplinary action outcomes, which is archived for a period of five years.

The investigations are conducted by the senior staff and supervisory personnel from the affected area. The investigations team includes the Laboratory Director and the QA Director. Investigations are conducted in a confidential manner until it is completed and resolved.

The investigation includes a review of the primary information in question by the investigations team. The team performs a review of associated data and similar historical data to determine if patterns exist. Interviews are conducted with key staff to determine the reasons for the observed practices.

Following data compilation, the investigations team reviews all information to formulate a consensus conclusion. The investigation results are documented along with the recommended course of action.

Corrective Action, Client Notification & Discipline. Investigations that reveal systematic data integrity issues will be referred for corrective action, resolution and disposition (Section 13). If the investigation indicates that an impact to data has occurred and the defective data has been released to clients, notification procedures will be initiated following the steps in Section 13.2.

In all cases of data integrity violations, some level of disciplinary action will be conducted on the responsible individual. The level of discipline will be consistent with the violation and may range from retraining and/or verbal reprimand to termination. A zero tolerance policy is in effect for unethical actions.

4.0 JOB DESCRIPTIONS OF KEY STAFF

4.1 ***Requirement***: Descriptions of key positions within the organization are defined to ensure that clients and staff understand duties and the responsibilities of the management staff and the reporting relationships between positions.

Vice President EHS. Responsible for overall process improvement for all business processes. Is also responsible for Quality Assurance, IT Development and Health and Safety. Reports directly to the Managing Director for SGS US operations.

Laboratory Director (also Inorganics Technical Director). Reports to the Vice President EHS. Establishes laboratory operations strategy. Direct supervision of client services, organic chemistry, inorganic chemistry, field services, and sample management. Maintains operational responsibility for the designated regional laboratories as defined in the SGS Organization Chart.

Director, Quality Assurance. Reports to the company Vice President EHS and functions independently from laboratory operations. Establishes the company quality agenda, develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities, monitors the quality system, and provides quality system feedback to management to be used for process improvement.

Manager, Quality Assurance. Reports to the QA Director. Manages quality assurance and quality control functions. Conducts internal audits and prepares reports for management review. Oversees proficiency testing program. Responsible for quality oversight at the Dayton location.

Manager, Client Services. Reports to the Laboratory Director. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

Manager, Volatiles (Organics Technical Director). Reports to the Laboratory Director. Directs the operations of the organics group, consisting of organics preparation and instrumental analysis. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition.

Manager, Semi VOA. Reports to the Lab Director. Expedites the analysis of samples and sample extracts. Executes daily analysis schedule. Supervises the analysis of samples for organic parameters using valid, documented methodology. Documents all data and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

Manager, General Chemistry. Reports to the Lab Director. Executes daily analysis schedule. Supervises the analysis of samples for wet chemistry parameters using valid, documented methodology. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

Manager, Metals. Reports to the Lab Director. Executes daily analysis schedule. Supervises the analysis of samples for metallic elements using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

Manager, Organic Preparation. Reports to the Lab Director. Executes the daily sample preparation schedule. Performs the extract of multi-media samples for organic constituents using valid, documented methodology. Prepares documentation for extracted samples. Assumes custody until transfer for analysis.

Manager, Field Services. Reports to the Laboratory Director. Conducts field sampling and analysis of "analyze immediately" parameters in support of ongoing field projects. Responsible for proper collection, preservation, documentation and shipment of field samples. Maintains field sampling and field instrumentation required to perform primary responsibilities.

Manager, Sample Management. Reports to the Laboratory Director. Develops, maintains and executes all procedures required for receipt of samples, verification of preservation, and chain of custody documentation. Responsible for maintaining and documenting secure storage, delivery of samples to laboratory units on request and courier services.

Manager, Health, Safety & Environment. Reports to the Vice President EHS. Responsible for developing company safety program and chemical hygiene plan. Reviews and updates these plans annually. Responsible for employee training on relevant health and safety topics. Documents employee training. Manages laboratory waste management program.

Technical Support Supervisor, Organics. Reports to the Volatiles Manager. Oversees instrument maintenance and new equipment installation. Conducts method development and implementation tasks.

Supervisor, Report Generation. Reports to the Lab Director. Compiles raw and processed sample data and assembles into client-ready reports. Initiates report scanning for archiving purposes. Maintains raw batch data in accessible storage. Mails completed reports to clients according to specified report turnaround schedule.

Quality Assurance Officers. Report to the Quality Assurance Manager. Perform quality control data review for trend monitoring purposes. Conduct internal audits and prepare reports for management review. Oversee proficiency testing program. Process quality control data for statistical purposes.

4.2 ***Employee Screening, Orientation, and Training***.

All potential laboratory employees are screened and interviewed by human resources and technical staff prior to their hire. The pre-screen process includes a review of their qualifications including education, training and work experience to verify that they have adequate skills to perform the tasks of the job.

Newly hired employees receive orientation training beginning the first day of employment by the Company. Orientation training consists of initial health and safety training including general laboratory safety, personal protection and building evacuation. Orientation also includes quality assurance program training, data integrity training, and an overview of the Company's goals, objectives, mission, and vision.

All technical staff receives training to develop and demonstrate proficiency for the methods they perform. New analysts work under supervision until the supervisory staff is satisfied that a thorough understanding of the method is apparent and method proficiency has been demonstrated, through a precision and accuracy study that has been documented, reviewed and approved by the QA Staff. Data from the study is compared to method acceptance limits. If the data is unacceptable, additional training is required. The analyst may also demonstrate proficiency by producing acceptable data through the analysis of an independently prepared proficiency sample.

Individual proficiency is demonstrated annually for each method performed. Data from initial and continuing proficiency demonstrations are archived in the individual's training folder.

4.3 ***Training Documentation***. The human resources department prepares a training file for every new employee. All information related to qualifications, experience, external training courses, and education are placed into the file. Verification documentation for orientation, health & safety, quality assurance, and ethics training is also included in the file.

Additional training documentation is added to the file as it is developed. This includes documentation of SOP understanding, data for initial and continuing demonstrations of proficiency, performance evaluation study data and notes and attendance lists from group training sessions.

The Quality Assurance Department maintains the employee training database. This database is a comprehensive inventory of training documentation for each individual employee. The database enables supervisors to obtain current status information on training data for individual employees on a job specific basis. It also enables the management staff to identify training documentation in need of completion.

Employee specific database records are created by human resources on the date of hire. Data base fields for job specific requirements such as SOP documentation of understanding and annual demonstration of analytical capability are automatically generated when the supervisor assigns a job responsibility. Employees acknowledge that their SOP responsibilities have been satisfied using a secure electronic process which updates the database record. Reports are produced which summarize the qualifications of individual employees or departments.

5.0 SIGNATORY APPROVALS

Requirement: Procedures have been developed for establishing the traceability of data and documents. The procedure consists of a signature hierarchy, indicating levels of authorization for signature approvals of data and information within the organization. Signature authority is granted for approval of specific actions based on positional hierarchy within the organization and knowledge of the operation that requires signature approval. SOP EQA032 Signature Authority explains the process of SGS Signature Authority and the use of electronic signatures in the laboratory. A log of signatures and initials of all employees is maintained by the QA Staff for cross-referencing purposes.

5.1 ***Signature Hierarchy***.

Vice President EHS. Approval of quality assurance policy in lieu of the Director, Quality Assurance.

Laboratory Director. Approval of final reports. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. Establishes and implements technical policy.

Director, Quality Assurance. Approval of quality assurance policy in the absence of the Vice President EHS. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers.

Manager, Client Services. QAP and sampling and analysis plan approval. Project specific contracts, pricing, and price modification agreements. Approval and acceptance of incoming work, Client Services policy.

Managers, Technical Departments. Methodology and department specific QAPs. Data review and approval, department specific supplies purchase. Technical approval of SOPs.

Manager, Sample Management. Initiation of laboratory sample custody and acceptance of all samples. Approval of department policies and procedures. Department specific supplies purchase.

Manager, Health, Safety & Environment. Approval of health and safety policy in the absence of the Vice President EHS. Approval of health and safety SOPs. Waste manifesting and approval.

Assistant Managers: Technical Departments. Data review approval, purchasing of expendable supplies.

Supervisor, Field Services. Sampling plan design and approval. Data review for field parameters. State form certification. Department policies and procedures. Department specific supplies purchase.

Supervisors, Technical Departments. Data review approval, purchasing of expendable supplies.

5.2 ***Signature Requirements***. All laboratory activities related to sample custody and generation or release of data must be approved using either initials, signatures or electronic, password protected procedures. The individual, who applies his signature initial or password to an activity or document, is authorized to do so within the limits assigned to them by their supervisor. All written signatures and initials must be applied in a readable format that can be cross-referenced to the signatures and initials log if necessary.

5.3 ***Signature and Initials Log***. The QA group maintains a signature and initials log. New employee signatures and initials are appended to the log on the first day of employment. Signature of individuals no longer employed by the company are retained, but annotated with their date of termination.

5.4 ***Electronic Signature Log.*** Key technical staff will sign a liability document for their signatures designating the use of their electronic signatures on an annual basis. Quality Assurance team keeps a wet copy of these signatures on form QA115.

6.0 DOCUMENTATION & DOCUMENT CONTROL

Requirement: Document control policies have been established which specify that any document used as an information source or for recording analytical or quality control information must be managed using defined document control procedures. Accordingly, policies and procedures required for the control, protection, and storage of any information related to the production of analytical data and the operation of the quality system to assure its integrity and traceability have been established and implemented in the laboratory. The system contains sufficient controls for managing, archiving and reconstructing all process steps which contributed to the generation of an analytical test result. Using this system, an audit trail for reported data can be produced, establishing complete traceability for the result.

6.1 ***Administrative Records***. Administrative (non-analytical) records are managed by the quality assurance department. These records consist of electronic documents which are retained in a limited access electronic directory or paper documents, which are released to the technical staff upon specific request.

Form Generation, Modification & Control. The quality assurance group approves and manages all forms used as either stand-alone documents or in logbooks to ensure their traceability. Forms are generated as computer files only and are maintained in a limited access master directory. The QA staff also manages and approves modifications to existing forms. Obsolete editions of modified forms are retained for seven years.

Approved forms are assigned a 5-character alphanumeric code. The first two alpha characters designate the department that uses the form; the next three digits are sequentially assigned number.

New forms must include the name SGS and appropriate spaces for signatures of approval and dates. Further design specifications are the responsibility of the originating department.

The technical staff is required to complete all forms to the maximum extent possible. If information for a specific item is unavailable, the analyst is required to "Z" the information block. The staff is also required to "Z" the uncompleted portions of a logbook or logbook form if the day's analysis does not fill the entire page of the form.

Logbook Control. All laboratory logbooks are controlled documents that are comprised of approved forms used to document specific processes. New logs are numbered and issued to a specific individual who is assigned responsibility for the log. Old logs are returned to QA for entry into the document archive system where they are retained for seven (7) years. Laboratory staff may hold a maximum of two consecutively dated logbooks of the same type in the laboratory including the most recently issued book to simplify review of recently completed analysis. The Organic prep department maintains multiple active copies of prep logbooks to facilitate production.

Controlled Documents. Key laboratory documents that are distributed internally and externally are numbered for tracking purposes. Individuals receiving documents, who must be informed when changes occur, receive controlled copies of those documents. Controlled status simplifies document updates and retrieval of outdated documents. Control is maintained through a document numbering procedure and document control logbook which identifies the individual receiving the controlled document and the date of receipt. Key documents are also distributed as uncontrolled documents if the recipient does not require updated copies when changes occur. Key documents in uncontrolled status are numbered and tracked using the same procedures as controlled documents.

Quality Systems Manual (QSM). All QSMs are assigned a number prior to distribution. The number, date of distribution, and identity of the individual receiving the document are recorded in the document control logbook. The numbering system is restarted with each new volume, which corresponds to the annual revision of the QSM. Electronic versions are distributed as PDF files.

Standard Operating Procedures (SOPs). SOPs are maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory. Official documents are copied to green paper and placed into the appropriate laboratory section as follows:

Administrative: One master copy for the administrative file.

Sample Management: One controlled green copy for the sample management file.

Organics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the organics laboratory file.

Inorganics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the inorganics laboratory file.

Field Services: One controlled green copy for each field sampling team (generally a single field technician).

The original, signed copy of the SOP is maintained in the master SOP binder by the QA staff. The QA staff collects outdated versions of SOPs as they are replaced and archived for a period of seven (7) years in the QA archives. Electronic versions of outdated SOPs are moved from the active SOP directory to the inactive directory.

6.2 ***Technical Records***. All records related to the analysis of samples and the production of an analytical result are archived in secure document storage or on electronic media and contain sufficient detail to produce an audit trail which re-creates the analytical result. These records include information related to the original client request, bottle order, sample login and custody, storage, sample preparation, analysis, data review and data reporting.

Each department involved in this process maintains controlled documents which enable them to maintain records of critical information relevant to their department's process.

6.3 ***Quality Control Support Data & Records***. All information and data related to the quality system is stored in a restricted access directory on the network server. Information on this directory is backed-up daily. Users of the quality assurance information and data have "read-only" access to the files contained in the directory. The QA staff and the laboratory director have write capability in this directory.

This directory contains all current and archived quality system manuals, SOPs, control limits, MDL studies, precision and accuracy data, official forms, internal audit reports, proficiency test scores and metrics calibration information.

The following information is retained in the directory:

Quality System Manuals
Standard Operating Procedures
ASTM & NIST Methods
Bottleware & Preservative QC Data
Certification Documentation
Change Management Data
External Audit Reports
Internal Audit Reports
Corrective Action Database
Laboratory Forms Directory
Health & Safety Manuals
Inactive Standard Operating Procedures
Method Detection Limit Data
Metrics Inventory & Calibration Data
Performance Limits
Proficiency Test Scores & Statistics
Project Specific Analytical Requirements
QC Report Reviews
Regulatory Agency Quality Documents
Staff Bios And Job Descriptions
State Specific Methods

6.4 ***Analytical Records***. All data related to the analysis of field samples are retained as either paper or electronic records that can be retrieved to compile a traceable audit trail for any reported result. All information is linked to the client job and sample number, which serves as a reference for all sample related information tracking.

Critical times in the life of the sample from collection through analysis to disposal are documented. This includes date and time of collection, receipt by the laboratory, preparation times and dates, analysis times and dates and data reporting information. Analysis times are calculated in hours and minutes.

Sample preparation information is recorded in a separate controlled logbook. It includes sample identification numbers, types of analysis, preparation and cleanup methods, sample weights and volumes, reagent lot numbers and volumes and any other information pertinent to the preparation procedure.

Information related to the identification of the instrument used for analysis is permanently attached to the electronic record. The record includes an electronic data file that indicates all instrument conditions employed for the analysis, including the type of analysis conducted. The analyst's identification is electronically attached to the record. The instrument tuning and calibration data is electronically linked to the sample or linked though paper logs which were used in the documentation of the analysis. Quality control and performance criteria are permanently linked to the paper archive or electronic file.
Paper records for the identity, receipt, preparation and evaluation of all standards and reagents used in the analysis are documented in prepared records and maintained in controlled documents or files. Lot number information linking these materials to the analysis performed is recorded in the logbooks associated with the samples in which they were used.

Manual calculations or peak integrations that were performed during the data review are retained as paper or scanned documents and included as part of the electronic archive. Signatures for data review are retained on paper or as scanned versions of the paper record for the permanent electronic file.

6.5 ***Confidential Business Information (CBI).*** Operational documents including SOPs, Quality Manuals, personnel information, internal operations statistics, and laboratory audit reports are considered confidential business information. Strict controls are placed on the release of this information to outside parties.

Release of CBI to outside parties or organizations may be authorized upon execution of a confidentiality agreement between SGS and the receiving organization or individual. CBI information release is authorized for third party auditors and commercial clients in electronic mode as Adobe Acrobat PDF format only.

6.6 ***Software Change Documentation & Control.*** Changes to software are documented as text within the code of the program undergoing change. Documentation includes a description of the change, reason for change and the date the change was placed into effect. Documentation indicating the adequacy of the change is prepared following the evaluation by the user who requested the change.

6.7 ***Report and Data Archiving***. SGS produces digital files of all raw and processed data which is maintained for a minimum period of seven (7) years. The archived files consist of all raw data files and source documents associated with the analysis of field samples and proficiency test samples. Data files and source documents associated with method calibration and project and method quality control are also archived. After seven years, the files may be discarded unless contractual arrangements exist which dictate different requirements. Client or regulatory agency specific data retention practices are employed for several government organizations such as the Department of Defense and the Massachusetts Department of Environmental Protection that require a retention period of ten (10) years. Data archiving may also be extended up to ten (10) years for specific commercial clients in response to contractual requirements.

Complete date and time stamped PDF reports are generated automatically from the laboratory information management system (LIMS) using the source documents archived on the document server. These source documents are maintained on a document server and archived to primary and clone tapes. The primary tapes remain on premises while the clone tapes are taken to a secure offsite location for permanent storage. Both the primary and clone tapes remain in storage for the remainder of the archive period.

6.8 ***Training***. The company maintains a training record for all employees that documents that they have received instruction on administrative and technical tasks that are required for the job they perform. Training records for individuals employed by the company are retained for a period of six months following their termination of employment.

Training File Origination. The QA department initiates training files for each employee. QA Officers retain the responsibility for the maintenance and tracking of all training related documentation in the file. The file is begun on the first day of employment. Information required for the file includes a copy of the individual's most current resume, detailing work experience and a copy of any college diplomas and transcript(s). Information added on the first day includes documentation of health and safety training, quality assurance training and a signed data integrity training and ethical conduct agreement.

Training documentation, training requirements, analyst proficiency information and other training related support documentation is tracked using a customized database application (Section 4.3). Database extracts provide an itemized listing of specific training requirements by job function. Training status summaries for individual analysts portray dates of completion for job specific training requirements.

6.9 ***Technical Training***. The supervisor of each new employee is responsible for developing a training plan for each new employee. The supervisor evaluates the employees training progress at regular frequencies. Supporting documentation, including demonstration of capability and precision and accuracy studies, which demonstrate an analyst's proficiency for a specific test, are added to the training file as completed. Employees and supervisors verify documentation of understanding (DOU) for all assigned standard operating procedures in the training database. Certificates or diplomas for any off-site training are also added to the file.

7.0 REFERENCE STANDARD TRACEABILITY

Requirement: Documented procedures, which establish traceability between any measured value and a national reference standard, are established by the laboratory as required. All metric measurements are traceable to NIST reference weights or thermometers that are calibrated on a regular schedule. All chemicals used for calibration of a quantitative process are traceable to an NIST reference that is documented by the vendor using a certificate of traceability. The laboratory maintains a documentation system that establishes the traceability links. The procedures for verifying and documenting traceability are documented in standard operating procedures.

7.1 ***Traceability of Metric Measurements - Thermometers***. SGS uses NIST thermometers to calibrate commercially purchased thermometers prior to their use in the laboratory and annually thereafter for liquid in glass thermometers or quarterly for electronic temperature measuring devices. If necessary, thermometers are assigned correction factors that are determined during their calibration using an NIST thermometer as the standard. The correction factor is documented in a thermometer calibration database and on a tag attached to the thermometer. The correction factor is applied to temperature measurements before recording the measurement in the temperature log. Calibration of each thermometer is verified and documented on a regular schedule. The NIST thermometer is checked for accuracy by an ISO 17025 approved vendor every five (5) years following the specifications for NIST thermometer calibration verification detailed in the United States Environmental Protection Agency's "Manual for the Certification of Laboratories Analyzing Drinking Water", Fifth Edition, February2005.

7.2 ***Traceability of Metric Measurements – Calibration Weights***. SGS uses calibrated weights, which are traceable to NIST standard weights to calibrate all balances used in the laboratory. Balances are calibrated to specific tolerances within the intended use range of the balance. Calibration checks are required on each day of use. If the tolerance criteria are not achieved, corrective action specified in the balance calibration SOP is applied before the balance can be used for laboratory measurements. Recalibration of all calibration weights is conducted and documented on a biannual basis.

7.3 ***Traceability of Chemical Standards***. All chemicals, with the exception of bulk dry chemicals and acids, purchased as reference standards for use in method calibration must establish traceability to NIST referenced material through a traceability certificate. Process links are established that enable a calibration standard solution to be traced to its NIST reference certificate.

Chemical standards used for analysis must meet the purity specifications of the method. These specifications must be stated in the reagents section of the method SOP.

7.4 ***Assignment of Reagent, Bulk Chemical and Standard Expiration Dates.*** Expiration date information for all purchased standards, prepared standard solutions and selected reagents is provided to SGS by the vendor as a condition of purchase. Neat materials, bulk chemicals including solvents, acids and inorganic reagents are not required to be purchased with expiration dates. An expiration date of five (5) years from the date of receipt shall be established. Prepared solutions are labeled with the expiration date provided by the manufacturer. In-house prepared solutions are assigned expiration dates that are consistent with the method that employs their use unless documented experience indicates that an alternate date can be applied. If alternate expiration dates are employed, their use is documented in the method SOP. Expiration dates for prepared inorganic reagents, which have not exhibited instability, are established at two years from the date of preparation for tracking purposes.

The earliest expiration date has been established as the limiting date for assigning expiration dates to prepared solutions. The assignments of expiration dates that are later than the expiration date of any derivative solution or material are prohibited.

7.5 ***Documentation of Traceability***. Traceability information is documented in individual logbooks designated for specific measurement processes. The quality assurance group maintains calibration documentation for metric references in separate logbooks.

Balance calibration verification is documented in logbooks that are assigned to each balance. The individual conducting the calibration is required to initial and date all calibration activities. Any defects that occur during calibration are also documented along with the corrective action applied and a demonstration of return to control. Annual service reports and certificates are retained on file by the QA staff.

Temperature control is documented in logbooks or an electronic temperature monitoring database assigned to the equipment being monitored. A calibrated thermometer or probe is assigned to each individual item. Uncorrected and corrected measurements are recorded. Logbooks document with the date and initials of the individual conducting the measurement on a daily or as used basis. The temperature database records temperatures automatically every 15 minutes. Corrective action, if required, is also documented including the demonstration of return to control.

Initial traceability of chemical standards is documented via a vendor-supplied certificate (not available for bulk dry chemicals and acids) that includes lot number, expiration date and certified concentration information. Solutions prepared using the vendor supplied chemical standards are documented in logbooks assigned to specific analytical processes. Alternatively, documentation may be entered into the electronic standards and reagent tracking log. The documentation includes links to the vendor's lot number, an internal lot number, and dates of preparation, expiration date, and the preparer's initials.

SGS employs commercially prepared standard solutions whose traceability can be demonstrated through a vendor supplied certificate of analysis that includes an experimental verification of the standard's true concentration. The test value for the verification analysis must agree within 1% of the vendor's true value before it can be employed for calibration purposes. If the test value differs from the nominal value by more than 1%, then the test value is used as the true value in laboratory calibrations and calculations. Purchased standards which do not have a certificate of analysis cannot be used for calibration or calibration verification purposes and are rejected or returned to the vendor.

Supervisors conduct regular reviews of logbooks, which are verified using a signature and date.

8.0 TEST PROCEDURES, METHOD REFERENCES, AND REGULATORY PROGRAMS

Requirements: The laboratory employs client specified or regulatory agency approved methods for the analysis of environmental samples. A list of active methods is maintained, which specifies the type of analyses performed and cross-references the methods to applicable environmental regulations. Routine procedures used by the laboratory for the execution of a method are documented in standard operating procedures. Method performance and sensitivity are demonstrated annually where required. Defined procedures for the use of method sensitivity limits for data reporting purposes are established by the QA Director and used consistently for all data reporting purposes.

8.1 ***Method Selection & Application***. SGS employs methods for environmental sample analysis that are consistent with the client's application, which are appropriate and applicable to the project objectives. SGS informs the client if the method proposed is inappropriate or outdated and suggests alternative approaches.

SGS employs documented, validated regulatory methods in the absence of a client specification and informs the client of the method selected. These methods are available to the client and other parties as determined by the client. Documented and validated in-house methods may be applied if they are appropriate to the project. The client is informed of the method selection.

8.2 ***Standard Operating Procedures***. Standard operating procedures (SOP) are prepared for routine methods executed by the laboratory, processes related to laboratory operations and sample or data handling. All SOPs are formatted to meet the specifications established by the National Environmental Laboratory Accreditation Conference, which are detailed in Module 4 – Quality Systems of the established Standards. The procedures describe the process steps in sufficient detail to enable an individual, who is unfamiliar with the procedure to execute it successfully.

SOPs are evaluated annually and edited if necessary. Reviewed SOPs that do not require modification include an evaluation summary form indicating that an evaluation was conducted and modifications were not needed. SOPs can be edited on a more frequent basis if changes are required for any reason. These may include a change to the methodology, elimination of systematic errors that dictate a need for process changes or modifications to incorporate a new version of the method promulgated by the originating regulatory agency. Procedural modifications are indicted using a revision number. SOPs are available for client review at the SGS facility upon request.

The complete list of the laboratories SOPs available as of the date of publication of this QSM version are detailed in Appendix II.

8.3 ***Method Validation***. Standard methods from regulatory sources are primarily used for all analysis. Standard methods do not require validation by the laboratory. Non-standard, in-house methods are validated prior to use. Validation is also performed for standard methods applied outside their intended scope of use. Validation is dependent upon the method application and may include analysis of quality control samples to develop precision and accuracy information for the intended use. A final method validation report is generated, which includes all data in the validation study. A statement of adequacy and/or equivalency is included in the report. A copy of the report is archived in the quality assurance directory of the company server.

Non-standard methods are validated prior to use. This includes the validation of modified standard methods to demonstrate comparability with existing methods. Demonstrations and validations are performed and documented prior to incorporating technological enhancements and nonstandard methods into existing laboratory methods used for general applications. The demonstration includes method specific requirements for assuring that significant performance differences do not occur when the enhancement is incorporated into the method. Validation is dependent upon method application and may include the analysis of quality control samples to develop precision and accuracy information for intended use.

The study procedures and specifications for demonstrating validation include comparable method sensitivity, calibration response, method precision; method accuracy and field sample consistency for several classes of analytical methods are detailed in this document. These procedures and specifications may vary depending upon the method and the modification.

8.4 ***Estimated Uncertainty.*** A statement of the estimated uncertainty of an analytical measurement accompanies the test result when required. Estimated uncertainty is derived from the performance limits established for spiked samples of similar matrices. The degree of uncertainty is derived from the negative or positive bias for spiked samples accompanying a specific parameter. When the uncertainty estimate is applied to a measured value, the possible quantitative range for that specific parameter at that measured concentration is defined. Well recognized regulatory methods that specify values for the major sources of uncertainty and specify the data reporting format do not require a further estimate of uncertainty.

8.5 ***Demonstration of Capability***. Confirmation testing is conducted to demonstrate that the laboratory is capable of performing the method before its application to the analysis of environmental samples. The results of the demonstration tests are compared to the quality control specifications of the method to determine if the performance is acceptable.

Capability demonstrations are conducted initially for every analyst on each method performed and annually on a method specific basis thereafter. Acceptable demonstrations are documented for individual training files and retained by the QA staff. New analytes, which are added to the list of analytes for an accredited method, are evaluated for applicability through a demonstration of capability similar to those performed for accredited analytes.

8.6 ***Method Detection Limit Determination***. Method detection limit (MDL) studies are performed as appropriate for routine methods used in the laboratory. MDL studies are also performed when there is a change to the method that affects how the method is performed or when an instrumentation change that impacts sensitivity occurs. The procedure used for determining MDLs is described in 40 CFR, Part 136 and Appendix B. Studies are performed for each method on water, soil and air matrices for every instrument that is used to perform the method. MDLs are established at the instrument level. The quality assurance staff manages the annual MDL determination process and is responsible for retaining MDL data on file. Approved MDLs are appended to the LIMS and used for data reporting purposes.

8.7 ***Limit of Detection (LOD).*** For the DoD ELAP, the limit of detection (LOD) for each method and target analyte of concern is established for each instrument that is used to perform the method. The LOD is established by initially spiking a water and/or soil matrix at approximately two to three times the calculated MDL (for a single-analyte standard) or two to four times the calculated MDL (for a multi-analyte standard). The LOD undergoes all sample processing steps and is validated by the qualitative identification of the analytes of interest. The spike concentration establishes the LOD and must be verified quarterly. If the spike concentration in the LOD cannot be verified at the initial level with appropriate analytical quality control, a higher LOD must be defined and verified.

8.8 ***Instrument Detection Limit Determination***. Instrument detection limits (IDLs) are determined for all inductively coupled argon plasma emission spectrophotometers and mass spectrometers. The IDL is determined for the wavelength (emission) of each element and the ion (mass spectrometry) of each element used for sample analysis. The IDL data is used to estimate instrument sensitivity in the absence of the sample matrix. IDL determinations are conducted at the frequency specified in the appropriate SOPs' for ICP and ICP/MS analysis.

8.9 ***Method Reporting Limit.*** The method reporting limit for organic methods is determined by the concentration of the lowest calibration standard in the calibration curve. This value is adjusted based on several sample preparation factors including sample volume, moisture content (soils), digestion, distillation or dilution. The low calibration standard is selected by department managers as the lowest concentration standard that can be used for calibration while continuing to meet the calibration linearity criteria of the method being used. The validity of the method reporting limits are confirmed through the analysis of a spiked quality control sample at the method reporting limit concentration. By definition, detected analytes at concentrations below the low calibration standard cannot be accurately quantitated and are qualified as estimated values.

The reporting limit for inorganics methods is defined as the concentration which is greater than the MDL where method quality control criteria has been achieved. The reporting limit for general chemistry methods employing multiple point calibrations must be greater than or equal to the concentration of the lowest standard of the calibration range.

The reporting limit established for both organic and inorganic analysis is above the calculated method detection limit where applicable.

8.10 ***Limit of Quantitation (LOQ).*** For the DoD ELAP the limit of quantitation (LOQ) for each analyte of concern is determined. The LOQ is set within the range of calibration is greater than the established LOD. Precision and bias criteria for the LOQ are established to meet client requirements and are verified quarterly.

8.11 ***Reporting of Quantitative Data.*** Analytical data for all methods is reported without qualification to the reporting limit established for each method. Data, for organic methods may be reported to the established method detection limit depending upon the client's requirements provided that all qualitative identification criteria for the detected parameter have been satisfied. All parameters reported at concentrations between the reporting limit and the method detection limit are qualified as estimated.

Data for inorganic methods are reported to the established method reporting limits. Inorganic data for specific methods may also be reported to the established method detection limit at client request. However, this data is always qualified as estimated.

Measured concentrations of detected analytes that exceed the upper limit of the calibration range are either diluted into the range and reanalyzed or qualified as an estimated value. The only exception to this applies to ICP and ICP/MS analysis, which can be reported to the upper limit of the experimentally determined linear range without qualification.

8.12 ***Precision and Accuracy Studies***. Annual precision and accuracy (P&A) studies, which demonstrate the laboratories ability to generate acceptable data, are performed for all routine methods used in the laboratory. The procedure used for generating organic P&A data is referenced in the majority of the regulatory methodology in use. The procedure requires quadruplicate analysis of a sample spiked with target analytes at a concentration in the working range of the method. This data may be compiled from a series of existing blank spikes or laboratory control samples. Accuracy (percent recovery) of the replicate analysis is averaged and compared to established method performance limits. Values within method limits indicate an acceptable performance demonstration. Precision and accuracy date is also used to annually demonstrate analytical capability for individual analysts. Annual demonstration of capability data is archived in individual training files.

Performance Limits. The Quality Assurance staff is responsible for compilation and maintenance of all precision and accuracy data used for performance limits. Quality control data for all test methods are accumulated and stored in the laboratory information management system (LIMS). Parameter specific QC data are extracted semi-annually for methods 8260, 8270, 8081, 8082 and annually for remaining methods. Each method is statistically processed to develop laboratory specific warning limits and control limits. The new limits are reviewed and approved by the supervisory staff prior to their use for data assessment.

The new limits are used to evaluate QC data for compliance with method requirements for a period of one year. Laboratory generated limits appear on all data reports.

8.13 ***Method Sources & References.*** The Quality Assurance Staff maintains a list of active methods used for the analysis of samples. This list includes valid method references from sources such as USEPA, ASTM or Standard Methods designations and the current version and version date.

Updated versions of approved reference methodology are placed into use as changes occur. The Quality Assurance staff and/or Technical Managers inform operations management of changes in method versions as they occur. The operations management staff selects an implementation date. The operations staff is responsible for completing all method use requirements prior to the implementation date. This includes modification of SOPs, completion of MDL and precision and accuracy studies and staff training. Documentation of these activities is provided to the QA staff who retains this information on file. The updated method is placed into service on the implementation date and the old version is de-activated.

Multiple versions of selected methods may remain in use to satisfy client specific needs. In these situations, the default method version becomes the most recent version. Client specific needs are communicated to the laboratory staff using method specific analytical method codes, which clearly depict the version to be used. The old method version is maintained as an active method until the specified client no longer requires the use of the older version.

SGS will not use methodology that represents significant departures from the reference method unless specifically directed by the client. If clients direct the laboratory to use a method modification that represents a significant departure from the reference method, the request will be documented in the project file.

8.14 ***Analytical Capabilities***. Appendix III provides a detailed listing of the methodology employed for the analysis of test samples.

9.0 SAMPLING, SAMPLE MANAGEMENT, LOGIN, CUSTODY, STORAGE AND DISPOSAL

Requirement: The laboratory must employ a system which ensures that client supplied product or supplied product (the sample) is adequately evaluated, acknowledged, and secured upon delivery to the laboratory. The system also assures that product chain of custody is maintained and that sample receipt conditions and preservation status are documented and communicated to the client and internal staff. The login procedure assigns, documents, and maps the specifications for the analysis of each unique sample to assure that the requested analysis is performed on the correct sample and enables the sample to be tracked throughout the laboratory analytical cycle. The system includes procedures for reconciling defects in sample condition or client provided data, which are identified at sample arrival. The system specifies the procedures for proper sample storage, transfer to the laboratory, and disposal after analysis. The system is also documented in standard operating procedures.

9.1 ***Order Receipt and Entry***. New orders are initiated and processed by the client services group (See Chapter 14, Procedures for Executing Client Specifications). The new order procedure includes mechanisms for providing bottles to clients, which meet the size, cleanliness, and preservation specifications for the analysis to be performed.

For new orders, the project manager prepares a bottle request form, which is submitted to sample management. This form provides critical project details to the sample management staff, which are used to prepare and assemble the sample bottles for shipment to the client prior to sampling.

The bottle order is assembled using bottles that meet US EPA specifications for contaminant free sample containers. SGS uses a combination of commercially supplied pre-cleaned bottles and bottles that have been tested for residual contamination and verified to meet USEPA specifications prior to use. Sterile bottles for microbiological samples are purchased from commercial sources.

Bottles, which are not purchased pre-cleaned, are checked to assure that they are free of contamination from targeted analytes before being released for use. Sterile bottles are checked for contamination with each lot. The QA staff retains a copy of the documentation of in-house contamination and sterility checks and maintains the responsibility for approving and releasing bottle lots for use following a review of the check data.

Preservative solutions that are specified for the analysis requested are dispensed into the sample bottle prior to shipment. All preservative solutions are prepared in the laboratory or purchased from commercial suppliers. Each solution is checked to assure that it is free of contamination from the compounds being analyzed before being released for use.

Reagent water for trip and field blanks is poured into appropriately labeled containers. All bottles are packed into ice chests with blank chain of custody forms and the original bottle order form. Completed bottle orders are delivered to clients using SGS couriers or commercial carriers for use in field sample collection.

9.2 ***Sampling***. Documented procedures are employed by the field staff for field sample collection and are accessible during sample collection activities. Field activities are documented which detail relevant field conditions, site data and the results of field measurements. Appropriate custody procedures for collected samples are initiated by the field staff at the time of sample collection. Samples are documented, labeled and preserved according to the specifications of the method and/or regulatory program prior to being shipped to the laboratory.

9.3 ***Sample Receipt and Custody***. Samples are delivered to the laboratory using a variety of mechanisms including SGS couriers, commercial shippers, and client self-delivery. Documented procedures are followed for arriving samples to assure that custody and integrity are maintained and handling/ preservation requirements are documented and maintained.

Sample custody documentation is initiated when the individual collecting the sample collects field samples. Custody documentation includes all information necessary to provide an unambiguous record of sample collection, sample identification, and sample collection chronology. Initial custody documentation employs either SGS or client generated custody forms.

SGS generates a chain of custody in situations where the individuals who collected the sample did not generate custody documentation in the field.

SGS defines sample custody as follows:

- The sample is in the actual custody or possession of the assigned responsible person,
- The sample is in a secure area.

The SGS facility is defined as a secure facility. Perimeter security has been established, which limits access to authorized individuals only. Visitors enter the facility through the building lobby and must register with the receptionist prior to entering controlled areas. While in the facility, visitors are required to wear a visitor's badge and must be accompanied by their hosts at all times. After hours, building access is controlled using a computerized passkey reader system. This system limits building access to individuals with a pre-assigned authorization status. After hours visitors are not authorized to be in the building. Clients delivering samples after hours must make advanced arrangements through client services and sample management to assure that staff is available to take delivery and maintain custody.

Upon arrival at SGS, the sample custodian reviews the chain of custody for the samples received to verify that the information on the form corresponds with the samples delivered. This includes verification that all listed samples are present and properly labeled, checks to verify that samples were transported and received at the required temperature, verification that the sample was received in proper containers, verification that sufficient volume is available to conduct the requested analysis, and a check of individual sample containers to verify test specific preservation requirements including the absence of headspace for volatile compound analysis.

Sample conditions and other observations are documented on the chain of custody by the sample custodian prior to completing acceptance of custody and in an online database that creates a permanent record of all sample login activities. The sample custodian accepts sample custody upon verification that the custody document is correct. Discrepancies or non-compliant situations are documented and communicated to the SGS Project Manager, who contacts the client for resolution. The resolution is documented and communicated to sample management for execution.

The sample management staff maintains an electronic sample receipt log. This log details all sample-related information in a searchable database that is updated upon data entry and backed up daily. The log records include critical date information, numbers of samples, numbers of bottles for each parameter, descriptions of bottles for each parameter, preservation conditions, bottle refrigerator location, and bottle conditions. Data entry into the log is secured using individual passwords.

During initial login, each bottle is assigned a unique number and is labeled with a barcode corresponding to that number. A bar-coding and scanning system electronically tracks sample custody transfers between individuals within the laboratory. Internal custody documentation may be required for compliance with regulatory agency or contractual specifications. A documented, chronological record of each sample transfer identifying each individual having possession of the sample is created in the laboratory information management system, which can be printed and included in data reports to demonstrate continuous custody.

9.4 ***Laboratory Preservation of Improperly Preserved Field Samples.*** SGS will attempt to preserve field samples that were received without proper preservation to the extent that it is feasible and supported by the methods in use. Laboratory preservation of improperly preserved or handled field samples is routinely performed for metals samples. Special handling procedures may also be applied to improperly preserved volatile organics.

Aqueous metals samples that were not nitric acid preserved to pH 2 in the field are laboratory preserved and held for twenty (24) hours to equilibrate prior to analysis. Aqueous metals samples requiring field filtration may be filtered in the laboratory within seventy-two (72) hours of receipt provided that the sample has not been acid preserved.

Unpreserved volatile organics that include Acrolein and /or Acrylonitrile must be analyzed within three (3) days; remaining samples may be analyzed within seven (7) days to minimize degradation of volatile organics if the laboratory is notified in advance of the failure to preserve upon collection. Laboratory preservation of unpreserved aqueous samples is not possible. A pH check of volatile organic samples prior to analysis will compromise the sample by allowing volatile organics to escape during the check. If the laboratory is not notified of the failure to field preserve an aqueous volatile organic sample, the defect will not be identified until sample analysis has been completed and the data is qualified accordingly.

9.5 ***Sample Tracking Via Status Change.*** An automated, electronic LIMS procedure records sample exchange transactions between departments and changes in analytical status. This system tracks all preparation, analytical, and data reporting procedures to which a sample is subjected while in the possession of the laboratory. Each individual receiving samples must acknowledge the change in custody and operational status in the LIMS. This step is required to maintain an accurate electronic record of sample status, dates of analytical activity, and custody throughout the laboratory.

Sample tracking is initiated at login where all chronological information related to sample collection dates and holding times are entered into the LIMS. This information is entered on an individual sample basis.

9.6 ***Sample Acceptance Policy***. Incoming samples must satisfy SGS's sample acceptance criteria before being logged into the system. Sample acceptance is based on the premise that clients have exercised proper protocols for sample collection. This includes complete documentation, sufficient volume, proper chemical preservation, temperature preservation, sample container sealing and labeling, and appropriate shipping container packing.

The sample management staff will make every attempt to preserve improperly preserved samples upon arrival. However, if preservation is not possible, the samples may be refused unless the client authorizes analysis. No samples will be accepted if holding times have been exceeded or will be exceeded before analysis can take place unless the client authorizes analysis.

Sample acceptance criteria include proper custody and sample labeling documentation. Proper custody documentation includes an entry for all physical samples delivered to the laboratory with an identification code that matches the sample bottle and a date and signature of the individual who collected the sample and delivered them to the laboratory.

SGS reserves the right to refuse any sample which in its sole and absolute discretion and judgment is hazardous, toxic and poses or may pose a health, safety or environmental risk during handling or processing. The company will not accept samples for analysis using methodology that is not performed by the laboratory or for methods that lab does not hold valid accreditations unless arrangements have been made to have the analysis conducted by a qualified subcontractor.

SGS does not accept radioactive samples, however, the policy for sample handling of Naturally Occurring Radioactive Materials (NORM) is described below:

Samples that meet the Federal Department of Transportation and International Air Transportation Association criteria could be accepted and handled following normal procedures (except for disposal) in the lab. This corresponds to samples with United Nations (UN) labels indicating levels of < 500 uR/hour. Samples containing levels at or higher than 500 uR/hour will not be accepted by SGS. Clients must inform SGS of the level of radiation by screening the samples and documenting the level on the Chain of Custody or other form in order for the samples to be accepted.

SGS would require that any shipments containing samples of this type must be clearly labeled with UN labels showing the measured level of radioactivity as < 500 uR/hour.

These samples cannot be disposed of in our normal waste streams. Therefore, on completion of analysis, the samples would be returned to the client or disposed of using an alternate waste handler. In either case, the client would be responsible for the additional shipping or disposal charges, as well as processing charges for segregating the waste stream in the lab.

9.7 ***Assignment of Unique Sample Identification Codes***. Unique identification codes are assigned to each sample bottle to assure traceability and unambiguously identify the tests to be performed in the laboratory.

The sample identification coding process begins with the assignment of a unique alphanumeric job number. A job is defined as a group of samples received on the same day, from a specific client pertaining to a specific project. A job may consist of groups of samples received over a multi-day period. The first two characters of the job number are alpha-characters that identify the laboratory facility. The next characters are numeric and sequence by one number with each new job.

Unique sample numbers are assigned to each bottle collected as a discrete entity from a designated sample point. This number begins with the job number and incorporates a second series of numbers beginning at one and continuing chronologically for each point of collection. The test to be performed is clearly identified on the bottle label. Multiple sample bottles collected for analysis of the same parameter are numbered bottle 1, 2, etc.

Alpha suffixes may be added to the sample number to identify special designations such as subcontracted tests, in-house QC checks, or re-logs. Multiple sample bottles for a specific analysis are labeled Bottle 1, Bottle 2, etc.

9.8 ***Subcontracted Analysis***. Subcontract laboratories are employed to perform analysis not performed by SGS. The quality assurance staff evaluates subcontract laboratories to assure their quality processes meet the standards of the environmental laboratory industry prior to engagement. Throughout the subcontract process, SGS follows established procedures to assure that sample custody is maintained and the data produced by the subcontractor meets established quality criteria.

Subcontracting Procedure. Subcontracting procedures are initiated through several mechanisms, which originate with sample management. Samples for analysis by a subcontractor are logged into the SGS system using regular login procedures. If subcontract parameters are part of the project or sample management has received subcontracting instructions for a specific project, a copy of the chain of custody is given to the appropriate project manager with the subcontracted parameters highlighted. This procedure triggers the subcontract process at the project management level. The project manager contacts an approved subcontractor that carries accreditation in the venue of the project location to place the subcontract order. A subcontract order form (SOF) is simultaneously prepared in electronic format, by the project manager and filed with the original chain of custody. The SOF and the subcontract chain of custody are forwarded to sample management, via email, for processing. A copy is filed with the original CoC.

Sample management signs the subcontract chain of custody and ships the sample(s) to the subcontractor. The subcontract CoC is filed with the original CoC and the request for subcontract. Copies are distributed to the login department, the project manager, sample management and the client.

Clients are verbally notified of the need to subcontract analysis as soon as the need is identified by the client services staff. This may occur during the initial project setup or at the time of login if the project setup had not been initiated through the client services staff. Copies of the subcontract CoC and the original CoC, which are electronically distributed to clients, constitutes documented client notification of the laboratories intent to subcontract analysis.

Subcontractor data packages are reviewed by the QA Staff to assess completeness and quality compliance. If completeness defects are detected, the subcontractor is asked to immediately upgrade the data package. If data quality defects are detected, the QA staff retains the package for further review. The QA staff will pursue a corrective action solution before releasing defective data to the client.

Approved subcontract data is entered into the laboratory information management system (LIMS) if possible and incorporated into the final report. All subcontract data is footnoted to provide the client with a clear indication of its source. Copies of original subcontract data are included in the data report depending on the reporting level specified by the client. Applicable subcontractor accreditation information is provided with the subcontractor data.

*Subcontract Laboratory Evaluation***.** The QA staff evaluates subcontract laboratories prior to engagement. The subcontract laboratory must provide SGS with proof of a valid certification to perform the requested analysis for the venue where they were collected and for a specific program should an approval or accreditation be required. In addition, the QA staff may require a copy of the laboratory's Quality Systems Manual, copies of SOPs used for the subcontracted analysis, a copy of the most recent performance evaluation study for the subcontracted parameter, copies of the internal data integrity policy and copies of the most recent regulatory agency or third party accreditor audit report. Certification verification must be submitted to SGS annually. If possible, the QA staff may conduct a site visit to the laboratory to inspect the quality system. SGS assumes the responsibility for the performance of all subcontractors who have successfully demonstrated their qualifications and should obtain an example data deliverable package prior to initiation of subcontract work for compliance review. Qualification of a subcontract laboratory may be bypassed if the primary client directs SGS to employ a specific subcontractor.

9.9 ***Sample Storage***. Following sample transfer to the sample custodian, samples are assigned to various secured, refrigerated storage areas depending upon the test to be performed and the matrix of the samples. The location (refrigerator and shelf) of each sample is recorded on the chain of custody adjacent to the line corresponding to each sample number and also entered into the LIMS. Samples remain in storage until the laboratory technician requests that they be transferred into the laboratory for analysis.

Second shift staff is authorized to retrieve samples from storage and initiate custody transfer. All sample request forms must be completed regardless of who performs the transfer.

Samples for volatile organics analysis are placed in storage in designated refrigerators by the sample custodian and immediately transferred to the organics group control. Sample custody is transferred to the department designee. These samples are segregated according to matrix to limit opportunities for cross contamination to occur.

Organics staff is authorized to retrieve samples from these storage areas for analysis. When analysis is complete, the samples are placed back into storage.

9.10 ***Sample Login***. Following sample custody transfer to the laboratory, the documentation that describes the client's analytical requirements are delivered to the sample login group for coding and entry to the Laboratory Information Management System (LIMS). This process translates all information related to collection time, turnaround time, sample analysis, and deliverables into a code which enables client requirements to be electronically distributed to the various departments within the laboratory for scheduling and execution.

The technical staff is alerted to client or project specific requirements through the use of a unique project code that is electronically attached to the job during login. The unique project code directs the technical staff to controlled specifications documents detailing the unique requirements.

9.11 ***Sample Retrieval for Analysis***. Individual laboratory departments prepare and submit written requests to the sample custodian to retrieve samples for analysis. The sample custodian retrieves all samples except volatile organics and delivers them to the requesting department. Retrieval priorities are established by the requesting department and submitted to the sample custodian when multiple requests are submitted. Internal custody transfers using the bar code scanning system occur whenever the samples change hands or locations.
After sample analysis has been completed, the department requests pick-up and return of the sample to the storage area. The sample custodian retrieves the sample and completes the

custody transfer from the department of the transfer back to sample management or sample storage.

9.12 ***Sample Disposal***. SGS retains all samples and sample extracts under proper storage for a minimum of 30 days following completion of the analysis report. Longer storage periods are accommodated on a client specific basis if required. Samples may also be returned to the client for disposal.

SGS disposes of all laboratory wastes following the requirements of the Resource Conservation and Recovery Act (RCRA). The Company has obtained and maintains a waste generator identification number, NJD982533622.

Sample management generates a sample disposal dump sheet from the LIMS tracking system each week, which lists all samples whose holding period has expired. Data from each sample is compared to the hazardous waste criteria established by the New Jersey DEP.

Samples containing constituents at concentrations above the criteria are labeled as hazardous and segregated into five general waste categories for disposal as follows:

- Waste Oil
- Soil (solids – positive and negative hazardous characteristics)
- Mixed Aqueous
- Sludges (semi-solids)
- PCB Hazardous Waste (USEPA 40 CFR 761 criteria).

Non-hazardous aqueous samples are diluted and disposed directly into the laboratory sink. All aqueous liquids pass through a neutralization system before entering the municipal system. Solid samples are emptied into consolidation drums and disposed as hazardous waste or non-hazardous wastes depending upon the results of hazardous characteristics determination. Samples classified as PCB hazardous wastes are labeled and packaged according to the requirements in 40 CFR 761.

Empty glass and plastic bottles from aqueous and solid samples are segregated for recycling. Recycled materials are collected by a commercial contractor and transferred to a county transfer facility for separation into various materials categories. These operations are classified as secure facilities employing cameras, security guards and fiber optic security systems.
The recyclable material is transported to a recycling facility for further processing. Separated glass is transported to a processing facility where it is acid washed in two, separate wash baths, rinsed in boiling water and ground into ½ inch chunks. The chunks are transported to an end product user for re-manufacturing into a glass product.

Separated plastic is transported to a processing facility where it is acid washed to remove the labels and adhesives and boiled for sterilization. The sample containers and any remaining labels are shredded and ground resulting in complete destruction of remaining labels the ground material is sent by rail car or tractor-trailer to various end users that melt and reform the material into useful products of their industry. The recycling facility employs a Code of Ethics in which all client names are confidential and are not divulged to any individual or corporation without written permission from the client.

Laboratory wastes are collected by waste stream in designated areas throughout the laboratory. Waste streams are consolidated twice each week by the waste custodian and transferred to stream specific drums for disposal through a permitted waste management contractor. Filled, consolidated drums are tested for hazardous characteristics and scheduled for removal from the facility for appropriate disposal based on the laboratory data.

All solvent extracts and digestates are collected for disposal following the thirty-day holding period and drummed according to their specific waste stream category. Chlorinated solvent extracts are drummed as chlorinated wastes (i.e., Methylene Chloride). Non-chlorinated solvent extracts are drummed as non-chlorinated wastes (i.e., acetone, hexane, methanol, and mixed solvents). Digestates are collected for disposal following the thirty-day holding period and drummed as corrosive liquid containing metals.

10.0 LABORATORY INSTRUMENTATION AND MEASUREMENT STANDARDS

Requirement: The laboratory has established procedures, which assure that instrumentation is performing to a pre-determined operational standard prior to the analysis of any samples. In general, these procedures follow the regulatory agency requirements established in promulgated methodology. The instrumentation selected to perform specified analysis are uniquely identified and capable of providing the method specified uncertainty of measurement needed. These procedures are documented and incorporated into the standard operating procedures for the method being executed.

10.1 ***Mass Tuning – Mass Spectrometers***. The mass spectrometer tune and sensitivity is monitored to assure that the instrument is assigning masses and mass abundances correctly and that the instrument has sufficient sensitivity to detect compounds at low concentrations. This is accomplished by analyzing a specific mass tuning compound at a fixed concentration. If the sensitivity is insufficient to detect the tuning compound, corrective action must be performed prior to the analysis of standards or samples. If the mass assignments or mass abundances do not meet criteria, corrective action must be performed prior to the analysis of standards or samples.

10.2 ***Wavelength Verification – Spectrophotometers***. Spectrophotometer detectors are checked on a regular schedule to verify proper response to the wavelength of light needed for the test in use. If the detector response does not meet specifications, corrective action (detector adjustment or replacement) is performed prior to the analysis of standards or samples.

10.3 ***Inter-element Interference Checks (Metals)***. Inductively Coupled Plasma Emission Spectrophotometers (ICP) are subject to a variety of spectral interferences, which can be minimized or eliminated by applying interfering element correction factors and background correction points. Interfering element correction factors are checked on a specified frequency through the analysis of check samples containing high levels of interfering elements. Analysis of single element interferant solutions is also conducted at a specified frequency.

If the check indicates that the method criteria have not been achieved for any element in the check standard, the analysis is halted and data from the affected samples are not reported. Sample analysis is resumed after corrective action has been performed and the correction factors have been re-calculated.

New interfering element correction factors are calculated and applied whenever the checks indicate that the correction factors are no longer meeting criteria. At a minimum, correction factors are replaced once a year.

Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) also is subject to isobaric elemental and polyatomic ion interferences. These interferences are corrected through the use of calculations. The accuracy of corrections is dependent on the sample matrix and instrument conditions and is verified by quality control checks on individual runs.

10.4 ***Calibration and Calibration Verification***. Many tests require calibration using a series of reference standards to establish the concentration range for performing quantitative analysis. Instrument calibration is performed using standards that are traceable to national standards. Method specific procedures for calibration are followed prior to any sample analysis. In general, if a reference method does not specify the number of calibration standards, the minimum number is two (one of which is at the reporting limit or limit of quantitation).

Calibration is performed using a linear regression calculation or calibration factors calculated from the curve. The calibration must meet method specific criteria for linearity or precision. If the criteria are not achieved, corrective action (re-calibration or instrument maintenance) is performed. The instrument must be successfully calibrated before analysis of samples can be conducted.

Initial calibration for metals analysis performed using inductively coupled plasma (ICP) employs the use of a single standard and a calibration blank to establish linearity. Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) can be calibrated using either a two point or a multi-point calibration, as long as all quality control criteria for the analysis can be achieved. The calibration blank contains all reagents that are placed into the calibration standard with the exception of the target elements. Valid calibration blanks must not contain any target elements.

Initial calibrations must be verified using a single concentration calibration standard from a second source (i.e. separate lot or different provider). The continuing validity of existing calibrations must be regularly verified using a single calibration standard. The response to the standard must meet pre-established criteria that indicate the initial calibration curve remains valid. If the criteria are not achieved corrective action (re-calibration) is performed before any additional samples may be analyzed.

If continuing calibration verification results are outside established criteria, data associated with the verification may be fully useable under the following conditions:

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported.

- When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level.

Calibration verification is also performed whenever it appears that the analytical system is out of calibration or no longer meets the calibration requirements. It is also performed when the time period between calibration verifications has expired.

Sample results are quantitated from the initial instrument calibration unless otherwise required by regulation, method, or program specific criteria.

10.5 ***Linear Range Verification and Calibration (ICP & ICP/MS Metals)***. Linear range verification is performed for all ICP and ICP/MS instrumentation. The regulatory program or analytical method specifies the verification frequency. A series of calibration standards are analyzed over a broad concentration range. The data from these analyses are used to determine the valid analytical range for the instrument. ICP instrument calibration is routinely performed using a single standard at a concentration within the linear range and a blank.

Some methods or analytical programs require a low concentration calibration check to verify that instrument sensitivity is sufficient to detect target elements at the reporting limit. The analytical method or regulatory program defines the criteria used to evaluate the low concentration calibration check. If the low calibration check fails criteria, corrective action is performed and verified through reanalysis of the low concentration calibration check before continuing with the field sample analysis. . ICP-MS instrument calibration is normally performed using multiple standards within the linear range and a blank, but may be done with a single standard at a concentration within the linear range and a blank.

10.6 ***Retention Time Development and Verification (GC)***. Chromatographic retention time windows are developed for all analysis performed using gas chromatographs with conventional detectors. An initial experimental study is performed, which establishes the width of the retention window for each compound. The retention time width of the window defines the time ranges for elution of specified target analytes on the primary and confirmation columns. Retention time windows are established upon initial calibration, applying the retention time range from the initial study to each target compound. Retention times are regularly confirmed through the analysis of an authentic standard during calibration verification. If the target analytes do not elute within the defined range during calibration verification, the instrument must be recalibrated and new windows defined. New studies are performed when major changes, such as column replacement are made to the chromatographic system.

10.7 ***Equipment List***. See Appendix IV for a listing of all equipment used for measurement and/or calibration in laboratory processes.

11.0 INSTRUMENT MAINTENANCE

Requirement. Documented procedures have been established for conducting equipment maintenance. The procedure includes maintenance schedules if required or documentation of daily maintenance activities. All instrument maintenance activities are documented in instrument specific logbooks.

11.1 ***Routine, Daily Maintenance***. Routine, daily maintenance is required on an instrument specific basis and is performed each time the instrument is used. Daily maintenance includes activities to insure a continuation of good analytical performance. This may include performance checks that indicate if non-routine maintenance is needed. If performance checks indicate the need for higher level maintenance, the equipment is taken out of service until maintenance is performed. Analysis cannot be continued until all performance checks meet established criteria and a return to operational control has been demonstrated and documented. The individual assigned to the instrument is responsible for daily maintenance.

11.2 ***Non-routine Maintenance***. Non-routine maintenance is initiated for catastrophic occurrences such as instrument failure. The need for non-routine maintenance is indicated by failures in general operating systems that result in an inability to conduct required performance checks or calibration. Equipment in this category is taken out of service, tagged accordingly and repaired before attempting further analysis. Before initiating repairs, all safety procedures for safe handling of equipment during maintenance, such as lock-out/tag-out are followed. Analysis is not resumed until the instrument meets all operational performance check criteria, is capable of being calibrated and a return to operational control has been demonstrated and documented. Section supervisors are responsible for identifying non-routine maintenance episodes and initiating repair activities to bring the equipment on-line. This may include initiating telephone calls to maintenance contractors if necessary. They are responsible for documenting all details related to the occurrence and repair.

11.3 ***Scheduled Maintenance***. Modern laboratory instrumentation rarely requires regular preventative maintenance. If required, the equipment is placed on a schedule, which dictates when maintenance is needed. Examples include annual balance calibration by an independent provider or ICP preventative maintenance performed by the instrument manufacturer. Section supervisors are responsible for initiating scheduled maintenance on equipment in this category. Scheduled maintenance is documented using routine documentation practices.

11.4 ***Maintenance Documentation***. Routine and non-routine maintenance activities are documented in logbooks assigned to instruments and equipment used for analytical measurements. The logbooks contain preprinted forms, which specify the required maintenance activities. The analyst or supervisor performing or initiating the maintenance activity is required to check the activity upon its completion and initial the form. This includes documenting that the instrument has been returned to operational control following the completion of the activity. Non-routine maintenance (repairs, upgrades) is documented on the back page of the service log.

12.0 QUALITY CONTROL PARAMETERS, PROCEDURES, AND CORRECTIVE ACTION

Requirement: All procedures used for test methods incorporate quality control parameters to monitor elements that are critical to method performance. Each quality parameter includes acceptance criteria that have been established by regulatory agencies for the methods in use. Criteria may also be established through client dictates or through the accumulation and statistical evaluation of internal performance data. Data obtained for these parameters during routine analysis must be evaluated by the analyst, and compared to the method criteria in use. If the criteria are not achieved, the procedures must specify corrective action and conformation of control before proceeding with sample analysis. QC parameters, procedures, and corrective action must be documented within the standard operating procedures for each method. In the absence of client specific objectives the laboratory must define qualitative objectives for completeness and representativeness of data.

12.1 ***Procedure***. Bench analysts are responsible for methodological quality control and sample specific quality control. Each method specifies the control parameters to be employed for the method in use and the specific procedures for incorporating them into the analysis. These control parameters are analyzed and evaluated with every designated sample group (batch).

The data from each parameter provides the analyst with critical decision making information on method performance. The information is used to determine if corrective action is needed to bring the method or the analysis of a specific sample into compliance. These evaluations are conducted throughout the course of the analysis. Each control parameter is indicative of a critical control feature. Failure of a methodological control parameter is indicative of either instrument or batch failure. Failure of a sample control parameter is indicative of control difficulties with a specific sample or samples.

Sample Batch. All samples analyzed in the laboratory are assigned to a designated sample batch, which contains all required quality control samples and a defined maximum number of field samples that are prepared and/or analyzed over a defined time period. The maximum number of field samples in the preparation batch is 20. SGS has incorporated The NELAC Institute (TNI) Standard batching policy as the sample-batching standard. This policy incorporates the requirement for blanks and spiked blanks as a time based function as defined by TNI Standard. Accordingly, the specified time period for a sample batch is 24 hours. Matrix spike/matrix spike duplicate, matrix spikes and duplicates are defined as sample frequency based functions and may be applied to several batches until the frequency requirement has been reached. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required every 20 samples.

Client criteria that defines a batch as a time based function which includes a matrix spike/matrix spike duplicates as a contractual specification will be honored. The typical batch contains a blank and a laboratory control sample (LCS or spiked blank). Batch documentation includes lot specifications for all reagents and standards used during preparation of the batch.

12.2 ***Methodological Control Parameters and Corrective Action***. Prior to the analysis of field samples the analyst must determine that the method is functioning properly. Specific control parameters indicate whether critical processes meet specified requirements before continuing with the analysis. Method specific control parameters must meet criteria before sample analysis can be conducted. Each of these parameters is related to processes that are under the control of the laboratory and can be adjusted if out of control.

Method Blank. A method blank is analyzed during the analysis of any field sample. The method blank is defined as a sample. It contains the same standards (internal standards, surrogates, matrix modifiers, etc.) and reagents that are added to the field sample during analysis, with the exception of the sample itself. If the method blank contains target analytes(s) at concentrations that exceed method detection limit concentrations (organics) or reporting limit concentrations (inorganics), the source of contamination is investigated and eliminated before proceeding with sample analysis. Target analyte(s) in method blanks at concentrations no greater than one-half of the reporting limit concentrations (metals) may be requested on a client or project specific basis. Systematic contamination is documented for corrective action and resolved following the established corrective action procedures.

Laboratory Control Samples (LCS or Spiked Blanks). A laboratory control sample (spiked blank or commercially prepared performance evaluation sample) is analyzed along with field samples to demonstrate that method accuracy is within acceptable limits. These spike solutions may be from different sources than the sources of the solutions used for method calibration depending upon the method requirements. All target components are included in the spike mixture over a two year period. The performance limits are derived from published method specifications or from statistical data generated from the analysis of laboratory method performance samples. Spiked blanks are blank matrices (reagent water or clean sand) spiked with target parameters and analyzed using the same methods used for samples. Accuracy data is compared to laboratory derived limits to determine if the method is in control. Laboratory control samples (LCS) are commercially prepared spiked samples in an inert matrix. Performance criteria for recovery of spiked analytes are pre-established by the commercial entity preparing the sample. The sample is analyzed in the laboratory as an external reference.

Accuracy data is compared to the applicable performance limits. If the spike accuracy exceeds the performance limits, corrective action, as specified in the SOP for the method is performed and verified before continuing with a field sample analysis. In some cases, decisions are made to continue with sample analysis if performance limits are exceeded, provided the unacceptable result has no negative impact on the sample data.

Blanks and spikes are routinely evaluated before samples are analyzed. However, in situations where sample analysis is performed using an auto sampler, they may be evaluated after sample analysis has occurred. If the blanks and spikes do not meet criteria, sample analysis is repeated.

Proficiency Testing. Proficiency test samples (PTs) are single or double blind spikes, introduced to the laboratory to assess method performance. PTs may be introduced as double blinds submitted by commercial clients, single or double blinds from regulatory agencies, or internal blinds submitted by the QA group.

A minimum of two single blind studies must be performed each year for every parameter in aqueous and solid matrices for each field of testing for which the laboratory maintains accreditation. Proficiency samples must be purchased as blinds from an A2LA accredited vendor. Data from these studies are provided to the laboratory by the vendor and reported to accrediting agencies. If unsatisfactory performance is noted, corrective action is performed to identify and eliminate any sources of error. A new single blind must be analyzed if required to demonstrate continuing proficiency.

PT samples performed for accrediting agencies or clients, which do not meet performance specifications, require a written summary that documents the corrective action investigation, findings, and corrective action implementation. A copy of this summary shall be submitted to the TNI Standard Primary Accrediting Authority, NJDEP Office of Quality Assurance for review.

Single or double blind proficiency test samples may be employed for self-evaluation purposes. Data from these analyses are compared to established performance limits. If the data does not meet performance specifications, the system is evaluated for sources of acute or systematic error. If required, corrective action is performed and verified before initiating or continuing sample analysis.

Trend Analysis for Control Parameters. The quality assurance staff is responsible for continuous analytical improvement through quality control data trend analysis. Accuracy data for spiked parameters in the spiked blank are statistically evaluated weekly for trends indicative of systematic problems. Data from LCS parameters and surrogates are pooled on a method, matrix, and instrument basis. This data is evaluated by comparison to existing control and warning limits. Trend analysis is performed automatically as follows:

- Any point outside the control limit
- Any three consecutive points between the warning and control limits
- Any eight consecutive points on the same side of the mean.
- Any six consecutive points increasing or decreasing

The results of the trend analysis are transmitted as .PDF files for supervisory evaluation prior to sample analysis. Trends that indicate the potential loss of statistical control are further evaluated to determine the impact on data quality and to determine if corrective action is necessary. If corrective action is indicated, the supervisor informs the analysts of the corrective actions to be performed. Return to control is demonstrated before analysis resumes.

12.3 ***Sample Control Parameters and Corrective Action***. The analysis of samples can be initiated following a successful demonstration that the method is operating within established controls. Additional controls are incorporated into the analysis of each sample to determine if the method is functioning within established specifications for each individual sample. Sample QC data is evaluated and compared to established performance criteria. If the criteria are not achieved the method or the SOP specifies the corrective action required to continue sample analysis. In many cases, failure to meet QC criteria is a function of sample matrix and cannot be remedied. Each parameter is designed to provide quality feedback on a defined aspect of the sampling and analysis episode.

Duplicates. Duplicate sample analysis is used to measure analytical precision. This can also be equated to laboratory precision for homogenous samples. Precision criteria are method dependent. If precision criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

Laboratory Spikes & Spiked Duplicates. Spikes and spiked duplicates are used to measure analytical precision and accuracy for the sample matrix selected. Precision and accuracy criteria are method dependent. If precision and accuracy criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before reporting sample data. All target components are included in the spike mixture over a two year period.

Serial Dilution (Metals). Serial dilutions of metals samples are analyzed to determine if analytical matrix effects may have impacted the reported data. If the value of the serially diluted samples does not agree with the undiluted value within a method-specified range, the sample matrix may be causing interferences, which may lead to either a high or low bias. If the serial dilution criterion is not achieved, it must be flagged to indicate possible bias from matrix effects.

Post Digestion Spikes. Digested samples are spiked and analyzed to determine if matrix interferences are biasing the results when the pre-digestion spike (matrix spike) recovery falls outside the control limits. It may also be used to determine potential interferences per client's specification. The sample is spiked at the concentration specified in the method SOP. No action is necessary if the post digestion spike is outside of the method criteria, unless a preparation problem is suspected with the spike, in which case the post digestion spike should be re-prepared and reanalyzed.

Surrogate Spikes (Organics). Surrogate spikes are organic compounds that are similar in behavior to the target analytes but unlikely to be found in nature. They are added to all quality control and field samples to measure method performance for each individual sample. Surrogate accuracy limits are derived from published method specifications or from the statistical evaluation of laboratory generated surrogate accuracy data. Accuracy data is compared to the applicable performance limits. If the surrogate accuracy exceeds performance limits, corrective action, as specified in the method or SOP is performed before sample data can be reported.

Internal Standards (Organic Methods). Internal standards are retention time and instrument response markers added to every sample to be used as references for quantitation. Their response is compared to reference standards and used to evaluate instrument sensitivity on a sample specific basis. Internal standard retention time is also compared to reference standards to assure that target analytes are capable of being located by their individual relative retention time.

If internal standard response criteria are not achieved, corrective action or additional action may be required. The recommended action must be completed before sample data can be reported.

If the internal standard retention time criteria are not achieved corrective action or additional action may be required. This may include re-calibration and re-analysis. Additional action must be completed before sample data is reported.

Internal Standards (ICP and ICP/MS Metals). Internal standards are used on ICP instruments to compensate for variations in response caused by differences in sample matrices. Multiple internal standards are used for each sample on ICP/MS instruments to compensate for variations in response caused by differences in sample matrices. This adjustment is performed automatically during sample analysis. The internal standard response of replicated sample analysis is monitored to detect potential analytical problems. If analytical problems are suspected, then the field samples may be reanalyzed or reanalyzed upon dilution to minimize the interferences. A different internal standard may be employed for quantitation in situations where the field sample contains the element typically used as the internal standard.

12.4 ***Laboratory Derived Quality Control Criteria.*** Control criteria for in-house methods and client specific modifications that exceed the scope of published methodology are defined and documented prior to the use of the method. The Quality Assurance Director is responsible for identifying additional control criteria needs. Control parameters and criteria, based on best technical judgment are established using input provided by the operations staff. These control parameters and criteria are documented and incorporated into the method.

The laboratory-derived criteria are evaluated for technical soundness on spiked samples prior to the use of the method on field samples. The technical evaluation is documented and archived by the Quality Assurance Staff.

When sufficient data from the laboratory developed control parameter is accumulated, the data is statistically processed and the experimentally derived control limits are incorporated into the method.

12.5 ***Bench Review & Corrective Action***. The bench chemists are responsible for all QC parameters. Before proceeding with sample analysis, they are required to successfully meet all instrumental QC criteria. They have the authority to perform any necessary corrective action before proceeding with sample analysis. Their authority includes the responsibility for assuring that departures from documented policies and procedures do not occur.

The bench chemists are also responsible for all sample QC parameters. If the sample QC criteria are not achieved, they are authorized and required to perform the method specified corrective action before reporting sample data.
Whenever possible, samples are analyzed straight to minimize detection and reporting limits. If dilutions need to be applied, the minimum dilution is used bring the target compounds in the range of the curve. This dilution may be determined from the original analysis or from screening data. If the target range is large, then multiple dilutions may be required to optimize reporting limits for the maximum number of targets. Up to 3 dilutions may be used for a given sample. In some cases, very high levels of an interfering target may force larger dilutions for other target compounds. In all cases a conservative approach to dilution is applied to minimize the increase of detection and reporting limits.

12.6 ***Data Qualifiers*****.** An alpha character coding system is employed for defining use limitations for reported data. These limitations are applied to analytical data by the analyst to clarify the usefulness of the reported data for data user. Common data qualifiers and their definitions are as follows:

Organics.

J: Indicates an estimated value. Applied to calculated concentrations for tentatively identified compounds and qualitatively identified compounds whose concentration is below the reporting limit, but above the MDL.

N: Indicates qualitative evidence of a tentatively identified compound whose identification is based on a mass spectral library search and is applied to all TIC results.

C: Applied to pesticide data that has been qualitatively confirmed by GC/MS.

B: Used for analytes detected in the sample and its associated method blank.

E: Applied to compounds whose concentration exceeds the upper limit of the calibration range.

Metals and Inorganics.

B: Applied if the reported concentration value was less than the reporting limit but greater than the MDL.

U: Applied if the reading is less than the MDL (or IDL if IDL reporting is being used).

E: Estimated concentration caused by the presence of interferences, normally applied when the serial dilution is out.

N: Spike sample recovery not within control limits.

*: Duplicate or matrix spike duplicate analysis not within control limits.

12.7 ***Data Package Review***. SGS employs at least two levels of data review, the final review must be performed by a manager, supervisor or designated reviewer, to assure that reported data has satisfied all quality control criteria and that client specifications and requirements have been met. Each production department has developed specific data review procedures, which must be completed before data is released to the client.

Analytical Review. The analyst conducts the primary review of all data. This review begins with a check of all instrument and method quality control and progresses through sample quality control, concluding with a check to assure that the client's requirements have been executed. Analyst checks focus on a review of qualitative determinations and checks of precision and accuracy data to verify that existing laboratory criteria have been achieved. Checks at this level may include comparisons with project specific criteria if applicable. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

Analysts who have met the qualification criteria for the method in use perform secondary, peer level data reviews. Analyst qualification requirements include a valid demonstration of capability and demonstrated understanding of the method SOP. Section supervisors may perform secondary review in-lieu of a peer review. Managers, Supervisors or designated reviewers evaluate 100% of the data produced by their department. It includes a check of all manual calculations; an accuracy check of manually transcribed data from bench sheets to the LIMS, a check of calibration and continuing calibration, all QC criteria and a comparison of the data package to client specified requirements. Also included are checks to assure the appropriate methodology was applied and that all anomalous information was properly flagged for communication in the case narrative. Supervisors have the authority to reject data and initiate re-analysis, corrective action, or reprocessing.

All laboratory data requiring manual entry into LIMS system is double-checked by the analysts performing initial data entry and the section supervisor. Verification of supervisory review is indicated on the raw data summary by the manager, supervisor, or designated reviewer's initials and date.

Electronic data that is manually edited at the bench by the primary analyst is automatically flagged by the instrument data system indicating an override by the analyst. All manual overrides must be verified and approved by a supervisor who initials and dates all manual changes.

Hard copies (or PDF) of manually integrated chromatographic peaks are printed that clearly depict the manually drawn baseline. The hard copy (or PDF) is reviewed and approved by the section manager, supervisor or designated reviewer (initialed and dated) and included in the data package of all full tier reports or the archived batch records of commercial report packages.

Edits to electronic data that have already been committed to the LIMS database are controlled through the use of the Master Edit function in LIMS. Permission to access this program is limited to those approved by the upper levels of laboratory management and is controlled by the Information Technology staff. A GALP electronic audit record trail is maintained for all changes that are made and is automatically appended to the record.

The group manager performs a tertiary review on a spot check basis. This review includes an evaluation of QC data against acceptance criteria and a check of the data package contents to assure that all analytical requirements and specifications were executed.

Report Generation Review. The report generation group reviews all data and supporting information delivered by the laboratory for completeness and compliance with client specifications. Missing deliverables are identified and obtained from the laboratory. The group also reviews the completed package to verify that the delivered product complies with all client specifications. Non-analytical defects are corrected before the package is sent to the client.

Project Management/Quality Control Review. Spot-check data package reviews are performed by the project management staff. Project management reviews focus on project specifications. If the project manager identifies defects in the product prior to release, he initiates immediate corrective action to rectify the situation.

The QA staff performs a post-delivery check of completed data packages to verify completeness and compliance with established quality control procedures. Approximately 10% of data packages are reviewed. Detected deficiencies are brought to the laboratories attention and corrective actions initiated as necessary.

The QA review focuses on all elements of the deliverable including analytical quality control, sample custody documentation case narratives and data qualifiers QA reviews at this step in the production process are geared towards systematic process defects, which require procedural changes to effect a corrective action. However, if defects are identified that have an adverse effect on data, the client is immediately informed following standard notification procedures. QA data review is not used in lieu of a peer level review or a supervisory review.

Data Reporting. Analytical data is released to clients following a secondary review by the manager, supervisor or designated reviewer. Data release at this stage of the process is limited to electronic information, which is released to clients through a secure, encrypted, password protected, Internet connection. Hard copy support data is compiled by the report generation group and assembled into the final report. The report is sent to the client following reviews by the report generation staff.

All data reports include specified information, which is required to identify the report and its contents. This information includes a title, name and address of the laboratory, a unique report number, total number of pages in the report, clients name and address, analytical method identification, arriving sample condition, sample and analysis dates, test results with units of measurement, authorized signature of data release, statement of applicability, report reproduction restrictions and TNI Standard requirements certification. Data reports for the DOD Defense ELAP clients also include the time of preparation and analysis.

12.8 ***Electronic Data Reduction.*** Raw data from sample analysis is entered into the laboratory information management system (LIMS) using automated processes or manual entry. Final data processing is performed by the LIMS using procedures developed by the Company.

All LIMS programs are tested and validated prior to use to assure that they consistently produce correct results. The Information Technology Staff performs software validation testing. The testing procedures are documented in an SOP. Software programs are not approved for use until they have demonstrated that they are capable of performing the required calculations.

12.9 ***Representativeness***. Data representativeness is based on the premise that qualitative and quantitative information developed for field samples is characteristic of the sample that was collected by the client and analyzed in the laboratory. The laboratory objective for representativeness defines data as representative if the criteria for all quality parameters associated with the analysis of the sample are achieved.

12.10 ***Comparability***. Analytical data is defined as comparable when data from a sample set analyzed by the laboratory is representatively equivalent to other sample sets analyzed separately regardless of the analytical logistics. The laboratory will achieve 100% comparability for all sample data which meets the criteria for the quality parameters associated with its analysis using the method requested by the client.

13.0 CORRECTIVE ACTION SYSTEM

Requirement. The laboratory employs policies and procedures for correcting defective processes, systematic errors, and quality defects enabling the staff to systematically improve product quality. The system includes procedures for communicating items requiring corrective action to responsible individuals, corrective action tracking procedures, corrective action documentation, monitoring of effectiveness, and reports to management. The system is fully documented in a standard operating procedure. Individual corrective actions and responses are documented in a dedicated database.

13.1 ***Procedure***. Corrective action is the step that follows the identification of a process defect. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance. The formal system is maintained by the quality assurance department. Operations management is responsible for working within the system to resolve identified deficiencies.

Routine Corrective Action. Routine corrective action is defined as the procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters or analytical system specifications.

Bench analysts have full responsibility and authority for performing routine corrective action. The resolution of defects at this level does not require a procedural change or staff re-training. The analyst is free to continue work once corrective action is complete and the analytical system has been returned to control. Documentation of routine corrective actions is limited to logbook comments for the analysis being performed.

Process Changes. Corrective actions in this category require procedural modifications. They may be the result of systematic defects identified during audits, the investigation of client inquiries, failed proficiency tests, product defects identified during data review, or method updates. Resolution of defects of this magnitude requires formal identification of the defect, development and documentation of a corrective action plan, and staff training to communicate the procedural change.

Technical Corrective Action. Technical corrective action encompasses routine corrective action performed by bench analysts for out of control systems and corrective actions performed for data produced using out of control systems. Technical corrective action for routine situations is conducted using the procedures detailed above.

Non-routine corrective actions apply to situations where the bench analysts failed to perform routine corrective action before continuing analysis. Supervisors and Department Managers perform corrective action in these situations. Documentation of all non-routine corrective actions is performed using the corrective action system.

Sample re-analysis is conducted if sufficient sample and holding time remain to repeat the analysis using an in-control system. If insufficient sample or holding time remains, the data is processed and qualifiers applied that describe the out of control situation. The occurrence is further documented in the case narrative and in the corrective action response. The corrective action must include provisions for retraining the analysts who failed to perform routine corrective action.

13.2 ***Documentation & Communication***. Routine corrective actions are documented as part of the analytical record. Notations are made in the comments section of the analytical chronicle or data sheet detailing the nonconformance and corrective action. Continuation of the analysis indicates that return to control was successful.

Corrective actions for process changes are documented, tracked and monitored for effectiveness. Supervisors or senior staff members may initiate corrective actions by generating a corrective action using the corrective action database application.

The corrective action database is an Access application. The initiator generates the corrective action investigation form, which is documented, tracked, distributed to responsible parties and archived through the application. The application assigns a tracking number, initiation data and due date to each action and copies the corrective action form to the database. E-mail message containing the form is automatically distributed to the responsible parties for resolution.

The responsible party identifies the root cause of the defect, initiates the immediate fix and develops and implements the procedural change. Existing documentation such as SOPs are edited to reflect the change. The affected staff is informed of the procedural change through a formal training session. The training is documented and copies are placed into individual training files. The corrective action form is completed by the responsible party and returned to the QA staff via e-mail using the database application.

Initial and completed corrective action forms are maintained in the corrective action database. This entire database is backed up and archived daily. The corrective action tracking form is maintained as an active report in the database.

Monitoring. The QA Staff monitors the implemented corrective action until it is evident that the action has been effective and the defect has been eliminated. The corrective action database is updated by QA to reflect closure of the corrective action. The QA staff assigns an error code to the corrective action for classification of the type of errors being committed. Additional monitoring of the corrective action is conducted during routine laboratory audits.

Additional monitoring of the corrective action is conducted by adding the corrective action to a verification list by the QA staff at closure. Verification is performed by the QA Staff to assure that the corrective action has remained in effect is scheduled for six (6) months from the initial closure date.

If QA determines that the corrective action response has not effectively remedied the deficiency, the process continues with a re-initiation of the corrective action. Corrective action continues until the defect is eliminated. If another procedural change is required, it is treated as a new corrective action, which is documented and monitored using established procedures.

Client Notification. Defective processes, systematic errors and/or quality defects may be detected during routine audits or data inquiries and may have negative impacts on data quality. In some cases, data affected may have been released to clients. If defective data has been released for use, SGS will identify and notify the affected clients of the defect and impact in accordance with Corrective Action SOP EQA011. For any Department of Defense (DoD) projects where instances of inappropriate and prohibited practices (as per the DoD QSM section 5.2.7) may have occurred, affected clients and the accrediting body (i.e., ANAB) must be notified within 15 business days of discovery and a corrective action plan must be provided within 30 business days of discovery.

14.0 PROCEDURES FOR EXECUTING CLIENT SPECIFICATIONS

Requirement. Systems have been established for evaluating and processing client specifications for routine and non-routine analytical services. The systems enable the client services staff to identify, evaluate, and document the requested specifications to determine if adequate resources are available to perform the analysis. The system includes procedures for communicating the specifications to the laboratory staff for execution and procedures for verifying the specifications have been executed.

14.1 ***Client Specific Requirements***. The project manager is the primary contact for clients requesting laboratory services. Client specifications are communicated using several mechanisms. The primary sources of information are the client's quality assurance project plan (QAPP) and the analytical services contract both of which detail the analytical, quality control and data reporting specifications for the project. In the absence of a QAPP, projects specifications can also be communicated using contracts, letters of authorization, or letters of agreement, which may be limited to a brief discussion of the analytical requirements and the terms and conditions for the work. These documents may also include pricing information, liabilities and scope of work, in addition to the analytical requirements. QAPPs include detailed analytical requirements and data quality objectives, which supersede those found in the referenced methods. This information is essential to successful project completion.

The client services staff provides additional assistance to clients who are unsure of the specifications they need to execute the sampling and analysis requirements of their project. They provide additional support to clients who require assistance in results interpretation as needed, provided they possess the expertise required to render an opinion.

The project manager is responsible for obtaining project documents, which specify the analytical requirements. Following project management and lab manager review, QAPPs are distributed to the QA staff for review and completion. The original QAPP is filed in a secure location.

For certain states or programs an additional form or checklist is required. In these instances QA must be notified if any new form is requested to confirm the accuracy of the new document.

14.2 ***Requirements for Non-Standard Analytical Specifications***. Client requirements that specify departures from documented policies, procedures, or standard specifications must be submitted to SGS in writing. These requirements are reviewed and approved by the technical staff before the project is accepted. Once accepted, the non-standard requirements become analytical specifications, which follow the routine procedure for communicating client specifications. Departures from documented policies, procedures, or standard specifications that do not follow this procedure are not permitted.

14.3 ***Evaluation of Resources.*** A resource evaluation is completed prior to accepting projects submitted by clients. The evaluation is initiated by the client services staff who prepares a brief synopsis that includes the logistical requirements of the project. Logistical specifications for new projects are summarized in writing for evaluation by the affected departments. The specifications are evaluated by the department manager from a scheduling and hardware resources perspective. The project is not accepted unless the department managers have the necessary resources to execute the project according to client specifications.

14.4 ***Documentation***. New projects are initiated using LIMS or a project set up form, which is completed prior to the start of the project. This form details all of the information needed to correctly enter the specifications for each client sample into the laboratory information management system (LIMS). The form includes data reporting requirements, billing information, data turnaround times, QA level, state of origin, and comments for detailing project specific requirements. The project manager is responsible for obtaining this information from the client and completing the form prior to sample arrival and login.

Sample receipt triggers project creation and the login process. The information on the set-up form is entered into the LIMS immediately prior to logging in the first sample. The set up form may be accompanied by a quotation, which details the analytical product codes and sample matrices. These details are also entered into the LIMS during login.

Special information is distributed to the laboratory supervisors and login department in electronic or hardcopy format upon project setup. All, project specific information is retained by the project manager in a secure file. The project manager maintains a personal telephone log, which details conversations with the client regarding the project.

Department managers prepare summary sheets that detail client specific analytical requirements for each test. Bench analysts use these sheets to obtain information regarding client specific analytical requirements before analyzing samples. A program code is established for each client that links the client specifications to a client project. This code is attached to a project by the project manager at login and listed on the work list for each work group conducting analysis for clients with standing requirements.

14.5 ***Communication***. A pre-project meeting is held between client services and the operations managers to discuss the specifications described in the QAPP, contract and/or related documents. Project logistics are discussed and finalized and procedures are developed to assure proper execution of the client's analytical specifications and requirements. Questions, raised in the review meeting, are discussed with the client for resolution. Exceptions to any requirements, if accepted by the client, are documented and incorporated into the QAPP or project documentation records.

Non-standard specifications for individual clients are documented in the LIMS at the client account level or program level. Simple specifications are documented as comments for each project. Once entered into the LIMS, these specifications become memorialized for all projects related to the client account. Complex specifications are assigned program codes that link the specification to detailed analytical specifications.

Upon sample arrival, these specifications are accessed through a terminal or printed as a hard copy and stored in a binder for individuals who require access to the specification. Specifications that are not entered into the LIMS are prohibited unless documented in an interdepartmental memo, which clearly identifies the project, client and effective duration of the specification.

14.6 ***Operational Execution***. A work schedule is prepared for each analytical department on a daily basis. Analytical specifications or program codes from recently arrived samples have now been entered into the LIMS database. The database is sorted by analytical due date and holding time, into product specific groups. Samples are scheduled for analysis by due date and holding time. The completed schedule, which is now defined as a work list, is printed. The list contains the client requested product codes, program codes and specifications required for the selected sample(s). Special requirements are communicated to the analyst using the comments section or relayed through verbal instructions provided by the supervisor. The bench analyst assumes full responsibility for performing the analysis according to the specifications printed on the work sheet.

14.7 ***Verification***. Prior to the release of data to the client, the report generation staff review the report and compare the completed product to the client specifications documentation to assure that all requirements have been met. Project managers may perform a spot check of projects with unique requirements to assure that the work was executed according to specifications.

15.0 CLIENT COMPLAINT RESOLUTION PROCEDURE

Requirement. The laboratory follows a formal system for managing and reconciling client complaints. The system includes procedures for documenting the complaint and communicating it to the appropriate department for resolution. The system also includes a quality assurance evaluation to determine if the complaint is related to systematic defects requiring corrective action and process changes.

15.1 ***Procedure***. Client complaints are communicated to client services representatives, quality assurance staff, or senior management staff for resolution. The individual receiving the complaint retains the responsibility for documentation and communicating the nature of the complaint to the responsible department(s) for resolution. The responsible party addresses the complaint. The resolution is communicated to the QA department and the originator for communication to the client. QA reviews the complaint and resolution to determine if systematic defects exist. If systematic defects are present, QA initiates a corrective action for the responsible party who develops and implements a response that eliminates the defect. If systematic defects are not present and the resolution is satisfactory, the QA Staff will close the complaint/inquiry with a no further action is necessary tag.

15.2 ***Documentation***. Client's complaints are documented by the individual receiving the complaint using the Data Query and Corrective Action Inquiry Process. This process generates an E-Mail message that contains detailed information essential to the complaint resolution. A record of the telephone conversation is maintained by client services. The message is distributed to the QA staff and the party bearing responsibility for resolution by E-Mail. The complaint resolution is documented on the message by the responsible party and returned to the originator. A copy is sent to QA for review and database archiving. Positive feedback from clients is now documented in the program. In the past, these types of communications with clients were discussed at the Client Services Meeting, but were not tracked by SGS. Documenting this information can be used to improve service to all clients.

15.3 ***Corrective Action***. Responses to data queries are required from the responsible party. At a minimum, the response addresses the query and provides an explanation to the complaint. Formal corrective action may focus on the single issue expressed in the complaint. Corrective action may include reprocessing of data, editing of the initial report, and re-issue to the client. If the QA review indicates a systematic error, process modification is required. The defective process at the root of the complaint is changed. SOPs are either created or modified to reflect the change. The party responsible for the process implements process changes.

15.4 ***QA Monitoring***. Process changes, implemented to resolve systematic defects, are monitored for effectiveness by QA. If monitoring indicates that the process change has not resolved the defect, QA works with the department management to develop and implement an effective process. If monitoring indicates that the defect has been resolved, monitoring is slowly discontinued and the corrective action is closed. Continued monitoring is incorporated as an element of the annual system audit.

16.0 CONTROL OF NONCONFORMING PRODUCT

Requirement: Policies and procedures have been developed and implemented that describe the procedures employed by the laboratory when any aspect of sample analysis or data reporting do not conform to established procedures or client specifications. These procedures include steps to ensure that process defects are corrected and affected work is evaluated to assess its impact to the client.

Procedure. Nonconforming product is identified through routine internal review and audit practices or through client inquiry. The individuals who identify the nonconformance or receiving a nonconformance inquiry immediately inform the Laboratory Director and the Quality Assurance Director. The Laboratory Director initiates an evaluation of the nonconformance through the Quality Assurance Department and takes full responsibility for managing the process and identifying the course of action to take, initiating corrective action and mitigating the impact of the nonconformance to the client. Reference SOP EQA 065 Control of Non-Conforming Product and EQA 038 Complaints & Data Inquiry for specific procedures on handling non-conformances and Data Inquires.

16.1 ***Corrective Action.*** The outcome of the evaluation dictates the course of action. This includes client notification when the quality of data reported has been impacted and may also include corrective action if applicable. Immediate corrective action is performed using the procedures specified in SGS SOP EQA011. However, additional action may be required including cessation of analysis and withholding and or recalling data reports. If the evaluation indicates that nonconforming data may have been issued to clients, the client is immediately notified and data may be recalled following the procedures specified in SOP EQA011. If work has been stopped because of a nonconformance, the Laboratory Director is the only individual authorized to direct a resumption of analysis.

Non-conformances caused by systematic process defects require retraining of the personnel involved as an element of the corrective action solution.

17.0 CONFIDENTIALITY PROTECTION PROCEDURES

Requirements: Policies and procedures have been developed to protect client data from release to unauthorized parties or accidental release of database information through accidental electronic transmission or illegal intrusion. These policies have been communicated to clients and staff. Electronic systems are regularly evaluated for effectiveness.

17.1 ***Client Anonymity***. Information related to the Company's clients is granted to employees on a "need to know" basis. An individual's position within the organization defines his "need to know". Individuals with "need to know" status are given password access to systems that contain client identity information and access to documents and document storage areas containing client reports and information. Access to client information by individuals outside of the Company is limited to the client and individuals authorized by the client.

Individuals outside of the Company may obtain client information through subpoena issued by a court of valid jurisdiction. Clients are informed when subpoenas are received ordering the release of their information.

Regulatory agency requests for data or reports:

If a regulatory agency requests additional data or a revised/upgraded report for regulatory drinking water work, the appropriate client services representative must be notified so that they will provide written and verbal notification to the client that the data is being provided to the agency. The notification to the client must come before the data is provided to the agency.

If a regulatory agency requests additional reports or data for any other type of work, the data cannot be released without the written approval from the client.

-For certain types of work (i.e. Hexavalent Chromium data), clients may provide, in advance, a written approval stating that data/reports can be provided to the state on request for that project.

In the case where SGS receives a subpoena or other legal request for data or a report, SGS Legal must be notified immediately and the following steps taken:

-A copy of the Subpoena or legal request is sent to SGS Legal
-SGS Legal is involved in the client notification process, the content of the notification, and how the client is notified
-SGS Legal is involved in the response to the regulatory agency

17.2 ***Documents***. Access to client documents is restricted to employees in need to know positions. Copies of all client reports are stored in secure electronic archives with restricted access. Reports and report copies are distributed to individuals who have been authorized by the client to receive them. Data reports or data are not released to third parties without verbally expressed or written permission from the client.

17.3 ***Electronic Data***.

Database Intrusion. Direct database entry is authorized for employees of SGS only on a need to know basis. Entry to the database is restricted through a user specific multiple password entry system. Direct access to the database outside the facility is possible through secured channels set up by SGS. A unique password is required for access to the local area network. A second unique password is required to gain access to the database. The staff receives read or write level authorization on a hierarchical privilege basis.

Internet Access. Access to client information is through an HTTP Web application only. It does not contain a mechanism that allows direct access to the database. Clients can gain access to their data only using a series of SGS assigned client and user specific passwords. The viewable data, which is encrypted during transmission, consists of an extraction of database information only.

Client Accessibility. Accessibility to client data delivered via electronic means follows strict protocols to insure confidentiality. Clients accessing electronic data are assigned a company account. The account profile, which is established by the MIS staff, grants explicit access to specific information pertaining to the client's project activity. Passwords are assigned on an individual basis within a client account. These accounts can be activated or deactivated by the MIS staff only.

17.4 ***Information Requests***. Client specific data or information is not released to third parties without verbally expressed or written permission from the client. Written permission is required from third parties, who contact the Company directly for the release of information. Verbal requests will be honored only if they are received directly from the client. These requests must be documented in a record of communication maintained by the authorized recipient.

17.5 ***Transfer of Records***. Archived data, which has previously been reported and transmitted to clients, is the exclusive property of SGS. In the event of a cessation of business activities due to business failure or sale, The Company's legal staff will be directed to arrange for the final disposition of archived data.

The final disposition of archived data will be accomplished using the approach detailed in the following sequence:

1. All data will be transferred to the new owners for the duration of the required archive period as a condition of sale.

2. If the new owners will not accept the data or the business has failed, letters will be sent to clients listed on the most recent active account roster offering them the option to obtain specific reports (identified by SGS Job Number) at their own expense.

3. A letter will be sent to the TNI Standard accrediting authority with organizational jurisdiction over the company offering them the option to obtain all unclaimed reports at their own expense.

4. All remaining archived data will be recycled using the most expedient means possible.

18.0 QUALITY AUDITS AND SYSTEM REVIEWS

Requirement: The quality assurance group conducts regularly scheduled audits of the laboratory to assess compliance with quality system requirements, technical requirements of applied methodology, and adherence to documentation procedures. The information gathered during these audits is used to provide feedback to senior management and perform corrective action where needed for quality improvement purposes.

18.1 ***Quality System Reviews***. Quality system reviews are performed annually by the Quality Assurance Director. In this review, the laboratory is evaluated for compliance with the laboratory Quality Systems Manual (QSM) and the quality system standards of the National Environmental Laboratory Accreditation Conference. Findings, which indicate non-compliance or deviation from the QSM, are flagged for corrective action. Corrective actions require either a return to compliance or a plan change to reflect an improved quality process. The Quality Assurance Director is responsible for making and documenting changes to the QSM.

18.2 ***Quality System Audits.*** Quality system audits are conducted to evaluate the effectiveness and laboratory compliance with individual quality system elements. These audits are conducted on an established schedule. Audit findings are documented and communicated to the management staff and entered into the corrective action system for resolution. If necessary, retraining is conducted to assure complete understanding of the system requirements.

18.3 ***Test Method Assessments.*** Test Method Assessments are performed throughout the year following an established schedule. Selected analytical procedures are evaluated for compliance with standard operating procedures (SOPs) and method requirements. If non-conformances exist, the published method serves as the standard for compliance. SOPs are edited for compliance if the document does not reflect method requirements. Analysts are trained to the new requirements and the process is monitored by quality assurance. Analysts are retrained in method procedures if an evaluation of bench practices indicates non-compliance with SOP requirements.

18.4 ***Documentation Audits***. Documentation audits are conducted during routine internal audits. The audit includes a check of measurement processes that require manual documentation. It also includes checks of data archiving systems and a search to find and remove any inactive versions of SOPs that may still be present in the laboratory and being accessed by the analysts. Non-conformances are corrected on the spot. Procedural modifications are implemented if the evaluation indicates a systematic defect.

18.5 ***Corrective Action Monitoring***. Defects or non-conformances that are identified during client or internal audits are documented in the corrective action systems (Section 13) and corrected through process modifications and/or retraining. Once a corrective action has been designed and implemented, it is monitored for compliance on a regular basis by the QA staff.

Spot corrections are performed if the staff is not following the new procedure. Monitoring of the corrective action continues until satisfactory implementation has been verified.

18.6 ***Preventive Action.*** Laboratory systems or processes, which may be faulty and pose the potential for non-conformances, errors, confusing reports or difficulties establishing traceability may be identified during internal audits. These items are highlighted for systematic change using the corrective action system and managed to resolution using the procedures for corrective action identified in EQA041.

18.7 ***Management Reports.*** Formal reports of all audit and proficiency testing activity are prepared for the management staff and presented as they occur. Additional reports may be presented orally at regularly scheduled staff meetings

Management reports may also address the following topics:

- Status and results of internal and external audits,
- Status and results of internal and external proficiency testing,
- Identification of quality control problems in the laboratory,
- Discussion of corrective action program issues,
- Status of external certifications and approvals,
- Status of staff training and qualifications,
- Discussion of new quality system initiatives.
- Recommendations for further action on listed items are included in the report.

19.0 HEALTH AND SAFETY

Requirement.

The company health and safety program meets the requirements established by the Occupational Safety and Health Administration (OSHA) including applicable regional and local regulations and laws. All employees receive training on the program and are required to comply with its policies and procedures at every level within our organization.

19.1 Policy.

SGS provides safe and healthy working conditions to all our employees (permanent and temporary), visitors, contractors and other stakeholders. We ensure that all our services and operations are performed and managed in such a way as to protect the environment.

The company will continuously assess and improve safety management systems, programs and tools towards our ''Zero incident'' target.

The company provides all necessary safety equipment, resources and training gives the Stop-Work-Authority to all employees and contractors in case of any risk to health, safety or environment.

19.2 Responsibilities.

Management is responsible for ensuring full compliance with company safety policies and procedures and investigating any incidents including root cause analysis and corrective action.

The Vice President EHS and Lab Director are ultimately responsible for management decisions and actions pertaining to the health and safety program.

The Health, Safety & Environment Manager reviews and updates the health and safety program annually, establishes company-wide training, and performs inspections and audits to ensure that program elements are being implemented and compliance is being met.

Department Managers and Supervisors are responsible for daily operations, employee oversight, and ensuring the requirements of the health and safety program are practiced daily.

Employees are responsible for following all safety rules and the proper use of protective devices provided by the company. The employee is expected to comply with the requirements of the health and safety program at all times.

19.3 Program Elements.

Safety Training and Communication.

All new employees to the company are provided health and safety training on their first day. Annual safety training is conducted for all employees. Additional training is provided when new substances, equipment, or procedures are introduced and when management is made aware of a situation that requires re-training.

Training is documented and appropriate records kept with Quality Assurance.

***Safety Committee*.**

The safety committee meets on a regular basis and establishes an additional safety "presence" throughout the facility. The safety committee promotes knowledge of health and safety at all levels, identifies and notifies of any unsafe work practices and conditions, and participates in development of safety initiatives.

Membership in the safety committee is open to any employee and will be comprised of both management and employee representatives.

Hazard Communication.

The hazard communication program enables employees to readily identify any laboratory hazards and protect themselves from those hazards. The program complies with the OSHA Hazard Communication Standard, Title 29 Code of Federal Regulations 1910.1200 and includes the following:

- Safety Data Sheets (SDS) available to all employees
- Chemical inventory
- Globally harmonized system of classification and labeling of chemicals

***Identification of Workplace Hazards*.**

The hazard identification procedures assure that hazards are identified and corrected before an incident occurs. Hazard identifications are reported to management by all employees and learnings are shared throughout the company.

***Employee Exposure Assessment*.**

Employee exposure assessment is performed to identify and evaluate potential exposure hazards in the workplace. The exposure assessment data is used to document safe practices and to determine if any changes or modifications may be required to improve the work environment.

Bloodborne Pathogens.

Awareness training on the OSHA Bloodborne Pathogen Standard, 29CFR1910.1030 is conducted to inform employees about standard precautions when someone is injured at work.

Chemical Hygiene Plan.

The Chemical Hygiene Plan meets the requirements established by the OSHA Occupational Exposure to Hazardous Chemicals in the Laboratory Standard, 29 CFR 1910.1450. The plan references best laboratory practices, engineering controls and personal protective equipment that are necessary when working in an environmental laboratory.

Chemical Spill Response.

The chemical spill response plan ensures immediate notification and corrective action in the event of a chemical spill.

Employees that are required to respond to an emergency spill are trained per the OSHA Hazardous Waste Operations and Emergency Response Standard, 29 CFR 1910.120.

Emergency Action & Evacuation.

All employees are trained on what to do in the event of an emergency that includes fire, explosion, gas leak, hazardous material spill, natural disaster and terrorist action. The plan identifies emergency coordinators, building evacuation meeting areas, and contact information for local and national emergency responders.

Lockout/Tagout.

Lockout/tagout procedures are established to ensure that mechanical and electrical equipment is made inoperable and safe before experienced individuals perform inspection, maintenance and repair.

Personal Protective Equipment.

Personal protective equipment (PPE) is provided to employees that includes safety eyewear, laboratory coat and protective gloves. Other PPE may be provided such as safety shoes, hearing protection and respirators depending on specific job tasks.

***Respiratory Protection*.**

The respiratory protection program assures proper training, medical evaluation and respirator selection and fit testing on an annual basis for employees that are required to wear this type of personal protective equipment.

Visitor and Contractor Safety.

A safety presentation including brochure is given to all visitors. Visitors must sign in, wear a visitor badge, follow the instructions of their escort, and sign out before leaving the premises.

Appendix I

Glossary of Terms

GLOSSARY OF TERMS

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Audit: a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same TNI Standard defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group.

Blank (BLK): a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations of a series of calibration standards and their instrument response.

Calibration Method: a defined technical procedure for performing a calibration.

Calibration Range: the range of concentrations between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Calibration Standard: a substance or reference material used to calibrate an instrument.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation, which is issued by a certifying body.

Chain of Custody (COC): an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to second column confirmation, alternate wavelength, derivatization, mass spectral, interpretation, alternative detectors or, additional cleanup procedures.

Continuing Calibration Verification (CCV): the verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Corrective Action (CA): the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Demonstration of Capability (DOC): a procedure to establish the ability of the analyst to generate acceptable accuracy.

Documentation of Understanding (DOU): certifies that the analyst or technician has read and understood the procedures detailed in the Standard Operating Procedure (SOP) and will follow the SOP as written.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate Analyses (DUP): the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

Field of Testing: TNI Standard's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required submit to only that portion of the accreditation process not previously addressed (see TNI Standard, section 1.9ff).

Laboratory Control Sample-LCS (such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Limit of Detection (LOD): an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific. DoD clarification is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limit of Quantitation (LOQ): the minimum levels, concentrations, or quantities of a target analyte that can be reported with a specified degree of confidence. DoD clarification is the lowest concentration that produces a quantitative result within specified limits of precision and bias. The LOQ shall be at or above the concentration of the lowest initial calibration standard.

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated a potable or potential potable water source. Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake. Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Biota: animal or plant tissue, consisting of entire organisms, homogenates, and/or organ or structure specific subsamples.

Matrix Spike-MS (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate -MSD (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank (MB): a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit (MDL): the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program.

NELAP Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference.

Performance Audit: the routine comparison of independently obtained *qualitative and quantitative* measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance (QA): an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control (QC): the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Reporting Limits (RL): the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user.

Reagent Blank (method reagent blank or method blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Sample Duplicate (SD): two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of TNI Standard and meets the approval requirements of TNI Standard procedures and policies.

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Validation: the process of substantiating specified performance criteria.

Work Cell: A defined group of analysts that together perform the method analysis. Members of the group and their specific functions within the work cell must be fully documented. A "work cell" is considered to be all those individuals who see a sample through the complete process of preparation, extraction, or analysis. The entire process is completed by a group of capable individuals; each member of the work cell demonstrates capability for each individual step in the method sequence.

Appendix II

Standard Operating Procedures Directory
SGS - Dayton

Section	Standard Operating Procedure Title	Number
Air Toxics	Air Analysis by TO-15	EAT001
Air Toxics	Summa Canister Cleaning and Certification	EAT002
Air Toxics	Air Analysis of Tedlar Bag/Summa Canister by TO-3	EAT003
Air Toxics	Laboratory Analysis of Dissolved Gases in Aqueous Samples	EAT004
Air Toxics	Air Analysis by NJDEP – SRWM Low Level USEPA TO-15	EAT005
Air Toxics	Calibration of Flow Controllers	EAT006
Air Toxics	Air Analysis by TO-15 for Minnesota Department of Health	ETA007
General Chem	Percent Solids - SM2540 G-97, ASTM D4643-00	EGN007
General Chem	Anionic Surfactants As MBAS	EGN008
General Chem	Nonionic Surfactants as CTAS	EGN009
General Chem	Total Solids, 160.3, SM2540 B-97	EGN010
General Chem	Composite Sample	EGN015
General Chem	Total Dissolved Solids (Total Filterable Residue) SM2540 C-97	EGN020
General Chem	Settleable Solids, 160.5	EGN021
General Chem	Nitrate/Nitrite & Nitrate Only By Cad. Red. Analysis	EGN026
General Chem	Total Volatile Solids, 160.4	EGN030
General Chem	Chlorine, Total Residual And Free	EGN033
General Chem	Total Alkalinity, 310.1	EGN037
General Chem	Acidity (pH 8.2)	EGN044
General Chem	Bicarbonate, Carbonate, Free Carbon Dioxide	EGN045
General Chem	Viscosity	EGN067
General Chem	Total Suspended Solids (Non-Filterable Residue)	EGN087
General Chem	Chemical Oxygen Dem: Hach 8000, Aqueous Samples - Soil Modified	EGN099
General Chem	Hardness As Caco3 By Titration	EGN101
General Chem	Orthophosphate	EGN102
General Chem	Nitrogen, Nitrite -Total-Waters/Soluble-Soils	EGN103
General Chem	Turbidity, 180.1	EGN116
General Chem	Sulfide	EGN118
General Chem	Sulfite	EGN119
General Chem	Apparent Color By Visual Comparison Method	EGN120
General Chem	Specific Conductance At 25.0 C	EGN124
General Chem	Chloride	EGN131
General Chem	Turbidity for Metals Drinking Waters	EGN132
General Chem	Odor & Odor at Elevated Temp.(Threshold Odor Test)	EGN133
General Chem	Biological Oxygen Demand (5 Day BOD)	EGN134
General Chem	Winkler Titration For DO Standardization	EGN135
General Chem	Dissolved Oxygen	EGN136
General Chem	Reactive Sulfide And Reactive Cyanide	EGN137

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Section	Standard Operating Procedure Title	Number
General Chem	Ignitability	EGN140
General Chem	TCLP - Semi-volatiles/Metals Extraction	EGN141
General Chem	TCLP- Volatiles Extraction	EGN142
General Chem	Paint Filter Test	EGN143
General Chem	Cyanides Amenable To Chlorination Preparation	EGN144
General Chem	Temperature	EGN146
General Chem	Iodine, Colorimetric Analysis	EGN148
General Chem	pH by Electrode – Water	EGN151
General Chem	Salinity - SM182520B	EGN158
General Chem	pH & Corrosivity for Soils/ Solid Wastes SW486 9045	EGN200
General Chem	BTU (Gross Calorific Value)	EGN202
General Chem	Percent Sulfur	EGN203
General Chem	Bulk Density (Dry Basis)	EGN204
General Chem	Percent Ash (Dry Basis)	EGN205
General Chem	Total Organic Content	EGN206
General Chem	Cyanide (Lachat Autoanalyzer)	EGN207
General Chem	Total Chlorine ASTM D808-91	EGN208
General Chem	Total Organic Chlorine ASTM D808-91	EGN209
General Chem	Total Kjeldahl Nitrogen (Lachat Autoanalyzer)	EGN210
General Chem	Specific Gravity	EGN211
General Chem	Hexavalent Chromium (Soils)	EGN214
General Chem	Ammonia (Lachat Autoanalyzer)	EGN216
General Chem	Phenols (Lachat Autoanalyzer)	EGN217
General Chem	Total Organic Halides	EGN218
General Chem	Total Organic Halides, Solid And Oil Matrices	EGN219
General Chem	Pour Point	EGN221
General Chem	Base Sediment In Petroleum Samples	EGN222
General Chem	Water Content In Petroleum Samples	EGN223
General Chem	Ignitability, Bunsen Burner Method	EGN226
General Chem	Organic Matter (Loss on Ignition)	EGN227
General Chem	Sulfide Analysis For Reactive Sulfides	EGN228
General Chem	Hexavalent Chromium In Waters by EPA 7196a Mod.	EGN230
General Chem	Hexavalent Chromium In Waters by SM18 4500 CR D	EGN231
General Chem	Total Organic Carbon In Soil Samples	EGN233
General Chem	Total Organic Carbon In Aqueous Samples	EGN234
General Chem	pH and Corrosivity for Aqueous and Multiphasic Wastes	EGN238
General Chem	Synthetic Precipitation Leaching Procedure for Non-Volatile Anal.	EGN239
General Chem	Synthetic Precipitation Leaching Procedure for Volatile Analytes	EGN240
General Chem	Cation Exchange Capacity Of Soils (Sodium Acetate)	EGN242
General Chem	Ferrous Iron	EGN243
General Chem	Specific Gravity (For Sludges And Solids)	EGN247
General Chem	N-Hexane Extract. Mat. & Silica Gel Treatment by Gravimetric Anal.	EGN249
General Chem	Oil & Grease – Gravimetric Anal. (So & Sl) – Hexane Extraction	EGN250

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Section	Standard Operating Procedure Title	Number
General Chem	Neutral Leaching of Solid Waste Sam. Using Shake Extraction	EGN252
General Chem	Oxidation-Reduction Potential	EGN253
General Chem	Titrimetric Method For Free Carbon Dioxide	EGN255
General Chem	Total Phosphorous EPA 365.3	EGN256
General Chem	Dissolved Silica	EGN257
General Chem	Grain Size and Sieve Testing	EGN258
General Chem	Hardness By Calculation	EGN259
General Chem	Spectrophotometer Calibration Check	EGN260
General Chem	Massachusetts Sieve Test	EGN262
General Chem	Volatile Suspended Solids	EGN264
General Chem	Unburned Combustibles (Volatile Solids)	EGN266
General Chem	Particulate Matter	EGN267
General Chem	Elutriate Preparation	EGN268
General Chem	Phosphorus, Hydrolyzable	EGN271
General Chem	Perchlorate by Ion Chromatography in Groundwater and Soil	EGN272
General Chem	Percent Lipids by Gravimetric Analysis	EGN273
General Chem	Cyanide Distillation/Aqueous Samples/Micro Method	EGN275
General Chem	Cyanide Distillation/Soil Samples/Micro Method	EGN276
General Chem	Calibration of General Chemistry Distillation Tubes	EGN277
General Chem	Phenols Distillation, Water Samples	EGN279
General Chem	Phenols Micro Distillation, Soil Samples	EGN280
General Chem	Inorganic Anions Determination by ion chromatography using IC 2000	EGN281
General Chem	Leaching of Solid Waste Samples using China Leaching Procedure	EGN283
General Chem	Ammonia Distillation, Water & Solid samples	EGN284
General Chem	Weak Acid Dissociable Cyanide / Micro-Distillation Method	EGN286
General Chem	Ferrous Iron for Hexavalent Chromium Sample Characterization	EGN288
General Chem	Calibration of Coliform Collection Bottles	EGN287
General Chem	Inorganic Carbon by Calculation	EGN289
General Chem	Procedure for Homogenization of Biota Samples	EGN290
General Chem	Hexavalent Chromium in Water by Ion Chromatography	EGN291
General Chem	Hexavalent Chromium in Soils by Ion Chromatography	EGN292
General Chem	Procedure for Wand Mixer Homogenization of Soil Samples	EGN293
General Chem	Hydrogen Sulfide	EGN294
General Chem	TCLPME-Multiple Extractions Procedure	EGN295
General Chem	Modified Elutriate Preparation	EGN296
General Chem	Procedure for Particle Size Reduction (Crushing) of Solid Matrices	EGN297
General Chem	Acid Volatile Sulfides	EGN298
General Chem	Pore Water Extraction from Soils for NVOC and Metals Analysis	EGN299
General Chem	Iodide, Colorimetric Analysis	EGN300
General Chem	Percent Solids and Moisture in Soil/Solid Matrices	EGN301
General Chem	Un-Ionized Ammonia	ENG302
General Chem	Density, ASTM Definition	EGN303
General Chem	HEM by Gravimetric Analysis Using Solid Phase Extraction	EGN304
General Chem	Hexavalent Chromium on Wipe Samples	EGN305
General Chem	Modified Mehlich Buffer pH	EGN306
General Chem	Screening Procedure to test for presence of sulfide	EGN307

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Section	Standard Operating Procedure Title	Number
General Chem	Black Carbon in Soil Samples	EGN308
General Chem	Physical Appearance (Sample Description)	EGN309
General Chem	Orthophosphate	EGN310
General Chem	Oxidizer Screen	EGN311
General Chem	Hexavalent Chromium by 218.7	EGN313
General Chem	Incremental sampling method	EGN314
General Chem	Total Organic Carbon In Soil Samples by SW846 9060A	EGN315
General Chem	Procedure for Particle Size reduction (crushing) / Homgenization of solid matrices, composite samples, phase separation, resin samples	EGN316
General Chem	Inline_4500NH3 H-11	EGN317
General Chem	Determination of Inorganic Anions By Ion Chromatography using the IC2000	EGN318
General Chem	Spike Witness	EGN319
General Chem	Phenol lachat 9066	EGN320
General Chem	Waste Extraction (STLC-CA)	EGN321
General Chem	Cyanide Amenable to Chlorination (Seal analyzer)	EGN322
General Chem	Determination of inorganic anions by ion chromatography using the IC2000	EGN323
General Chem	Volatile Fatty Acids by Ion Chromatography	EGN324
Facilities Maint.	Facilities Maintenance	EFM001
Facilities Maint.	Lab Coats_Lockers	EFM002
Field Operations	Aqueous Grab Sampling Procedures	EFP001
Field Operations	Use of Automatic Wastewater Sampler	EFP002
Field Operations	Free and Total residual Chlorine	EFP003
Field Operations	Decontamination of Sampling Equipment	EFP004
Field Operations	Dissolved Oxygen	EFP005
Field Operations	Dissolved Oxygen by Winkler Titration	EFP006
Field Operations	Metal Sample Field Filtering Procedure	EFP008
Field Operations	Sampling Procedure for Monitoring Wells	EFP013
Field Operations	Subsurface Soil Sampling Procedure	EFP016
Field Operations	Residential Potable Well Sampling Procedure	EFP018
Field Operations	Potable Water Line Sampling Procedure	EFP019
Field Operations	Sampling Drinking Water Wells for Volatile Organics	EFP022
Field Operations	Documentation Requirements for Field Services	EFP028
Field Operations	Field Oxidation-Reduction Potential	EFP029
Field Operations	Turbidity, Field Test	EFP030
Field Operations	Analysis for Dissolved Oxygen by DO Probe	EFP031
Field Operations	Field pH in Water by Electrode	EFP032
Field Operations	Field Measurement of Specific Conductance and Resistivity	EFP033
Field Operations	Low Flow Monitoring Well Sampling	EFP034

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Section	Standard Operating Procedure Title	Number
Health & Safety	Contamination Avoidance Procedure	EHS001
Health & Safety	Measuring Face Velocities in Laboratory Fume Hoods	EHS002
Health & Safety	Proper Handling of Compressed Gas Cylinders	EHS003
Health & Safety	Sample and Waste Disposal (Formerly ESM003)	EHS004
Health & Safety	Handling and Management of Inorganic Wastes (Formerly EGN265)	EHS005
Health & Safety	Handling, Treatment, and Disposal of Foreign Soils	EHS006
Health & Safety	Management of Industrial Product Samples	EHS007
Health & Safety	Organic Prep Air Monitoring	EHS008
Health & Safety	Laboratory Visitor Safety Procedure	EHS009
Information Tech	Information Security & Integrity Procedure	EMI001
Information Tech	Procedures for Requesting Software or Software Revisions	EMI002
Information Tech	Development, Implementation, Delivery, & Revision of EDDs	EMI003
Information Tech	Data Systems Maintenance and Information Handling	EMI006
Metals Analysis	Mercury Analysis of Non-Potable and Potable Water Samples	EMA215
Metals Analysis	Metals by ICP-MS: EPA 200.8	EMA216
Metals Analysis	Metals by ICP-MS: SW846 6020	EMA217
Metals Analysis	Metals by ICP Atomic Emission Spectrometry using Solid State ICP	EMA222
Metals Analysis	Metals by ICP Atomic Emission Spectrometry – EPA 200.7	EMA223
Metals Analysis	Low Level Mercury by EPA 1631	EMA224
Metals Analysis	Low Level Mercury by EPA 245.7	EMA225
Metals Analysis	Metals by inductively coupled plasma-Mass Spectrometry (ICP-MS)	EMA226
Metals Analysis	Metals by Inductively coupled plasma atomic emission spectrometry (ICP) using Using Solid State ICP	EMA227
Metals Analysis	Cold Vapor Analysis of Mercury For Soil Samples	EMA228
Metals Analysis	Metals by ICP: SW846 6010D	EMA6010D
Metals Analysis	Metals by ICP-MS: SW846 6020B	EMA6020B
Metals Prep	Digestion of DW for ICP Analysis	EMP048
Metals Prep	Non-Potable Waters Digestion For ICP/Flame Analysis	EMP070
Metals Prep	Soil Digestion For ICP Analysis	EMP073
Metals Prep	Non-Potable Water Digestion for Flame/ICP (Total & Dissolved)	EMP081
Metals Prep	Digestion Of Non-Potable Waters For Total Recoverable Metals	EMP200
Metals Prep	Metals Spiking Solution and Standards Preparation and Use	EMP202
Metals Prep	Calibration of Metals Digestion Tubes	EMP203
Metals Prep	ICP and ICP/MS Analysis of TPPM-10 Filters	EMP207
Metals Prep	Digestion of Waters for Acid Extractable Metals	EMP208
Metals Prep	Lab Preservation Filtration of Metals Samples	EMP209

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Section	Standard Operating Procedure Title	Number
Microbiology	Microbiological Quality Control	EMB001
Microbiology	Coliform, Total By Colilert, SM18 9223 B	EMB002
Microbiology	Total Coliform: Membrane Filtration/Fecal Coliform Confirmation	EMB003
Microbiology	Total Plate Count SM18 9215B	EMB008
Microbiology	General Petroleum Degraders	EMB009
Microbiology	Calibration of Microbiology Coliform Collection Bottles	EMB010
Microbiology	Coliform, Fecal	EMB127
Microbiology	Water Suitability	EMB128
Organics-GC	Dibromo-3-chloropropane & 1,2,3-Trichloropropane	EGC504
Organics-GC	Pesticides & PCBs in Wastewater by EPA 608	EGC608
Organics-GC	1,2-DBE, 1,2-DB-3-CP & 1,2,3-TCP by Micro-extraction and GC	EGC8011
Organics-GC	Pesticides Analysis by SW8081	EGC8081
Organics-GC	PCB Analysis SW8082	EGC8082
Organics-GC	Herbicides by SW846 – 8151	EGC8151
Organics-GC	Herbicides by SW846 – 8151 Low Volume	EGC8151L
Organics-GC	Alcohols by Direct Aqueous Injection GC/FID SW 8015	EGCALDAI
Organics-GC	New Jersey Extractable Petroleum Hydrocarbons	EGCNJEPH
Organics-GC	Oil Identification by Gas Chromatography Fingerprint	EGCOILID
Organics-GC/MS	Volatile Organics in Drinking Water by EPA 524	EMS524
Organics-GC/MS	Volatile Organics in Wastewater by EPA 624	EMS624
Organics-GC/MS	Semi-Volatile Organics by EPA 625	EMS625
Organics-GC/MS	Volatile Organics by SW8260B	EMS8260B
Organics-GC/MS	Volatile Organics by SW8260C	EMS8260C
Organics-GC/MS	Ethylene/Propylene Glycol Analysis DAI-GC/MS(SIM)	EMS8260DAI
Organics-GC/MS	Semi-Volatile Organics by SW8270D	EMS8270D
Organics Prep	Prep of Base Neutral/Acid Extractables: Water Matrices	EOP001
Organics Prep	Extraction of Semivolatile Organics from Solids By Sonication	EOP003
Organics Prep	Preparation of Semi-volatile Extractables in Aqueous Samples with Reduced Volume	EOP004
Organics Prep	Alumina Cleanup of Organic Extracts: SW3610	EOP005
Organics Prep	Continuous Liquid/Liquid Extraction Water: SW3520C	EOP007
Organics Prep	Sulfur Cleanup of Organic Extracts: SW846 3660B	EOP011
Organics Prep	Testing & Approval Of Organics Solvents	EOP013
Organics Prep	Preparation & Use of MDL Check Solution	EOP014
Organics Prep	Preparation of Petroleum Oils & Organic Wastes for PCBs by SW 8082	EOP017
Organics Prep	Removal of Sulfur from Extracts with Tetrabutylammonium Sulfite	EOP018
Organics Prep	Soxhlet Extraction of Solids For Semi-Volatile Organics	EOP020
Organics Prep	Preparation of Petroleum Products for EPA 8081	EOP021
Organics Prep	Preparation of Petroleum Products for BNA by EPA 8270C	EOP022
Organics Prep	Calibration of Extract Vials	EOP026
Organics Prep	Spike Witness	EOP027

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Section	Standard Operating Procedure Title	Number
Organics Prep	Prep. and analysis of Bis(2-chloroethyl) ether (BCEE) in Aqueous samples with SIM and Isotope Dilution Quantitation	EOP028
Organics Prep	Preparation of Drying Agents, Ottawa Sand, and Sodium Chloride	EOP029
Organics Prep	Petroleum Oils & Org Wastes Prep for DRO SW 8015	EOP030
Organics Prep	Petroleum Oils & Org Wastes Prep for Herbicides SW 8151	EOP031
Organics Prep	Petroleum Oils & Org Wastes Prep for BNJEPH	EOP032
Organics Prep	Extractions batch scheduling & associated quality control	EOP033
Organics Prep	Microwave Extraction of Pesticides &/or PCBs from solid samples	EOP3546
Organics Prep	Alumina Column Cleanup SW3611	EOP3611
Organics Prep	Florisil Column Cleanup SW3620	EOP3620
Organics Prep	Silica Gel Cleanup SW3630	EOP3630
Organics Prep	Acid Base Partitioning SW3650	EOP3650
Organics Prep	Sulfuric Acid/Permanganate Cleanup SW3665	EOP3665
Organics Prep	Purge-And-Trap Extraction Of Aqueous Samples	EOP5030
Organics Prep	Collection/Preservation of Solids for VO Analysis: 5035	EOP5035
Organics Prep	Cleanup of Organic Extracts by Gel Permeation Chromatography	EOPGPC
Project Mgmt	Procedure For The Management Of Client Projects	EPM001
Project Mgmt	Client Specific Method Modifications	EPM002
Project Mgmt	Procedure For The Notification Of DW Exceedences	EPM003
Project Mgmt	Data Entry for Sample Log-In	EPM004
Project Mgmt	Subcontracting high volume	EPM005
Project Mgmt	Procedure for the Mangement and Reporting of Samples and Projects for FAA	EPM006
Project Mgmt	Procedure for the management of EHS Lab Chat	EPM007
Quality Assurance	Preparation, Approval, Distribution & Archiving of SOPs	EQA001
Quality Assurance	Calibration of Analytical Balances	EQA002
Quality Assurance	Calibration of Thermometers	EQA003
Quality Assurance	Calibration and Use of Auto-Pipettes	EQA004
Quality Assurance	Temperature Monitoring-	EQA005
Quality Assurance	Sample Container Cleaning & Quality Control	EQA006
Quality Assurance	Calibration of Kuderna-Danish Collection Tubes	EQA007
Quality Assurance	Preparation and Analysis of Sample Preservatives	EQA008
Quality Assurance	Personnel Training and Analyst Proficiency	EQA009
Quality Assurance	Sample Batching Procedure	EQA010
Quality Assurance	Corrective Action Procedure	EQA011
Quality Assurance	Glassware Preparation For Inorganic Lab Use	EQA012
Quality Assurance	Preparation Of Glassware For Organics Extraction	EQA013
Quality Assurance	Standards Traceability Documentation Procedure	EQA014
Quality Assurance	Template for Standard Operating Procedures	EQA016
Quality Assurance	Management/Reporting Of Proficiency Test (PT) Samples	EQA017
Quality Assurance	Creating/Distributing/Tracking Internal Chains Of Custody	EQA018
Quality Assurance	Creating New Accounts	EQA019
Quality Assurance	Creating New Projects	EQA020

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Section	Standard Operating Procedure Title	Number
Quality Assurance	Creating Product Codes	EQA021
Quality Assurance	Procedures For The Purchase Of Laboratory Supplies	EQA023
Quality Assurance	Control & Archiving Of Laboratory Documents	EQA025
Quality Assurance	Confidentiality Protection Procedures	EQA027
Quality Assurance	Quality System Review	EQA028
Quality Assurance	Contract Review	EQA029
Quality Assurance	Procedure for the Development and Application of MDLs and RLs	EQA030
Quality Assurance	Subcontracting Procedures	EQA031
Quality Assurance	Signature Authority	EQA032
Quality Assurance	Review of Inorganic Data	EQA034
Quality Assurance	Review of Organic Data	EQA035
Quality Assurance	Documentation of Equipment Maintenance	EQA036
Quality Assurance	Procedures for Accepting Departures from Laboratory Specifications	EQA037
Quality Assurance	Client Complaints Resolution Procedure	EQA038
Quality Assurance	Employee Technical Ethics Responsibilities	EQA039
Quality Assurance	Internal Audit Procedure	EQA041
Quality Assurance	Procedure for Obtaining Representative Sample Aliquots	EQA042
Quality Assurance	Procedure for Development &use of In-House Q C Criteria	EQA043
Quality Assurance	Manual Integration of Chromatographic Peaks	EQA044
Quality Assurance	Deionized Water Quality Control	EQA046
Quality Assurance	Management and Control of Change	EQA047
Quality Assurance	Laboratory Equipment Purchase and Removal From Service	EQA048
Quality Assurance	Calibration of Microliter Syringes	EQA049
Quality Assurance	Autosampler Vial Labeling Procedure (formally EOP041-01)	EQA050
Quality Assurance	pH for Volatile Samples	EQA051
Quality Assurance	Quality Control Review of Data Packages	EQA054
Quality Assurance	Procedures for Determining Method Comparability	EQA055
Quality Assurance	Refrigerator Storage Holding Blank Procedure	EQA056
Quality Assurance	Data Integrity Training Procedure	EQA057
Quality Assurance	Data Integrity Monitoring Procedure	EQA058
Quality Assurance	Procedure for Conducting Data Integrity Investigations	EQA059
Quality Assurance	Quality Control Requirements for Organics by GC/GCMS using EPA 500 & 600 Series, SW846 8000 Series and CLP Methodologies	EQA060
Quality Assurance	Procedure for the Confidential Reporting of Data Integrity Issues	EQA061
Quality Assurance	Calibration of Volumetric Dispensers for Volume Critical Processes	EQA062
Quality Assurance	Calibration of Volumetric Dispensers / Non-Critical Volumes Processes	EQA063
Quality Assurance	Glassware Preparation for use in VOA analysis	EQA064
Quality Assurance	Control of Non-Conforming Product	EQA065
Quality Assurance	Client Notification of Key Personnel Changes	EQA066
Quality Assurance	Review of Inorganic Notebooks	EQA067
Quality Assurance	Disposal of Spent Semi-Volatile Organic Extracts	EQA068
Quality Assurance	Compressed Gas Management	EQA069
Quality Assurance	Procedure for Tracking Quality Control Non-Conformances	EQA070
Quality Assurance	Procedure for the Development and Application of Experimental Method Detection Limits, limits of detection, and limits of quantitation for inorganic applications	EQA071
Quality Assurance	Procedure for Particle Size Reduction (Crushing)/Homogenization of solid matrices	EQA072

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Section	Standard Operating Procedure Title	Number
Report Generation	Report Generation–Data Package	ERG002
Sample Mgmt.	Sample Storage	ESM001
Sample Mgmt.	Chain Of Custody And Log In Procedure	ESM002
Sample Mgmt.	Temperature Maintenance Of Shipping Coolers	ESM004
Sample Mgmt.	Cooler Packaging And Shipping Procedure	ESM008
Sample Mgmt.	Procedures for Sample Couriers	ESM011
Sample Mgmt.	Summa Canister Shipment & Retrieval: NJDEP 03-X-35135	ESM012

Appendix III

Analytical Capabilities

Annual Certified Parameter List

SGS ACCUTEST INC. - DAYTON (Lab ID Number: 12129)
2235 US Hwy 130, Dayton, NJ 08810

Downloaded: *December 8, 2017*
https://www13.state.nj.us/DataMiner

Lab Contact Name	NANCY COLE
E-mail Address	nancy.cole@sgs.com
Contact Phone Number	732-329-0200
Fax Number	732-329-3499

Parameter	Matrix Code	Status	Approved Method	Technique	Parameter Code	Eligible to Report NJ Data	Nelap State or Country Code	Latest Certification Status Date
Acetaldehyde	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03500	Yes	NJ	3/5/2004
Acetone	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03510	Yes	NJ	12/1/2006
Acetonitrile	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03520	Yes	NJ	9/8/2016
Acetophenone	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03530	Yes	NJ	3/5/2004
Acrolein	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03540	Yes	NJ	3/5/2004
Acrylamide	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03550	Yes	NJ	3/5/2004
Acrylic acid	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03560	Yes	NJ	3/5/2004
Acrylonitrile	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03570	Yes	NJ	9/8/2016
Allyl chloride	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03580	Yes	NJ	3/5/2004
Benzene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03600	Yes	NJ	3/5/2004
Benzyl chloride	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03610	Yes	NJ	3/5/2004
Bis (2-chloroethyl) ether	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03620	Yes	NJ	3/5/2004
Bis (chloromethyl) ether	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03630	Yes	NJ	3/5/2004
Bromodichloromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03640	Yes	NJ	3/5/2004
Bromoform	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03650	Yes	NJ	3/5/2004
Bromomethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03660	Yes	NJ	3/5/2004
Butadiene (1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03670	Yes	NJ	3/5/2004
Butadiene (2-chloro-1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03680	Yes	NJ	3/5/2004
Butylbenzene (n-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03690	Yes	NJ	9/8/2016
Carbon disulfide	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03700	Yes	NJ	3/5/2004
Carbon oxysulfide (Carbonyl sulfide)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03710	Yes	NJ	3/5/2004
Carbon tetrachloride	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03720	Yes	NJ	3/5/2004
Catechol	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03730	Yes	NJ	3/5/2004
Chloroacetic acid	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03740	Yes	NJ	3/5/2004
Chlorobenzene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03750	Yes	NJ	3/5/2004
Chloroethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03760	Yes	NJ	3/5/2004
Chloroform	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03770	Yes	NJ	3/5/2004
Chloromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03780	Yes	NJ	3/5/2004
Chloromethyl methyl ether	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03790	Yes	NJ	3/5/2004
Chlorotoluene (2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03800	Yes	NJ	3/5/2004
Cresols/Cresylic acid	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03810	Yes	NJ	3/5/2004
Cyclohexane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03820	Yes	NJ	3/5/2004
Diazomethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03830	Yes	NJ	3/5/2004
Dibromo-3-chloropropane (1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03840	Yes	NJ	3/5/2004
Dibromochloromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03850	Yes	NJ	2/15/2007
Dibromoethane (1,2-) (EDB)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03860	Yes	NJ	3/5/2004
Dichlorobenzene (1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03870	Yes	NJ	3/5/2004
Dichlorobenzene (1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03880	Yes	NJ	3/5/2004
Dichlorobenzene (1,4-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03890	Yes	NJ	3/5/2004
Dichlorodifluoromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03900	Yes	NJ	3/5/2004
Dichloroethane (1,1-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03910	Yes	NJ	3/5/2004
Dichloroethane (1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03920	Yes	NJ	3/5/2004
Dichloroethene (1,1-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03930	Yes	NJ	3/5/2004
Dichloroethene (cis-1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03940	Yes	NJ	2/15/2007
Dichloroethene (trans-1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03950	Yes	NJ	3/5/2004
Dichlorofluoromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03960	Yes	NJ	3/5/2004
Dichloropropane (1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03970	Yes	NJ	3/5/2004
Dichloropropene (cis-1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03980	Yes	NJ	3/5/2004
Dichloropropene (trans-1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.03990	Yes	NJ	2/15/2007
Dichlorotetrafluoroethane (1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04000	Yes	NJ	3/5/2004
Diethyl sulfate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04010	Yes	NJ	3/5/2004
Dimethyl formamide (N, N-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04020	Yes	NJ	3/5/2004
Dimethyl sulfate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04040	Yes	NJ	3/5/2004
Dimethylcarbamoyl chloride	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04060	Yes	NJ	3/5/2004
Dioxane (1,4-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04070	Yes	NJ	3/5/2004
Epichlorohydrin	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04080	Yes	NJ	3/5/2004
Epoxybutane (1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04090	Yes	NJ	3/5/2004
Ethanol	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04100	Yes	NJ	7/16/2008
Ethyl acetate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04110	Yes	NJ	2/15/2007
Ethyl acrylate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04120	Yes	NJ	3/5/2004
Ethylbenzene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04140	Yes	NJ	3/5/2004
Ethyltoluene (4-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04170	Yes	NJ	3/5/2004
Heptane (n-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04200	Yes	NJ	3/5/2004
Hexachlorobutadiene (1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04210	Yes	NJ	3/5/2004
Hexachloroethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04220	Yes	NJ	3/5/2004
Hexane (n-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04230	Yes	NJ	3/5/2004
Hexanone (2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04240	Yes	NJ	7/1/2007
Isophorone	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04250	Yes	NJ	3/5/2004
Isopropanol	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04260	Yes	NJ	7/16/2008
Isopropylbenzene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04270	Yes	NJ	3/5/2004
Methyl ethyl ketone (MEK)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04290	Yes	NJ	3/5/2004
Methyl iodide	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04300	Yes	NJ	3/5/2004
Methyl isobutyl ketone (MIBK)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04310	Yes	NJ	3/5/2004
Methyl isocyanate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04320	Yes	NJ	3/5/2004
Methyl methacrylate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04330	Yes	NJ	3/5/2004
Methyl tert-butyl ether	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04340	Yes	NJ	3/5/2004
Methylene chloride (Dichloromethane)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04350	Yes	NJ	3/5/2004

Methylphenol (2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04370	Yes	NJ	3/5/2004
Naphthalene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04380	Yes	NJ	7/24/2009
Nitrobenzene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04390	Yes	NJ	3/5/2004
Nitropropane (2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04400	Yes	NJ	3/5/2004
N-Nitrosodimethylamine	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04410	Yes	NJ	3/5/2004
N-Nitrosomorpholine	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04420	Yes	NJ	3/5/2004
N-Nitroso-N-methylurea	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04430	Yes	NJ	3/5/2004
Phenol	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04440	Yes	NJ	3/5/2004
Phosgene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04450	Yes	NJ	3/5/2004
Propane sultone (1,3-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04460	Yes	NJ	3/5/2004
Propiolactone (beta-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04470	Yes	NJ	3/5/2004
Propionaldehyde	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04480	Yes	NJ	3/5/2004
Propylbenzene (n-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04490	Yes	NJ	9/8/2016
Propylene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04510	Yes	NJ	2/15/2007
Propylene oxide	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04520	Yes	NJ	3/5/2004
Sec-butylbenzene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04540	Yes	NJ	1/18/2017
Styrene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04550	Yes	NJ	3/5/2004
Styrene oxide	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04560	Yes	NJ	3/5/2004
Tert-butyl alcohol	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04570	Yes	NJ	2/15/2007
Tetrachloroethane (1,1,2,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04590	Yes	NJ	3/5/2004
Tetrachloroethene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04600	Yes	NJ	3/5/2004
Tetrahydrofuran	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04610	Yes	NJ	2/15/2007
Toluene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04620	Yes	NJ	2/15/2007
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04630	Yes	NJ	2/15/2007
Trichlorobenzene (1,2,4-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04640	Yes	NJ	3/5/2004
Trichloroethane (1,1,1-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04650	Yes	NJ	3/5/2004
Trichloroethane (1,1,2-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04660	Yes	NJ	3/5/2004
Trichloroethene	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04670	Yes	NJ	3/5/2004
Trichlorofluoromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04680	Yes	NJ	7/1/2007
Trifluorochloroethene (HCFC-1113)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04696	Yes	NJ	10/18/2016
Trifluoro (1,1,2-) dichloroethane (1,2-) (HCFC-123a)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04698	Yes	NJ	10/18/2016
Trifluoromethane	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04700	Yes	NJ	3/5/2004
Trimethylbenzene (1,2,4-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04710	Yes	NJ	3/5/2004
Trimethylbenzene (1,3,5-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04720	Yes	NJ	3/5/2004
Trimethylpentane (2,2,4-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04730	Yes	NJ	3/5/2004
Vinyl acetate	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04740	Yes	NJ	3/5/2004
Vinyl bromide	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04750	Yes	NJ	3/5/2004
Vinyl chloride	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04760	Yes	NJ	3/5/2004
Xylene (m-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04770	Yes	NJ	3/5/2004
Xylene (o-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04780	Yes	NJ	3/5/2004
Xylene (p-)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04790	Yes	NJ	3/5/2004
Xylenes (total)	AE	Certified	EPA TO-15	GC/MS, Canisters	AE04.04800	Yes	NJ	3/5/2004
Benzene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.04910	No	NJ	11/5/2015
Benzyl chloride	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.04920	No	NJ	4/16/2015
Bromodichloromethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.04930	No	NJ	4/16/2015
Bromoform	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.04950	No	NJ	4/16/2015
Bromomethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.04960	No	NJ	4/16/2015
Butadiene (1,3-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.04970	No	NJ	4/16/2015
Carbon disulfide	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05050	No	NJ	4/16/2015
Carbon tetrachloride	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05060	No	NJ	4/16/2015
Chlorobenzene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05070	No	NJ	4/16/2015
Chloroethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05080	No	NJ	4/16/2015
Chloroform	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05090	No	NJ	4/16/2015
Chloromethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05100	No	NJ	4/16/2015
Chlorotoluene (2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05110	No	NJ	4/16/2015
Cyclohexane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05120	No	NJ	4/16/2015
Dibromochloromethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05150	No	NJ	4/16/2015
Dibromoethane (1,2-) (EDB)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05160	No	NJ	4/16/2015
Dichlorobenzene (1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05170	No	NJ	4/16/2015
Dichlorobenzene (1,3-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05180	No	NJ	4/16/2015
Dichlorobenzene (1,4-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05190	No	NJ	4/16/2015
Dichlorodifluoromethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05200	No	NJ	4/16/2015
Dichloroethane (1,1-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05210	No	NJ	4/16/2015
Dichloroethane (1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05220	No	NJ	4/16/2015
Dichloroethene (1,1-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05230	No	NJ	4/16/2015
Dichloroethene (cis-1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05240	No	NJ	4/16/2015
Dichloroethene (trans-1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05250	No	NJ	4/16/2015
Dichloropropane (1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05260	No	NJ	4/16/2015
Dichloropropene (cis-1,3-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05270	No	NJ	4/16/2015
Dichloropropene (trans-1,3-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05280	No	NJ	4/16/2015
Dichlorotetrafluoroethane (1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05290	No	NJ	4/16/2015
Dioxane (1,4-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05300	No	NJ	4/16/2015
Ethanol	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05320	No	NJ	4/16/2015
Ethyl acetate	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05350	No	NJ	4/16/2015
Ethylbenzene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05370	No	NJ	4/16/2015
Ethylbenzene (1-methyl-4-) [Ethyltoluene (4-)]	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05400	No	NJ	4/16/2015
Heptane (n-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05440	No	NJ	4/16/2015
Hexachlorobutadiene (1,3-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05450	No	NJ	4/16/2015
Hexane (n-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05460	No	NJ	4/16/2015
Hexanone (2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05470	No	NJ	4/16/2015
Isopropanol	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05520	No	NJ	4/16/2015
Isopropylbenzene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05540	No	NJ	4/16/2015
Methyl ethyl ketone (MEK)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05610	No	NJ	4/16/2015
Methyl tert-butyl ether	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05640	No	NJ	4/16/2015
Methylene chloride (Dichloromethane)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05660	No	NJ	4/16/2015
Methylnaphthalene (1-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05670	No	NJ	4/16/2015
Methylnaphthalene (2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05680	No	NJ	4/16/2015
Naphthalene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05700	No	NJ	4/16/2015

Nonane (-n)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05720	No	NJ	4/16/2015
Pentane (-n)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05820	No	NJ	4/16/2015
Propylene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05890	No	NJ	4/16/2015
Styrene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05920	No	NJ	4/16/2015
Tetrachloroethane (1,1,2,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05940	No	NJ	4/16/2015
Tetrachloroethene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05950	No	NJ	4/16/2015
Toluene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05960	No	NJ	4/16/2015
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05970	No	NJ	4/16/2015
Trichlorobenzene (1,2,4-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05980	No	NJ	4/16/2015
Trichloroethane (1,1,1-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.05990	No	NJ	4/16/2015
Trichloroethane (1,1,2-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06000	No	NJ	4/16/2015
Trichloroethene	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06010	No	NJ	4/16/2015
Trichlorofluoromethane	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06020	No	NJ	4/16/2015
Trimethylbenzene (1,2,4-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06030	No	NJ	4/16/2015
Trimethylbenzene (1,3,5-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06032	No	NJ	3/5/2005
Trimethylpentane (2,2,4-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06040	No	NJ	4/16/2015
Vinyl bromide	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06060	No	NJ	4/16/2015
Vinyl chloride	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06070	No	NJ	4/16/2015
Xylene (m- + p-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06080	No	NJ	4/16/2015
Xylene (o-)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06090	No	NJ	4/16/2015
Xylenes (total)	AE	Applied	EPA TO-17	GC/MS, Sorbent Tubes	AE04.06100	No	NJ	4/16/2015
Benzene	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06220	Yes	NJ	2/15/2007
Ethylbenzene	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06260	Yes	NJ	2/15/2007
Isopropylbenzene	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06270	Yes	NJ	2/15/2007
Methane	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06280	Yes	NJ	2/15/2007
Methyl tert-butyl ether	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06290	Yes	NJ	2/15/2007
Tert-butyl alcohol	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06300	Yes	NJ	2/15/2007
Toluene	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06320	Yes	NJ	2/15/2007
Xylenes (total)	AE	Certified	EPA TO-3	GC, FID and/or ECD, Cryogenic	AE04.06350	Yes	NJ	2/15/2007
Heterotrophic bacteria	DW	Certified	SM 9215 B	Pour Plate	DW01.00070	Yes	NJ	7/1/2004
Total coliform / E. coli	DW	Certified	SM 9223 B	ONPG-MUG (Autoanalysis Colilert	DW01.00100	Yes	NJ	8/13/2003
Alkalinity	DW	Certified	SM 2320 B	Electrometric Titration	DW03.00010	Yes	NJ	7/1/2002
Ammonia	DW	Certified	SM 4500 NH3 H	Automated Phenate	DW03.00070	Yes	NJ	7/1/2002
Chloride	DW	Certified	EPA 300.0	Ion Chromatography	DW03.00420	Yes	NJ	7/1/2002
Color	DW	Certified	SM 2120 B	Platinum-Cobalt	DW03.00550	Yes	NJ	7/1/2002
Conductivity	DW	Certified	SM 2510 B	Conductance	DW03.00590	Yes	NJ	7/1/2002
Cyanide	DW	Certified	EPA 335.4	Spectrophotometric, Distill, Semi	DW03.00720	Yes	NJ	7/1/2002
Dissolved organic carbon (DOC)	DW	Certified	SM 5310 B	High Temp. Combustion, Filtration	DW03.00760	Yes	NJ	7/1/2002
Fluoride	DW	Certified	EPA 300.0	Ion Chromatography	DW03.00860	Yes	NJ	10/31/2011
Foaming agents	DW	Certified	SM 5540 C	Methylene Blue	DW03.00910	Yes	NJ	7/1/2002
Nitrate	DW	Certified	EPA 353.2	Automated Cadmium Reduction	DW03.00940	Yes	NJ	7/1/2002
Nitrite	DW	Certified	SM 4500-NO2 B	Spectrophotometric	DW03.01300	Yes	NJ	7/1/2002
Odor	DW	Certified	SM 2150 B	Consistent Series	DW03.01320	Yes	NJ	7/1/2002
Orthophosphate	DW	Certified	SM 4500-P E	Colorimetric	DW03.01360	Yes	NJ	11/17/2017
Perchlorate	DW	Certified	EPA 314.0	Ion Chromatography	DW03.01480	Yes	NJ	6/2/2004
Residue - nonfilterable (TSS)	DW	Applied	SM 2540 D	Gravimetric, 103-105 Deg C, Post	DW03.01520	No	NJ	7/1/2017
Sulfate	DW	Certified	EPA 300.0	Ion Chromatography	DW03.01600	Yes	NJ	7/1/2002
Total dissolved solids (TDS)	DW	Certified	SM 2540 C	Gravimetric At 180	DW03.01660	Yes	NJ	7/1/2002
Total hardness	DW	Certified	SM 2340 C	Titrimetric, EDTA	DW03.01690	Yes	NJ	7/1/2004
Total organic carbon (TOC)	DW	Certified	SM 5310 B	High Temp. Combustion	DW03.01710	Yes	NJ	7/1/2002
Turbidity	DW	Certified	EPA 180.1	Nephelometric	DW03.01790	Yes	NJ	7/1/2002
Chlorine - residual	DW	Certified	SM 4500-Cl F	DPD, Ferrous Titrimetric	DW04.00020	Yes	NJ	7/1/2002
pH	DW	Certified	SM 4500-H B	Electrometric	DW04.00150	Yes	NJ	7/1/2002
Temperature	DW	Certified	SM 2550 B	Thermometric	DW04.00170	Yes	NJ	7/1/2002
Chromium (VI)	DW	Certified	EPA 218.7	Ion Chromatography	DW06.00242	Yes	NJ	1/18/2017
Mercury	DW	Certified	EPA 245.1	Manual Cold Vapor	DW06.00480	Yes	NJ	7/1/2002
Silica	DW	Certified	SM 4500-Si D (18/19th Ed.)	Molybdosilicate	DW06.00600	Yes	NJ	7/1/2004
Aluminum	DW	Certified	EPA 200.7	ICP	DW07.00001	Yes	NJ	7/1/2002
Aluminum	DW	Certified	EPA 200.8	ICP/MS	DW07.00020	Yes	NJ	5/16/2003
Antimony	DW	Certified	EPA 200.8	ICP/MS	DW07.00050	Yes	NJ	5/16/2003
Arsenic	DW	Certified	EPA 200.8	ICP/MS	DW07.00070	Yes	NJ	5/16/2003
Barium	DW	Certified	EPA 200.7	ICP	DW07.00080	Yes	NJ	7/1/2002
Barium	DW	Certified	EPA 200.8	ICP/MS	DW07.00110	Yes	NJ	5/16/2003
Beryllium	DW	Certified	EPA 200.7	ICP	DW07.00120	Yes	NJ	7/1/2002
Beryllium	DW	Certified	EPA 200.8	ICP/MS	DW07.00150	Yes	NJ	5/16/2003
Boron	DW	Certified	EPA 200.7	ICP	DW07.00160	Yes	NJ	9/8/2016
Cadmium	DW	Certified	EPA 200.7	ICP	DW07.00170	Yes	NJ	7/1/2002
Cadmium	DW	Certified	EPA 200.8	ICP/MS	DW07.00190	Yes	NJ	5/16/2003
Calcium	DW	Certified	EPA 200.7	ICP	DW07.00200	Yes	NJ	7/1/2002
Calcium-hardness	DW	Certified	EPA 200.7	Ca as Carbonate	DW07.00230	Yes	NJ	7/1/2002
Chromium	DW	Certified	EPA 200.7	ICP	DW07.00240	Yes	NJ	7/1/2002
Chromium	DW	Certified	EPA 200.8	ICP/MS	DW07.00270	Yes	NJ	5/16/2003
Cobalt	DW	Certified	EPA 200.7	ICP	DW07.00280	Yes	NJ	9/8/2016
Cobalt	DW	Certified	EPA 200.8	ICP/MS	DW07.00290	Yes	NJ	9/8/2016
Copper	DW	Certified	EPA 200.7	ICP	DW07.00300	Yes	NJ	7/1/2002
Copper	DW	Certified	EPA 200.8	ICP/MS	DW07.00330	Yes	NJ	5/16/2003
Iron	DW	Certified	EPA 200.7	ICP	DW07.00340	Yes	NJ	7/1/2002
Lead	DW	Certified	EPA 200.8	ICP/MS	DW07.00380	Yes	NJ	5/16/2003
Magnesium	DW	Certified	EPA 200.7	ICP	DW07.00400	Yes	NJ	7/1/2002
Manganese	DW	Certified	EPA 200.7	ICP	DW07.00430	Yes	NJ	7/1/2002
Manganese	DW	Certified	EPA 200.8	ICP/MS	DW07.00460	Yes	NJ	6/16/2003
Molybdenum	DW	Certified	EPA 200.7	ICP	DW07.00480	Yes	NJ	9/8/2016
Molybdenum	DW	Certified	EPA 200.8	ICP/MS	DW07.00490	Yes	NJ	9/8/2016
Nickel	DW	Certified	EPA 200.7	ICP	DW07.00500	Yes	NJ	7/1/2002
Nickel	DW	Certified	EPA 200.8	ICP/MS	DW07.00530	Yes	NJ	5/16/2003
Potassium	DW	Certified	EPA 200.7	ICP	DW07.00540	Yes	NJ	9/8/2016
Selenium	DW	Certified	EPA 200.8	ICP/MS	DW07.00560	Yes	NJ	5/16/2003
Silica	DW	Certified	EPA 200.7	ICP	DW07.00570	Yes	NJ	7/1/2002
Silver	DW	Certified	EPA 200.7	ICP	DW07.00600	Yes	NJ	7/1/2002
Silver	DW	Certified	EPA 200.8	ICP/MS	DW07.00630	Yes	NJ	5/16/2003
Sodium	DW	Certified	EPA 200.7	ICP	DW07.00640	Yes	NJ	7/1/2002
Strontium	DW	Certified	EPA 200.7	ICP	DW07.00660	Yes	NJ	9/8/2016

Thallium	DW	Certified	EPA 200.8	ICP/MS	DW07.00670	Yes	NJ	5/23/2003
Tin	DW	Certified	EPA 200.7	ICP	DW07.00680	Yes	NJ	9/8/2016
Titanium	DW	Certified	EPA 200.7	ICP	DW07.00690	Yes	NJ	9/8/2016
Total hardness	DW	Applied	EPA 200.7	Hardness By Calculation	DW07.00700	No	NJ	8/15/2017
Vanadium	DW	Certified	EPA 200.7	ICP	DW07.00750	Yes	NJ	9/8/2016
Vanadium	DW	Certified	EPA 200.8	ICP/MS	DW07.00760	Yes	NJ	9/8/2016
Zinc	DW	Certified	EPA 200.7	ICP	DW07.00770	Yes	NJ	7/1/2002
Zinc	DW	Certified	EPA 200.8	ICP/MS	DW07.00800	Yes	NJ	5/16/2003
Dibromo-3-chloropropane (1,2-)	DW	Certified	EPA 504.1	Solvent Extract, GC	DW08.00710	Yes	NJ	8/13/2003
Dibromoethane (1,2-) (EDB)	DW	Certified	EPA 504.1	Solvent Extract, GC	DW08.00720	Yes	NJ	8/13/2003
Trichloropropane (1,2,3-)	DW	Certified	EPA 504.1	Solvent Extract, GC	DW08.00730	Yes	NJ	8/13/2003
Dioxane (1,4-)	DW	Applied	EPA 522	SPE, GC/MS/SIM, Isotope Dilution	DW09.02260	No	NJ	7/1/2017
Acetone	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02270	Yes	NJ	7/1/2002
Acrylonitrile	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02280	Yes	NJ	7/1/2002
Allyl chloride	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02290	Yes	NJ	7/1/2002
Benzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02300	Yes	NJ	7/1/2002
Bromobenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02310	Yes	NJ	7/1/2002
Bromochloromethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02320	Yes	NJ	7/1/2002
Bromodichloromethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02330	Yes	NJ	7/1/2002
Bromoform	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02340	Yes	NJ	7/1/2002
Bromomethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02350	Yes	NJ	7/1/2002
Butanone (2-) (Methyl ethyl ketone)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02360	Yes	NJ	7/1/2002
Butylbenzene (n-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02370	Yes	NJ	7/1/2002
Carbon disulfide	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02380	Yes	NJ	7/1/2002
Carbon tetrachloride	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02390	Yes	NJ	7/1/2002
Chloroacetonitrile	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02400	Yes	NJ	7/1/2002
Chlorobenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02410	Yes	NJ	7/1/2002
Chlorobutane (1-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02420	Yes	NJ	7/1/2002
Chloroethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02430	Yes	NJ	7/1/2002
Chloroform	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02440	Yes	NJ	7/1/2002
Chloromethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02450	Yes	NJ	7/1/2002
Chlorotoluene (2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02460	Yes	NJ	7/1/2002
Chlorotoluene (4-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02470	Yes	NJ	7/1/2002
Dibromo-3-chloropropane (1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02480	Yes	NJ	8/13/2003
Dibromochloromethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02490	Yes	NJ	7/1/2002
Dibromoethane (1,2-) (EDB)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02500	Yes	NJ	7/1/2002
Dibromomethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02510	Yes	NJ	7/1/2002
Dichloro-2-butene (trans-1,4-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02520	Yes	NJ	7/1/2002
Dichlorobenzene (1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02530	Yes	NJ	7/1/2002
Dichlorobenzene (1,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02540	Yes	NJ	7/1/2002
Dichlorobenzene (1,4-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02550	Yes	NJ	7/1/2002
Dichlorodifluoromethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02560	Yes	NJ	7/1/2002
Dichloroethane (1,1-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02570	Yes	NJ	7/1/2002
Dichloroethane (1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02580	Yes	NJ	7/1/2002
Dichloroethene (1,1-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02590	Yes	NJ	7/1/2002
Dichloroethene (cis-1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02600	Yes	NJ	7/1/2002
Dichloroethene (trans-1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02610	Yes	NJ	7/1/2002
Dichloropropane (1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02620	Yes	NJ	7/1/2002
Dichloropropane (1,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02630	Yes	NJ	7/1/2002
Dichloropropane (2,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02640	Yes	NJ	7/1/2002
Dichloropropanone (1,1-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02650	Yes	NJ	7/1/2002
Dichloropropene (1,1-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02660	Yes	NJ	7/1/2002
Dichloropropene (cis-1,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02670	Yes	NJ	7/1/2002
Dichloropropene (trans-1,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02680	Yes	NJ	7/1/2002
Diethyl ether (Ethyl ether)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02690	Yes	NJ	7/1/2002
Ethyl methacrylate	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02700	Yes	NJ	7/1/2002
Ethylbenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02710	Yes	NJ	7/1/2002
Hexachlorobutadiene (1,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02720	Yes	NJ	7/1/2002
Hexachloroethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02730	Yes	NJ	7/1/2002
Hexane (n-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02740	Yes	NJ	1/18/2017
Hexanone (2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02750	Yes	NJ	7/1/2002
Isopropylbenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02760	Yes	NJ	7/1/2002
Isopropyltoluene (4-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02770	Yes	NJ	7/1/2002
Methacrylonitrile	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02780	Yes	NJ	7/1/2002
Methyl acrylate	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02790	Yes	NJ	7/1/2002
Methyl iodide	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02800	Yes	NJ	7/1/2002
Methyl methacrylate	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02810	Yes	NJ	7/1/2002
Methyl tert-butyl ether	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02820	Yes	NJ	7/1/2002
Methylene chloride (Dichloromethane)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	DW09.02830	Yes	NJ	7/1/2002
Naphthalene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02840	Yes	NJ	7/1/2002
Nitrobenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02850	Yes	NJ	7/1/2002
Nitropropane (2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02860	Yes	NJ	7/1/2002
Pentachloroethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02870	Yes	NJ	7/1/2002
Pentanone (4-methyl-2-) (MIBK)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02880	Yes	NJ	7/1/2002
Propionitrile	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02890	Yes	NJ	7/1/2002
Propylbenzene (n-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02900	Yes	NJ	7/1/2002
Sec-butylbenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02910	Yes	NJ	7/1/2002
Styrene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02920	Yes	NJ	7/1/2002
Tert-butyl alcohol	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02930	Yes	NJ	7/1/2002
Tert-butylbenzene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02940	Yes	NJ	7/1/2002
Tetrachloroethane (1,1,1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02950	Yes	NJ	7/1/2002
Tetrachloroethane (1,1,2,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02960	Yes	NJ	7/1/2002
Tetrachloroethene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02970	Yes	NJ	7/1/2002
Tetrahydrofuran	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02980	Yes	NJ	7/1/2002
Toluene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.02990	Yes	NJ	7/1/2002
Trichlorobenzene (1,2,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03000	Yes	NJ	7/1/2002
Trichlorobenzene (1,2,4-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03010	Yes	NJ	7/1/2002
Trichloroethane (1,1,1-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03030	Yes	NJ	7/1/2002
Trichloroethane (1,1,2-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03040	Yes	NJ	7/1/2002
Trichloroethene	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03050	Yes	NJ	7/1/2002
Trichlorofluoromethane	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03060	Yes	NJ	7/1/2002
Trichloropropane (1,2,3-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03070	Yes	NJ	7/1/2002

Trimethylbenzene (1,2,4-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03080	Yes	NJ	7/1/2002
Trimethylbenzene (1,3,5-)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03090	Yes	NJ	7/1/2002
Vinyl chloride	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03100	Yes	NJ	7/1/2002
Xylenes (total)	DW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection,	DW09.03130	Yes	NJ	7/1/2002
Fecal coliform	NPW	Certified	SM 9222 D-97	Membrane Filter (MF), Single Step	NPW01.00300	Yes	NJ	7/1/2002
Heterotrophic plate count	NPW	Certified	SM 9215 B	Pour Plate	NPW01.00390	Yes	NJ	7/1/2002
Total coliform	NPW	Certified	SM 9222 B-97	MF Single Step or Two Step	NPW01.00530	Yes	NJ	7/1/2002
Acidity as CaCO3	NPW	Certified	SM 2310 B-11	Electrometric or Phenolphthalein	NPW03.00020	Yes	NJ	7/1/2002
Alkalinity as CaCO3	NPW	Certified	SM 2320 B-11	Electrometric or Color Titration	NPW03.00060	Yes	NJ	7/1/2002
Ammonia	NPW	Certified	SM 4500-NH3 B plus H-11	Distillation or Gas Diffusion, Semi-	NPW03.00270	Yes	NJ	7/1/2002
Biochemical oxygen demand	NPW	Certified	SM 5210 B-11	Dissolved Oxygen Depletion - Membrane	NPW03.00350	Yes	NJ	7/1/2002
Bromide	NPW	Certified	EPA 300.0	Ion Chromatography	NPW03.00540	Yes	NJ	7/1/2002
Bromide	NPW	Certified	SW-846 9056	Ion Chromatography	NPW03.00570	Yes	NJ	7/1/2002
Bromide	NPW	Certified	SW-846 9056A	Ion Chromatography	NPW03.00580	Yes	NJ	7/1/2002
Carbonaceous BOD (CBOD)	NPW	Certified	SM 5210 B-11	Diss. Oxygen Depl., Nitrif. Inhib. -	NPW03.00660	Yes	NJ	7/1/2002
Chemical oxygen demand	NPW	Certified	SM 5220 C-11	Titrimetric	NPW03.00750	Yes	NJ	8/13/2013
Chloride	NPW	Certified	SM 4500-Cl C-11	Titrimetric, Mercuric Nitrate	NPW03.00970	Yes	NJ	7/1/2002
Chloride	NPW	Certified	EPA 300.0	Ion Chromatography	NPW03.01100	Yes	NJ	7/1/2002
Chloride	NPW	Certified	SW-846 9056	Ion Chromatography	NPW03.01150	Yes	NJ	7/1/2002
Chloride	NPW	Certified	SW-846 9056A	Ion Chromatography	NPW03.01160	Yes	NJ	7/1/2002
Color	NPW	Certified	SM 2120 B-11	Colorimetric (Platinum-Cobalt)	NPW03.01370	Yes	NJ	7/1/2002
Cyanide	NPW	Certified	EPA 335.4	Distillation, Spectrophotometric (Auto)	NPW03.01530	Yes	NJ	7/1/2002
Cyanide	NPW	Certified	SW-846 9012B	Colorimetric, Automated	NPW03.01550	Yes	NJ	7/1/2002
Cyanide - amenable to Cl2	NPW	Certified	SM 4500-CN B-11 and G-11	Manual Distillation, Titrimetr/Spectro	NPW03.01660	Yes	NJ	7/1/2002
Cyanide - amenable to Cl2	NPW	Certified	SM 4500-CN C-11 and G-11	Manual Distillation, Titrimetr/Spectro	NPW03.01670	Yes	NJ	7/1/2002
Dissolved organic carbon (DOC)	NPW	Certified	SM 5310 B	Filtration and Combustion	NPW03.01750	Yes	NJ	1/23/2012
Fluoride	NPW	Certified	EPA 300.0	Ion Chromatography	NPW03.01930	Yes	NJ	7/1/2002
Fluoride	NPW	Certified	SW-846 9056	Ion Chromatography	NPW03.01970	Yes	NJ	7/1/2002
Fluoride	NPW	Certified	SW-846 9056A	Ion Chromatography	NPW03.01980	Yes	NJ	7/1/2002
Hardness - total as CaCO3	NPW	Certified	SM 2340 C-11	Titrimetric, EDTA	NPW03.02110	Yes	NJ	8/13/2003
Kjeldahl nitrogen - total	NPW	Certified	EPA 351.2	Digestion, Semiauto. Digestor,	NPW03.02470	Yes	NJ	7/1/2002
Nitrate - nitrite	NPW	Certified	EPA 353.2	Cadmium Reduction, Automated	NPW03.02790	Yes	NJ	7/1/2002
Nitrite	NPW	Certified	SM 4500-NO2 B-11	Spectrophotometric, Manual	NPW03.02960	Yes	NJ	7/1/2002
Oil & grease - hem-LL	NPW	Certified	EPA 1664A	Gravimetric, Hexane Extractable Material-	NPW03.03200	Yes	NJ	7/1/2002
Oil & grease - sgt-non polar	NPW	Certified	EPA 1664A	Gravimetric, Silica Gel Treated-Hem-LL	NPW03.03340	Yes	NJ	10/27/2003
Organic nitrogen	NPW	Certified	User Defined EPA 351.2-SM 4500 NH3 B plus G (20th ED)	Total Kjeldahl-N Minus Ammonia-N	NPW03.03400	Yes	NJ	7/1/2002
Orthophosphate	NPW	Certified	EPA 365.3	Ascorbic Acid, Manual Two Reagent	NPW03.03510	Yes	NJ	2/19/2013
Perchlorate	NPW	Certified	User Defined EPA 314.0	Ion Chromatography	NPW03.03710	No	NJ	10/6/2010
Phenols	NPW	Certified	EPA 420.4	Manual Distillation, Colorimetric Auto	NPW03.03810	Yes	NJ	7/1/2002
Phosphorus (total)	NPW	Certified	EPA 365.3	Persulfate Digestion + Manual	NPW03.03860	Yes	NJ	7/1/2002
Residue - filterable (TDS)	NPW	Certified	SM 2540 C-11	Gravimetric, 180 Degrees C	NPW03.04010	Yes	NJ	10/10/2014
Residue - nonfilterable (TSS)	NPW	Certified	SM 2540 D-11	Gravimetric, 103-105 Degrees C, Post	NPW03.04050	Yes	NJ	7/1/2002
Residue - settleable	NPW	Certified	SM 2540 F-11	Volumetric (Imhoff Cone) or Gravimetric	NPW03.04080	Yes	NJ	7/1/2002
Residue - total	NPW	Certified	SM 2540 B-11	Gravimetric, 103-105 Degrees C	NPW03.04100	Yes	NJ	7/1/2002
Residue - volatile	NPW	Certified	EPA 160.4	Gravimetric, 550 Degrees C	NPW03.04130	Yes	NJ	7/1/2002
Salinity	NPW	Certified	SM 2520 B	Electrical Conductivity	NPW03.04170	Yes	NJ	7/1/2002
Specific conductance	NPW	Certified	SM 2510 B-11	Wheatstone Bridge	NPW03.04250	Yes	NJ	11/9/2017
Specific conductance	NPW	Certified	SW-846 9050A	Wheatstone Bridge	NPW03.04270	Yes	NJ	11/9/2017
Sulfate	NPW	Certified	EPA 300.0	Ion Chromatography	NPW03.04490	Yes	NJ	7/1/2002
Sulfate	NPW	Certified	SW-846 9056	Ion Chromatography	NPW03.04540	Yes	NJ	7/1/2002
Sulfate	NPW	Certified	SW-846 9056A	Ion Chromatography	NPW03.04550	Yes	NJ	7/1/2002
Sulfides	NPW	Certified	SM 4500-S B, C plus F-11	Titrimetric, Iodine	NPW03.04650	Yes	NJ	7/1/2002
Sulfides, acid sol. & insol.	NPW	Certified	SW-846 9034	Titration	NPW03.04700	Yes	NJ	7/1/2002
Surfactants	NPW	Certified	SM 5540 C-11	Colorimetric (Methylene Blue)	NPW03.04720	Yes	NJ	7/1/2002
Total organic carbon (TOC)	NPW	Certified	SM 5310 B-11	Combustion	NPW03.04790	Yes	NJ	7/1/2002
Total organic carbon (TOC)	NPW	Certified	SW-846 9060A	Infrared Spectrometry or FID	NPW03.04880	Yes	NJ	7/1/2002
Total organic halides (TOX)	NPW	Certified	SW-846 9020B	Combustion, Titration	NPW03.04930	Yes	NJ	7/1/2002
Total, fixed, and volatile solids (SQAR)	NPW	Certified	SM 2540 G SM 18th Ed.	Gravimetric, 500 Degrees C	NPW03.04960	Yes	NJ	1/15/2009
Turbidity	NPW	Certified	EPA 180.1	Nephelometric	NPW03.05010	Yes	NJ	7/1/2002
Chlorine	NPW	Certified	SM 4500-Cl F-11	DPD-FAS	NPW04.00050	Yes	NJ	7/1/2002
Oxygen (dissolved)	NPW	Certified	SM 4500-O G-11	Membrane Electrode	NPW04.00230	Yes	NJ	7/1/2002
Oxygen (dissolved)	NPW	Certified	SM 4500-O C-11	Winkler, Azide Modification	NPW04.00310	Yes	NJ	7/1/2002
pH	NPW	Certified	SM 4500-H B-11	Electrometric	NPW04.00380	Yes	NJ	5/16/2017
pH (corrosivity)	NPW	Certified	SW-846 9040C	Aqueous, Electrometric	NPW04.00420	Yes	NJ	5/16/2017
Sulfite - SO3	NPW	Certified	SM 4500-SO3 B-11	Titrimetric, Iodine-Iodate	NPW04.00470	Yes	NJ	7/1/2002
Temperature	NPW	Certified	SM 2550 B-00	Thermometric	NPW04.00490	Yes	NJ	7/1/2002
Metals	NPW	Certified	SW-846 1311	TCLP, Toxicity Procedure, Shaker	NPW06.00020	Yes	NJ	7/1/2002
Metals	NPW	Certified	SW-846 1312	Synthetic PPT Leachate Procedure	NPW06.00030	Yes	NJ	7/1/2002
Metals, Total Rec and Dissolved	NPW	Certified	SW-846 3005A	Acid Digestion/Surface and Groundwater,	NPW06.00050	Yes	NJ	7/1/2002
Metals, Total	NPW	Certified	SW-846 3010A	Acid Digestion/Aqueous Samples, ICP,	NPW06.00060	Yes	NJ	7/1/2002
Chromium (VI)	NPW	Certified	SW-846 7196A	Colorimetric	NPW07.01000	Yes	NJ	7/1/2002
Chromium (VI)	NPW	Certified	SM 3500-Cr B-11	0.45u Filter, Colorimetric DPC	NPW07.01020	Yes	NJ	7/1/2002
Chromium (VI)	NPW	Certified	SW-846 7199	Ion Chromatography	NPW07.01050	Yes	NJ	4/21/2006
Iron, Ferrous	NPW	Certified	SM 3500-Fe B-11	Digestion, Colorimetric (Phenanthroline)	NPW07.01690	No	NJ	4/6/2010
Mercury	NPW	Certified	EPA 245.7	Cold Vapor Atomic Fluorescence	NPW07.02130	Yes	NJ	10/6/2010
Mercury	NPW	Certified	EPA 245.1	Manual Cold Vapor	NPW07.02160	Yes	NJ	7/1/2002
Mercury - liquid waste	NPW	Certified	SW-846 7470A	AA, Manual Cold Vapor	NPW07.02190	Yes	NJ	7/1/2002
Mercury	NPW	Certified	EPA 1631E	Purge & Trap Atomic Fluorescence	NPW07.02200	Yes	NJ	10/6/2010
Silica - dissolved	NPW	Certified	SM 4500-SiO2 C-11	0.45u Filtration + Colorimetric (Manual)	NPW07.02860	Yes	NJ	7/1/2002
Aluminum	NPW	Certified	SW-846 6010B	ICP	NPW08.00001	Yes	NJ	7/1/2002
Aluminum	NPW	Certified	SW-846 6010C	ICP	NPW08.00010	Yes	NJ	7/1/2002
Aluminum	NPW	Certified	SW-846 6010D	ICP	NPW08.00012	Yes	NJ	7/1/2017
Aluminum	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.00050	Yes	NJ	7/1/2002
Aluminum	NPW	Certified	SW-846 6020	ICP/MS	NPW08.00070	Yes	NJ	8/13/2003
Aluminum	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.00080	Yes	NJ	8/13/2003
Aluminum	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.00082	Yes	NJ	7/1/2017
Aluminum	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.00130	Yes	NJ	5/16/2003
Antimony	NPW	Certified	SW-846 6010B	ICP	NPW08.00170	Yes	NJ	7/1/2002
Antimony	NPW	Certified	SW-846 6010C	ICP	NPW08.00180	Yes	NJ	7/1/2002
Antimony	NPW	Certified	SW-846 6010D	ICP	NPW08.00182	Yes	NJ	7/1/2017
Antimony	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.00220	Yes	NJ	7/1/2002

Antimony	NPW	Certified	SW-846 6020	ICP/MS	NPW08.00240	Yes	NJ	8/13/2003
Antimony	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.00250	Yes	NJ	8/13/2003
Antimony	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.00252	Yes	NJ	7/1/2017
Antimony	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.00300	Yes	NJ	5/16/2003
Arsenic	NPW	Certified	SW-846 6010B	ICP	NPW08.00330	Yes	NJ	7/1/2002
Arsenic	NPW	Certified	SW-846 6010C	ICP	NPW08.00340	Yes	NJ	7/1/2002
Arsenic	NPW	Certified	SW-846 6010D	ICP	NPW08.00342	Yes	NJ	7/1/2017
Arsenic	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.00370	Yes	NJ	7/1/2002
Arsenic	NPW	Certified	SW-846 6020	ICP/MS	NPW08.00390	Yes	NJ	8/13/2003
Arsenic	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.00400	Yes	NJ	8/13/2003
Arsenic	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.00402	Yes	NJ	7/1/2017
Arsenic	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.00450	Yes	NJ	5/16/2003
Barium	NPW	Certified	SW-846 6010B	ICP	NPW08.00470	Yes	NJ	7/1/2002
Barium	NPW	Certified	SW-846 6010C	ICP	NPW08.00480	Yes	NJ	7/1/2002
Barium	NPW	Certified	SW-846 6010D	ICP	NPW08.00482	Yes	NJ	7/1/2017
Barium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.00510	Yes	NJ	7/1/2002
Barium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.00530	Yes	NJ	8/13/2003
Barium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.00540	Yes	NJ	8/13/2003
Barium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.00542	Yes	NJ	7/1/2017
Barium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.00590	Yes	NJ	5/16/2003
Beryllium	NPW	Certified	SW-846 6010B	ICP	NPW08.00630	Yes	NJ	7/1/2002
Beryllium	NPW	Certified	SW-846 6010C	ICP	NPW08.00640	Yes	NJ	7/1/2002
Beryllium	NPW	Certified	SW-846 6010D	ICP	NPW08.00642	Yes	NJ	7/1/2017
Beryllium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.00680	Yes	NJ	7/1/2002
Beryllium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.00700	Yes	NJ	8/13/2003
Beryllium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.00710	Yes	NJ	8/13/2003
Beryllium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.00712	Yes	NJ	7/1/2017
Beryllium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.00760	Yes	NJ	5/16/2003
Boron	NPW	Certified	SW-846 6010B	ICP	NPW08.00810	Yes	NJ	7/1/2002
Boron	NPW	Certified	SW-846 6010C	ICP	NPW08.00820	Yes	NJ	7/1/2002
Boron	NPW	Certified	SW-846 6010D	ICP	NPW08.00822	Yes	NJ	7/1/2017
Boron	NPW	Certified	EPA 200.7	ICP	NPW08.00860	Yes	NJ	7/1/2002
Boron	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.00890	Yes	NJ	7/13/2017
Boron	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.00892	Yes	NJ	7/13/2017
Boron	NPW	Certified	EPA 200.8	ICP/MS	NPW08.00940	Yes	NJ	7/13/2017
Cadmium	NPW	Certified	SW-846 6010B	ICP	NPW08.00970	Yes	NJ	7/1/2002
Cadmium	NPW	Certified	SW-846 6010C	ICP	NPW08.00980	Yes	NJ	7/1/2002
Cadmium	NPW	Certified	SW-846 6010D	ICP	NPW08.00982	Yes	NJ	7/1/2017
Cadmium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.01030	Yes	NJ	7/1/2002
Cadmium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.01050	Yes	NJ	8/13/2003
Cadmium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.01060	Yes	NJ	8/13/2003
Cadmium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.01062	Yes	NJ	7/1/2017
Cadmium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.01110	Yes	NJ	5/16/2003
Calcium	NPW	Certified	SW-846 6010B	ICP	NPW08.01160	Yes	NJ	7/1/2002
Calcium	NPW	Certified	SW-846 6010C	ICP	NPW08.01170	Yes	NJ	7/1/2002
Calcium	NPW	Certified	SW-846 6010D	ICP	NPW08.01172	Yes	NJ	7/1/2017
Calcium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.01200	Yes	NJ	7/1/2004
Calcium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.01220	Yes	NJ	7/1/2004
Calcium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.01230	Yes	NJ	7/1/2004
Calcium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.01232	Yes	NJ	7/1/2017
Calcium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.01270	Yes	NJ	7/1/2004
Chromium	NPW	Certified	SW-846 6010B	ICP	NPW08.01300	Yes	NJ	7/1/2002
Chromium	NPW	Certified	SW-846 6010C	ICP	NPW08.01310	Yes	NJ	7/1/2002
Chromium	NPW	Certified	SW-846 6010D	ICP	NPW08.01312	Yes	NJ	7/1/2017
Chromium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.01350	Yes	NJ	7/1/2002
Chromium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.01370	Yes	NJ	8/13/2003
Chromium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.01380	Yes	NJ	8/13/2003
Chromium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.01382	Yes	NJ	7/1/2017
Chromium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.01430	Yes	NJ	7/1/2002
Cobalt	NPW	Certified	SW-846 6010B	ICP	NPW08.01490	Yes	NJ	7/1/2002
Cobalt	NPW	Certified	SW-846 6010C	ICP	NPW08.01500	Yes	NJ	7/1/2002
Cobalt	NPW	Certified	SW-846 6010D	ICP	NPW08.01502	Yes	NJ	7/1/2017
Cobalt	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.01530	Yes	NJ	7/1/2002
Cobalt	NPW	Certified	SW-846 6020	ICP/MS	NPW08.01550	Yes	NJ	8/13/2003
Cobalt	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.01560	Yes	NJ	8/13/2003
Cobalt	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.01562	Yes	NJ	7/1/2017
Cobalt	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.01610	Yes	NJ	5/16/2003
Copper	NPW	Certified	SW-846 6010B	ICP	NPW08.01640	Yes	NJ	7/1/2002
Copper	NPW	Certified	SW-846 6010C	ICP	NPW08.01650	Yes	NJ	7/1/2002
Copper	NPW	Certified	SW-846 6010D	ICP	NPW08.01652	Yes	NJ	7/1/2017
Copper	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.01690	Yes	NJ	7/1/2002
Copper	NPW	Certified	SW-846 6020	ICP/MS	NPW08.01710	Yes	NJ	8/13/2003
Copper	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.01720	Yes	NJ	8/13/2003
Copper	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.01722	Yes	NJ	7/1/2017
Copper	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.01770	Yes	NJ	5/16/2003
Hardness - total as CaCO3	NPW	Certified	EPA 200.7	Ca + Mg Carbonates, ICP	NPW08.01890	Yes	NJ	7/1/2002
Iron	NPW	Certified	SW-846 6010B	ICP	NPW08.01990	Yes	NJ	7/1/2002
Iron	NPW	Certified	SW-846 6010C	ICP	NPW08.02000	Yes	NJ	7/1/2002
Iron	NPW	Certified	SW-846 6010D	ICP	NPW08.02002	Yes	NJ	7/1/2017
Iron	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.02040	Yes	NJ	7/1/2002
Iron	NPW	Certified	SW-846 6020	ICP/MS	NPW08.02060	Yes	NJ	7/1/2004
Iron	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.02070	Yes	NJ	7/1/2004
Iron	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.02072	Yes	NJ	7/1/2017
Iron	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.02110	Yes	NJ	7/1/2004
Lead	NPW	Certified	SW-846 6010B	ICP	NPW08.02160	Yes	NJ	7/1/2002
Lead	NPW	Certified	SW-846 6010C	ICP	NPW08.02170	Yes	NJ	7/1/2002
Lead	NPW	Certified	SW-846 6010D	ICP	NPW08.02172	Yes	NJ	7/1/2017
Lead	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.02210	Yes	NJ	7/1/2002
Lead	NPW	Certified	SW-846 6020	ICP/MS	NPW08.02230	Yes	NJ	8/13/2003
Lead	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.02240	Yes	NJ	8/13/2003
Lead	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.02242	Yes	NJ	7/1/2017
Lead	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.02290	Yes	NJ	5/16/2003
Lithium	NPW	Certified	SW-846 6010B	ICP	NPW08.02350	Yes	NJ	2/10/2017

Lithium	NPW	Certified	SW-846 6010C	ICP	NPW08.02360	Yes	NJ	2/10/2017
Lithium	NPW	Certified	SW-846 6010D	ICP	NPW08.02362	Yes	NJ	7/1/2017
Magnesium	NPW	Certified	SW-846 6010B	ICP	NPW08.02370	Yes	NJ	7/1/2002
Magnesium	NPW	Certified	SW-846 6010C	ICP	NPW08.02380	Yes	NJ	7/1/2002
Magnesium	NPW	Certified	SW-846 6010D	ICP	NPW08.02382	Yes	NJ	7/1/2017
Magnesium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.02420	Yes	NJ	7/1/2002
Magnesium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.02440	Yes	NJ	7/1/2004
Magnesium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.02450	Yes	NJ	7/1/2004
Magnesium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.02452	Yes	NJ	7/1/2017
Magnesium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.02490	Yes	NJ	7/1/2004
Manganese	NPW	Certified	SW-846 6010B	ICP	NPW08.02530	Yes	NJ	7/1/2002
Manganese	NPW	Certified	SW-846 6010C	ICP	NPW08.02540	Yes	NJ	7/1/2002
Manganese	NPW	Certified	SW-846 6010D	ICP	NPW08.02542	Yes	NJ	7/1/2017
Manganese	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.02580	Yes	NJ	7/1/2002
Manganese	NPW	Certified	SW-846 6020	ICP/MS	NPW08.02600	Yes	NJ	8/13/2003
Manganese	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.02610	Yes	NJ	8/13/2003
Manganese	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.02612	Yes	NJ	7/1/2017
Manganese	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.02660	Yes	NJ	7/1/2002
Molybdenum	NPW	Certified	SW-846 6010B	ICP	NPW08.02710	Yes	NJ	7/1/2002
Molybdenum	NPW	Certified	SW-846 6010C	ICP	NPW08.02720	Yes	NJ	7/1/2002
Molybdenum	NPW	Certified	SW-846 6010D	ICP	NPW08.02722	Yes	NJ	7/1/2017
Molybdenum	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.02750	Yes	NJ	7/1/2002
Molybdenum	NPW	Certified	SW-846 6020	ICP/MS	NPW08.02770	Yes	NJ	7/1/2004
Molybdenum	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.02780	Yes	NJ	7/1/2004
Molybdenum	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.02782	Yes	NJ	7/1/2017
Molybdenum	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.02830	Yes	NJ	5/16/2003
Nickel	NPW	Certified	SW-846 6010B	ICP	NPW08.02860	Yes	NJ	7/1/2002
Nickel	NPW	Certified	SW-846 6010C	ICP	NPW08.02870	Yes	NJ	7/1/2002
Nickel	NPW	Certified	SW-846 6010D	ICP	NPW08.02872	Yes	NJ	7/1/2017
Nickel	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.02910	Yes	NJ	7/1/2002
Nickel	NPW	Certified	SW-846 6020	ICP/MS	NPW08.02930	Yes	NJ	8/13/2003
Nickel	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.02940	Yes	NJ	8/13/2003
Nickel	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.02942	Yes	NJ	7/1/2017
Nickel	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.02990	Yes	NJ	5/16/2003
Potassium	NPW	Certified	SW-846 6010B	ICP	NPW08.03130	Yes	NJ	7/1/2002
Potassium	NPW	Certified	SW-846 6010C	ICP	NPW08.03140	Yes	NJ	7/1/2002
Potassium	NPW	Certified	SW-846 6010D	ICP	NPW08.03142	Yes	NJ	7/1/2017
Potassium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.03150	Yes	NJ	7/1/2002
Potassium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.03200	Yes	NJ	7/1/2004
Potassium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.03220	Yes	NJ	7/1/2004
Potassium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.03230	Yes	NJ	7/1/2004
Potassium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.03232	Yes	NJ	7/1/2017
Selenium	NPW	Certified	SW-846 6010B	ICP	NPW08.03270	Yes	NJ	7/1/2002
Selenium	NPW	Certified	SW-846 6010C	ICP	NPW08.03280	Yes	NJ	7/1/2002
Selenium	NPW	Certified	SW-846 6010D	ICP	NPW08.03282	Yes	NJ	7/1/2017
Selenium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.03310	Yes	NJ	7/1/2007
Selenium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.03330	Yes	NJ	8/13/2003
Selenium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.03340	Yes	NJ	8/13/2003
Selenium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.03342	Yes	NJ	7/1/2017
Selenium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.03390	Yes	NJ	5/16/2003
Silica - dissolved	NPW	Certified	EPA 200.7	0.45u Filtration + ICP	NPW08.03440	Yes	NJ	7/1/2007
Silver	NPW	Certified	SW-846 6010B	ICP	NPW08.03520	Yes	NJ	7/1/2002
Silver	NPW	Certified	SW-846 6010C	ICP	NPW08.03530	Yes	NJ	7/1/2002
Silver	NPW	Certified	SW-846 6010D	ICP	NPW08.03532	Yes	NJ	7/1/2017
Silver	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.03570	Yes	NJ	7/1/2002
Silver	NPW	Certified	SW-846 6020	ICP/MS	NPW08.03590	Yes	NJ	8/13/2003
Silver	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.03600	Yes	NJ	8/13/2003
Silver	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.03602	Yes	NJ	7/1/2017
Silver	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.03650	Yes	NJ	5/16/2003
Sodium	NPW	Certified	SW-846 6010B	ICP	NPW08.03700	Yes	NJ	7/1/2002
Sodium	NPW	Certified	SW-846 6010C	ICP	NPW08.03710	Yes	NJ	7/1/2002
Sodium	NPW	Certified	SW-846 6010D	ICP	NPW08.03712	Yes	NJ	7/1/2017
Sodium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.03740	Yes	NJ	7/1/2002
Sodium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.03760	Yes	NJ	7/1/2004
Sodium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.03770	Yes	NJ	7/1/2004
Sodium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.03772	Yes	NJ	7/1/2017
Sodium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.03810	Yes	NJ	7/1/2005
Strontium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.03840	Yes	NJ	9/8/2016
Strontium	NPW	Certified	SW-846 6010B	ICP	NPW08.03850	Yes	NJ	7/1/2002
Strontium	NPW	Certified	SW-846 6010C	ICP	NPW08.03860	Yes	NJ	7/1/2002
Strontium	NPW	Certified	SW-846 6010D	ICP	NPW08.03862	Yes	NJ	7/1/2017
Strontium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.03880	Yes	NJ	7/13/2017
Strontium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.03882	Yes	NJ	7/1/2017
Thallium	NPW	Certified	SW-846 6010B	ICP	NPW08.03920	Yes	NJ	7/1/2002
Thallium	NPW	Certified	SW-846 6010C	ICP	NPW08.03930	Yes	NJ	7/1/2002
Thallium	NPW	Certified	SW-846 6010D	ICP	NPW08.03932	Yes	NJ	7/1/2017
Thallium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.03950	Yes	NJ	7/1/2002
Thallium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.03970	Yes	NJ	8/13/2003
Thallium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.03980	Yes	NJ	8/13/2003
Thallium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.03982	Yes	NJ	7/1/2017
Thallium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.04030	Yes	NJ	5/16/2003
Tin	NPW	Certified	SW-846 6010B	ICP	NPW08.04100	Yes	NJ	7/1/2002
Tin	NPW	Certified	SW-846 6010C	ICP	NPW08.04110	Yes	NJ	7/1/2002
Tin	NPW	Certified	SW-846 6010D	ICP	NPW08.04112	Yes	NJ	7/1/2017
Tin	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.04130	Yes	NJ	7/1/2002
Tin	NPW	Certified	SW-846 6020	ICP/MS	NPW08.04140	Yes	NJ	7/1/2004
Tin	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.04150	Yes	NJ	7/1/2004
Tin	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.04152	Yes	NJ	7/1/2017
Tin	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.04190	Yes	NJ	5/16/2003
Titanium	NPW	Certified	SW-846 6010B	ICP	NPW08.04200	Yes	NJ	7/1/2007
Titanium	NPW	Certified	SW-846 6010C	ICP	NPW08.04210	Yes	NJ	7/1/2007
Titanium	NPW	Certified	SW-846 6010D	ICP	NPW08.04212	Yes	NJ	7/1/2017
Titanium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.04220	Yes	NJ	7/1/2002

Titanium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.04240	Yes	NJ	7/13/2017
Titanium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.04242	Yes	NJ	7/1/2017
Titanium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.04280	Yes	NJ	5/16/2003
Vanadium	NPW	Certified	SW-846 6010B	ICP	NPW08.04380	Yes	NJ	7/1/2002
Vanadium	NPW	Certified	SW-846 6010C	ICP	NPW08.04390	Yes	NJ	7/1/2002
Vanadium	NPW	Certified	SW-846 6010D	ICP	NPW08.04392	Yes	NJ	7/1/2017
Vanadium	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.04430	Yes	NJ	7/1/2002
Vanadium	NPW	Certified	SW-846 6020	ICP/MS	NPW08.04450	Yes	NJ	8/13/2003
Vanadium	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.04460	Yes	NJ	8/13/2003
Vanadium	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.04462	Yes	NJ	7/1/2017
Vanadium	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.04510	Yes	NJ	5/16/2003
Zinc	NPW	Certified	SW-846 6010B	ICP	NPW08.04560	Yes	NJ	7/1/2002
Zinc	NPW	Certified	SW-846 6010C	ICP	NPW08.04570	Yes	NJ	7/1/2002
Zinc	NPW	Certified	SW-846 6010D	ICP	NPW08.04572	Yes	NJ	7/1/2017
Zinc	NPW	Certified	EPA 200.7	Digestion, ICP	NPW08.04610	Yes	NJ	7/1/2002
Zinc	NPW	Certified	SW-846 6020	ICP/MS	NPW08.04630	Yes	NJ	8/13/2003
Zinc	NPW	Certified	SW-846 6020A	ICP/MS	NPW08.04640	Yes	NJ	8/13/2003
Zinc	NPW	Certified	SW-846 6020B	ICP/MS	NPW08.04642	Yes	NJ	7/1/2017
Zinc	NPW	Certified	EPA 200.8	Digestion, ICP/MS	NPW08.04690	Yes	NJ	5/16/2003
Zirconium	NPW	Certified	SW-846 6010B	ICP	NPW08.04740	Yes	NJ	2/10/2017
Zirconium	NPW	Certified	SW-846 6010C	ICP	NPW08.04742	Yes	NJ	2/10/2017
Zirconium	NPW	Certified	SW-846 6010D	ICP	NPW08.04744	Yes	NJ	7/1/2017
Organics	NPW	Certified	SW-846 1312	Synthetic PPT Leachate Procedure	NPW09.00040	Yes	NJ	7/1/2002
Semivolatile organics	NPW	Certified	SW-846 1311	TCLP, Toxicity Procedure, Shaker	NPW09.00080	Yes	NJ	7/1/2002
Semivolatile organics	NPW	Certified	SW-846 3510C	Separatory Funnel Extraction	NPW09.00090	Yes	NJ	7/1/2002
Semivolatile organics	NPW	Certified	SW-846 3520C	Continuous Liquid-Liquid Extraction	NPW09.00110	Yes	NJ	7/1/2002
Volatile organics	NPW	Certified	SW-846 1311	TCLP, Toxicity Procedure, ZHE	NPW09.00290	Yes	NJ	7/1/2002
Volatile organics	NPW	Certified	SW-846 5030B	Purge & Trap Aqueous	NPW09.00330	Yes	NJ	7/1/2002
Volatile organics	NPW	Certified	SW-846 5030C	Purge & Trap Aqueous	NPW09.00340	Yes	NJ	7/1/2017
Acrolein	NPW	Certified	EPA 603	Purge & Trap, GC (FID)	NPW10.03010	Yes	NJ	7/1/2004
Acrylonitrile	NPW	Certified	EPA 603	Purge & Trap, GC (FID)	NPW10.03020	Yes	NJ	7/1/2005
Aldrin	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03360	Yes	NJ	7/1/2002
Alpha BHC	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03370	Yes	NJ	7/1/2002
Beta BHC	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03380	Yes	NJ	7/1/2002
Chlordane	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03390	Yes	NJ	7/1/2002
Chlordane (alpha) (cis-)	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03400	Yes	NJ	12/1/2006
Chlordane (gamma) (trans-)	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03410	Yes	NJ	12/1/2006
DDD (4,4'-)	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03430	Yes	NJ	7/1/2002
DDE (4,4'-)	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03440	Yes	NJ	7/1/2002
DDT (4,4'-)	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03450	Yes	NJ	7/1/2002
Delta BHC	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03460	Yes	NJ	7/1/2002
Dieldrin	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03470	Yes	NJ	7/1/2002
Endosulfan I	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03480	Yes	NJ	7/1/2002
Endosulfan II	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03490	Yes	NJ	7/1/2002
Endosulfan sulfate	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03500	Yes	NJ	7/1/2002
Endrin	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03510	Yes	NJ	7/1/2002
Endrin aldehyde	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03520	Yes	NJ	7/1/2002
Endrin ketone	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03530	Yes	NJ	7/1/2002
Heptachlor	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03550	Yes	NJ	7/1/2002
Heptachlor epoxide	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03560	Yes	NJ	7/1/2002
Lindane (gamma BHC)	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03570	Yes	NJ	7/1/2002
PCB 1016	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03590	Yes	NJ	7/1/2002
PCB 1221	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03600	Yes	NJ	7/1/2002
PCB 1232	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03610	Yes	NJ	7/1/2002
PCB 1242	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03620	Yes	NJ	7/1/2002
PCB 1248	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03630	Yes	NJ	7/1/2002
PCB 1254	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03640	Yes	NJ	7/1/2002
PCB 1260	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03650	Yes	NJ	7/1/2002
Toxaphene	NPW	Certified	EPA 608	Extract/GC (ECD)	NPW10.03660	Yes	NJ	7/1/2002
Butane	NPW	Certified	Other J. Chrom. Sci. RSK-175	GC, Headspace, FID	NPW10.06000	Yes	NJ	9/8/2016
Ethane	NPW	Certified	Other J. Chrom. Sci. RSK-175	GC, Headspace, FID	NPW10.06010	Yes	NJ	7/1/2007
Ethene	NPW	Certified	Other J. Chrom. Sci. RSK-175	GC, Headspace, FID	NPW10.06020	Yes	NJ	7/1/2007
Methane	NPW	Certified	Other J. Chrom. Sci. RSK-175	GC, Headspace, FID	NPW10.06040	Yes	NJ	7/1/2007
Propane	NPW	Certified	Other J. Chrom. Sci. RSK-175	GC, Headspace, FID	NPW10.06050	Yes	NJ	7/1/2007
Extractable Petroleum Hydrocarbons	NPW	Certified	Other NJDEP EPH 10/08, Rev. 3	Extraction, GC, FID	NPW10.06060	Yes	NJ	8/27/2010
Petroleum Organics	NPW	Certified	Other NJ-OQA-QAM-025, Rev. 7	Extraction, GC, FID	NPW10.06070	Yes	NJ	3/19/2007
Dibromo-3-chloropropane (1,2-)	NPW	Certified	SW-846 8011	Microextraction, GC, ECD	NPW10.07680	Yes	NJ	8/13/2003
Dibromoethane (1,2-) (EDB)	NPW	Certified	SW-846 8011	Microextraction, GC, ECD	NPW10.07690	Yes	NJ	8/13/2003
Trichloropropane (1,2,3-)	NPW	Certified	SW-846 8011	Microextraction, GC, ECD	NPW10.07700	Yes	NJ	8/13/2003
Butanol (1-)	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07750	Yes	NJ	2/16/2011
Diesel range organic	NPW	Certified	SW-846 8015B	Extraction, GC, FID	NPW10.07770	Yes	NJ	7/1/2002
Ethyl alcohol	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07790	Yes	NJ	7/1/2005
Gasoline range organic	NPW	Certified	SW-846 8015B	GC P&T, FID	NPW10.07820	Yes	NJ	7/1/2002
Iso-butyl alcohol	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07830	Yes	NJ	7/1/2002
Isopropyl alcohol	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07840	Yes	NJ	7/1/2005
Methyl alcohol (Methanol)	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07850	Yes	NJ	8/13/2003
Propyl Alcohol (n-)	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07910	Yes	NJ	2/16/2011
Tert-butyl alcohol	NPW	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	NPW10.07940	Yes	NJ	7/1/2002
Butanol (1-)	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08010	Yes	NJ	2/16/2011
Diesel range organic	NPW	Certified	SW-846 8015C	Extraction, GC, FID	NPW10.08030	Yes	NJ	7/1/2002
Ethyl alcohol	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08060	Yes	NJ	7/1/2005
Ethylene glycol	NPW	Applied	SW-846 8015C	GC, Direct Injection, FID	NPW10.08070	No	NJ	10/7/2014
Gasoline range organic	NPW	Certified	SW-846 8015C	GC P&T, FID	NPW10.08100	Yes	NJ	7/1/2002
Iso-butyl alcohol	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08120	Yes	NJ	7/1/2002
Isopropyl alcohol	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08130	Yes	NJ	7/1/2005
Methyl alcohol (Methanol)	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08140	Yes	NJ	8/13/2003
Propyl Alcohol (n-)	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08210	Yes	NJ	2/16/2011
Propylene glycol	NPW	Applied	SW-846 8015C	GC, Direct Injection, FID	NPW10.08220	No	NJ	10/7/2014
Tert-butyl alcohol	NPW	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	NPW10.08260	Yes	NJ	7/1/2002
Butanol (1-)	NPW	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	NPW10.08330	Yes	NJ	7/1/2017
Diesel range organic	NPW	Certified	SW-846 8015D	Extraction, GC, FID	NPW10.08360	Yes	NJ	7/1/2017
Ethyl alcohol	NPW	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	NPW10.08400	Yes	NJ	7/1/2017

Gasoline range organic	NPW	Certified	SW-846 8015D	GC P&T, FID	NPW10.08440	Yes	NJ	7/1/2017
Iso-butyl alcohol	NPW	Certified	SW-846 8015D	GC, Direct injection or P & T, FID	NPW10.08460	Yes	NJ	7/1/2017
Isopropyl alcohol	NPW	Certified	SW-846 8015D	GC, Direct injection or P & T, FID	NPW10.08470	Yes	NJ	7/1/2017
Methyl alcohol (Methanol)	NPW	Certified	SW-846 8015D	GC, Direct injection or P & T, FID	NPW10.08480	Yes	NJ	7/1/2017
Propyl Alcohol (n-)	NPW	Certified	SW-846 8015D	GC, Direct injection or P & T, FID	NPW10.08550	Yes	NJ	7/1/2017
Tert-butyl alcohol	NPW	Certified	SW-846 8015D	GC, Direct injection or P & T, FID	NPW10.08600	Yes	NJ	7/1/2017
Aldrin	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09480	Yes	NJ	7/1/2002
Alpha BHC	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09490	Yes	NJ	7/1/2002
Beta BHC	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09510	Yes	NJ	7/1/2002
Chlordane (alpha) (cis-)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09520	Yes	NJ	7/1/2002
Chlordane (gamma) (trans-)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09530	Yes	NJ	7/1/2002
Chlordane (technical)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09540	Yes	NJ	7/1/2002
DDD (4,4'-)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09610	Yes	NJ	7/1/2002
DDE (4,4'-)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09620	Yes	NJ	7/1/2002
DDT (4,4'-)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09630	Yes	NJ	7/1/2002
Delta BHC	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09640	Yes	NJ	7/1/2002
Dieldrin	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09650	Yes	NJ	7/1/2002
Endosulfan I	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09660	Yes	NJ	7/1/2002
Endosulfan II	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09670	Yes	NJ	7/1/2002
Endosulfan sulfate	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09680	Yes	NJ	7/1/2002
Endrin	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09690	Yes	NJ	7/1/2002
Endrin aldehyde	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09700	Yes	NJ	7/1/2002
Endrin ketone	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09710	Yes	NJ	7/1/2002
Heptachlor	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09730	Yes	NJ	7/1/2002
Heptachlor epoxide	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09740	Yes	NJ	7/1/2002
Lindane (gamma BHC)	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09770	Yes	NJ	7/1/2002
Methoxychlor	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09780	Yes	NJ	7/1/2002
Mirex	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09810	Yes	NJ	4/3/2008
Toxaphene	NPW	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	NPW10.09850	Yes	NJ	7/1/2002
Alachlor	NPW	Applied	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09870	No	NJ	7/1/2017
Alachlor	SCM	Applied	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09870	No	NJ	7/1/2017
Aldrin	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09880	Yes	NJ	7/1/2002
Alpha BHC	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09890	Yes	NJ	7/1/2002
Beta BHC	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09910	Yes	NJ	7/1/2002
Chlordane (alpha) (cis-)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09920	Yes	NJ	7/1/2002
Chlordane (gamma) (trans-)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09930	Yes	NJ	7/1/2002
Chlordane (technical)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.09940	Yes	NJ	7/1/2002
DDD (4,4'-)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10010	Yes	NJ	7/1/2002
DDE (4,4'-)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10020	Yes	NJ	7/1/2002
DDT (4,4'-)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10030	Yes	NJ	7/1/2002
Delta BHC	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10040	Yes	NJ	7/1/2002
Dieldrin	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10050	Yes	NJ	7/1/2002
Endosulfan I	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10060	Yes	NJ	7/1/2002
Endosulfan II	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10070	Yes	NJ	7/1/2002
Endosulfan sulfate	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10080	Yes	NJ	7/1/2002
Endrin	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10090	Yes	NJ	7/1/2002
Endrin aldehyde	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10100	Yes	NJ	7/1/2002
Endrin ketone	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10110	Yes	NJ	7/1/2002
Heptachlor	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10130	Yes	NJ	7/1/2002
Heptachlor epoxide	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10140	Yes	NJ	7/1/2002
Hexachlorobenzene	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10150	Yes	NJ	9/21/2017
Lindane (gamma BHC)	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10170	Yes	NJ	7/1/2002
Methoxychlor	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10180	Yes	NJ	7/1/2002
Mirex	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10210	Yes	NJ	4/3/2008
Toxaphene	NPW	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	NPW10.10250	Yes	NJ	7/1/2002
PCB 1016	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10480	Yes	NJ	7/1/2002
PCB 1221	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10490	Yes	NJ	7/1/2002
PCB 1232	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10500	Yes	NJ	7/1/2002
PCB 1242	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10510	Yes	NJ	7/1/2002
PCB 1248	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10520	Yes	NJ	7/1/2002
PCB 1254	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10530	Yes	NJ	7/1/2002
PCB 1260	NPW	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	NPW10.10540	Yes	NJ	7/1/2002
PCB 1016	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10780	Yes	NJ	7/1/2002
PCB 1221	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10790	Yes	NJ	7/1/2002
PCB 1232	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10800	Yes	NJ	7/1/2002
PCB 1242	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10810	Yes	NJ	7/1/2002
PCB 1248	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10820	Yes	NJ	7/1/2002
PCB 1254	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10830	Yes	NJ	7/1/2002
PCB 1260	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10840	Yes	NJ	7/1/2002
PCB 1262	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10850	Yes	NJ	10/12/2011
PCB 1268	NPW	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	NPW10.10860	Yes	NJ	10/12/2011
D (2,4-)	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12230	Yes	NJ	7/1/2002
Dalapon	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12240	Yes	NJ	7/1/2002
DB (2,4-)	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12250	Yes	NJ	8/13/2003
Dicamba	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12270	Yes	NJ	7/1/2002
Dichlorprop	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12290	Yes	NJ	8/13/2003
Dinoseb	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12300	Yes	NJ	7/1/2002
MCPA	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12320	Yes	NJ	8/13/2003
MCPP	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12330	Yes	NJ	8/13/2003
Pentachlorophenol	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12350	Yes	NJ	8/13/2003
Picloram	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12360	Yes	NJ	7/1/2002
T (2,4,5-)	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12370	Yes	NJ	7/1/2002
TP (2,4,5-) (Silvex)	NPW	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	NPW10.12380	Yes	NJ	7/1/2002
Methoxychlor	NPW	Certified	User Defined EPA 608	Extract/GC (ECD)	NPW10.14320	Yes	NJ	7/1/2002
Beta BHC	NPW	Certified	User Defined EPA 608	GC	NPW10.14520	Yes	NJ	7/1/2002
Chlordane	NPW	Certified	User Defined EPA 608	GC	NPW10.14530	Yes	NJ	7/1/2002
Delta BHC	NPW	Certified	User Defined EPA 608	GC	NPW10.14570	Yes	NJ	7/1/2002
Endosulfan sulfate	NPW	Certified	User Defined EPA 608	GC	NPW10.14630	Yes	NJ	7/1/2002
Endrin	NPW	Certified	User Defined EPA 608	GC	NPW10.14640	Yes	NJ	7/1/2002
Methoxychlor	NPW	Certified	User Defined EPA 608	GC	NPW10.14700	Yes	NJ	7/1/2002
Simazine	NPW	Certified	User Defined EPA 608	GC	NPW10.14780	Yes	NJ	5/17/2006
Toxaphene	NPW	Certified	User Defined EPA 608	GC	NPW10.14800	Yes	NJ	7/1/2002
Acetone	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07870	Yes	NJ	8/13/2003

Acetonitrile	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07880	Yes	NJ	9/8/2016
Acrolein	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07890	Yes	NJ	7/1/2005
Acrylonitrile	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07900	Yes	NJ	7/1/2005
Allyl chloride	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07910	Yes	NJ	9/8/2016
Amyl acetate (n-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07920	Yes	NJ	9/8/2016
Amyl alcohol (n-)	NPW	Applied	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07930	No	NJ	8/13/2003
Benzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07940	Yes	NJ	7/1/2002
Bromobenzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07950	Yes	NJ	9/8/2016
Bromochloromethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07960	Yes	NJ	9/8/2016
Bromodichloromethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07970	Yes	NJ	7/1/2002
Bromoform	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.07990	Yes	NJ	7/1/2002
Bromomethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08000	Yes	NJ	7/1/2002
Butanol (1-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08020	Yes	NJ	9/8/2016
Butanone (2-) (Methyl ethyl ketone)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08030	Yes	NJ	7/1/2005
Butyl acetate (n-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08040	Yes	NJ	8/13/2003
Butylbenzene (n-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08070	Yes	NJ	9/8/2016
Carbon disulfide	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08080	Yes	NJ	7/1/2005
Carbon tetrachloride	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08090	Yes	NJ	7/1/2002
Chlorobenzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08100	Yes	NJ	7/1/2002
Chloroethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08110	Yes	NJ	7/1/2002
Chloroethyl vinyl ether (2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08120	Yes	NJ	7/1/2002
Chloroform	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08130	Yes	NJ	7/1/2002
Chloromethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08140	Yes	NJ	7/1/2002
Chlorotoluene (2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08150	Yes	NJ	9/8/2016
Chlorotoluene (4-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08160	Yes	NJ	9/8/2016
Cyclohexane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08180	Yes	NJ	9/8/2016
Cyclohexanone	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08190	Yes	NJ	9/8/2016
Dibromo-3-chloropropane (1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08200	Yes	NJ	9/8/2016
Dibromochloromethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08210	Yes	NJ	7/1/2002
Dibromoethane (1,2-) (EDB)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08220	Yes	NJ	7/1/2015
Dibromomethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08230	Yes	NJ	9/8/2016
Dichloro-2-butene (trans-1,4-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08250	Yes	NJ	9/8/2016
Dichlorobenzene (1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08260	Yes	NJ	7/1/2002
Dichlorobenzene (1,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08270	Yes	NJ	7/1/2002
Dichlorobenzene (1,4-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08280	Yes	NJ	7/1/2002
Dichloroethane (1,1-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08290	Yes	NJ	7/1/2002
Dichloroethane (1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08300	Yes	NJ	7/1/2002
Dichloroethene (1,1-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08310	Yes	NJ	7/1/2002
Dichloroethene (cis-1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08320	Yes	NJ	7/1/2005
Dichloroethene (trans-1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08330	Yes	NJ	7/1/2002
Dichloropropane (1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08340	Yes	NJ	7/1/2002
Dichloropropane (1,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08350	Yes	NJ	9/8/2016
Dichloropropane (2,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08360	Yes	NJ	7/26/2013
Dichloropropene (1,1-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08370	Yes	NJ	9/8/2016
Dichloropropene (cis-1,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08380	Yes	NJ	7/1/2002
Dichloropropene (trans-1,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08390	Yes	NJ	7/1/2002
Diethyl ether (Ethyl ether)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08400	Yes	NJ	7/1/2007
Diisopropyl Ether [DIPE]	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08410	Yes	NJ	7/1/2007
Dioxane (1,4-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08420	Yes	NJ	7/1/2005
Ethyl acetate	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08440	Yes	NJ	8/13/2003
Ethyl methacrylate	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08450	Yes	NJ	9/8/2016
Ethylbenzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08460	Yes	NJ	7/1/2002
Ethyl-tert-butyl Ether [ETBE]	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08470	Yes	NJ	12/1/2006
Heptane (n-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08480	Yes	NJ	8/13/2003
Hexachlorobutadiene (1,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08490	Yes	NJ	9/8/2016
Hexane (n-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08500	Yes	NJ	8/13/2003
Hexanone (2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08510	Yes	NJ	7/1/2005
Isobutyraldehyde	NPW	Applied	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08530	No	NJ	8/13/2003
Isopropanol	NPW	Applied	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08540	No	NJ	8/13/2003
Isopropyl acetate	NPW	Applied	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08550	No	NJ	8/13/2003
Isopropyl ether	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08560	Yes	NJ	10/27/2003
Isopropylbenzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08570	Yes	NJ	7/1/2007
Isopropyltoluene (4-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08580	Yes	NJ	9/8/2016
Methyl acetate	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08600	Yes	NJ	9/8/2016
Methyl formate	NPW	Applied	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08610	No	NJ	8/13/2003
Methyl iodide	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08620	Yes	NJ	9/8/2016
Methyl isobutyl ketone (MIBK)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08630	Yes	NJ	10/27/2003
Methyl methacrylate	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08640	Yes	NJ	9/8/2016
Methyl tert-butyl ether	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08650	Yes	NJ	7/1/2002
Methylcyclohexane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08660	Yes	NJ	9/8/2016
Methylene chloride (Dichloromethane)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08670	Yes	NJ	7/1/2002
Nitropropane (2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08680	Yes	NJ	9/8/2016
Propylbenzene (n-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08720	Yes	NJ	9/8/2016
Sec-butylbenzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08730	Yes	NJ	9/8/2016
Styrene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08740	Yes	NJ	7/1/2002
tert-Amylmethyl ether [TAME]	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08750	Yes	NJ	12/1/2006
Tert-butyl alcohol	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08770	Yes	NJ	7/1/2002
Tert-butylbenzene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08780	Yes	NJ	9/8/2016
Tetrachloroethane (1,1,1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08790	Yes	NJ	9/8/2016
Tetrachloroethane (1,1,2,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08800	Yes	NJ	7/1/2002
Tetrachloroethene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08810	Yes	NJ	7/1/2002
Tetrahydrofuran	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08820	Yes	NJ	8/13/2003
Toluene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08830	Yes	NJ	7/1/2002
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08840	Yes	NJ	7/1/2005
Trichlorobenzene (1,2,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08850	Yes	NJ	9/8/2016
Trichloroethane (1,1,1-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08860	Yes	NJ	7/1/2002
Trichloroethane (1,1,2-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08870	Yes	NJ	7/1/2002
Trichloroethene	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08880	Yes	NJ	7/1/2002
Trichlorofluoromethane	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08890	Yes	NJ	7/1/2002
Trichloropropane (1,2,3-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08900	Yes	NJ	9/8/2016
Trimethylbenzene (1,2,4-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08920	Yes	NJ	7/1/2005

Trimethylbenzene (1,3,5-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08930	Yes	NJ	7/1/2005
Vinyl acetate	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08940	Yes	NJ	7/1/2007
Vinyl chloride	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08950	Yes	NJ	7/1/2002
Xylene (m- + p-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08960	Yes	NJ	7/1/2005
Xylene (o-)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.08980	Yes	NJ	7/1/2005
Xylenes (total)	NPW	Certified	EPA 624	GC/MS, P & T, Capillary Column	NPW11.09000	Yes	NJ	7/1/2002
Acenaphthene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09010	Yes	NJ	7/1/2002
Acenaphthylene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09020	Yes	NJ	7/1/2002
Acetophenone	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09030	Yes	NJ	7/1/2002
Acetylaminofluorene (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09040	Yes	NJ	9/8/2016
Alpha - terpineol	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09050	Yes	NJ	8/13/2003
Aminobiphenyl (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09060	Yes	NJ	9/8/2016
Aniline	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09070	Yes	NJ	8/13/2003
Anthracene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09080	Yes	NJ	7/1/2002
Aramite	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09090	Yes	NJ	9/8/2016
Benzidine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09110	Yes	NJ	7/1/2002
Benzo(a)anthracene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09120	Yes	NJ	7/1/2002
Benzo(a)pyrene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09130	Yes	NJ	7/1/2002
Benzo(b)fluoranthene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09140	Yes	NJ	7/1/2002
Benzo(ghi)perylene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09150	Yes	NJ	7/1/2002
Benzo(k)fluoranthene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09170	Yes	NJ	7/1/2002
Benzoic acid	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09180	Yes	NJ	7/1/2002
Benzyl alcohol	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09190	Yes	NJ	9/8/2016
Bis (2-chloroethoxy) methane	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09210	Yes	NJ	7/1/2002
Bis (2-chloroethyl) ether	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09220	Yes	NJ	7/1/2002
Bis(2-chloroisopropyl)ether[2,2'-oxybis(1-chloropropane)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09230	Yes	NJ	7/1/2002
Bis (2-ethylhexyl) phthalate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09240	Yes	NJ	7/1/2002
Bromophenyl-phenyl ether (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09250	Yes	NJ	7/1/2002
Butylbenzylphthalate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09260	Yes	NJ	7/1/2002
Carbazole	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09270	Yes	NJ	7/1/2002
Chloroaniline (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09280	Yes	NJ	7/1/2002
Chlorobenzilate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09290	Yes	NJ	9/8/2016
Chloronaphthalene (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09310	Yes	NJ	7/1/2002
Chlorophenol (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09320	Yes	NJ	7/1/2002
Chlorophenyl-phenyl ether (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09330	Yes	NJ	7/1/2002
Chrysene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09340	Yes	NJ	7/1/2002
Decane (n-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09350	Yes	NJ	8/13/2003
Dibenz(a,h)acridine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09380	Yes	NJ	12/1/2006
Dibenzo(a,h)anthracene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09410	Yes	NJ	7/1/2002
Dibenzofuran	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09440	Yes	NJ	7/1/2002
Dichloroaniline (2,3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09450	Yes	NJ	8/13/2003
Dichlorobenzidine (3,3'-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09460	Yes	NJ	7/1/2002
Dichlorophenol (2,4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09470	Yes	NJ	7/1/2002
Dichlorophenol (2,6-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09480	Yes	NJ	9/8/2016
Diethyl phthalate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09490	Yes	NJ	7/1/2002
Dimethoate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09500	Yes	NJ	9/8/2016
Dimethyl benzidine (3,3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09510	Yes	NJ	9/8/2016
Dimethyl phthalate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09520	Yes	NJ	7/1/2002
Dimethylaminoazobenzene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09530	Yes	NJ	9/8/2016
[illegible]	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09540	Yes	NJ	12/1/2006
Dimethylphenol (2,4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09550	Yes	NJ	7/1/2002
Di-n-butyl phthalate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09560	Yes	NJ	7/1/2002
Dinitrobenzene (1,3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09570	Yes	NJ	9/8/2016
Dinitrophenol (2,4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09580	Yes	NJ	7/1/2002
Dinitrophenol (2-methyl-4,6-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09590	Yes	NJ	7/1/2002
Dinitrotoluene (2,4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09600	Yes	NJ	7/1/2002
Dinitrotoluene (2,6-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09610	Yes	NJ	7/1/2002
Di-n-octyl phthalate	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09620	Yes	NJ	7/1/2002
Diphenylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09630	Yes	NJ	9/8/2016
Diphenylhydrazine (1,2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09640	Yes	NJ	7/1/2004
Famphur	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09680	Yes	NJ	9/8/2016
Fluoranthene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09690	Yes	NJ	7/1/2002
Fluorene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09700	Yes	NJ	7/1/2002
Hexachlorobenzene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09710	Yes	NJ	7/1/2002
Hexachlorobutadiene (1,3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09720	Yes	NJ	7/1/2002
Hexachlorocyclopentadiene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09730	Yes	NJ	7/1/2002
Hexachloroethane	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09740	Yes	NJ	7/1/2002
Hexachloropropene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09760	Yes	NJ	9/8/2016
Indeno(1,2,3-cd)pyrene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09780	Yes	NJ	7/1/2002
Isophorone	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09790	Yes	NJ	8/13/2003
Methylnaphthalene (1-)	NPW	Applied	EPA 625	Extract, GC/MS	NPW11.09799	No	NJ	7/1/2016
Kepone	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09820	Yes	NJ	9/8/2016
Methanesulfonate (Ethyl-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09830	Yes	NJ	9/8/2016
Methanesulfonate (Methyl-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09840	Yes	NJ	9/8/2016
Methapyrilene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09850	Yes	NJ	9/8/2016
Methyl phenol (4-chloro-3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09860	Yes	NJ	7/1/2002
Methylcholanthrene (3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09870	Yes	NJ	9/8/2016
Methylnaphthalene (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09880	Yes	NJ	7/1/2002
Methylphenanthrene (1-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09890	Yes	NJ	7/1/2002
Methylphenol (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09900	Yes	NJ	8/13/2003
Methylphenol (3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09910	Yes	NJ	9/8/2016
Methylphenol (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09920	Yes	NJ	7/1/2002
Naphthalene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09930	Yes	NJ	7/1/2002
Napthoquinone (1,4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09940	Yes	NJ	9/8/2016
Napthhylamine (1-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09950	Yes	NJ	9/8/2016
Napthhylamine (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09960	Yes	NJ	9/8/2016
Nitroaniline (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09970	Yes	NJ	7/1/2002
Nitroaniline (3-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09980	Yes	NJ	7/1/2002
Nitroaniline (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.09990	Yes	NJ	7/1/2002
Nitrobenzene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10000	Yes	NJ	7/1/2002
Nitrophenol (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10010	Yes	NJ	7/1/2002
Nitrophenol (4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10020	Yes	NJ	7/1/2002

N-Nitrosodiethylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10030	Yes	NJ	7/1/2004
N-Nitrosodimethylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10040	Yes	NJ	7/1/2002
N-Nitroso-di-n-butylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10050	Yes	NJ	7/1/2004
N-Nitroso-di-n-propylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10060	Yes	NJ	7/1/2002
N-Nitrosodiphenylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10070	Yes	NJ	7/1/2002
N-Nitrosomethylethylamine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10080	Yes	NJ	9/8/2016
N-Nitrosomorpholine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10090	Yes	NJ	9/8/2016
N-Nitrosopiperidine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10100	Yes	NJ	9/8/2016
N-Nitrosopyrrolidine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10110	Yes	NJ	7/1/2004
Octadecane (n-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10120	Yes	NJ	8/13/2003
Pentachlorobenzene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10200	Yes	NJ	7/1/2004
Pentachlorophenol	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10230	Yes	NJ	7/1/2002
Phenacetin	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10240	Yes	NJ	9/8/2016
Phenanthrene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10250	Yes	NJ	7/1/2002
Phenol	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10260	Yes	NJ	7/1/2002
Phenylethylamine (alpha, alpha-Dimethyl)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10280	Yes	NJ	9/8/2016
Phosphorothioate (O,O,O-triethyl)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10290	Yes	NJ	9/8/2016
Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10300	Yes	NJ	9/8/2016
Picoline (2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10310	Yes	NJ	9/8/2016
Pyrene	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10320	Yes	NJ	7/1/2002
Pyridine	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10330	Yes	NJ	7/1/2002
Quinoline -1-Oxide (4-Nitro)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10340	Yes	NJ	9/8/2016
Safrole	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10350	Yes	NJ	9/8/2016
Tetrachlorobenzene (1,2,4,5-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10390	Yes	NJ	7/1/2004
Tetrachlorophenol (2,3,4,6-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10400	Yes	NJ	12/1/2006
Toluidine (2-) (2-Methylaniline)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10420	Yes	NJ	9/8/2016
Toluidine (5-nitro-2-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10430	Yes	NJ	9/8/2016
Trichlorobenzene (1,2,4-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10440	Yes	NJ	7/1/2002
Trichlorophenol (2,4,5-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10460	Yes	NJ	7/1/2002
Trichlorophenol (2,4,6-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10470	Yes	NJ	7/1/2002
Trinitrobenzene (1,3,5-)	NPW	Certified	EPA 625	Extract, GC/MS	NPW11.10480	Yes	NJ	9/8/2016
TCDD (2,3,7,8-)	NPW	Certified	EPA 625 (screen only)	GC/MS, Selected Ion Monitoring	NPW11.10680	Yes	NJ	9/8/2016
Trimethylpentane (2,2,4-)	NPW	Certified	SW-846 8260B	GC/MS, Extract or Dir Inj, Capillary	NPW11.13100	Yes	NJ	10/15/2010
Acetone	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13110	Yes	NJ	7/1/2002
Acetonitrile	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13120	Yes	NJ	7/1/2004
Acrolein	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13130	Yes	NJ	7/1/2002
Acrylonitrile	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13140	Yes	NJ	7/1/2002
Allyl chloride	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13150	Yes	NJ	7/1/2002
Benzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13180	Yes	NJ	7/1/2002
Benzyl chloride	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13190	Yes	NJ	7/1/2007
Bromobenzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13200	Yes	NJ	7/1/2005
Bromochloromethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13210	Yes	NJ	7/1/2005
Bromodichloromethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13220	Yes	NJ	7/1/2002
Bromoform	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13240	Yes	NJ	7/1/2002
Bromomethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13250	Yes	NJ	7/1/2002
Butadiene (2-chloro-1,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13260	Yes	NJ	7/1/2007
Butanol (1-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13270	Yes	NJ	12/2/2008
[illegible]	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13290	Yes	NJ	7/1/2002
Butylbenzene (n-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13330	Yes	NJ	7/1/2005
Carbon disulfide	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13340	Yes	NJ	7/1/2002
Carbon tetrachloride	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13350	Yes	NJ	7/1/2002
Chlorobenzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13360	Yes	NJ	7/1/2002
Chloroethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13370	Yes	NJ	7/1/2002
Chloroethyl vinyl ether (2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13380	Yes	NJ	7/1/2002
Chloroform	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13390	Yes	NJ	7/1/2002
Chloromethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13400	Yes	NJ	7/1/2002
Chlorotoluene (2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13410	Yes	NJ	7/1/2005
Chlorotoluene (4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13420	Yes	NJ	7/1/2005
Cyclohexane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13430	Yes	NJ	12/2/2008
Cyclohexanone	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13440	Yes	NJ	7/1/2005
Dibromo-3-chloropropane (1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13450	Yes	NJ	7/1/2004
Dibromochloromethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13460	Yes	NJ	7/1/2002
Dibromoethane (1,2-) (EDB)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13470	Yes	NJ	7/1/2004
Dibromomethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13480	Yes	NJ	12/1/2006
Dichloro-2-butene (trans-1,4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13500	Yes	NJ	7/1/2004
Dichlorobenzene (1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13510	Yes	NJ	7/1/2002
Dichlorobenzene (1,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13520	Yes	NJ	7/1/2002
Dichlorobenzene (1,4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13530	Yes	NJ	7/1/2002
Dichlorodifluoromethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13540	Yes	NJ	7/1/2002
Dichloroethane (1,1-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13550	Yes	NJ	7/1/2002
Dichloroethane (1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13560	Yes	NJ	7/1/2002
Dichloroethene (1,1-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13570	Yes	NJ	7/1/2002
Dichloroethene (cis-1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13580	Yes	NJ	7/1/2002
Dichloroethene (trans-1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13590	Yes	NJ	7/1/2002
Dichloropropane (1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13600	Yes	NJ	7/1/2002
Dichloropropane (1,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13610	Yes	NJ	7/1/2005
Dichloropropane (2,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13620	Yes	NJ	7/1/2005
Dichloropropene (1,1-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13630	Yes	NJ	7/1/2005
Dichloropropene (cis-1,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13640	Yes	NJ	7/1/2002
Dichloropropene (trans-1,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13650	Yes	NJ	7/1/2002
Diethyl ether (Ethyl ether)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13660	Yes	NJ	7/1/2005
Diisopropyl Ether [DIPE]	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13670	Yes	NJ	12/1/2006
Dioxane (1,4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13680	Yes	NJ	7/1/2004
Ethanol	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13690	Yes	NJ	7/1/2007
Ethyl acetate	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13700	Yes	NJ	7/1/2005
Ethyl methacrylate	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13710	Yes	NJ	7/1/2005
Ethylbenzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13720	Yes	NJ	7/1/2002
Ethyl-tert-butyl Ether [ETBE]	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13730	Yes	NJ	12/1/2006
Heptane (n-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13740	Yes	NJ	1/23/2012
Hexachlorobutadiene (1,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13750	Yes	NJ	7/1/2002
Hexachloroethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13760	Yes	NJ	7/1/2002

Hexane (n-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13770	Yes	NJ	1/23/2012
Hexanone (2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13780	Yes	NJ	7/1/2002
Iso-butyl alcohol	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13790	Yes	NJ	7/1/2005
Isopropylbenzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13820	Yes	NJ	7/1/2005
Isopropyltoluene (4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13830	Yes	NJ	7/1/2005
Methacrylonitrile	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13840	Yes	NJ	7/1/2005
Methyl acetate	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13850	Yes	NJ	12/2/2008
Methyl acrylate	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13860	Yes	NJ	7/1/2007
Methyl iodide	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13870	Yes	NJ	7/1/2004
Methyl methacrylate	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13880	Yes	NJ	7/1/2005
Methyl tert-butyl ether	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13890	Yes	NJ	7/1/2002
Methylcyclohexane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13900	Yes	NJ	4/6/2010
Methylene chloride (Dichloromethane)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection, Capillary	NPW11.13910	Yes	NJ	7/1/2002
Naphthalene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13940	Yes	NJ	7/1/2002
Nitropropane (2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13960	Yes	NJ	12/2/2008
Pentachloroethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.13990	Yes	NJ	7/1/2005
Pentanone (4-methyl-2-) (MIBK)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14010	Yes	NJ	7/1/2002
Propionitrile	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14020	Yes	NJ	7/1/2005
Propylbenzene (n-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14030	Yes	NJ	7/1/2005
Sec-butylbenzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14040	Yes	NJ	7/1/2005
Styrene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14050	Yes	NJ	7/1/2002
tert-Amylmethyl ether [TAME]	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14060	Yes	NJ	12/1/2006
Tert-butyl alcohol	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14070	Yes	NJ	7/1/2004
Tert-butylbenzene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14080	Yes	NJ	7/1/2005
Tetrachloroethane (1,1,1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14090	Yes	NJ	7/1/2002
Tetrachloroethane (1,1,2,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14100	Yes	NJ	7/1/2002
Tetrachloroethene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14110	Yes	NJ	7/1/2002
Tetrahydrofuran	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14120	Yes	NJ	7/1/2005
Toluene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14130	Yes	NJ	7/1/2002
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection, Capillary	NPW11.14150	Yes	NJ	7/1/2004
Trichlorobenzene (1,2,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14160	Yes	NJ	7/1/2005
Trichlorobenzene (1,2,4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14170	Yes	NJ	7/1/2002
Trichloroethane (1,1,1-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14180	Yes	NJ	7/1/2002
Trichloroethane (1,1,2-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14190	Yes	NJ	7/1/2002
Trichloroethene	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14200	Yes	NJ	7/1/2002
Trichlorofluoromethane	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14210	Yes	NJ	7/1/2002
Trichloropropane (1,2,3-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14220	Yes	NJ	7/1/2004
Trimethylbenzene (1,2,4-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14240	Yes	NJ	7/1/2005
Trimethylbenzene (1,3,5-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14250	Yes	NJ	7/1/2005
Vinyl acetate	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14260	Yes	NJ	7/1/2004
Vinyl chloride	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14270	Yes	NJ	7/1/2002
Xylene (m-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14280	Yes	NJ	7/1/2005
Xylene (o-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14290	Yes	NJ	7/1/2005
Xylene (p-)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14300	Yes	NJ	7/1/2005
Xylenes (total)	NPW	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.14310	Yes	NJ	7/1/2002
Trimethylpentane (2,2,4-)	NPW	Certified	SW-846 8260C	GC/MS, Extract or Dir Inj, Capillary	NPW11.14320	Yes	NJ	10/15/2010
Acetone	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14330	Yes	NJ	7/1/2002
Acetonitrile	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14340	Yes	NJ	7/1/2004
Acrolein	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14350	Yes	NJ	7/1/2002
Acrylonitrile	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14360	Yes	NJ	7/1/2002
Allyl chloride	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14370	Yes	NJ	7/1/2005
Amyl alcohol (t-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14380	Yes	NJ	1/18/2017
Benzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14390	Yes	NJ	7/1/2002
Benzyl chloride	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14400	Yes	NJ	7/1/2007
Bromobenzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14410	Yes	NJ	7/1/2005
Bromochloromethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14420	Yes	NJ	7/1/2005
Bromodichloromethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14430	Yes	NJ	7/1/2002
Bromoform	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14450	Yes	NJ	7/1/2002
Bromomethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14460	Yes	NJ	7/1/2002
Butadiene (2-chloro-1,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14470	Yes	NJ	7/1/2007
Butanol (1-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14480	Yes	NJ	12/2/2008
Butanol (3,3-Dimethyl-1-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14490	Yes	NJ	9/8/2016
Butanone (2-) (Methyl ethyl ketone)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14500	Yes	NJ	7/1/2002
Butyl formate (t-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14510	Yes	NJ	9/8/2016
Butylbenzene (n-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14540	Yes	NJ	7/1/2005
Carbon disulfide	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14550	Yes	NJ	7/1/2002
Carbon tetrachloride	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14560	Yes	NJ	7/1/2002
Chlorobenzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14570	Yes	NJ	7/1/2002
Chloroethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14580	Yes	NJ	7/1/2002
Chloroethyl vinyl ether (2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14590	Yes	NJ	7/1/2002
Chloroform	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14600	Yes	NJ	7/1/2002
Chloromethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14610	Yes	NJ	7/1/2002
Chlorotoluene (2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14620	Yes	NJ	7/1/2005
Chlorotoluene (4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14630	Yes	NJ	7/1/2005
Cyclohexane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14650	Yes	NJ	12/2/2008
Cyclohexanone	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14660	Yes	NJ	7/1/2005
Dibromo-3-chloropropane (1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14670	Yes	NJ	7/1/2004
Dibromochloromethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14680	Yes	NJ	7/1/2002
Dibromoethane (1,2-) (EDB)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14690	Yes	NJ	7/1/2004
Dibromomethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14700	Yes	NJ	12/1/2006
Dichloro-2-butene (trans-1,4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14720	Yes	NJ	7/1/2004
Dichlorobenzene (1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14730	Yes	NJ	7/1/2002
Dichlorobenzene (1,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14740	Yes	NJ	7/1/2002
Dichlorobenzene (1,4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14750	Yes	NJ	7/1/2002
Dichlorodifluoromethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14760	Yes	NJ	7/1/2002
Dichloroethane (1,1-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14770	Yes	NJ	7/1/2002
Dichloroethane (1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14780	Yes	NJ	7/1/2002
Dichloroethene (1,1-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14790	Yes	NJ	7/1/2002
Dichloroethene (cis-1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14800	Yes	NJ	7/1/2002
Dichloroethene (trans-1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14810	Yes	NJ	7/1/2002
Dichloropropane (1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14820	Yes	NJ	7/1/2002

Dichloropropane (1,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14830	Yes	NJ	7/1/2005
Dichloropropane (2,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14840	Yes	NJ	7/1/2005
Dichloropropene (1,1-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14850	Yes	NJ	7/1/2005
Dichloropropene (cis-1,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14860	Yes	NJ	7/1/2002
Dichloropropene (trans-1,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14870	Yes	NJ	7/1/2002
Diethyl ether (Ethyl ether)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14880	Yes	NJ	7/1/2005
Diisopropyl Ether [DIPE]	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14890	Yes	NJ	12/1/2006
Dioxane (1,4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14900	Yes	NJ	7/1/2004
Ethanol	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14910	Yes	NJ	7/1/2007
Ethyl acetate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14920	Yes	NJ	7/1/2005
Ethyl methacrylate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14930	Yes	NJ	7/1/2005
Ethylbenzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14940	Yes	NJ	7/1/2002
Ethyl-tert-butyl Ether [ETBE]	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14950	Yes	NJ	12/1/2006
Heptane (n-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14960	Yes	NJ	1/23/2012
Hexachlorobutadiene (1,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14970	Yes	NJ	7/1/2002
Hexachloroethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14980	Yes	NJ	7/1/2002
Hexane (n-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.14990	Yes	NJ	1/23/2012
Hexanone (2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15000	Yes	NJ	7/1/2002
Iso-butyl alcohol	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15010	Yes	NJ	7/1/2005
Isopropyl acetate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15030	Yes	NJ	9/8/2016
Isopropylbenzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15040	Yes	NJ	7/1/2005
Isopropyltoluene (4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15050	Yes	NJ	7/1/2005
Methacrylonitrile	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15060	Yes	NJ	7/1/2005
Methyl acetate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15070	Yes	NJ	12/2/2008
Methyl acrylate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15080	Yes	NJ	7/1/2007
Methyl iodide	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15090	Yes	NJ	7/1/2004
Methyl methacrylate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15100	Yes	NJ	7/1/2005
Methyl tert-butyl ether	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15110	Yes	NJ	7/1/2002
Methylcyclohexane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15120	Yes	NJ	4/6/2010
Methylene chloride (Dichloromethane)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection, Capillary	NPW11.15130	Yes	NJ	7/1/2002
Naphthalene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15160	Yes	NJ	7/1/2002
Nitropropane (2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15180	Yes	NJ	12/2/2008
Pentachloroethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15210	Yes	NJ	7/1/2005
Pentanone (4-methyl-2-) (MIBK)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15230	Yes	NJ	7/1/2002
Propionitrile	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15240	Yes	NJ	7/1/2005
Propylbenzene (n-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15250	Yes	NJ	7/1/2005
Sec-butylbenzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15260	Yes	NJ	7/1/2005
Styrene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15270	Yes	NJ	7/1/2002
tert-Amylmethyl ether [TAME]	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15280	Yes	NJ	12/1/2006
Tert-butyl alcohol	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15300	Yes	NJ	7/1/2004
Tert-butylbenzene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15310	Yes	NJ	7/1/2005
Tetrachloroethane (1,1,1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15320	Yes	NJ	7/1/2002
Tetrachloroethane (1,1,2,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15330	Yes	NJ	7/1/2002
Tetrachloroethene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15340	Yes	NJ	7/1/2002
Tetrahydrofuran	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15350	Yes	NJ	7/1/2005
Toluene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15360	Yes	NJ	7/1/2002
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection, Capillary	NPW11.15380	Yes	NJ	7/1/2004
Trichlorobenzene (1,2,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15390	Yes	NJ	7/1/2005
Trichlorobenzene (1,2,4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15400	Yes	NJ	7/1/2002
Trichloroethane (1,1,1-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15410	Yes	NJ	7/1/2002
Trichloroethane (1,1,2-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15420	Yes	NJ	7/1/2002
Trichloroethene	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15430	Yes	NJ	7/1/2002
Trichlorofluoromethane	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15440	Yes	NJ	7/1/2002
Trichloropropane (1,2,3-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15450	Yes	NJ	7/1/2004
Trimethylbenzene (1,2,4-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15470	Yes	NJ	7/1/2005
Trimethylbenzene (1,3,5-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15480	Yes	NJ	7/1/2005
Vinyl acetate	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15490	Yes	NJ	7/1/2004
Vinyl chloride	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15500	Yes	NJ	7/1/2002
Xylene (m-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15510	Yes	NJ	7/1/2005
Xylene (o-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15520	Yes	NJ	7/1/2005
Xylene (p-)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15530	Yes	NJ	7/1/2005
Xylenes (total)	NPW	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	NPW11.15540	Yes	NJ	7/1/2002
Dioxane (1,4-)	NPW	Certified	SW-846 8260C	GC/MS/SIM, P & T or Direct Injection,	NPW11.15545	Yes	NJ	9/8/2016
Acenaphthene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17750	Yes	NJ	7/1/2002
Acenaphthylene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17760	Yes	NJ	7/1/2002
Acetophenone	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17770	Yes	NJ	7/1/2005
Acetylaminofluorene (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17780	Yes	NJ	7/1/2005
Alpha - terpineol	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17800	Yes	NJ	7/1/2005
Aminobiphenyl (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17820	Yes	NJ	7/1/2005
Aniline	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17840	Yes	NJ	7/1/2004
Anthracene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17850	Yes	NJ	7/1/2002
Aramite	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17860	Yes	NJ	12/1/2006
Atrazine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17870	Yes	NJ	11/17/2009
Benzaldehyde	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17890	Yes	NJ	11/17/2009
Benzenethiol	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17900	Yes	NJ	9/8/2016
Benzidine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17910	Yes	NJ	7/1/2004
Benzo(a)anthracene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17920	Yes	NJ	7/1/2002
Benzo(a)pyrene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17930	Yes	NJ	7/1/2002
Benzo(b)fluoranthene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17940	Yes	NJ	7/1/2002
Benzo(ghi)perylene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17950	Yes	NJ	7/1/2002
Benzo(k)fluoranthene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17970	Yes	NJ	7/1/2002
Benzoic acid	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.17980	Yes	NJ	7/1/2004
Benzyl alcohol	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18000	Yes	NJ	7/1/2005
Biphenyl (1,1'-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18030	Yes	NJ	11/17/2009
Bis (2-chloroethoxy) methane	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18040	Yes	NJ	7/1/2002
Bis (2-chloroethyl) ether	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18050	Yes	NJ	7/1/2002
Bis(2-chloroisopropyl)ether[2,2'-oxybis(1-chloropropane)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18060	Yes	NJ	7/1/2002
Bis (2-ethylhexyl) phthalate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18070	Yes	NJ	7/1/2002
Bromophenyl-phenyl ether (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18080	Yes	NJ	7/1/2002
Butylbenzylphthalate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18090	Yes	NJ	7/1/2002

Caprolactam	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18100	Yes	NJ	11/17/2009
Carbazole	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18110	Yes	NJ	7/1/2002
Chloroaniline (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18150	Yes	NJ	7/1/2002
Chlorobenzilate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18160	Yes	NJ	7/1/2005
Chloronaphthalene (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18180	Yes	NJ	7/1/2002
Chlorophenol (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18190	Yes	NJ	7/1/2002
Chlorophenyl-phenyl ether (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18200	Yes	NJ	7/1/2002
Chrysene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18210	Yes	NJ	7/1/2002
Decane (n-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18250	Yes	NJ	10/15/2010
Diallate (cis)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18270	Yes	NJ	12/1/2006
Diallate (trans)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18280	Yes	NJ	12/1/2006
Dibenz(a,h)acridine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18290	Yes	NJ	12/1/2006
Dibenzo(a,h)anthracene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18320	Yes	NJ	7/1/2002
Dibenzofuran	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18360	Yes	NJ	7/1/2002
Dichlorobenzene (1,2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18370	Yes	NJ	7/1/2004
Dichlorobenzene (1,3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18380	Yes	NJ	7/1/2004
Dichlorobenzene (1,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18390	Yes	NJ	7/1/2002
Dichlorobenzidine (3,3'-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18400	Yes	NJ	7/1/2002
Dichlorophenol (2,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18410	Yes	NJ	7/1/2002
Dichlorophenol (2,6-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18420	Yes	NJ	12/1/2006
Diethyl phthalate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18440	Yes	NJ	7/1/2002
Dimethoate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18450	Yes	NJ	12/1/2006
Dimethyl benzidine (3,3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18460	Yes	NJ	12/1/2006
Dimethyl phthalate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18470	Yes	NJ	7/1/2002
Dimethylaminoazobenzene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18480	Yes	NJ	12/1/2006
Dimethylbenz(a)anthracene (7,12-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18530	Yes	NJ	12/1/2006
Dimethylphenol (2,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18540	Yes	NJ	7/1/2002
Di-n-butyl phthalate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18550	Yes	NJ	7/1/2002
Dinitrobenzene (1,3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18560	Yes	NJ	12/1/2006
Dinitrophenol (2,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18580	Yes	NJ	7/1/2002
Dinitrophenol (2-methyl-4,6-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18590	Yes	NJ	7/1/2002
Dinitrotoluene (2,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18600	Yes	NJ	7/1/2002
Dinitrotoluene (2,6-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18610	Yes	NJ	7/1/2002
Di-n-octyl phthalate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18620	Yes	NJ	7/1/2002
Dinoseb	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18630	Yes	NJ	7/1/2005
Diphenylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18640	Yes	NJ	7/1/2002
Diphenylhydrazine (1,2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18650	Yes	NJ	12/1/2006
Disulfoton	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18660	Yes	NJ	7/1/2005
Famphur	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18740	Yes	NJ	12/1/2006
Fluoranthene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18750	Yes	NJ	7/1/2002
Fluorene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18760	Yes	NJ	7/1/2002
Hexachlorobenzene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18790	Yes	NJ	7/1/2002
Hexachlorobutadiene (1,3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18800	Yes	NJ	7/1/2002
Hexachlorocyclopentadiene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18810	Yes	NJ	7/1/2002
Hexachloroethane	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18820	Yes	NJ	7/1/2002
Hexachlorophene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18830	Yes	NJ	12/1/2006
Hexachloropropene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18840	Yes	NJ	7/1/2002
Hydroquinone	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18850	Yes	NJ	2/4/2010
Indene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18860	Yes	NJ	9/8/2016
Indeno(1,2,3-cd)pyrene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18870	Yes	NJ	7/1/2002
Isodrin	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18880	Yes	NJ	7/1/2005
Isophorone	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18890	Yes	NJ	7/1/2002
Isosafrole (cis-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18900	Yes	NJ	12/1/2006
Isosafrole (trans-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18910	Yes	NJ	12/1/2006
Kepone	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18920	Yes	NJ	7/1/2005
Methanesulfonate (Ethyl-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18940	Yes	NJ	12/1/2006
Methanesulfonate (Methyl-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18950	Yes	NJ	12/1/2006
Methapyrilene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18960	Yes	NJ	12/1/2006
Methyl phenol (4-chloro-3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18980	Yes	NJ	7/1/2002
Methylcholanthrene (3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.18990	Yes	NJ	4/23/2009
Methylnaphthalene (1-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19000	Yes	NJ	1/23/2012
Methylnaphthalene (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19010	Yes	NJ	7/1/2002
Methylphenol (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19020	Yes	NJ	7/1/2002
Methylphenol (3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19030	Yes	NJ	7/1/2002
Methylphenol (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19040	Yes	NJ	7/1/2002
Naphthalene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19050	Yes	NJ	7/1/2002
Napthoquinone (1,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19060	Yes	NJ	12/1/2006
Napthylamine (1-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19070	Yes	NJ	12/1/2006
Napthylamine (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19080	Yes	NJ	12/1/2006
Nitroaniline (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19090	Yes	NJ	7/1/2002
Nitroaniline (3-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19100	Yes	NJ	7/1/2002
Nitroaniline (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19110	Yes	NJ	7/1/2002
Nitrobenzene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19120	Yes	NJ	7/1/2002
Nitrophenol (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19140	Yes	NJ	7/1/2002
Nitrophenol (4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19150	Yes	NJ	7/1/2002
N-Nitrosodiethylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19160	Yes	NJ	7/1/2004
N-Nitrosodimethylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19170	Yes	NJ	7/1/2005
N-Nitroso-di-n-butylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19180	Yes	NJ	7/1/2005
N-Nitroso-di-n-propylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19190	Yes	NJ	7/1/2004
N-Nitrosodiphenylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19200	Yes	NJ	7/1/2002
N-Nitrosomethylethylamine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19210	Yes	NJ	7/1/2005
N-Nitrosomorpholine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19220	Yes	NJ	7/1/2005
N-Nitrosopiperidine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19230	Yes	NJ	12/1/2006
N-Nitrosopyrrolidine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19240	Yes	NJ	7/1/2005
Octadecane (n-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19250	Yes	NJ	10/15/2010
Parathion	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19260	Yes	NJ	7/1/2005
Parathion methyl	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19270	Yes	NJ	7/1/2005
Pentachlorobenzene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19350	Yes	NJ	7/1/2005
Pentachloroethane	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19360	Yes	NJ	7/1/2007
Pentachloronitrobenzene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19370	Yes	NJ	7/1/2005
Pentachlorophenol	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19380	Yes	NJ	7/1/2002
Phenacetin	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19390	Yes	NJ	12/1/2006
Phenanthrene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19400	Yes	NJ	7/1/2002

Phenol	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19410	Yes	NJ	7/1/2002
Phenylenediamine (1,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19420	Yes	NJ	12/1/2006
Phenylethylamine (alpha, alpha-Dimethyl)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19430	Yes	NJ	12/1/2006
Phorate	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19440	Yes	NJ	7/1/2005
Phosphorothioate (O,O,O-triethyl)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19450	Yes	NJ	12/1/2006
Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19460	Yes	NJ	12/1/2006
Picoline (2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19470	Yes	NJ	7/1/2005
Pronamide	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19480	Yes	NJ	7/1/2005
Pyrene	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19490	Yes	NJ	7/1/2002
Pyridine	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19500	Yes	NJ	7/1/2002
Quinoline	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19510	Yes	NJ	9/8/2016
Quinoline -1-Oxide (4-Nitro)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19520	Yes	NJ	12/1/2006
Safrole	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19530	Yes	NJ	12/1/2006
Tetrachlorobenzene (1,2,4,5-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19580	Yes	NJ	7/1/2005
Tetrachlorophenol (2,3,4,6-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19590	Yes	NJ	12/1/2006
Toluidine (2-) (2-Methylaniline)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19600	Yes	NJ	7/1/2005
Toluidine (5-nitro-2-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19620	Yes	NJ	12/1/2006
Trichlorobenzene (1,2,4-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19640	Yes	NJ	7/1/2002
Trichlorophenol (2,4,5-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19650	Yes	NJ	7/1/2002
Trichlorophenol (2,4,6-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19660	Yes	NJ	7/1/2002
Trinitrobenzene (1,3,5-)	NPW	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.19680	Yes	NJ	12/1/2006
Acenaphthene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19690	Yes	NJ	5/18/2015
Acenaphthylene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19700	Yes	NJ	5/18/2015
Anthracene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19710	Yes	NJ	5/18/2015
Benzo(a)anthracene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19720	Yes	NJ	1/2/2007
Benzo(a)pyrene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19730	Yes	NJ	1/2/2007
Benzo(b)fluoranthene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19740	Yes	NJ	1/2/2007
Benzo(ghi)perylene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19750	Yes	NJ	5/15/2015
Benzo(k)fluoranthene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19760	Yes	NJ	1/2/2007
Chrysene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19770	Yes	NJ	5/18/2015
Dibenzo(a,h)anthracene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19780	Yes	NJ	1/2/2007
Dinitrophenol (2-methyl-4,6-)	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19790	Yes	NJ	12/1/2015
Dioxane (1,4-)	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19794	Yes	NJ	12/1/2015
Fluoranthene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19800	Yes	NJ	5/18/2015
Fluorene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19810	Yes	NJ	5/18/2015
Hexachlorobenzene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19820	Yes	NJ	1/2/2007
Hexachlorobutadiene (1,3-)	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19830	Yes	NJ	12/1/2015
Indeno(1,2,3-cd)pyrene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19840	Yes	NJ	5/18/2015
Methylnaphthalene (2-)	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19860	Yes	NJ	1/2/2007
Naphthalene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19870	Yes	NJ	5/18/2015
Pentachlorophenol	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19890	Yes	NJ	1/23/2012
Phenanthrene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19900	Yes	NJ	7/26/2013
Pyrene	NPW	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	NPW11.19910	Yes	NJ	7/26/2013
Dichlorobenzene (1,2-)	NPW	Applied	User Defined EPA 625	Extract, GC/MS	NPW11.20880	No	NJ	3/7/2016
Dinoseb	NPW	Applied	User Defined EPA 625	Extract, GC/MS	NPW11.20910	No	NJ	3/7/2016
Disulfoton	NPW	Applied	User Defined EPA 625	Extract, GC/MS	NPW11.20920	No	NJ	3/7/2016
Isodrin	NPW	Applied	User Defined EPA 625	Extract, GC/MS	NPW11.20930	No	NJ	3/7/2016
Parathion	NPW	Applied	User Defined EPA 625	Extract, GC/MS	NPW11.20940	No	NJ	3/7/2016
Parathion methyl	NPW	Applied	User Defined EPA 625	Extract, GC/MS	NPW11.20950	No	NJ	3/7/2016
Dioxane (1,4-)	NPW	Certified	User Defined SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	NPW11.21110	Yes	NJ	7/26/2013
1,1,1-Trifluoroethane	NPW	Certified	User Defined SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.21260	Yes	NJ	7/26/2013
1-Chloro-1,1-difluoroethane	NPW	Certified	User Defined SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW11.21270	Yes	NJ	7/26/2013
1,1,1-Trifluoroethane	NPW	Certified	User Defined EPA 624	GC/MS, P & T, Capillary Column	NPW11.21280	Yes	NJ	7/26/2013
1,1-Dichloro-1-fluoroethane	NPW	Certified	User Defined EPA 624	GC/MS, P & T, Capillary Column	NPW11.21290	Yes	NJ	7/26/2013
1-Chloro-1,1-difluoroethane	NPW	Certified	User Defined EPA 624	GC/MS, P & T, Capillary Column	NPW11.21300	Yes	NJ	7/26/2013
Dichlorodifluoromethane	NPW	Certified	User Defined EPA 624	GC/MS, P & T, Capillary Column	NPW11.21600	Yes	NJ	7/1/2002
Naphthalene	NPW	Certified	User Defined EPA 624	GC/MS, P & T, Capillary Column	NPW11.21850	Yes	NJ	12/1/2006
Trichlorobenzene (1,2,4-)	NPW	Certified	User Defined EPA 624	GC/MS, P & T, Capillary Column	NPW11.21980	Yes	NJ	8/20/2013
Ethylene glycol	NPW	Certified	User Defined SW-846 8260B	GC/MS/SIM, Direct Aqueous Injection	NPW11.22120	Yes	NJ	11/12/2008
Propylene glycol	NPW	Certified	User Defined SW-846 8260B	GC/MS/SIM, Direct Aqueous Injection	NPW11.22130	Yes	NJ	11/12/2008
Acetone [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection,	NPW11.24001	No	NJ	7/1/2017
Benzene [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection,	NPW11.24010	No	NJ	7/1/2017
Chlorobenzene [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	NPW11.24020	No	NJ	7/1/2017
Chloroform [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection,	NPW11.24030	No	NJ	7/1/2017
Dichlorobenzene (1,2-) [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	NPW11.24040	No	NJ	7/1/2017
Dichloroethane (1,2-) [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	NPW11.24050	No	NJ	7/1/2017
Methylene chloride [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	NPW11.24060	No	NJ	7/1/2017
Pentanone (4-methyl-2-) (MIBK) [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	NPW11.24070	No	NJ	7/1/2017
Tetrahydrofuran [40CFR136, Table 1F]	NPW	Certified	EPA 524.2	GC/MS, P & T or Direct Injection, Capillary	NPW11.24080	Yes	NJ	7/13/2017
Toluene [40CFR136, Table 1F]	NPW	Applied	EPA 524.2	GC/MS, P & T or Direct Injection,	NPW11.24090	No	NJ	7/1/2017
1,1-Dichloro-1-fluoroethane	NPW	Certified	User Defined SW-846 8260B	GC/MS, P & T or Direct Injection,	NPW16.00001	Yes	NJ	7/26/2013
Diesel range organic	NPW	Certified	User Defined TCEQ 1005	Extraction, GC, FID	NPW16.01150	Yes	NJ	10/15/2010
Cation-exchange capacity	SCM	Certified	SW-846 9081	Soils, Sodium Acetate	SCM02.00020	Yes	NJ	7/1/2002
Chlorine - total, solid waste	SCM	Certified	SW-846 5050	Combustion, Bomb Oxidation	SCM02.00060	Yes	NJ	7/1/2007
Free liquid	SCM	Certified	SW-846 9095	Flow-Through Paint Filter, Observation	SCM02.00130	Yes	NJ	7/1/2002
Heat of combustion (BTU)	SCM	Certified	ASTM D240	Bomb Calorimeter	SCM02.00160	Yes	NJ	7/1/2007
Ignitability	SCM	Certified	SW-846 1010A	Pensky Martens	SCM02.00180	Yes	NJ	2/15/2017
pH - soil and waste	SCM	Certified	SW-846 9045D	Mix with Water or Calcium Chlorides	SCM02.00270	Yes	NJ	7/1/2002
Bromide	SCM	Certified	SW-846 9056	Ion Chromatography	SCM03.00120	Yes	NJ	7/1/2002
Bromide	SCM	Certified	SW-846 9056A	Ion Chromatography	SCM03.00130	Yes	NJ	7/1/2002
Chloride	SCM	Certified	SW-846 9056	Ion Chromatography	SCM03.00210	Yes	NJ	7/1/2002
Chloride	SCM	Certified	SW-846 9056A	Ion Chromatography	SCM03.00220	Yes	NJ	7/1/2002
Cyanide	SCM	Certified	SW-846 9012B	Colorimetric, Automated	SCM03.00310	Yes	NJ	7/1/2002
Cyanide - amenable to Cl2	SCM	Certified	SW-846 9012B	Distillation, Colorimetric (Automated)	SCM03.00382	Yes	NJ	7/6/2016
Extractable organic halides (EOX)	SCM	Certified	SW-846 9023	Extraction	SCM03.00420	Yes	NJ	7/1/2002

Fluoride	SCM	Certified	SW-846 9056	Ion Chromatography	SCM03.00460	Yes	NJ	7/1/2002
Fluoride	SCM	Certified	SW-846 9056A	Ion Chromatography	SCM03.00470	Yes	NJ	7/1/2002
Kjeldahl nitrogen - total	SCM	Certified	EPA 351.2	Digestion, Semi-automated	SCM03.00640	Yes	NJ	1/18/2017
Nitrate - nitrite	SCM	Certified	EPA 353.2	Cadmium Reduction, Automated	SCM03.00720	Yes	NJ	1/18/2017
Nitrite	SCM	Certified	SM 4500-NO2 B-11	Spectrophotometric, Manual	SCM03.00790	Yes	NJ	1/18/2017
Oil & grease - sludge-hem	SCM	Certified	SW-846 9071B	Extraction & Gravimetric	SCM03.00800	Yes	NJ	7/1/2002
Sulfate	SCM	Certified	SW-846 9056	Ion Chromatography	SCM03.01010	Yes	NJ	7/1/2002
Sulfate	SCM	Certified	SW-846 9056A	Ion Chromatography	SCM03.01020	Yes	NJ	7/1/2002
Sulfides, acid sol. & insol.	SCM	Certified	SW-846 9034	Titration	SCM03.01080	Yes	NJ	7/1/2002
Total organic carbon (TOC)	SCM	Certified	OTHER NJ Modified SW-846 9060A	Infrared Spectrometry or FID	SCM03.01120	Yes	NJ	7/1/2002
Total organic carbon (TOC)	SCM	Certified	Other Lloyd Kahn	Pyrolytic	SCM03.01130	Yes	NJ	7/16/2012
Metals	SCM	Certified	SW-846 3050B	Acid Digestion, Soil Sediment & Sludge	SCM05.00010	Yes	NJ	7/1/2002
Metals	SCM	Certified	SW-846 3060A	Chromium VI Digestion	SCM05.00020	Yes	NJ	7/1/2002
Metals	SCM	Certified	SW-846 1312	Synthetic PPT Leachate Procedure	SCM05.00130	Yes	NJ	7/1/2002
Metals	SCM	Certified	SW-846 1311	TCLP, Toxicity Procedure, Shaker	SCM05.00140	Yes	NJ	7/1/2002
Chromium (VI)	SCM	Certified	SW-846 7196A	Colorimetric	SCM06.00320	Yes	NJ	7/1/2002
Chromium (VI)	SCM	Certified	SW-846 7199	Ion Chromatography	SCM06.00350	Yes	NJ	4/21/2006
Mercury - solid waste	SCM	Certified	SW-846 7471A	AA, Manual Cold Vapor	SCM06.00650	Yes	NJ	7/1/2002
Mercury - solid waste	SCM	Certified	SW-846 7471B	AA, Manual Cold Vapor	SCM06.00660	Yes	NJ	7/1/2002
Aluminum	SCM	Certified	SW-846 6010B	ICP	SCM07.00010	Yes	NJ	7/1/2002
Aluminum	SCM	Certified	SW-846 6010C	ICP	SCM07.00020	Yes	NJ	7/1/2002
Aluminum	SCM	Certified	SW-846 6010D	ICP	SCM07.00022	Yes	NJ	7/1/2017
Aluminum	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00030	Yes	NJ	8/13/2003
Aluminum	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00040	Yes	NJ	8/13/2003
Aluminum	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00042	Yes	NJ	7/1/2017
Antimony	SCM	Certified	SW-846 6010B	ICP	SCM07.00050	Yes	NJ	7/1/2002
Antimony	SCM	Certified	SW-846 6010C	ICP	SCM07.00060	Yes	NJ	8/13/2003
Antimony	SCM	Certified	SW-846 6010D	ICP	SCM07.00062	Yes	NJ	7/1/2017
Antimony	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00080	Yes	NJ	8/13/2003
Antimony	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00090	Yes	NJ	8/13/2003
Antimony	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00092	Yes	NJ	7/1/2017
Arsenic	SCM	Certified	SW-846 6010B	ICP	SCM07.00110	Yes	NJ	7/1/2002
Arsenic	SCM	Certified	SW-846 6010C	ICP	SCM07.00120	Yes	NJ	7/1/2002
Arsenic	SCM	Certified	SW-846 6010D	ICP	SCM07.00122	Yes	NJ	7/1/2017
Arsenic	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00140	Yes	NJ	8/13/2003
Arsenic	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00150	Yes	NJ	8/13/2003
Arsenic	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00152	Yes	NJ	7/1/2017
Barium	SCM	Certified	SW-846 6010B	ICP	SCM07.00160	Yes	NJ	7/1/2002
Barium	SCM	Certified	SW-846 6010C	ICP	SCM07.00170	Yes	NJ	7/1/2002
Barium	SCM	Certified	SW-846 6010D	ICP	SCM07.00172	Yes	NJ	7/1/2017
Barium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00190	Yes	NJ	8/13/2003
Barium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00200	Yes	NJ	8/13/2003
Barium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00202	Yes	NJ	7/1/2017
Beryllium	SCM	Certified	SW-846 6010B	ICP	SCM07.00220	Yes	NJ	7/1/2002
Beryllium	SCM	Certified	SW-846 6010C	ICP	SCM07.00230	Yes	NJ	7/1/2002
Beryllium	SCM	Certified	SW-846 6010D	ICP	SCM07.00232	Yes	NJ	7/1/2017
Beryllium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00250	Yes	NJ	8/13/2003
Beryllium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00260	Yes	NJ	8/13/2003
Beryllium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00262	Yes	NJ	7/1/2017
Boron	SCM	Certified	SW-846 6010B	ICP	SCM07.00270	Yes	NJ	7/1/2002
Boron	SCM	Certified	SW-846 6010C	ICP	SCM07.00280	Yes	NJ	7/1/2002
Boron	SCM	Certified	SW-846 6010D	ICP	SCM07.00282	Yes	NJ	7/1/2017
Boron	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00300	Yes	NJ	9/8/2016
Boron	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00302	Yes	NJ	7/1/2017
Cadmium	SCM	Certified	SW-846 6010B	ICP	SCM07.00320	Yes	NJ	7/1/2002
Cadmium	SCM	Certified	SW-846 6010C	ICP	SCM07.00330	Yes	NJ	7/1/2002
Cadmium	SCM	Certified	SW-846 6010D	ICP	SCM07.00332	Yes	NJ	7/1/2017
Cadmium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00350	Yes	NJ	8/13/2003
Cadmium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00360	Yes	NJ	8/13/2003
Cadmium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00362	Yes	NJ	7/1/2017
Calcium	SCM	Certified	SW-846 6010B	ICP	SCM07.00380	Yes	NJ	7/1/2002
Calcium	SCM	Certified	SW-846 6010C	ICP	SCM07.00390	Yes	NJ	7/1/2002
Calcium	SCM	Certified	SW-846 6010D	ICP	SCM07.00392	Yes	NJ	7/1/2017
Calcium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00400	Yes	NJ	7/1/2004
Calcium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00410	Yes	NJ	7/1/2004
Calcium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00412	Yes	NJ	7/1/2017
Chromium	SCM	Certified	SW-846 6010B	ICP	SCM07.00420	Yes	NJ	7/1/2002
Chromium	SCM	Certified	SW-846 6010C	ICP	SCM07.00430	Yes	NJ	7/1/2002
Chromium	SCM	Certified	SW-846 6010D	ICP	SCM07.00432	Yes	NJ	7/1/2017
Chromium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00450	Yes	NJ	8/13/2003
Chromium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00460	Yes	NJ	8/13/2003
Chromium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00462	Yes	NJ	7/1/2017
Cobalt	SCM	Certified	SW-846 6010B	ICP	SCM07.00490	Yes	NJ	7/1/2002
Cobalt	SCM	Certified	SW-846 6010C	ICP	SCM07.00500	Yes	NJ	7/1/2002
Cobalt	SCM	Certified	SW-846 6010D	ICP	SCM07.00502	Yes	NJ	7/1/2017
Cobalt	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00520	Yes	NJ	8/13/2003
Cobalt	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00530	Yes	NJ	8/13/2003
Cobalt	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00532	Yes	NJ	7/1/2017
Copper	SCM	Certified	SW-846 6010B	ICP	SCM07.00540	Yes	NJ	7/1/2002
Copper	SCM	Certified	SW-846 6010C	ICP	SCM07.00550	Yes	NJ	7/1/2002
Copper	SCM	Certified	SW-846 6010D	ICP	SCM07.00552	Yes	NJ	7/1/2017
Copper	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00570	Yes	NJ	8/13/2003
Copper	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00580	Yes	NJ	8/13/2003
Copper	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00582	Yes	NJ	7/1/2017
Iron	SCM	Certified	SW-846 6010B	ICP	SCM07.00600	Yes	NJ	7/1/2002
Iron	SCM	Certified	SW-846 6010C	ICP	SCM07.00610	Yes	NJ	7/1/2002
Iron	SCM	Certified	SW-846 6010D	ICP	SCM07.00612	Yes	NJ	7/1/2017
Iron	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00620	Yes	NJ	7/1/2004
Iron	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00630	Yes	NJ	7/1/2004
Iron	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00632	Yes	NJ	7/1/2017
Lead	SCM	Certified	SW-846 6010B	ICP	SCM07.00650	Yes	NJ	7/1/2002
Lead	SCM	Certified	SW-846 6010C	ICP	SCM07.00660	Yes	NJ	7/1/2002

Lead	SCM	Certified	SW-846 6010D	ICP	SCM07.00662	Yes	NJ	7/1/2017
Lead	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00680	Yes	NJ	8/13/2003
Lead	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00690	Yes	NJ	8/13/2003
Lead	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00692	Yes	NJ	7/1/2017
Lithium	SCM	Certified	SW-846 6010B	ICP	SCM07.00710	Yes	NJ	2/10/2017
Lithium	SCM	Certified	SW-846 6010C	ICP	SCM07.00720	Yes	NJ	2/10/2017
Lithium	SCM	Certified	SW-846 6010D	ICP	SCM07.00722	Yes	NJ	7/1/2017
Magnesium	SCM	Certified	SW-846 6010B	ICP	SCM07.00730	Yes	NJ	7/1/2002
Magnesium	SCM	Certified	SW-846 6010C	ICP	SCM07.00740	Yes	NJ	7/1/2002
Magnesium	SCM	Certified	SW-846 6010D	ICP	SCM07.00742	Yes	NJ	7/1/2017
Magnesium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00750	Yes	NJ	7/1/2004
Magnesium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00760	Yes	NJ	7/1/2004
Magnesium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00762	Yes	NJ	7/1/2017
Manganese	SCM	Certified	SW-846 6010B	ICP	SCM07.00780	Yes	NJ	7/1/2002
Manganese	SCM	Certified	SW-846 6010C	ICP	SCM07.00790	Yes	NJ	7/1/2002
Manganese	SCM	Certified	SW-846 6010D	ICP	SCM07.00792	Yes	NJ	7/1/2017
Manganese	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00810	Yes	NJ	8/13/2003
Manganese	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00820	Yes	NJ	8/13/2003
Manganese	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00822	Yes	NJ	7/1/2017
Molybdenum	SCM	Certified	SW-846 6010B	ICP	SCM07.00840	Yes	NJ	7/1/2002
Molybdenum	SCM	Certified	SW-846 6010C	ICP	SCM07.00850	Yes	NJ	7/1/2002
Molybdenum	SCM	Certified	SW-846 6010D	ICP	SCM07.00852	Yes	NJ	7/1/2017
Molybdenum	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00870	Yes	NJ	7/1/2004
Molybdenum	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00880	Yes	NJ	7/1/2004
Molybdenum	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00882	Yes	NJ	7/1/2017
Nickel	SCM	Certified	SW-846 6010B	ICP	SCM07.00900	Yes	NJ	7/1/2002
Nickel	SCM	Certified	SW-846 6010C	ICP	SCM07.00910	Yes	NJ	7/1/2002
Nickel	SCM	Certified	SW-846 6010D	ICP	SCM07.00912	Yes	NJ	7/1/2017
Nickel	SCM	Certified	SW-846 6020	ICP/MS	SCM07.00930	Yes	NJ	8/13/2003
Nickel	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.00940	Yes	NJ	8/13/2003
Nickel	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.00942	Yes	NJ	7/1/2017
Potassium	SCM	Certified	SW-846 6010B	ICP	SCM07.00980	Yes	NJ	7/1/2002
Potassium	SCM	Certified	SW-846 6010C	ICP	SCM07.00990	Yes	NJ	7/1/2002
Potassium	SCM	Certified	SW-846 6010D	ICP	SCM07.00992	Yes	NJ	7/1/2017
Potassium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01000	Yes	NJ	7/1/2004
Potassium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01010	Yes	NJ	7/1/2004
Potassium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01012	Yes	NJ	7/1/2017
Selenium	SCM	Certified	SW-846 6010B	ICP	SCM07.01030	Yes	NJ	7/1/2002
Selenium	SCM	Certified	SW-846 6010C	ICP	SCM07.01040	Yes	NJ	7/1/2002
Selenium	SCM	Certified	SW-846 6010D	ICP	SCM07.01042	Yes	NJ	7/1/2017
Selenium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01060	Yes	NJ	8/13/2003
Selenium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01070	Yes	NJ	8/13/2003
Selenium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01072	Yes	NJ	7/1/2017
Silver	SCM	Certified	SW-846 6010B	ICP	SCM07.01110	Yes	NJ	7/1/2002
Silver	SCM	Certified	SW-846 6010C	ICP	SCM07.01120	Yes	NJ	7/1/2002
Silver	SCM	Certified	SW-846 6010D	ICP	SCM07.01122	Yes	NJ	7/1/2017
Silver	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01140	Yes	NJ	8/13/2003
Silver	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01150	Yes	NJ	8/13/2003
Silver	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01152	Yes	NJ	7/1/2017
Sodium	SCM	Certified	SW-846 6010B	ICP	SCM07.01170	Yes	NJ	7/1/2002
Sodium	SCM	Certified	SW-846 6010C	ICP	SCM07.01180	Yes	NJ	7/1/2002
Sodium	SCM	Certified	SW-846 6010D	ICP	SCM07.01182	Yes	NJ	7/1/2017
Sodium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01190	Yes	NJ	7/1/2004
Sodium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01200	Yes	NJ	7/1/2004
Sodium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01202	Yes	NJ	7/1/2017
Strontium	SCM	Certified	SW-846 6010B	ICP	SCM07.01210	Yes	NJ	7/1/2002
Strontium	SCM	Certified	SW-846 6010C	ICP	SCM07.01220	Yes	NJ	7/1/2002
Strontium	SCM	Certified	SW-846 6010D	ICP	SCM07.01222	Yes	NJ	7/1/2017
Strontium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01240	Yes	NJ	7/13/2017
Strontium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01242	Yes	NJ	7/13/2017
Thallium	SCM	Certified	SW-846 6010B	ICP	SCM07.01280	Yes	NJ	7/1/2002
Thallium	SCM	Certified	SW-846 6010C	ICP	SCM07.01290	Yes	NJ	7/1/2002
Thallium	SCM	Certified	SW-846 6010D	ICP	SCM07.01292	Yes	NJ	7/1/2017
Thallium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01310	Yes	NJ	8/13/2003
Thallium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01320	Yes	NJ	8/13/2003
Thallium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01322	Yes	NJ	7/1/2017
Tin	SCM	Certified	SW-846 6010B	ICP	SCM07.01370	Yes	NJ	7/1/2002
Tin	SCM	Certified	SW-846 6010C	ICP	SCM07.01380	Yes	NJ	7/1/2002
Tin	SCM	Certified	SW-846 6010D	ICP	SCM07.01382	Yes	NJ	7/1/2017
Tin	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01390	Yes	NJ	7/1/2004
Tin	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01400	Yes	NJ	7/1/2004
Tin	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01402	Yes	NJ	7/1/2017
Titanium	SCM	Certified	SW-846 6010B	ICP	SCM07.01410	Yes	NJ	7/1/2007
Titanium	SCM	Certified	SW-846 6010C	ICP	SCM07.01420	Yes	NJ	7/1/2007
Titanium	SCM	Certified	SW-846 6010D	ICP	SCM07.01422	Yes	NJ	7/1/2017
Titanium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01440	Yes	NJ	7/13/2017
Titanium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01442	Yes	NJ	7/13/2017
Vanadium	SCM	Certified	SW-846 6010B	ICP	SCM07.01520	Yes	NJ	7/1/2002
Vanadium	SCM	Certified	SW-846 6010C	ICP	SCM07.01530	Yes	NJ	7/1/2002
Vanadium	SCM	Certified	SW-846 6010D	ICP	SCM07.01532	Yes	NJ	7/1/2017
Vanadium	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01550	Yes	NJ	8/13/2003
Vanadium	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01560	Yes	NJ	8/13/2003
Vanadium	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01562	Yes	NJ	7/1/2017
Zinc	SCM	Certified	SW-846 6010B	ICP	SCM07.01580	Yes	NJ	7/1/2002
Zinc	SCM	Certified	SW-846 6010C	ICP	SCM07.01590	Yes	NJ	7/1/2002
Zinc	SCM	Certified	SW-846 6010D	ICP	SCM07.01592	Yes	NJ	7/1/2017
Zinc	SCM	Certified	SW-846 6020	ICP/MS	SCM07.01610	Yes	NJ	8/13/2003
Zinc	SCM	Certified	SW-846 6020A	ICP/MS	SCM07.01620	Yes	NJ	8/13/2003
Zinc	SCM	Certified	SW-846 6020B	ICP/MS	SCM07.01622	Yes	NJ	7/1/2017
Zirconium	SCM	Certified	SW-846 6010B	ICP	SCM07.01640	Yes	NJ	2/10/2017
Zirconium	SCM	Certified	SW-846 6010C	ICP	SCM07.01642	Yes	NJ	2/10/2017
Zirconium	SCM	Certified	SW-846 6010D	ICP	SCM07.01644	Yes	NJ	7/1/2017
Organics	SCM	Certified	SW-846 1312	Synthetic PPT Leachate Procedure	SCM08.00080	Yes	NJ	7/1/2002

Organics	SCM	Certified	SW-846 3580A	Waste Dilution	SCM08.00090	Yes	NJ	7/1/2003
Semivolatile organics	SCM	Certified	SW-846 3650B	Cleanup-Acid/Base Partition	SCM08.00140	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3610B	Cleanup-Alumina	SCM08.00150	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3620B	Cleanup-Florisil	SCM08.00160	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3620C	Cleanup-Florisil	SCM08.00170	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3640A	Cleanup-Gel Permeation	SCM08.00180	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3630C	Cleanup-Silica Gel	SCM08.00190	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3660B	Cleanup-Sulfur Removal	SCM08.00200	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3665A	Cleanup-Sulfuric Acid/KMnO4	SCM08.00220	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3546	Microwave Extraction	SCM08.00240	Yes	NJ	4/20/2012
Semivolatile organics	SCM	Certified	SW-846 3611B	Petroleum Waste, Cleanup Alumina	SCM08.00250	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3540C	Soxhlet Extraction	SCM08.00280	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 1311	TCLP, Toxicity Procedure, Shaker	SCM08.00320	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3550B	Ultrasonic Extraction	SCM08.00340	Yes	NJ	7/1/2002
Semivolatile organics	SCM	Certified	SW-846 3550C	Ultrasonic Extraction	SCM08.00350	Yes	NJ	7/1/2002
Volatile organics	SCM	Certified	SW-846 1311	TCLP, Toxicity Procedure, ZHE	SCM08.00390	Yes	NJ	7/1/2002
Volatile organics	SCM	Certified	SW-846 3810	Headspace, GC or GC/MS Screen	SCM08.00410	Yes	NJ	7/1/2002
Volatile organics - high conc.	SCM	Certified	SW-846 5035A	Methanol Extract, Closed System P & T	SCM08.00440	Yes	NJ	7/1/2002
Volatile organics - high conc.	SCM	Certified	SW-846 5035	Methanol Extract, Closed System P & T	SCM08.00450	Yes	NJ	7/1/2002
Volatile organics - low conc.	SCM	Certified	SW-846 5035A	Closed System Purge & Trap	SCM08.00460	Yes	NJ	7/1/2002
Volatile organics - low conc.	SCM	Certified	SW-846 5035	Closed System Purge & Trap	SCM08.00470	Yes	NJ	7/1/2002
Extractable Petroleum Hydrocarbons	SCM	Certified	Other NJDEP EPH 10/08, Rev. 3	Extraction, GC, FID	SCM09.00050	Yes	NJ	8/27/2010
Petroleum Organics	SCM	Certified	Other NJ-OQA-QAM-025, Rev. 7	Extraction, GC, FID	SCM09.00060	Yes	NJ	3/19/2007
Butanol (1-)	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00160	Yes	NJ	2/16/2011
Diesel range organic	SCM	Certified	SW-846 8015B	Extraction, GC, FID	SCM09.00180	Yes	NJ	7/1/2002
Ethyl alcohol	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00200	Yes	NJ	7/1/2005
Gasoline range organic	SCM	Certified	SW-846 8015B	GC P&T, FID	SCM09.00230	Yes	NJ	7/1/2002
Iso-butyl alcohol	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00240	Yes	NJ	7/1/2002
Isopropyl alcohol	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00250	Yes	NJ	7/1/2005
Methyl alcohol (Methanol)	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00260	Yes	NJ	8/13/2003
Propyl Alcohol (n-)	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00320	Yes	NJ	2/16/2011
Tert-butyl alcohol	SCM	Certified	SW-846 8015B	GC, Direct Injection or P & T, FID	SCM09.00350	Yes	NJ	7/1/2002
Butanol (1-)	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00420	Yes	NJ	2/16/2011
Diesel range organic	SCM	Certified	SW-846 8015C	Extraction, GC, FID	SCM09.00440	Yes	NJ	7/1/2002
Ethyl alcohol	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00470	Yes	NJ	7/1/2005
Ethylene glycol	SCM	Applied	SW-846 8015C	GC, Direct Injection, FID	SCM09.00480	No	NJ	10/7/2014
Gasoline range organic	SCM	Certified	SW-846 8015C	GC P&T, FID	SCM09.00510	Yes	NJ	7/1/2002
Iso-butyl alcohol	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00530	Yes	NJ	7/1/2002
Isopropyl alcohol	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00540	Yes	NJ	7/1/2005
Methyl alcohol (Methanol)	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00550	Yes	NJ	8/13/2003
Propyl Alcohol (n-)	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00620	Yes	NJ	2/16/2011
Propylene glycol	SCM	Applied	SW-846 8015C	GC, Direct Injection, FID	SCM09.00630	No	NJ	10/7/2014
Tert-butyl alcohol	SCM	Certified	SW-846 8015C	GC, Direct Injection or P & T, FID	SCM09.00670	Yes	NJ	7/1/2002
Butanol (1-)	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.00740	Yes	NJ	7/1/2017
Diesel range organic	SCM	Certified	SW-846 8015D	Extraction, GC, FID	SCM09.00770	Yes	NJ	7/1/2017
Ethyl alcohol	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.00810	Yes	NJ	7/1/2017
Ethylene glycol	SCM	Applied	SW-846 8015D	GC, Direct Injection, FID	SCM09.00820	No	NJ	7/1/2017
Gasoline range organic	SCM	Certified	SW-846 8015D	GC P&T, FID	SCM09.00850	Yes	NJ	7/1/2017
Iso-butyl alcohol	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.00870	Yes	NJ	7/1/2017
Isopropyl alcohol	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.00880	Yes	NJ	7/1/2017
Methyl alcohol (Methanol)	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.00890	Yes	NJ	7/1/2017
Propyl Alcohol (n-)	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.00960	Yes	NJ	7/1/2017
Propylene glycol	SCM	Applied	SW-846 8015D	GC, Direct Injection, FID	SCM09.00970	No	NJ	7/1/2017
Tert-butyl alcohol	SCM	Certified	SW-846 8015D	GC, Direct Injection or P & T, FID	SCM09.01010	Yes	NJ	7/1/2017
Aldrin	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.01890	Yes	NJ	7/1/2002
Alpha BHC	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.01900	Yes	NJ	7/1/2002
Beta BHC	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.01920	Yes	NJ	7/1/2002
Chlordane (alpha) (cis-)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.01930	Yes	NJ	7/1/2002
Chlordane (gamma) (trans-)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.01940	Yes	NJ	7/1/2002
Chlordane (technical)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.01950	Yes	NJ	7/1/2002
DDD (4,4'-)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02020	Yes	NJ	7/1/2002
DDE (4,4'-)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02030	Yes	NJ	7/1/2002
DDT (4,4'-)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02040	Yes	NJ	7/1/2002
Delta BHC	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02050	Yes	NJ	7/1/2002
Dieldrin	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02060	Yes	NJ	7/1/2002
Endosulfan I	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02070	Yes	NJ	7/1/2002
Endosulfan II	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02080	Yes	NJ	7/1/2002
Endosulfan sulfate	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02090	Yes	NJ	7/1/2002
Endrin	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02100	Yes	NJ	7/1/2002
Endrin aldehyde	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02110	Yes	NJ	7/1/2002
Endrin ketone	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02120	Yes	NJ	7/1/2002
Heptachlor	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02140	Yes	NJ	7/1/2002
Heptachlor epoxide	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02150	Yes	NJ	7/1/2002
Lindane (gamma BHC)	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02180	Yes	NJ	7/1/2002
Methoxychlor	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02190	Yes	NJ	7/1/2002
Mirex	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02220	Yes	NJ	4/3/2008
Toxaphene	SCM	Certified	SW-846 8081A	GC, Extraction, ECD or HECD, Capillary	SCM09.02260	Yes	NJ	7/1/2002
Alachlor	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02280	Yes	NJ	7/13/2017
Aldrin	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02290	Yes	NJ	7/1/2002
Alpha BHC	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02300	Yes	NJ	7/1/2002
Beta BHC	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02320	Yes	NJ	7/1/2002
Chlordane (alpha) (cis-)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02330	Yes	NJ	7/1/2002
Chlordane (gamma) (trans-)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02340	Yes	NJ	7/1/2002
Chlordane (technical)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02350	Yes	NJ	7/1/2002
DDD (4,4'-)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02420	Yes	NJ	7/1/2002
DDE (4,4'-)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02430	Yes	NJ	7/1/2002
DDT (4,4'-)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02440	Yes	NJ	7/1/2002
Delta BHC	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02450	Yes	NJ	7/1/2002
Dieldrin	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02460	Yes	NJ	7/1/2002
Endosulfan I	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02470	Yes	NJ	7/1/2002
Endosulfan II	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02480	Yes	NJ	7/1/2002
Endosulfan sulfate	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02490	Yes	NJ	7/1/2002

Endrin	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02500	Yes	NJ	7/1/2002
Endrin aldehyde	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02510	Yes	NJ	7/1/2002
Endrin ketone	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02520	Yes	NJ	7/1/2002
Heptachlor	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02540	Yes	NJ	7/1/2002
Heptachlor epoxide	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02550	Yes	NJ	7/1/2002
Hexachlorobenzene	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02560	Yes	NJ	9/21/2017
Lindane (gamma BHC)	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02580	Yes	NJ	7/1/2002
Methoxychlor	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02590	Yes	NJ	7/1/2002
Mirex	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02620	Yes	NJ	4/3/2008
Toxaphene	SCM	Certified	SW-846 8081B	GC, Extraction, ECD or HECD, Capillary	SCM09.02660	Yes	NJ	7/1/2002
PCB 1016	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02890	Yes	NJ	7/1/2002
PCB 1221	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02900	Yes	NJ	7/1/2002
PCB 1232	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02910	Yes	NJ	7/1/2002
PCB 1242	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02920	Yes	NJ	7/1/2002
PCB 1248	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02930	Yes	NJ	7/1/2002
PCB 1254	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02940	Yes	NJ	7/1/2002
PCB 1260	SCM	Certified	SW-846 8082	GC, Extraction, ECD or HECD, Capillary	SCM09.02950	Yes	NJ	7/1/2002
PCB 1016	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03190	Yes	NJ	7/1/2002
PCB 1221	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03200	Yes	NJ	7/1/2002
PCB 1232	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03210	Yes	NJ	7/1/2002
PCB 1242	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03220	Yes	NJ	7/1/2002
PCB 1248	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03230	Yes	NJ	7/1/2002
PCB 1254	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03240	Yes	NJ	7/1/2002
PCB 1260	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03250	Yes	NJ	7/1/2002
PCB 1262	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03260	Yes	NJ	10/12/2011
PCB 1268	SCM	Certified	SW-846 8082A	GC, Extraction, ECD or HECD, Capillary	SCM09.03270	Yes	NJ	10/12/2011
D (2,4-)	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04640	Yes	NJ	7/1/2002
Dalapon	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04650	Yes	NJ	7/1/2002
DB (2,4-)	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04660	Yes	NJ	8/13/2003
Dicamba	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04680	Yes	NJ	7/1/2002
Dichlorprop	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04700	Yes	NJ	8/13/2003
Dinoseb	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04710	Yes	NJ	7/1/2002
MCPA	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04730	Yes	NJ	8/13/2003
MCPP	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04740	Yes	NJ	8/13/2003
Pentachlorophenol	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04760	Yes	NJ	8/13/2003
Picloram	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04770	Yes	NJ	7/1/2002
T (2,4,5-)	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04780	Yes	NJ	7/1/2002
TP (2,4,5-) (Silvex)	SCM	Certified	SW-846 8151A	GC, Extraction, ECD, Capillary	SCM09.04790	Yes	NJ	7/1/2002
Acetone	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04590	Yes	NJ	7/1/2002
Acetonitrile	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04600	Yes	NJ	7/1/2004
Acrolein	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04610	Yes	NJ	7/1/2002
Acrylonitrile	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04620	Yes	NJ	7/1/2002
Allyl chloride	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04630	Yes	NJ	7/1/2005
Benzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04660	Yes	NJ	7/1/2002
Benzyl chloride	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04670	Yes	NJ	7/1/2007
Bromobenzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04680	Yes	NJ	7/1/2005
Bromochloromethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04690	Yes	NJ	7/1/2005
Bromodichloromethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04700	Yes	NJ	7/1/2002
Bromoform	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04720	Yes	NJ	7/1/2002
Bromomethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04730	Yes	NJ	7/1/2002
Butadiene (2-chloro-1,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04740	Yes	NJ	7/1/2007
Butanol (1-)	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.04750	Yes	NJ	12/2/2008
Butanone (2-) (Methyl ethyl ketone)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04770	Yes	NJ	7/1/2002
Butylbenzene (n-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04810	Yes	NJ	7/1/2005
Carbon disulfide	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04820	Yes	NJ	7/1/2002
Carbon tetrachloride	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04830	Yes	NJ	7/1/2002
Chlorobenzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04840	Yes	NJ	7/1/2002
Chloroethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04850	Yes	NJ	7/1/2002
Chloroethyl vinyl ether (2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04860	Yes	NJ	7/1/2002
Chloroform	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04870	Yes	NJ	7/1/2002
Chloromethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04880	Yes	NJ	7/1/2002
Chlorotoluene (2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04890	Yes	NJ	7/1/2005
Chlorotoluene (4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04900	Yes	NJ	7/1/2005
Cyclohexane	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.04910	Yes	NJ	12/2/2008
Cyclohexanone	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04920	Yes	NJ	7/1/2005
Dibromo-3-chloropropane (1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04930	Yes	NJ	7/1/2004
Dibromochloromethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04940	Yes	NJ	7/1/2002
Dibromoethane (1,2-) (EDB)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04950	Yes	NJ	7/1/2004
Dibromomethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04960	Yes	NJ	12/1/2006
Dichloro-2-butene (trans-1,4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04980	Yes	NJ	7/1/2004
Dichlorobenzene (1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.04990	Yes	NJ	7/1/2002
Dichlorobenzene (1,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05000	Yes	NJ	7/1/2002
Dichlorobenzene (1,4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05010	Yes	NJ	7/1/2002
Dichlorodifluoromethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05020	Yes	NJ	7/1/2002
Dichloroethane (1,1-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05030	Yes	NJ	7/1/2002
Dichloroethane (1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05040	Yes	NJ	7/1/2002
Dichloroethene (1,1-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05050	Yes	NJ	7/1/2002
Dichloroethene (cis-1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05060	Yes	NJ	7/1/2002
Dichloroethene (trans-1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05070	Yes	NJ	7/1/2002
Dichloropropane (1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05080	Yes	NJ	7/1/2002
Dichloropropane (1,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05090	Yes	NJ	7/1/2005
Dichloropropane (2,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05100	Yes	NJ	7/1/2005
Dichloropropene (1,1-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05110	Yes	NJ	7/1/2005
Dichloropropene (cis-1,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05120	Yes	NJ	7/1/2002
Dichloropropene (trans-1,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05130	Yes	NJ	7/1/2002
Diethyl ether (Ethyl ether)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05140	Yes	NJ	7/1/2005
Diisopropyl Ether [DIPE]	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05150	Yes	NJ	12/1/2006
Dioxane (1,4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05160	Yes	NJ	7/1/2004
Ethanol	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05170	Yes	NJ	7/1/2007
Ethyl acetate	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05180	Yes	NJ	7/1/2005
Ethyl methacrylate	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05190	Yes	NJ	7/1/2005
Ethylbenzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05200	Yes	NJ	7/1/2002
Ethyl-tert-butyl Ether [ETBE]	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05210	Yes	NJ	12/1/2006

Heptane (n-)	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05220	Yes	NJ	1/23/2012
Hexachlorobutadiene (1,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05230	Yes	NJ	7/1/2002
Hexachloroethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05240	Yes	NJ	7/1/2002
Hexane (n-)	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05250	Yes	NJ	1/23/2012
Hexanone (2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05260	Yes	NJ	7/1/2002
Iso-butyl alcohol	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05270	Yes	NJ	7/1/2005
Isopropylbenzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05300	Yes	NJ	7/1/2005
Isopropyltoluene (4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05310	Yes	NJ	7/1/2005
Methacrylonitrile	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05320	Yes	NJ	7/1/2005
Methyl acetate	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05330	Yes	NJ	12/2/2008
Methyl acrylate	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05340	Yes	NJ	7/1/2007
Methyl iodide	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05350	Yes	NJ	7/1/2004
Methyl methacrylate	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05360	Yes	NJ	7/1/2005
Methyl tert-butyl ether	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05370	Yes	NJ	7/1/2002
Methylcyclohexane	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05380	Yes	NJ	4/6/2010
Methylene chloride (Dichloromethane)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection, Capillary	SCM10.05390	Yes	NJ	7/1/2002
Naphthalene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05420	Yes	NJ	7/1/2002
Nitropropane (2-)	SCM	Certified	SW-846 8260B	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05440	Yes	NJ	12/2/2008
Pentachloroethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05470	Yes	NJ	7/1/2005
Pentanone (4-methyl-2-) (MIBK)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05490	Yes	NJ	7/1/2002
Propionitrile	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05500	Yes	NJ	7/1/2005
Propylbenzene (n-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05510	Yes	NJ	7/1/2005
Sec-butylbenzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05520	Yes	NJ	7/1/2005
Styrene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05530	Yes	NJ	7/1/2002
tert-Amylmethyl ether [TAME]	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05540	Yes	NJ	12/1/2006
Tert-butyl alcohol	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05550	Yes	NJ	7/1/2004
Tert-butylbenzene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05560	Yes	NJ	7/1/2005
Tetrachloroethane (1,1,1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05570	Yes	NJ	7/1/2002
Tetrachloroethane (1,1,2,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05580	Yes	NJ	7/1/2002
Tetrachloroethene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05590	Yes	NJ	7/1/2002
Tetrahydrofuran	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05600	Yes	NJ	7/1/2005
Toluene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05610	Yes	NJ	7/1/2002
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection, Capillary	SCM10.05630	Yes	NJ	7/1/2004
Trichlorobenzene (1,2,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05640	Yes	NJ	7/1/2005
Trichlorobenzene (1,2,4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05650	Yes	NJ	7/1/2002
Trichloroethane (1,1,1-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05660	Yes	NJ	7/1/2002
Trichloroethane (1,1,2-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05670	Yes	NJ	7/1/2002
Trichloroethene	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05680	Yes	NJ	7/1/2002
Trichlorofluoromethane	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05690	Yes	NJ	7/1/2002
Trichloropropane (1,2,3-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05700	Yes	NJ	7/1/2004
Trimethylbenzene (1,2,4-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05720	Yes	NJ	7/1/2005
Trimethylbenzene (1,3,5-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05730	Yes	NJ	7/1/2005
Trimethylpentane (2,2,4-)	SCM	Certified	SW-846 8260B	GC/MS, Extract or Dir Inj, Capillary	SCM10.05740	Yes	NJ	10/15/2010
Vinyl acetate	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05750	Yes	NJ	7/1/2004
Vinyl chloride	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05760	Yes	NJ	7/1/2002
Xylene (m-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05770	Yes	NJ	7/1/2005
Xylene (o-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05780	Yes	NJ	7/1/2005
Xylene (p-)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05790	Yes	NJ	7/1/2005
Xylenes (total)	SCM	Certified	SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.05800	Yes	NJ	7/1/2002
Acetone	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05810	Yes	NJ	7/1/2002
Acetonitrile	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05820	Yes	NJ	7/1/2004
Acrolein	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05830	Yes	NJ	7/1/2002
Acrylonitrile	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05840	Yes	NJ	7/1/2002
Allyl chloride	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05850	Yes	NJ	7/1/2005
Benzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05870	Yes	NJ	7/1/2002
Benzyl chloride	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05880	Yes	NJ	7/1/2007
Bromobenzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05890	Yes	NJ	7/1/2005
Bromochloromethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05900	Yes	NJ	7/1/2005
Bromodichloromethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05910	Yes	NJ	7/1/2002
Bromoform	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05930	Yes	NJ	7/1/2002
Bromomethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05940	Yes	NJ	7/1/2002
Butadiene (2-chloro-1,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05950	Yes	NJ	7/1/2007
Butanol (1-)	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05960	Yes	NJ	12/2/2008
Butanol (3,3-Dimethyl-1-)	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05970	Yes	NJ	9/8/2016
Butanone (2-) [Methyl ethyl ketone]	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.05980	Yes	NJ	7/1/2002
Butyl formate (t-)	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.05990	Yes	NJ	9/8/2016
Butylbenzene (n-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06020	Yes	NJ	7/1/2005
Carbon disulfide	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06030	Yes	NJ	7/1/2002
Carbon tetrachloride	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06040	Yes	NJ	7/1/2002
Chlorobenzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06050	Yes	NJ	7/1/2002
Chloroethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06060	Yes	NJ	7/1/2002
Chloroethyl vinyl ether (2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06070	Yes	NJ	7/1/2002
Chloroform	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06080	Yes	NJ	7/1/2002
Chloromethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06090	Yes	NJ	7/1/2002
Chlorotoluene (2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06100	Yes	NJ	7/1/2005
Chlorotoluene (4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06110	Yes	NJ	7/1/2005
Cyclohexane	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.06130	Yes	NJ	12/2/2008
Cyclohexanone	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06140	Yes	NJ	7/1/2005
Dibromo-3-chloropropane (1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06150	Yes	NJ	7/1/2004
Dibromochloromethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06160	Yes	NJ	7/1/2002
Dibromoethane (1,2-) (EDB)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06170	Yes	NJ	7/1/2004
Dibromomethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06180	Yes	NJ	12/1/2006
Dichloro-2-butene (trans-1,4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06200	Yes	NJ	7/1/2004
Dichlorobenzene (1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06210	Yes	NJ	7/1/2002
Dichlorobenzene (1,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06220	Yes	NJ	7/1/2002
Dichlorobenzene (1,4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06230	Yes	NJ	7/1/2002
Dichlorodifluoromethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06240	Yes	NJ	7/1/2002
Dichloroethane (1,1-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06250	Yes	NJ	7/1/2002
Dichloroethane (1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06260	Yes	NJ	7/1/2002
Dichloroethene (1,1-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06270	Yes	NJ	7/1/2002
Dichloroethene (cis-1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06280	Yes	NJ	7/1/2002

Dichloroethene (trans-1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06290	Yes	NJ	7/1/2002
Dichloropropane (1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06300	Yes	NJ	7/1/2002
Dichloropropane (1,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06310	Yes	NJ	7/1/2005
Dichloropropane (2,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06320	Yes	NJ	7/1/2005
Dichloropropene (1,1-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06330	Yes	NJ	7/1/2005
Dichloropropene (cis-1,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06340	Yes	NJ	7/1/2002
Dichloropropene (trans-1,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06350	Yes	NJ	7/1/2002
Diethyl ether (Ethyl ether)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06360	Yes	NJ	7/1/2005
Diisopropyl Ether [DIPE]	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06370	Yes	NJ	12/1/2006
Dioxane (1,4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06380	Yes	NJ	7/1/2004
Ethanol	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06390	Yes	NJ	7/1/2007
Ethyl acetate	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06400	Yes	NJ	7/1/2005
Ethyl methacrylate	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06410	Yes	NJ	7/1/2005
Ethylbenzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06420	Yes	NJ	7/1/2002
Ethyl-tert-butyl Ether [ETBE]	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06430	Yes	NJ	12/1/2006
Heptane (n-)	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.06440	Yes	NJ	1/23/2012
Hexachlorobutadiene (1,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06450	Yes	NJ	7/1/2002
Hexachloroethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06460	Yes	NJ	7/1/2002
Hexane (n-)	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.06470	Yes	NJ	1/23/2012
Hexanone (2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06480	Yes	NJ	7/1/2002
Iso-butyl alcohol	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06490	Yes	NJ	7/1/2005
Isopropyl acetate	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06510	Yes	NJ	9/8/2016
Isopropylbenzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06520	Yes	NJ	7/1/2005
Isopropyltoluene (4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06530	Yes	NJ	7/1/2005
Methacrylonitrile	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06540	Yes	NJ	7/1/2005
Methyl acetate	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.06550	Yes	NJ	12/2/2008
Methyl acrylate	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06560	Yes	NJ	7/1/2007
Methyl iodide	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06570	Yes	NJ	7/1/2004
Methyl methacrylate	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06580	Yes	NJ	7/1/2005
Methyl tert-butyl ether	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06590	Yes	NJ	7/1/2002
Methylcyclohexane	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.06600	Yes	NJ	4/6/2010
Methylene chloride (Dichloromethane)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection, Capillary	SCM10.06610	Yes	NJ	7/1/2002
Naphthalene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06640	Yes	NJ	7/1/2002
Nitropropane (2-)	SCM	Certified	SW-846 8260C	GC/MS, P&T, or Direct Injection, Capillary	SCM10.06660	Yes	NJ	12/2/2008
Pentachloroethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06690	Yes	NJ	7/1/2005
Pentanone (4-methyl-2-) (MIBK)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06710	Yes	NJ	7/1/2002
Propionitrile	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06720	Yes	NJ	7/1/2005
Propylbenzene (n-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06730	Yes	NJ	7/1/2005
Sec-butylbenzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06740	Yes	NJ	7/1/2005
Styrene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06750	Yes	NJ	7/1/2002
tert-Amylmethyl ether [TAME]	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06760	Yes	NJ	12/1/2006
Tert-butyl alcohol	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06780	Yes	NJ	7/1/2004
Tert-butylbenzene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06790	Yes	NJ	7/1/2005
Tetrachloroethane (1,1,1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06800	Yes	NJ	7/1/2002
Tetrachloroethane (1,1,2,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06810	Yes	NJ	7/1/2002
Tetrachloroethene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06820	Yes	NJ	7/1/2002
Tetrahydrofuran	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06830	Yes	NJ	7/1/2005
Toluene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06840	Yes	NJ	7/1/2002
Trichloro (1,1,2-) trifluoroethane (1,2,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection, Capillary	SCM10.06860	Yes	NJ	7/1/2004
Trichlorobenzene (1,2,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06870	Yes	NJ	7/1/2005
Trichlorobenzene (1,2,4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06880	Yes	NJ	7/1/2002
Trichloroethane (1,1,1-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06890	Yes	NJ	7/1/2002
Trichloroethane (1,1,2-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06900	Yes	NJ	7/1/2002
Trichloroethene	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06910	Yes	NJ	7/1/2002
Trichlorofluoromethane	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06920	Yes	NJ	7/1/2002
Trichloropropane (1,2,3-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06930	Yes	NJ	7/1/2004
Trimethylbenzene (1,2,4-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06950	Yes	NJ	7/1/2005
Trimethylbenzene (1,3,5-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06960	Yes	NJ	7/1/2005
Trimethylpentane (2,2,4-)	SCM	Certified	SW-846 8260C	GC/MS, Extract or Dir Inj, Capillary	SCM10.06970	Yes	NJ	10/15/2010
Vinyl acetate	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06980	Yes	NJ	7/1/2004
Vinyl chloride	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.06990	Yes	NJ	7/1/2002
Xylene (m-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.07000	Yes	NJ	7/1/2005
Xylene (o-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.07010	Yes	NJ	7/1/2005
Xylene (p-)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.07020	Yes	NJ	7/1/2005
Xylenes (total)	SCM	Certified	SW-846 8260C	GC/MS, P & T or Direct Injection,	SCM10.07030	Yes	NJ	7/1/2002
Dioxane (1,4-)	SCM	Certified	SW-846 8260C	GC/MS/SIM, P & T or Direct Injection,	SCM10.07035	Yes	NJ	9/8/2016
Acenaphthene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09230	Yes	NJ	7/1/2002
Acenaphthylene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09240	Yes	NJ	7/1/2002
Acetophenone	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09250	Yes	NJ	7/1/2005
Acetylaminofluorene (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09260	Yes	NJ	7/1/2005
Alpha - terpineol	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09280	Yes	NJ	7/1/2005
Aminobiphenyl (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09300	Yes	NJ	7/1/2005
Aniline	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09320	Yes	NJ	7/1/2004
Anthracene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09330	Yes	NJ	7/1/2002
Aramite	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09340	Yes	NJ	9/8/2016
Atrazine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09350	Yes	NJ	11/17/2009
Benzaldehyde	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09370	Yes	NJ	11/17/2009
Benzenethiol	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09380	Yes	NJ	9/8/2016
Benzidine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09390	Yes	NJ	7/1/2004
Benzo(a)anthracene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09400	Yes	NJ	7/1/2002
Benzo(a)pyrene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09410	Yes	NJ	7/1/2002
Benzo(b)fluoranthene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09420	Yes	NJ	7/1/2002
Benzo(ghi)perylene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09430	Yes	NJ	7/1/2002
Benzo(k)fluoranthene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09450	Yes	NJ	7/1/2002
Benzoic acid	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09460	Yes	NJ	7/1/2004
Benzyl alcohol	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09480	Yes	NJ	7/1/2005
Biphenyl (1,1'-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09510	Yes	NJ	11/17/2009
Bis (2-chloroethoxy) methane	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09520	Yes	NJ	7/1/2002
Bis (2-chloroethyl) ether	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09530	Yes	NJ	7/1/2002
Bis(2-chloroisopropyl)ether[2,2'-oxybis(1-chloropropane)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09540	Yes	NJ	7/1/2002

Bis (2-ethylhexyl) phthalate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09550	Yes	NJ	7/1/2002
Bromophenyl-phenyl ether (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09560	Yes	NJ	7/1/2002
Butylbenzylphthalate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09570	Yes	NJ	7/1/2002
Caprolactam	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09580	Yes	NJ	11/17/2009
Carbazole	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09590	Yes	NJ	7/1/2002
Chloroaniline (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09630	Yes	NJ	7/1/2002
Chlorobenzilate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09640	Yes	NJ	7/1/2005
Chloronaphthalene (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09660	Yes	NJ	7/1/2002
Chlorophenol (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09670	Yes	NJ	7/1/2002
Chlorophenyl-phenyl ether (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09680	Yes	NJ	7/1/2002
Chrysene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09690	Yes	NJ	7/1/2002
Decane (n-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09730	Yes	NJ	10/15/2010
Diallate (cis)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09750	Yes	NJ	12/1/2006
Diallate (trans)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09760	Yes	NJ	12/1/2006
Dibenz(a,h)acridine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09770	Yes	NJ	12/1/2006
Dibenzo(a,h)anthracene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09800	Yes	NJ	7/1/2002
Dibenzofuran	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09840	Yes	NJ	7/1/2002
Dichlorobenzene (1,2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09850	Yes	NJ	7/1/2004
Dichlorobenzene (1,3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09860	Yes	NJ	7/1/2004
Dichlorobenzene (1,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09870	Yes	NJ	7/1/2002
Dichlorobenzidine (3,3'-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09880	Yes	NJ	7/1/2002
Dichlorophenol (2,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09890	Yes	NJ	7/1/2002
Dichlorophenol (2,6-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09900	Yes	NJ	12/1/2006
Diethyl phthalate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09920	Yes	NJ	7/1/2002
Dimethoate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09930	Yes	NJ	12/1/2006
Dimethyl phthalate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09950	Yes	NJ	7/1/2002
Dimethylaminoazobenzene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.09960	Yes	NJ	12/1/2006
Dimethylbenz(a)anthracene (7,12-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10010	Yes	NJ	12/1/2006
Dimethylphenol (2,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10020	Yes	NJ	7/1/2002
Di-n-butyl phthalate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10030	Yes	NJ	7/1/2002
Dinitrobenzene (1,3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10040	Yes	NJ	12/1/2006
Dinitrophenol (2,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10060	Yes	NJ	7/1/2002
Dinitrophenol (2-methyl-4,6-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10070	Yes	NJ	7/1/2002
Dinitrotoluene (2,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10080	Yes	NJ	7/1/2002
Dinitrotoluene (2,6-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10090	Yes	NJ	7/1/2002
Di-n-octyl phthalate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10100	Yes	NJ	7/1/2002
Dinoseb	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10110	Yes	NJ	7/1/2005
Diphenylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10120	Yes	NJ	7/1/2002
Diphenylhydrazine (1,2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10130	Yes	NJ	12/1/2006
Disulfoton	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10140	Yes	NJ	7/1/2005
Famphur	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10220	Yes	NJ	9/8/2016
Fluoranthene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10230	Yes	NJ	7/1/2002
Fluorene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10240	Yes	NJ	7/1/2002
Hexachlorobenzene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10270	Yes	NJ	7/1/2002
Hexachlorobutadiene (1,3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10280	Yes	NJ	7/1/2002
Hexachlorocyclopentadiene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10290	Yes	NJ	7/1/2002
Hexachloroethane	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10300	Yes	NJ	7/1/2002
Hexachloropropene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10320	Yes	NJ	7/1/2002
Hydroquinone	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10330	Yes	NJ	2/4/2010
Indene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10340	Yes	NJ	9/8/2016
Indeno(1,2,3-cd)pyrene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10350	Yes	NJ	7/1/2002
Isodrin	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10360	Yes	NJ	7/1/2005
Isophorone	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10370	Yes	NJ	7/1/2002
Isosafrole (cis-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10380	Yes	NJ	12/1/2006
Isosafrole (trans-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10390	Yes	NJ	12/1/2006
Kepone	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10400	Yes	NJ	7/1/2005
Methanesulfonate (Ethyl-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10420	Yes	NJ	12/1/2006
Methanesulfonate (Methyl-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10430	Yes	NJ	12/1/2006
Methapyrilene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10440	Yes	NJ	9/8/2016
Methyl phenol (4-chloro-3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10460	Yes	NJ	7/1/2002
Methylcholanthrene (3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10470	Yes	NJ	4/23/2009
Methylnaphthalene (1-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10480	Yes	NJ	1/23/2009
Methylnaphthalene (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10490	Yes	NJ	7/1/2002
Methylphenol (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10500	Yes	NJ	7/1/2002
Methylphenol (3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10510	Yes	NJ	7/1/2002
Methylphenol (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10520	Yes	NJ	7/1/2002
Naphthalene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10530	Yes	NJ	7/1/2002
Napthoquinone (1,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10540	Yes	NJ	12/1/2006
Napthylamine (1-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10550	Yes	NJ	12/1/2006
Napthylamine (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10560	Yes	NJ	12/1/2006
Nitroaniline (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10570	Yes	NJ	7/1/2002
Nitroaniline (3-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10580	Yes	NJ	7/1/2002
Nitroaniline (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10590	Yes	NJ	7/1/2002
Nitrobenzene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10600	Yes	NJ	7/1/2002
Nitrophenol (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10620	Yes	NJ	7/1/2002
Nitrophenol (4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10630	Yes	NJ	7/1/2002
N-Nitrosodiethylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10640	Yes	NJ	7/1/2004
N-Nitrosodimethylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10650	Yes	NJ	7/1/2005
N-Nitroso-di-n-butylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10660	Yes	NJ	7/1/2005
N-Nitroso-di-n-propylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10670	Yes	NJ	7/1/2004
N-Nitrosodiphenylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10680	Yes	NJ	7/1/2002
N-Nitrosomethylethylamine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10690	Yes	NJ	7/1/2005
N-Nitrosomorpholine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10700	Yes	NJ	7/1/2005
N-Nitrosopiperidine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10710	Yes	NJ	12/1/2006
N-Nitrosopyrrolidine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10720	Yes	NJ	7/1/2005
Octadecane (n-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10730	Yes	NJ	10/15/2010
Parathion	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10740	Yes	NJ	7/1/2005
Parathion methyl	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10750	Yes	NJ	7/1/2005
Pentachlorobenzene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10830	Yes	NJ	7/1/2005
Pentachloroethane	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10840	Yes	NJ	7/1/2007
Pentachloronitrobenzene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10850	Yes	NJ	7/1/2005
Pentachlorophenol	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10860	Yes	NJ	7/1/2002
Phenacetin	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10870	Yes	NJ	12/1/2006

Phenanthrene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10880	Yes	NJ	7/1/2002
Phenol	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10890	Yes	NJ	7/1/2002
Phenylenediamine (1,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10900	Yes	NJ	9/8/2016
Phenylethylamine (alpha, alpha-Dimethyl)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10910	Yes	NJ	12/1/2006
Phorate	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10920	Yes	NJ	7/1/2005
Phosphorothioate (O,O,O-triethyl)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10930	Yes	NJ	12/1/2006
Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10940	Yes	NJ	12/1/2006
Picoline (2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10950	Yes	NJ	7/1/2005
Pronamide	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10960	Yes	NJ	7/1/2005
Pyrene	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10970	Yes	NJ	7/1/2002
Pyridine	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10980	Yes	NJ	7/1/2002
Quinoline	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.10990	Yes	NJ	9/8/2016
Quinoline -1-Oxide (4-Nitro)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11000	Yes	NJ	12/1/2006
Safrole	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11010	Yes	NJ	12/1/2006
Tetrachlorobenzene (1,2,4,5-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11060	Yes	NJ	7/1/2005
Tetrachlorophenol (2,3,4,6-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11070	Yes	NJ	12/1/2006
Toluidine (2-) (2-Methylaniline)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11080	Yes	NJ	7/1/2005
Toluidine (5-nitro-2-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11100	Yes	NJ	12/1/2006
Trichlorobenzene (1,2,4-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11120	Yes	NJ	7/1/2002
Trichlorophenol (2,4,5-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11130	Yes	NJ	7/1/2002
Trichlorophenol (2,4,6-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11140	Yes	NJ	7/1/2002
Trinitrobenzene (1,3,5-)	SCM	Certified	SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.11160	Yes	NJ	12/1/2006
Acenaphthene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11170	Yes	NJ	5/18/2015
Acenaphthylene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11180	Yes	NJ	5/18/2015
Anthracene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11190	Yes	NJ	5/18/2015
Benzo(a)anthracene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11200	Yes	NJ	1/2/2007
Benzo(a)pyrene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11210	Yes	NJ	1/2/2007
Benzo(b)fluoranthene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11220	Yes	NJ	1/2/2007
Benzo(ghi)perylene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11230	Yes	NJ	5/18/2015
Benzo(k)fluoranthene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11240	Yes	NJ	1/2/2007
Chrysene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11250	Yes	NJ	5/18/2015
Dibenzo(a,h)anthracene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11260	Yes	NJ	1/2/2007
Dinitrophenol (2-methyl-4,6-)	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11270	No	NJ	12/1/2015
Dioxane (1,4-)	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11274	Yes	NJ	1/18/2017
Fluoranthene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11280	Yes	NJ	5/18/2015
Fluorene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11290	Yes	NJ	5/18/2015
Hexachlorobenzene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11300	Yes	NJ	1/2/2007
Hexachlorobutadiene (1,3-)	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11310	Yes	NJ	12/1/2015
Indeno(1,2,3-cd)pyrene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11320	Yes	NJ	1/2/2007
Methylnaphthalene (2-)	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11340	Yes	NJ	5/18/2015
Naphthalene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11350	Yes	NJ	5/18/2015
Pentachlorophenol	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11370	Yes	NJ	1/2/2007
Phenanthrene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11380	Yes	NJ	5/18/2015
Pyrene	SCM	Certified	SW-846 8270D	GC/MS/SIM, Extract or Dir Inj, Capillary	SCM10.11390	Yes	NJ	5/18/2015
Dioxane (1,4-)	SCM	Certified	User Defined SW-846 8270D	GC/MS, Extract or Dir Inj, Capillary	SCM10.12330	Yes	NJ	1/23/2012
1,1,1-Trifluoroethane	SCM	Certified	User Defined SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.12810	Yes	NJ	7/26/2013
1-Chloro-1,1-difluoroethane	SCM	Certified	User Defined SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.12820	Yes	NJ	7/26/2013
1,1-Dichloro-1-fluoroethane	SCM	Certified	User Defined SW-846 8260B	GC/MS, P & T or Direct Injection,	SCM10.12824	Yes	NJ	7/26/2013
Ethylene glycol	SCM	Certified	User Defined SW-846 8260B	GC/MS/SIM, Direct Aqueous Injection	SCM10.12860	Yes	NJ	11/12/2008
Propylene glycol	SCM	Certified	User Defined SW-846 8260B	GC/MS/SIM, Direct Aqueous Injection	SCM10.12870	Yes	NJ	11/12/2008
Diesel range organic	SCM	Certified	User Defined TCEQ 1005	Extraction, GC, FID	SCM14.00920	Yes	NJ	10/15/2010
Perchlorate	SCM	Certified	User Defined EPA 314	Ion Chromatography	SCM14.01940	Yes	NJ	10/6/2010

Method Capabilities—Non-NELAP Methods

Analytes	Method Number	Program	Chemistry Field
Phenols	EPA 420.4	Drinking Water	Inorganic Analysis
Carbon Dioxide	SM 4500-CO_2 C or D	Wastewater	Inorganic Analysis
Iodide	SM 4500-I B	Wastewater	Inorganic Analysis
Nonionic Surfactants as CTAS	SM 5540 D	Wastewater	Inorganic Analysis
Particulate Matter	EPA 160.2M	Wastewater	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3	Wastewater	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76	Wastewater	Inorganic Analysis
Specific Gravity	ASTM D1298-85	Wastewater	Inorganic Analysis
Total Organic Content	ASTM D2974-87	Wastewater	Inorganic Analysis
Unburned Combustibles	EPA 160.1+160.4	Wastewater	Inorganic Analysis
Viscosity	ASTM D445/6	Wastewater	Inorganic Analysis
Volatile Suspended Solids	EPA 160.2+160.4	Wastewater	Inorganic Analysis
Weak Acid Dissociable Cyanide Prep	SM 4500-CN I	Wastewater	Inorganic Analysis
Ammonia	EPA 350.1M	Solid/Haz. Waste	Inorganic Analysis
Ammonia	EPA 350.2M	Solid/Haz. Waste	Inorganic Analysis
Base Sediment	ASTM D473-81	Solid/Haz. Waste	Inorganic Analysis
Bulk Density (Dry Basis)	ASTM D2937-94M	Solid/Haz. Waste	Inorganic Analysis
Chemical Oxygen Demand	HACH 8000M	Solid/Haz. Waste	Inorganic Analysis
Chloride	EPA 325.3M	Solid/Haz. Waste	Inorganic Analysis
Grain Size & Sieve Testing	ASTM D422-63	Solid/Haz. Waste	Inorganic Analysis
Heat Content, BTU	ASTM D3286-85	Solid/Haz. Waste	Inorganic Analysis
Ignitability (Flashpoint)	ASTM D93-90/SW846 Ch 7	Solid/Haz. Waste	Inorganic Analysis
Multiple Extractions	SW846 1320	Solid/Haz. Waste	Inorganic Analysis
Neutral Leaching Procedure	ASTM D3987-85	Solid/Haz. Waste	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2M	Solid/Haz. Waste	Inorganic Analysis
Organic Matter (Ignition Loss)	AASHTO T267-86M	Solid/Haz. Waste	Inorganic Analysis
Orthophosphate	EPA 365.2M	Solid/Haz. Waste	Inorganic Analysis
Percent Ash (Dry Basis)	ASTM D482-91	Solid/Haz. Waste	Inorganic Analysis
Percent Solids	ASTM D4643-00	Solid/Haz. Waste	Inorganic Analysis
Percent Sulfur	ASTM D129-61	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Total	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis
Pour Point	ASTM D97-87	Solid/Haz. Waste	Inorganic Analysis
Reactive Cyanide	SW846 7.3.3.2	Solid/Haz. Waste	Inorganic Analysis

Method Capabilities—Non-NELAP Methods

Analytes	Method Number	Program	Chemistry Field
Reactive Sulfide	SW846 7.3.4.2	Solid/Haz. Waste	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76M	Solid/Haz. Waste	Inorganic Analysis
Specific Gravity of Solids	ASTM D1429-86M	Solid/Haz. Waste	Inorganic Analysis
Sulfide (S)	EPA 376.1 M	Solid/Haz. Waste	Inorganic Analysis
Sulfite (SO_3)	EPA 377.1M	Solid/Haz. Waste	Inorganic Analysis
Total Chlorine	ASTM D808-91	Solid/Haz. Waste	Inorganic Analysis
Total Kjeldahl Nitrogen	EPA 351.2M	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	CORP ENG 81	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	LLOYD KAHN 1988	Solid/Haz. Waste	Inorganic Analysis
Total Organic Chlorine	ASTM D808-91M	Solid/Haz. Waste	Inorganic Analysis
Total Plate Count	SM 9215BM	Solid/Haz. Waste	Inorganic Analysis
Total Volatile Solids	EPA 160.4M	Solid/Haz. Waste	Inorganic Analysis
Water Content	ASTM D95-83	Solid/Haz. Waste	Inorganic Analysis

Appendix IV

Laboratory Equipment

Equipment (Air Lab)	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GC-AA	GC Agilent 7890A/FID	CN10361127	HP Chemstation	HP Enviroquant	Air Laboratory	N/A
GC-J			HP Chemstation	HP Enviroquant	Air Laboratory	N/A
GCMS- 5W	Agilent Technologies 5975C / 7890A / Entech7200pre-concentrator pre-concentrator	US13207902/CN13141001/1123	HP Chemstation	HP Chemstation	Air Laboratory	2013
GCMS-2W	Agilent Technologies 5975C / 7890A Entech 7016CA	CN10361158 / US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Air Laboratory	2012
GCMS-3W	Agilent Technologies 5973 / 6890N Entech 7016A	CN10425086 / US41746669 / 1351	HP Chemstation	HP Enviroquant	Air Laboratory	2007
GCMS-Q	Hewlett-Packard 5890ll / 5971 MSD / Entech Air Samp 7000	3033A31092 / 3188A02934	HP Chemstation	HP Enviroquant	Air Laboratory	1993
GCMS-W	Agilent Technologies 5973 / 6890N AS Entech 7016CA	US44621451 / CN10517032 / 1119	HP Chemstation	HP Enviroquant	Air Laboratory	2005
GC-QT	Agilent 6890 / PID / FID / Entech 7032AB-L	US10148124/1176	HP Chemstation	HP Enviroquant	Air Laboratory	2010
GC-WW	Hewlett-Packard6890 / PID	US00010037	HP Chemstation	HP Enviroquant	Air Laboratory	2010
GCMS – 6W			HP Chemstation	HP Enviroquant	Air Laboratory	
OVEN – 10A	Entech 3100A Canister cleaner	0404-4596	None	None	Air Laboratory	N/A
OVEN – 10C	Entech 3100A Canister cleaner	0404-4597	None	None	Air Laboratory	N/A
OVEN – 10E	Entech 3100A Canister cleaner	N/A	None	None	Air Laboratory	N/A
OVEN -10F	Entech 3100A Canister cleaner	N/A	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-1)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-2)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-3)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-4)	None	None	None	Air Laboratory	N/A

Flow Meters	Flow Professor	FP1, FP2, FP3, FP4	None	None	Air Laboratory	N/A
Equipment (Air Lab, cont'd)	**Manufacture & Description**	**Serial Number**	**Operating System Software**	**Data Processing Software**	**Location**	**Purchase**
Cleaning System	Entech		None	None		
Tube Conditioner	Markes International TC-20	R-10659	None	None		
Wrist Action Shaker	Burrell Model 75		None	None		
Cleaning System-1	Entech 3100A	1064	None	None		

Equipment (General Chemistry Lab)	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
DO Meter	YSI-51B	92A035818	None	None	Field Serv.	1998
DO Meter	YSI-55/12ft	00C0598BG	None	None	Field Serv.	2000
PH Meter-10	YSI	JC02538	None	None	Field Serv.	2007
PH Meter-11	YSI	JC02540	None	None	Field Serv.	2010
PH Meter-9	Orion 250A	O18019	None	None	Field Serv.	2007
SCON Meter	YSI-30	J0183	None	None	Field Serv.	2004
Balance- Top Load	Ohaus Adventure AV212 (B-36)	8029131104	None	None	IC Lab	2008
Balance- Analytical	Ohaus Adventurer (B-24)	1225032523P	None	None	Inorganics	2004
Balance- Analytical (B-5)	Mettler AE 160 (B-5)	C11620	None	None	Inorganics	1999
Balance- Top Load (B-43)	Ohaus Adv. Pro (B43)	8032501223	None	None	Inorganics	2012
Balance- Top Load (B-14)	Denver Inst. Co. XL500 (B-14)	B045530	None	None	Inorganics	Pre-2000
Balance- Top Load (B-52)	Ohaus Adv. Pro (B52)	B334691952	None	None	Inorganics	2013
Balance- Top Load (B-16)	Ohaus Explorer (B-16)	E1581119212171	None	None	Inorganics	2001
Balance- Top Load (B-21)	Ohaus Adventurer (B-21)	E1021218270448	None	None	Inorganics	2001
Balance- Top Load (B-27)	Ohaus Adventurer AV412 (B-27)	8026251106	None	None	Inorganics	2005
Balance- Top Load (B-32)	Sartorius TE31025 (B-32)	21950273	None	None	Inorganics	2007
Balance- Top Load (B-39)	Denver P-214 (B-39)	25450279	None	None	Inorganics	2010
Balance- Top Load (B-53)	A+D HR-250A (B-53)	687601248	None	None	Inorganics	2012
Balance- Top	Ohaus Adv. Pro (B-37)	8029161122	None	None	Inorganics	2013

Load (B-37)						
Equipment (General Chem Lab, cont'd)	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
Balance- Top Load(B-51)	(B-51)		None	None		
Calorimeter	PARR 1261EA	1499	None	None	Inorganics	1996
COD Block	HACH DRB200	11020C0029	None	None	Inorganics	2010
Distillation Block 1	Lachat Micro Distillation system	A2000738	None	None	Inorganics	2010
Distillation Block 2	Lachat Micro Distillation system	A2000726	None	None	Inorganics	2010
Distillation Block 3	Lachat Micro Distillation system	A2000807	None	None	Inorganics	2010
DO Meter	YSI 5000	07B1560	None	None	Inorganics	2008
FIA Analyzer	Lachat Quikchem 8000	13200001620	None	None	Inorganics	
Flashpoint	Koehler – K16200	R07002295	None	None	Inorganics	2010
Flashpoint	Koehler – K16200	R07002563B	None	None	Inorganics	2010
IC-2	Dionex ICS2000	2090737	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-3	Dionex ICS2000	2110028	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-4	Dionex ICS2000	4060060	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-6	Dionex ICS3000	Column 6040160	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2006
IC-7	Dionex IC5000+	Pump-13120208, IC-7 7199, IC-A (2187), Column 13117597	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2013
IC-8	Dionex IC5000, 5000-1	Column 10120556				

Equipment (General Chem Lab, cont'd))	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
IC-9	IC5000, 5000-3	Column 11090696				
IC-B	IC- 2100 Fatty Acids	11090126				
Seal Analyzer	Discreet Analyzer (AQ-2)	190185				
IR Spec.	Buck Scientific HC-404	687	None	None	Inorganics	1997
Oven (Inc-21)	Fisher	N/A	None	None	Inorganics	2014
Oven (Inc-7)	Precision	699030922	None	None	Inorganics	2014
Oven Inc 19	Total Dissolved Solids(180^{o}C)	20-2100149111	None	None	Inorganics	2014
PH Meter-46	Thermo Orion 4 Star	B10299	None	None	Inorganics	2008
PH Meter-47	Thermo Orion 4 Star	B04869	None	None	Inorganics	2008
PH Meter-50	Orion Star Series	B27564	None	None	Inorganics	2010
pH Meter-53	VWR Symphony B10P	1223350009	None	None	Inorganics	2013
PH Meter-54	Thermo Orion 710A	X08035	None	None	Inorganics	2013
PH Meter-55	Thermo-Orion	X10686	None	None	Inorganics	2014
pH Meter-57	VWR Symphony B10P	1411150002	None	None	Inorganics	2014
pH Meter-59	VWR Symphony B10P	14087S0006	None	None	Inorganics	2014
pH Meter-60	VWR Symphony B10P	1413950006	None	None	Inorganics	2014
pH-eH Meter-22	Thermo Orion 4 Star	SN00742	None	None	Inorganics	2008
pH Meter-62	VWR Symphony B10P		None	None		
SCON Meter	Amber Science 1056	01020851056-101	None	None	Inorganics	2001
SCON Meter	Orion 145+	78035	None	None	Inorganics	2004
Solvent Evaporator	Horizon SPE-DEX 3000XL	09-1031	None	None	Inorganics	2010
Solvent Evaporator	Horizon SPEED VAP III	09-0739	None	None	Inorganics	2010

Equipment (General Chem Lab cont'd)	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
TCLP Rotator 4	Assoc. Design and Mfg. Co. 3740-24-BRE-TM	N/A	None	None	Inorganics	2000
TCLP Rotator 5	Analytical Testing Corp. 42R5BCI-E3	0685KZJP0013	None	None	Inorganics	2002
TCLP Rotator 7&8	Assoc. Design and Mfg. Co. 3740-48BRE	N/A	None	None	Inorganics	2000
TCLP Rotator 9&10	Assoc. Design and Mfg. Co. 3740-48BRE	2132337	None	None	Inorganics	1996
TOC-L Analyzer	Shimadzu TOC-L	H52516900071	Shimadzu TOC Control	Shamadzu TOC Control	Inorganics	2012
TOC-L Analyzer	Shimadzu TOC-L	H52515000114NK	Shimadzu TOC Control	Shamadzu TOC Control	Inorganics	2013
TOC-V Analyzer	Shimadzu TOC-V CSH	H52504400192NK	Shimadzu TOC Control	Shimadzu TOC Control	Inorganics	2007
TOX Analyzer	Mitsubishi TOX-100	N/A	None	None	Inorganics	1996
TOX Analyzer	Mitsubishi TOX-100	A7M 42997	None	None	Inorganics	2008
UVVIS Spec E	Spectronix 20 Genesys	3SGD.352011	None	None	Inorganics	2007
UVVIS Spec J	Thermo Electron Corp. Genesys 20	3SGQ235018	None	None	Inorganics	20012
UVVIS Spec L	Thermo Electron Corp. Genesys 20	3SGS073003	None	None	Inorganics	2014
UVVIS Spec M	Spectronix 20 Genesys	3SG82480005	None	None	Inorganics	2013
UVVIS Spec N	Spectronix 20 Genesys	3SGS247010	None	None	Inorganics	2013
Pensky Martens	Pensky Martens 35000-0	1043454	None	None		
Lachat Module	Lachat Ammonia Distillation Module	16-107-06-S-J	None	None		

Equipment (General Chem Lab cont'd)	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchased
TOC Analyzer	Scimadzu	H544114900158 AE	None	None		
TOC Analyzer	Scimadzu, Autosampler	H571149000354 SA	None	None		
TOC Analyzer	Scimadzu, Autosampler	52514900066 NK	None	None		
PH Meter-23	Thermo Orion Model 310	SN013786	None	None	Inorganics	2008
Hot Block 8	Environmental Express	N/A	None	None	Mercury Prep	
Hot Block 7	Environmental Express	N/A	None	None	Mercury Prep	
Automatic Pensky Martens	Seta PM-93 Flash Point Closed Cup Tester	1043454	None	None	Gen Chem	2017

Equipment (Metals)	Manufacturer & Description	Serial Number	Operating System	Data Processing System	Location	Purchase
ICP	Thermo ICP 6500 Duo	ICP-20074909	ITEVA	ITEVA	Metals	2007
ICP	Thermo ICP 6500 Duo	ICP-20114506	ITEVA	ITEVA	Metals	2011
ICP	Thermo ICP 6500 Duo	ICP-20072601	ITEVA	ITEVA	Metals Analysis	2007
ICP	Thermo ICP 6500 Duo	IC5D20122506	ITEVA	ITEVA	Metals Analysis	2012
ICP	Thermo ICP 6500 Duo	IC76DC134708	ITEVA/QTEGRA	ITEVA/QTEGRA	Metals Analysis	2014
ICP-MS	Agilent 7700 Series	JP12412081	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2014
ICP-MS	Agilent 7700 Series	JP10340551	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2010
ICP Auto-Sampler	Express AutoSampler	071406XPS	None	None		
Hot Block 1	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 2	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 3	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 4	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 5	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 6	Environmental Express	N/A	None	None	Metals Prep	
Balance- Top Load	Ohaus Scout II (B-20)	BJ320905	None	None	Methanol Prep	2002
Balance- Top Load	Ohaus Scout II (B-25)	BJ514770	None	None	Methanol Prep	2004
Balance- Top Load	Ohaus Adventurer AR3130 (B-26)	1240-P	None	None		
Balance – Analytical	Ohaus Adventurer (B-24)	1225032523P	None	None		
Hg Analyzer	HYDRAA II	64013	Envoy	Envoy		
Hg Analyzer	Leeman Mercury Analyzer HYDRAAF Gold+	9003	WIN Hg Runner	WIN Hg Runner		
Hg Analyzer 7	Hydra II	64631	Envoy	Envoy		

Equipment (Microbiology Lab)	Manufacture & Description	Serial Number	Operating System	Data Processing System	Location	Purchase
Autoclave	Tuttnauer	1308435	None	None	Microbiology	2011
Incubator BOD	VWR	702499	None	None	Microbiology	2011
Incubator (Plates)	Theclo Precision	11T3	None	None	Microbiology	N/A
Incubator(BOD)	ISOTEMP	317646	None	None	Microbiology	2010
Incubator-Water Bath	INC-2	1200991	None	None	Microbiology	N/A
Refrigerator	R-44	0503MCBR980W0087	None	None	Microbiology	N/A
Incubator (Plates)	Thelco Precision	4-D-5	None	None	Microbiology	N/A

Equipment (Organic Prep)	Manufacture & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
Balance- Top Load (B-46)	Ohaus Adventurer Pro (B-46)	B304755401	None	None	Organic Prep	Pre-2000
Balance- Top Load (B-45)	Ohaus Adventurer Pro (B-45)	B033051054	None	None	Organic Prep	2002
Balance- Top Load (B-42)	Ohaus Adventurer Pro (B-42)	B031331113	None	None	Organic Prep	2007
Balance- Top Load (B-47)	Ohaus Adventurer Pro (B-47)	4755411	None	None	Organic Prep	2013
Buchi -1	Buchi Concentrator System	1000175446	None	None	Organic Prep	2014
Buchi -2	Buchi Concentrator System	1000175108	None	None	Organic Prep	2014
Buchi-3	Buchi Concentrator System	1000175657	None	None	Organic Prep	2014
Buchi-4	Buchi Concentrator System	Not in service	None	None	Organic Prep	N/A
Centrifuge	Thermo Scientific	41394883	None	None	Organic Prep	2014
GPC4	Waters 717	717-000152	None	None	Organic Prep	1992
Microwave-3	MARS 6 CEM	MJ2659 (warranty expires June 2014)	None	None	Organic Prep	2013
Microwave-4	MARS 6 CEM	MJ2198	None	None	Organic Prep	2013
Microwave-5	MARS 6 CEM	MJ2197	None	None	Organic Prep	2013
Microwave-6	MARS 6 CEM	MJ2670	None	None		
Mini Water Bath	Thermo Scientific	234221-1379	None	None	Organic prep	2014
N-EVAP 1	Organomation	59301	None	None	Organic Prep	2014
N-EVAP 2	Organomation	58202	None	None	Organic Prep	2014
Sonicator	Fisher	F550	None	None	Organic Prep	N/A
Sonicator	Bransen	BIO3037527	None	None	Organic Prep	N/A
Sonicator	Misonix	S3000	None	None	Organic Prep	1997
Water Bath 1	Organomation	13385	None	None	Organic Prep	2010
Water Bath 10	Organomation	58394	None	None	Organic prep	2014
Water Bath 11	Organomation	58384	None	None	Organic prep	2014

Water Bath 3	Organomation	58471	None	None	Organic Prep	2010
Water Bath 4	Organomation	58421	None	None	Organic Prep	2014
Equipment (Organic Prep, cont'd)	Manufacturer & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
Water Bath 5	Organomation	58422	None	None	Organic Prep	2014
Water Bath 8	Organomation	58424	None	None	Organic Prep	2014
Water Bath 9	Organomation	58425	None	None	Organic prep	2013
Water Bath 6	Organomation	58423	None	None	Organic Prep	2014
Water Bath 7	Organomation	58379	None	None	Organic Prep	2014

Equipment (OrganicsLab)	Manufacturer & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
GC-SC	Hewlett-Packard 5890 / FID / OI4551 / 4560	2443AO3797	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-SR	Hewlett-Packard 5890 / FID / Tekmar 7000	2612A07448	HP Chemstation	HP Enviroquant	Organics; Screening	1992
GC-ST	Hewlett-Packard 5890 / FID / NPD / HP 7673 AS / Tek	314OA38871	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC-SV	Hewlett-Packard 5890 / FID / OI4551 / 4560	LR47-359C / N244460743 / 3336A58859	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC 7Y/7Zz	Agilent Technologies 6890N / 7683	US00043006 / US12211759 / CN52926441 / CN60931595	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-5G	Agilent Technologies 7890N/7693	CN12131022 / CN12060027 / CN12070097 / U20782/U20781	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GC-5Y-5Z	Agilent Technologies 7890N / 7683	CN11461115 / CN11380009 / CN11390012 / CN73342671	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-6G	Agilent Technologies 6890N 7683	CN10611064 / CN44330971 / CN40334835 / U4788 / U18013	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-6y-6z	Agilent Technologies 7890N / 7683	CN11461118 / CN10310044 / CN83252932 / CN73342695	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-7G	Agilent Technologies 6890N 7683	US10606009 / CN53236207 / CN40434847 / U23574/ U24374	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-8Y/8Z	Agilent Technologies 6890N / 7683	US10240121 / GT030513A / CN43038210 / CN40334821	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-4P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10251017 / US102440773 / CN34727122 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-5P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10222060 / US21844818 / CN52834726 / CN21725012	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-XX	Hewlett-Packard 6890 / Dual ECD / HP 7683 AS	US00022968 / CN32023953 / CN32030876 / U0109 / U0905	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GC-UV	Hewlett-Packard 5890 / Dual FID / OI 4551 / 4560	2921A23322	HP Chemstation	HP Enviroquant	Organics; Volatiles	1996
GC-2Y/2Z	Agilent Technologies 6890N 7683	CN10407032 / CN61633946 / US94209706 / US01112207	HP Chemstation	HP Enviroquant	Organics; SVOCs	2004
GC-OA	Agilent Technologies 6890N / 7683	US10240147 / CN23021337 / CN320308791 / U5591 / U7670	HP Chemstation	HP Enviroquant	Organics; SVOCs	2002

Equipment (OrganicsLab)	Manufacturer & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
GC-YZ/ZZ	Hewlett-Packard 6890 / 6890	US00011065 / 3527A39121 / 3521A42714 / 3511A42110	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GC-EF	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	2541A06786 / 2942A20889 /F1916 / F5562	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-LM	Hewlett-Packard 6890 / PID / FID / OI 4551 / 4560 P&T	US00008927	HP Chemstation	HP Enviroquant	Organics; Volatiles	1998
GCMS-L	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560 P&T	2921A22898 / 2623A01291	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-SY	Hewlett-Packard 5890 / FID / OI4551A / 4560	2643A10503	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-1G	Agilent Technologies 6890N / 7683	US10322012 / CN23821917 / CN23326744 / U21778 / U5597	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GC-2G	Agilent Technologies 6890N / 7683	CN10450110 / CN24922557 / CN45022276 / U17684 / U7668	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3G	Agilent Technologies 6890N / 7683	CN10450109 / CN24922566 / CN45022167 / U7666 / U7667	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3Y/3Z	Agilent Technologies 7890A / 7683B	CN10735014 / CN74345941 / CN83252932 / CN73342695	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GC-4G	Agilent Technologies 6890N / 7693	CN10361136 / CN10340093 / CN10310033 / U17615 / U17614	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-4Y/4Z	Agilent Technologies 7890A / 7693B	CN10832133 / CN84451068 / CN83252936 / CN73342671	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-2M	Agilent Technologies 5975 / 6890N AS 7683	CN10612028 / US60532578 / CN4593809290 / US82601187	HP Chemstation	HP Enviroquant	Organics; SVOCs	2012
GCMS-2P	Agilent Technologies 5975C / 7890A / 7693	US10237403 / CN10241022 / CN10210021 / CN10180007	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC – 8G	Agilent 7890A	CN1039N62 / CN10370238	HP Chemstation	HP Enviroquant	Organics; SVOCs	
GC – 9G	Agilent 6890	US00041387	HP Chemstation	HP Enviroquant	Organics; SVOCs	
GCMS-3E	Agilent Technologies 5975 / 6890N / 7683	CN10614011 / US61332852 / CN23326747 / US93901916	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-3M	Agilent Technologies 5975B / 6890N / Agilent 7683B	US65125107 / CN10703029 / CN73943902 / US83801832	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-3P	Agilent Technologies 5975C / 7890A / 7693	CN10361100 / CN10361163 /	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010

GCMS-4M	Agilent Technologies 5975C / 7890A / 7683B	US73317574 / CN1074251 / CN74043923 / CN74145736	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
Equipment (OrganicsLab)	Manufacturer & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
GCMS-4P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10251017 / US102440773 / CN34727122 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-6P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10536029 / US52420712 / US10310521 / CN55230259	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-F	Agilent 6890 / 5973 MSD / 7683 AS	US00034179 / US01140200 / CN40327643 / CN138822139	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GCMS-M	Hewlett-Packard 6890 / 5973 MSD / HP 7683 AS	US00021813 / US802111003 / US81501001 / CN61038860	HP Chemstation	HP Enviroquant	Organics; SVOCs	1999
GCMS-P	Agilent Technologies 5973 / 6890N AS 7683 AS	US10251064 / US21844598 / CN74145733 / CN24828486	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GCMS-R	Agilent Technologies 6890 / 5973 MSD / 7683	US00021820 / US81211033 / US84202752 / CN61639349	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GCMS-Z	Agilent Technologies 5973 / 6890N AS 7683 AS	US10251028 / US21844586 / CN24828485 / CN23321564	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
Balance- Top Load (B-28)	Ohaus Sport (B-28)	7124230518	None	None	Organics; Volatiles	2005
Balance- Top Load (B-34)	Ohaus Adventure AV412 (B-34)	8028391117	None	None	Organics; Volatiles	2007
GC-GH	Hewlett-Packard 5890	2938A25059	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-1A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10314026 / US30945331	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-1B	Agilent Technologies 7890A / 5975C /Teledyne / Tekmar AquaTek AS	CN10845177 / US83111119	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GCMS-1C	Agilent Technologies 5973 / 6890N AS 4551 / 4560	CN10425085 / US41746667	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2A	Agilent Technologies 5973 / 6890N AS Tekmar Solatek 72	CN10314028 / US30945325	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-2B	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10441033 / US 43146954	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2C	Agilent Technologies 5973 / 6890N AS 4551A / 4560	CN10441035 / US 43146953	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004

Equipment (OrganicsLab)	Manufacturer & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
GCMS-2D	Agilent Technologies 5973 / 6890N AS 4552 / 4560	CN10432038 / US43146771	HP Chemstation	HP Enviroquant	**Organics; Volatiles**	**2004**
GCMS-2E	Agilent Technologies 5975 / 6890N AS 4551A / 4660	CN10612046 / US60532596	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-2H	Agilent Technologies 6890 / 5973	US10123019 / US10440806	HP Chemstation	HP Enviroquant	Organics; Semi-Volatiles	
GCMS-3A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10432042 / US43146776	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-3B	Agilent Technologies 6890 / 5973 / OI 4551A / 4660	US10240044 / US21844015	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-3C	Agilent Technologies 5973 / 6890N AS 45551A / 4660	CN10517038 / US44621480	HP Chemstation	HP Enviroquant	Organics; Volatiles	2005
GCMS-3D	Agilent Technologies 5975B / 6890N AS 4551A / 4660	CN10637120 / US62724193	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS -3H	Agilent Technologies 5975B / 6890A/7683	US10250091 / CN24227710	HP Chemstation	HP Enviroquant	Organics; Semi-Volatiles	
GCMS-3V	Agilent Technologies 5975C/7890A/OI 4552/ 4560	US1321790 / CN13141045	HP Chemstation	HP Enviroquant	Organics; Volatiles	2013
GCMS-4B	OI 4660/ OI 4551A/Agilent Technologies 5975C / 7890A	G0444466534P/ F04345BI44/ US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4D	Agilent Technologies 5975C / 7890A	US10237301 / CN10241019	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4V	Agilent Technologies 5975C/7890A/OI 4100/ 4660	Us13307901 / CN13331029	HP Chemstation	HP Enviroquant	Organics; Volatiles	2013
GCMS-A	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	US00033272 / US94212183	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-C	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	2643A122671 / 2807A1146	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-D	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 ARCHON	US00030551 / US93122843	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001
GCMS-E	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560	US00031161 / US93112044	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001

	ARCHON					
GCMS-G	Hewlett-Packard 5890ll / 5970 MSD / OI 4552 / 4660	2919A22540 / 2807A11004	HP Chemstation	HP Enviroquant	Organics; Volatiles	1989
Equipment (OrganicsLab)	Manufacturer & Description	Serial Number	Operating System	Data Processing Software	Location	Purchase
GCMS-I	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560	2623A08318 / 2637A01687	HP Chemstation	HP Enviroquant	Organics; Volatiles	1986
GCMS-J	Hewlett-Packard 5890 / 5970 MSD / OI 4552 / 4560 P&T	2643A11557 / 3034A12779	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-K	Hewlett-Packard 5890l1 / 5970 MSD / OI 4551 / 4560 P&T	2750A116838 / 2905A11628	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-N	Hewlett-Packard 5890 / 5970 MSD / Tekmar 2000 / 2032 P&T	2750A17088 / 2716A10218	HP Chemstation	HP Enviroquant	Organics; Volatiles	1988
GCMS-S	Hewlett-Packard 6890 / 5973 MSD /OI 660 ARCHON	US00024322 / US82311313/ H216466453P / 13295	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-T	Hewlett-Packard 6890 / 5973 MSD / OI 4551A / 4660 P&T	US00024323 / US82311482	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-U	Hewlett-Packard 6890 / 5973 MSD / HP 4551A / 4660	US00032623 / US94212203	HP Chemstation	HP Enviroquant	Organics; Volatiles	1999
GCMS-V	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10149085 / US10441917	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-X	Agilent Technologies 5973 / 6890N AS 4552 / 4660	US21843889 / US10239071	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-Y	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10240013 / US21844012	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GC-PF	Agilent Technologies 6890N AS 4552 / 4560	US10235024 / 12995 / J542460192	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
PH Meter-13	VWR IS B20	5942	None	None	Sample Management	2010
Balance- Top Load (B-33)	Ohaus Adventure AV412 (B-33)	8028391184	None	None	Sample Management	2007
Balance- Top Load (B-30)	Ohaus Adventurer AV412 (B-30)	8026391160	None	None	Screen	2005

LAB MANAGER: [signature]

QA MANAGER: Joseph Ravino

EFFECTIVE DATE: 9 / 11 / 2017

TITLE: AIR ANALYSIS BY TO-15
REFERENCES: EPA TO-15 AND TO-15 NJDEP-LL
REVISED SECTIONS: 12.3.3, 13.6.2

1.0 SCOPE AND APPLICATION

1.1 This method is for the analysis of volatile organics on whole ambient air samples collected in summa canisters. This procedure is applicable to all compounds listed under EPA method TO-15 as the cryofocusing technique can trap a wide range of polar and non-polar compounds.

2.0 METHOD SUMMARY

2.1 A whole air sample collected in a summa passivated canister or Restek "Silcocan", is concentrated by adsorption and cryofocusing and introduced into a GC/MS for target compound analysis.

2.2 The GC/MS is calibrated with a minimum 5 level curve with quantitation performed by internal standard technique. Standards are purchased as commercial certified gas standards and dynamically diluted into working calibration standards.

2.3 A nominal sample volume of 400cc is used and adjusted if necessary based on dilutions and/or canister pressurization. Air is drawn out of a canister and trapped on a glass bead trap, tenax trap and cyrofocused prior to introduction into the GC/MS. The GC oven is temperature programmed to separate the compounds of interest with detection by a mass selective detector.

2.4 This method is applicable to the compounds listed on Table 5 which, are routinely calibrated.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the low calibration standard used in the analysis. Detected concentrations below these reporting limits cannot be reported without qualification. Total volatiles based on total peak areas as calibrated to the total area of pentane or heptane have a reporting limit of 10ppbv. See Table 5.

3.2 Method Detection Limit Study. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B.

3.2.1 Experimental MDLs must be determined annually for this method. The spike concentration must be at or below the reporting limit.

3.2.2 MDL studies are to be performed with volumes of spiked zero air that is routinely analyzed for live samples (i.e. 400cc).

3.2.3 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.

CONTINUING CALIBRATION - analytical standard run every 24 hours to verify the initial calibration of the system.

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the mass spectrometer to the target compounds.

MATRIX DUPLICATE - a second aliquot of the same matrix as the sample analyzed in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards (or SMC's for VOA), that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMIT (MDL) The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs are determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used in this SOW and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

RELATIVE PERCENT DIFFERENCE (RPD) - As used in this SOW and elsewhere to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

REPORTING LIMIT (RL) – The reporting limit is established at either the method detection limit or the lowest concentration standard in the calibration curve, depending on the requirements of different specific regulatory programs. Detected concentration below this concentration cannot be reported without qualification.

ZERO AIR – Ultra purity grade commercially available compressed air. Contains less than 0.1ppm of hydrocarbons, 1ppm of carbon dioxide and carbon monoxide, and less than 5ppm moisture.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the SGS Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected human or mammalian carcinogens: benzene, carbon tetrachloride, chloroform, and vinyl chloride. Primary standards of these toxic compounds must be prepared in a hood. A NIOSH/Mass approved toxic gas respirator must be worn when the analyst handles high concentrations of these toxic compounds.

5.4 Releasing pressurized summa canisters must be performed under a ventilation hood.

6.0 HOLDING TIME & PRESERVATION

6.1 30 days for canisters from collection to analysis.

6.2 Summa Canisters are stored at ambient temperature.

7.0 INTERFERENCES

7.1 High CO2 samples such as landfill gas may freeze and restrict flow on the traps causing reduced sample volume.

7.2 Common laboratory solvents such as methylene chloride, ethanol, hexane, iso-propanol, freon-113 and acetone may be detected at low level concentrations. The values qualified with a “B” if they are also detected in the method blank.

7.3 Isopropanol and Ethanol(as described in TO15 NJDEP-LL)

7.3.1 High concentrations of isopropanol and ethanol in indoor air samples are causing laboratories to conduct unnecessary dilutions of samples. These two alcohols are present in numerous products found in residences and businesses. Ethanol is also a gasoline additive. This is one source of the elevated levels of the alcohols in the samples.

7.3.2 The commercial gas suppliers are routinely adding these two compounds to the standard gas mixtures; therefore, if the compounds are in the standards, the concentrations of the compounds must be reported in the samples. Ethanol has been reported by the standard manufacturers not to be stable within the standard mixtures.

7.3.3 Isopropanol is used as tracer gas compounds for soil gas analysis. The presence of this compound in soil gas samples may be an indication that the seal around the tubing was not tight. However, the presence of these compounds in soil gas when the alcohols were not used as the tracer gas may be indication of another source of contamination.

7.3.4 If these compounds are of concern at site, then this method may not be appropriate for the reporting of these compounds and a different method will be proposed. Laboratory certification will be required for any proposed method.

7.3.5 The laboratory is not required to dilute the sample to bring the concentration of the two alcohols compounds within the calibration range of the instrument.

8.0 APPARATUS

8.1 Hewlett Packard 5890 series II GC with 5971 MSD,

8.2 Agilent 6890 GC with 5973 MSD.

8.3 Agilent 6890 and 7890A GC with 5975 MSD

8.4 PC based Hewlett Packard Chemstation with Enviroquant software.

8.5 Entech model 7016CA 16-position canister autosampler.

8.6 Entech model 7100 pre-concentrator.

8.7 30”Hg-30psig “NIST” traceable pressure/vac gauge, accurate to 0.25%, for sample receipt check and pressurization, if necessary.

8.8 1- Liter certified (as per SOP EAT002) “mini” canisters or silcocans evacuated to under 0.05mm Hg.

8.9 6- Liter certified (as per SOP EAT002) passivated summa canisters or silcocans evacuated to under 0.05mm Hg. A separate group must be maintained for method blank analysis

8.10 Passive flow controllers equipped with particulate filter – Entech CS1200 or equivalent

8.11 Flow controller critical orifices for varying sampling time ranges (see table 10).

8.12 Digital Flow Meter for flow controller calibration

8.13 Various gas tight syringes for standard and sample dilutions.

8.14 Various swagelok fittings.

8.15 Syringe adapters for summa canisters if manual injection or dilution needed.

8.16 Tedlar Bags – for secondary sample dilutions.

9.0 STANDARDS AND REAGENTS

The manufacturer brands listed may be substituted with equivalent standards. Refer to table 5 for a list of compounds in the TO-14 reporting list, TO-15 reporting list, and add-on compounds.

9.1 Spectra Gases certified internal/surrogate gas standard at the following concentrations.

- Bromochloromethane 40ppbv
- 1,4-Difluorobenzene 40ppbv
- Chlorobenzene-d5 40ppbv
- 4-bromofluorobenzene 40ppbv

9.2 Spectra Gases certified 1ppmv TO-15 stock gas standard.

9.3 Spectra Gases certified 1ppmv second source TO-15 stock gas standard (for LCS)

9.4 Spectra Gases 1ppmv Napthalene gas standard with 3ppmv Bromoform as a stabilizer.

9.5 Absolute Standards 1000 ug/ml naphthalene standard in methanol.

9.6 Reagent grade organic free water.

9.7 Air Gas brand Ultra Zero Grade air

9.8 Air Gas brand Ultra High Purity (UHP) helium

9.9 Air Gas liquid nitrogen Dewar

9.10 Standards dilution canister preparation

9.10.1 All canisters must be certified and under full vacuum.

9.10.2 Make sure sampling valve is closed. Using a wrench, remove the protective swagelok cap exposing the ¼” threaded sampling port.

9.10.3 Add 80ul of organic free reagent grade water into the threaded port of the evacuated 6-Liter canister and attach a syringe adaptor for standard introduction.

9.11 Stock gas standard preparation

9.11.1 Place the stock gas standard cylinder of interest in or near the evacuation hood and attach syringe adaptor to gas regulator.

9.11.2 Turn on stock standard valve and regulate delivery pressure to approximately 5psig and let purge for a few seconds.

9.11.3 Attach gas tight standard syringe and draw a full volume to rinse. Expel contents under the hood and proceed to standard concentration of interest.

9.12 Calibration Standards

9.12.1 **<u>40ppbv "standard" compound list</u>**

9.12.1.1 With a 500cc gas tight syringe, measure 400cc of the 1ppm stock standard.

9.12.1.2 Attach the syringe to a prepared 6-Liter canister.

9.12.1.3 Open the sampling valve and draw in the entire 400 cc.

9.12.1.4 Close the valve and remove the syringe adaptor.

9.12.1.5 Attach a zero air supply to the canister equipped with a fine metering regulator and a NIST vacuum/pressure gauge.

9.12.1.6 Adjust the air pressure regulator to 9.8psig and slowly open the canister sampling valve only enough to hear the air draw but keeping a positive reading on the NIST gauge reading from dipping below 0 psig.

9.12.1.7 The final pressure of 9.8psig equates to an actual volume of 10-liters in a 6-liter canister.

9.12.1.8 Once the pressure equilibrates, first close the canister valve and then the air supply.

9.12.1.9 Let standard equilibrate for 30 minutes prior to use.

9.12.2 **<u>2ppbv "standard" compound list</u>**

9.12.2.1 With a 500cc gas tight syringe, measure 500cc of the 40ppbv standard that is equipped with a syringe adaptor.

9.12.2.2 Follow the remaining steps outlined in 9.12.1.2 through 9.12.1.9

9.12.3 **<u>0.4ppbv "standard" compound list</u>**

9.12.3.1 With a 500cc gas tight syringe, measure 100cc of the 40ppbv standard that is equipped with a syringe adaptor.

9.12.3.2 Follow the remaining steps outlined in 9.12.1.2 through 9.12.1.9

9.12.4 **<u>0.1ppbv "standard" compound list</u>**

9.12.4.1 With a 500cc gas tight syringe, measure 1cc of the 1ppm standard that is equipped with a syringe adaptor.

9.12.4.2 Follow the remaining steps outlined in 9.12.1.2 through 9.12.1.9

9.13 Blank Spike (BS)Laboratory Control Standard (LCS)

9.13.1 **<u>40ppbv BS standard</u>**

9.13.4.1 Follow the same procedure as 9.12.1 using the 1ppmvBS stock standards.

9.13.4.2 100cc of this standard is used for an equivalent 10ppbv BS.

9.14 Method Blank

9.14.1 A separate stock of canisters is maintained for use exclusively as method blanks. These canisters are not to be used for field sampling.

9.14.2 Inject approximately 80ul of organic free reagent water into the threaded port of an evacuated 6-Liter canister. Do not open valve as the water will be drawn in when the zero air is attached.

9.14.3 A 6 liter evacuated canister is filled and pressurized to approximately 15 psig with zero grade air.

9.15 Working Standards Storage Period

9.15.2 Any working standards or LCS must not be used after 30 days from preparation or of the stock standard expiration date if this date is sooner. An expiration date of 30 days after the preparation date must me documented on the standards tag and standards logbook.

10.0 SUMMA CANISTER HANDLING

10.1 Canister Cleaning and Certification – Refer to SGS Accutest Laboratories SOP EAT002

10.2 Canister Shipping

10.2.1 Record prepared certified summa canister (Refer to SOP EAT002) and vacuum in canister logbook. Vacuum must be recorded to the nearest 0.2” hg Vacuum.

10.2.2 Grab samples are summa canisters without flow controllers taking about 20 seconds to fill.

10.3 Flow Controller Calibration

10.3.1 For integrated sampling, a canister must be equipped with a clean calibrated detachable flow controller.

10.3.2 Select and install the appropriate critical orifice (table 10) that corresponds to the desired sampling period.

10.3.3 The flow controller is calibrated by attaching it to a clean summa canister under vacuum and adjusting the flow control calibrator while measuring the flow in cc/min with a flow meter.

10.3.4 Slight vacuum (1 to 8”Hg) remains in the canister after sampling to indicate a consistent sampling event. Therefore the flow controller is calibrated at a rate not to completely fill the canister.

10.3.5 For a 24 hour sample, a flow of 3.8cc/min theoretically fills a 6-Liter canister with 5.47 liters of sample (3.8cc/min)(60min)(24 hr).

10.4 Canister Receipt

10.4.1 Upon receipt of the canister, the pressure or vacuum must be checked to ensure proper sampling was performed. If excessive vacuum (>15” Hg) is measured the client is notified to inquire about the shortened sampling period and re-sampling.

10.4.2 The pressure or vacuum along with received date and lab sample number must be recorded in the canister logbook to the nearest 0.2 “hg vacuum or 0.2 psig if under positive pressure.

10.4.3 Canisters received at greater than or equal to 8” Hg vacuum, must be pressurized to ensure sample draw with the diaphragm pump.

10.4.4 Canisters pressurized upon receipt must not exceed 6.5 Liters total. Refer to the “Canister Pressurization Calculation” in table 6.

10.4.5 If a flow controller was supplied, the flow must be verified upon receipt and recorded in the logbook.

10.5 Canister Retention Time

10.5.1 Canisters that are shipped from the lab are no longer considered as being stored under controlled conditions. A 15 day period is the maximum allowed field holding period.

10.5.2 All canisters transferred out of controlled storage must be returned to the lab for recleaning and certification. This requirement applies to canisters that were not used for sampling, but were stored in an uncontrolled environment.

10.5.3 In-house canister retention time. Once the canisters have undergone the final evacuation as detailed in SOP EAT002, they may be stored in the laboratory for 2 months.

11.0 CALIBRATION

11.1 Entech Autosampler/ Concentrator conditions

11.1.1 7016CA autosampler Valve: 100^{o}C

11.1.2 Transfer Line: 80^{o}C

11.1.3 7100 Concentrator

	Internal	Standard	Sample	Sweep Gas	Transfer
Preflush (sec)	5	2	15	5	-
Flow Rate (sccm)	100	150	150	100	15
Vol (cc/min)	100	varies	varies	75	40

Note: the mass flow controller may have a false reading in standby, as in 5 or 6. The trapping cc/min must be increased by this amount as per the manufacturer (100 must be set at 105 or 106 in this case).

	Trap	Preheat	Desorb	Bake
Module 1	-150 °C	20 °C	20 °C	150 °C/ 10 min
Module 2	-10 °C	no	180 °C	190 °C/ 3.5 min
Module 3	-150 °C	100 °C	4.5min	100 °C/ 3min

GC/MS Transfer line 100 °C

Total event cycle time 35 min

11.2 GC Conditions

11.2.1 Hewlett Packard 5980 or Agilent 6890 gas chromatograph.

11.2.2 Column – Restek 60 meter RTX-1, 0.25mm id, 1.0 um film thickness.

11.2.3 Helium carrier gas at approx. 12psig column head pressure.

11.2.4 GC Temperatures:

Injection port 120 °C

Detector 280 °C

Oven 40 °C held for 5min
8 °C /min to 210 °C and held for 0.0min
25 °C/min to 260 °C and held for 3.0min

Total runtime 29.25 min

Electronic Pressure Control: Constant Flow at 1.4cc/min

Purge Valve Off at 1.00 min

11.2.5 Optimize GC conditions for compound separation and sensitivity. Baseline separation of benzene and carbon tetrachloride is an indication of acceptable chromatographic performance.

11.3 Mass Spectrometer Conditions

11.3.1 Hewlett Packard 5971, Agilent 5973, or Agilent 5975 MSD with linear quadrupole.

11.3.2 Scan from 35-300 amu every 1.0 seconds or less utilizing a 70 volt (nominal) electron energy in the electron impact ionization mode.

11.3.3 Set baseline noise threshold to 250 with a solvent delay of approximately 3.3 minutes or just before the elution of propylene.

11.3.4 Mass spectrum must meet all the criteria in Table 1 when injecting 100cc of 20ppbv 4-Bromofluorobenzene (BFB). This is equivalent to 5ppbv when considering a 400cc nominal volume.

11.4 Data System

11.4.1 A computer system containing the latest compatible version Hewlett Packard chemstation software interfaced to the mass spectrometer.

11.4.2 Set the data acquisition mode method to the conditions described in 12.3.
The software performs continuous acquisition and storage on machine- readable media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.

11.4.3 The data analysis mode method defines each compound retention time, characteristic ions (table 4), and calibration to identify and quantify each compound in the data file.

11.4.4 The quantitation is performed by internal standard option using multi-point calibration and multipoint internal standards.

11.4.5 The NIST mass spectral library (75,000 compounds) is used for non- target peak tentative identification.

11.5 Daily BFB system performance tuning.

11.5.1 The 40ppbv internal standard and 40ppbv surrogate is attached to the internal standard port of the Entech 7100 utilizing flushed 1/8” copper tubing.

11.5.1.1 The BFB standard is prepared in humidified zero air.

11.5.2 100cc of this standard is sampled which is equivalent to 5ppbv of BFB.

11.5.3 The GC/MS and Entech concentrator conditions are the same as in section 11.1-11.3.

11.5.4 Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background.

11.5.4.1 Select the scans at the peak apex and one to each side of the apex.

11.5.4.2 Calculate an average of the mass abundances from the three scans.

11.5.5 Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peaks and no more than 20 scans prior to the elution of BFB. The background subtraction is designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning. Spectra of the background subtracted BFB peak must be checked to verify acceptable performance criteria are achieved (see Table 1).

11.5.6 This performance test must be passed before any samples, blanks, or standards are analyzed.

11.5.7 If all the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are met.

11.5.8 The injection time of the acceptable tune analysis is considered the start of the 24-hour clock.

11.6 Initial Calibration

11.6.1 All volumes are calculated based on a nominal volume of 400cc.

11.6.2 A multi-level calibration is performed utilizing 0.04, 0.1, 0.2, 0.5, 5, 10, 20, and 40 ppbv. For Selective Ion Monitoring (SIM) analysis the initial calibration curve uses lower concentration standards than normal analysis. Typical ICAL levels are 0.001, 0.005, 0.01, 0.02, 0.05, 0.1,and 0.2ppbv

11.6.2.1 The 0.2ppbv standard, with the exception of propylene and ethanol, must be part of the calibration curve to satisfy the reporting limits. The propylene and ethanol curves must contain the 0.5ppbv.

11.6.2.2 Saturation may occur on some of the highly polar compounds (alcohols, 1,4-dioxane) that may require removing of the 40ppbv standard from the calibration curve in order to meet criteria.

11.6.2.3 A minimum of 5 calibration points must be used for each compound.

11.6.2.4 A 0.04ppbv may be analyzed for limited projects and limited compounds upon client request.

11.6.3 The 0.4, 2.0 and 40ppbv calibration standards are attached to sample ports on the Entech 7100.

11.6.4 Considering a nominal volume of 400cc, volumes of 40cc and 100cc are sampled from the 0.4ppbv standard (9.12.3) for the 0.04 and 0.1 standards respectively. Volumes of 40cc and 100cc are sampled from the 2ppbv standard (9.12.2) for the

0.2 and 0.5, standards. Volumes of 50, 100, 200 and 400 are sampled from the 40ppbv standard (9.12.1) for the 5, 10, 20, and 40ppbv.

11.6.5 For Selective Ion Monitoring (SIM) analysis considering a nominal volume of 400cc using the 0.1 ppb standard (9.12.4) use volumes of 800cc, 400cc, 200cc, 80cc, 40cc and 20cc for the 0.2, 0.1, 0.05, 0.02, 0.01, 0.05ppbv standards, and 40cc of the 0.01ppbv standards for the 0.001ppbv standard.

11.6.6 Internal standard/ surrogate- volume is 100cc of the stock standard (8.1) for all standards, samples and quality control resulting in a 10ppbv internal standard and 5ppbv surrogate standard concentration.

11.6.7 Detector Saturation - Occasionally, several compounds in higher concentration standards exhibit chromatographic peak saturation. Unsymmetrical peaks that initially appear to be symmetrical that exhibit a perpendicular drop to the baseline are characteristic of peak saturation. The apex of a saturated peak looks abnormal and may exhibit a plateau. Saturated chromatographic peaks must not be used in the calibration curve and must be eliminated from the calibration. This results in decreased concentration for the upper calibration range limit.

11.6.8 The Relative Response Factor (RRF) is calculated for each compound at every standard level.

11.6.9 Mean Relative Response Factor - Calculate the average of the values obtained at the five concentrations.

11.6.10 Percent Relative Standard Deviation (% RSD) is calculated for all calibration levels

11.6.11 Calculate the Relative Retention Time (RRT) for each target compound over the initial calibration range.

11.6.12 Mean Relative Retention Time- Calculate the mean of the relative retention times for each analyte target compound over the initial calibration range.

11.6.13 The following criteria must be met for the initial calibration to be valid.

11.6.13.1 The percent relative standard deviation must be less than 30 %, with the exception of naphthalene.

11.6.13.2 Up to two compounds may exceed 30% but must be less than 40% for a valid initial calibration, with the exception of naphthalene.

11.6.13.3 The relative retention time for each target compound at each calibration level must be within 0.06 RRT units of the mean relative retention time for the compound.

11.6.13.4 The area response of each calibration level must be within 40% of the mean area response over the initial calibration range for each internal standard.

11.6.13.5 The retention time shift for each of the internal standards at each calibration level must be within 20 seconds (0.33 minutes) of the mean retention time over the initial calibration range for each internal standard.

11.6.13.6 If the acceptance criteria are not met due to peak saturation the high standard can be dropped for that compound, but a minimum of 5 standards must be used. This will lower the upper calibration range and may require additional dilutions. If a particular standard(s) are the cause of the failure, rerun that standard(s) one time only. If this fails then the calibration curve must be rerun.

11.7 Continuing calibration

11.7.1 A continuing calibration check standard is analyzed at 10ppbv, which is equivalent to 100cc of the 40ppbv standard. Calibration checks must be acquired every 24 hrs.

11.7.2 A 10ppbv naphthalene standard is analyzed every 24 hours when samples are requested for naphthalene. A 10ppbv standard is equivalent to 100cc of the 40ppbv naphthalene standard.

11.7.3 The percent difference (%D) for all continuing calibration compounds must be less than 30%.

11.7.4 If the continuing calibration check fails to meet the criteria, it is repeated one time. If it fails a second time, corrective action is taken and two consecutive CCVs must pass in order to continue with sample analysis or a new initial calibration must be performed.

11.7.4.1 Corrective Action may include but is not limited to: tuning the instrument, cleaning the source, changing or clipping the column. All maintenance must be recorded in the maintenance logbook.

11.7.4.2 If retuning is performed due to a first failed CCV, the BFB may be reported out of the second CCV run.

11.8 Initial Calibration Verification (ICV) Second Source Standard

11.8.1 Prepare the second source calibration check standards from separate sources of stock standards from the calibration curve. An ICV must be analyzed immediately after each initial calibration.

11.8.1.1 The percent difference (%D) for all target compounds must be less than 30 % for all compounds.

11.8.1.2 The ICV acceptance criteria must be met before any samples are analyzed. If there are compounds outside of the acceptance criteria, samples may be analyzed if these compounds are nontarget.

11.9 TO-15 SIM analysis

11.9.1 For SIM analysis, the Scan Parameters are changed. Scanning windows are established in the instrument run method which uses a minimum of one target ion and one secondary ion for each target analyte. Appropriate time is allowed for the elution of each peak of interest.

11.9.2 Initial Calibration is performed using concentrations of 0.001, 0.005, 0.01, 0.02, 0.05, 0.1 and 0.2ppb. For SIM compounds the % RSD must be less than or equal to 30%.

11.9.3 Prepare the second source calibration check standards from separate sources of stock standards from the calibration curve. An ICV must be analyzed immediately after each initial calibration. The ICV must be analyzed at a concentration of 0.05 ppbv.

11.9.3.1 The percent difference(%D) for all SIM compounds on the must be less than 30 %.

11.9.3.2 If the ICV fails to meet the criteria then the compounds that failed must not be reported for that Initial Calibration.

11.9.4 A continuing calibration check standard is analyzed at 0.05 ppbv Calibration checks must be acquired every 24 hrs.

11.9.4.1 The percent difference (%D) for all continuing calibration compounds must less than 30%.

11.9.4.2 If the continuing calibration check fails to meet the criteria, it is repeated one time. If it fails a second time, corrective action is taken and a new initial calibration must be performed.

12.0 SAMPLE ANALYSIS

12.1 Internal Standard

12.1.1 100 cc of the internal/ surrogate standard is equivalent to 10ppbv that is added to all standards, samples and QC.

12.1.2 If any of the internal standard areas change by greater than +/-40% or retention time changes by more than 0.33 minutes from the last daily calibration check standard the mass spectrometer must be inspected for malfunctions and corrections be made, as appropriate.

12.2 Method Blank

12.2.1 A separate stock of canisters is maintained for use exclusively as method blanks. These canisters are not to be used for field sampling.

12.2.2 To monitor for possible laboratory contamination, laboratory method blanks are analyzed at least once in a 24-hour analytical sequence. All steps in the analytical procedure are performed on the blank

12.2.3 A volume of 400cc is sampled from the method blank as prepared in 10.5. This volume is the most dilution air that could be added to any sample to verify the dilution air source along with the procedure is non-detect for all compounds.

12.2.4 Method blanks are analyzed and evaluated before any samples can be run and must be less than the MDL for all target compounds. The surrogate must meet the generated in-house acceptance criteria in LIMS. Occasionally, lab background such as isopropanol cannot be fully eliminated and is flagged appropriately in any samples

.

12.2.5 If the method blank fails to meet these criteria the source of contamination must be determined and the method blank be rerun before any samples are run.

12.3 Blank Spike (BS) and Blank Spike Duplicate (BSD).

12.3.1 A Blank Spike (BS) is prepared to contain 40ppbv each analyte .100 cc of the BS is sampled in duplicate BSD for a 10ppbv.

12.3.2 Percent recoveries (% R) (see section 14.2) must fall within 70-130%. All of the compounds must be within acceptable ranges with one exception. The BS is acceptable if a few compounds have a bias high recovery as long as no hits are reported in associated samples.

12.3.3 Relative Percent Difference (RPD) (see section 14.3) must be less than or equal to 25%. All of the compounds reported as target compounds must be within acceptable ranges.

12.3.4 If laboratory control samples do not meet criteria, calculations are checked. A new BS must be prepared and analyzed and possibly a new calibration if the problem isn't rectified.

12.4 Sample analysis – General

12.4.1 Unknown samples are screened by the TO-3/PID/FID system or a GC/MS system dedicated to screening.

12.4.2 A sample volume of 400cc at ambient temperature and pressure is standard for analysis to achieve the reporting limits required. Smaller sample amounts down to 20 cc can be sampled accurately with the concentrators mass flow controller.

12.4.3 Sample volumes are adjusted accordingly (table 6) when canisters are received with excess vacuum and require dilution air (8.7) in order for the concentrator to draw an accurate volume.

12.4.4 Samples requiring further dilution beyond the minimum 20cc (greater than 20X) that can be sampled from the primary sample canister are prepared as secondary dilutions in additional canisters or tedlar bags. This practice is commonly used for soil vapor samples.

12.4.5 Secondary dilution information is recorded in the secondary dilution log (table 7).

12.5 Summa canister sample analysis

12.5.1 Check canister pressure and document upon laboratory receipt.

12.5.2 The canister is pressurized upon receipt if excessive vacuum remains at receipt (>/=8 "Hg). If the canister is pressurized, the sampling volume must be adjusted to compensate for the dilution. Refer to the "Canister Pressurization Calculation" in Table 6.

12.6 Sample Dilution

12.6.1 Less sample volume can be designated by the concentrator software down to 20cc. With normal volume being 400cc, this would result in a 1:20 dilution. Further dilutions require a dilution into a secondary vessel.

12.6.2 To manually draw a volume out of a canister, positive canister pressure is required.

12.6.3 To perform a secondary dilution, the canister vacuum at the time must be recorded. This vacuum varies from the received vacuum if sample has already been drawn.

12.6.4 Record the vacuum in the “Canister Secondary Dilution” log. Refer to table 7.

12.6.5 When pressurizing the canister for a manual sample draw, the volume of a 6-Liter canister must not exceed 6.5-Liters. Refer to Table 8 for the proper pressurization.

12.6.6 A measured volume of the newly pressurized original canister is drawn out with a gas-tight syringe and introduced into a secondary vessel (6-Liter, 1-Liter canister or 1-Liter tedlar bag). The secondary vessel is diluted with zero grade air.

12.6.7 The final sample dilution factor (DF) is calculated by (original canister dilution factor) x (secondary vessel dilution factor) x (instrument dilution factor). The instrument dilution factor is the nominal volume of 400cc/ amount of sample introduced by the auto sampler. An example calculation of a final sample multiplier is as follows;

12.6.7.1.1 Original canister is pressurized to a factor of 1.2

12.6.7.1.2 The amount introduced to the dilution vessel results in an additional factor of 10

12.6.7.1.3 The autosampler introduces 40cc from the secondary vessel for an additional factor of 400/40 = 10

12.6.7.1.4 Final sample multiplier = 1.2 x 10 x 10 = 120

13.0 QUALITY CONTROL

QC Requirements Summary:

BFB.	Every 24 hrs.
Initial Calibration(IC)	As needed
Calibration Check Std(CCV).	Every 24 hrs.
Initial Calibration Verification (ICV)	After every IC
Batch blank	Every 24 hrs.
Matrix Duplicate	one per 20 samples
Blank Spike (BS)	one per 20 samples
Blank Spike Duplicate (BSD)	one per 20 samples
Surrogate	every sample and standard.
Internal Standard	every sample and standard.

13.1 Daily GC/MS Performance Check - refer to section 11.5.

13.2 Initial Calibration - Refer to section 11.6.

13.3 Continuing Calibration Check - refer to section 11.7.

13.4 Method Blank (zero grade air) at 400 cc - refer to section 12.2.

13.5 Blank Spike (BS)) - refer to section 12.3.

13.6 Matrix Duplicate.

13.6.1 One sample is selected at random. Calculate the Relative Percent Difference for all hits.

13.6.2 Evaluate the RPD of target hits versus the limit of 25%. If the RPD does not meet this limit and matrix interference is suspected, no further action is required.

13.7 Surrogate

13.7.1 All blanks, samples, and matrix spikes contain surrogate compounds that are used to monitor method performance. All samples are spiked with 100cc of the internal/surrogate standard that is equivalent to 5ppbv of 4-Bromofluorobenzene.

13.7.2 If the % recovery of 4-Bromofluorobenzene does not meet the control limits generated in house, the recovery must be flagged and:

13.7.2.1 The calculation must be checked.

13.7.2.2 The sample must be reanalyzed to verify recovery of the surrogate is out of control limits due to apparent matrix interference.

13.7.3 If surrogate recoveries are acceptable upon reanalysis, the data from the reanalysis is reported. If the reanalysis date did not meet the hold time, then both sets of data are submitted with the reanalysis reported.

13.7.4 If surrogates are still outside control limits upon reanalysis, then both sets of data must be submitted for confirmation with the first analysis reported.

13.8 Internal Standard.

13.8.1 Retention time for all internal standards must be within $\pm$ 0.33 minutes (20 seconds) of the corresponding internal standard in the latest continuing calibration or 10ppbv standard of initial calibration.

13.8.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within +/-40 % of the corresponding area in the latest calibration standard (24 hr. time period).

13.8.3 If area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed at the same concentration unless matrix interferences are visibly present in the chromatogram, then a smaller volume is analyzed.

13.8.4 If areas are acceptable upon reanalysis, the reanalysis data is reported.

13.8.5 If areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported.

14.0 CALCULATIONS

14.1 Concentration (Conc.)

$$C_x = \frac{A_x C_{is} DF}{A_{is} \overline{RRF}}$$

where: C_x = Compound concentration, ppbv.

A_x = Area of the characteristic ion for the compound to be measured, counts.

A_{is} = Area of the characteristic ion for the specific internal standard, counts.

C_{is} = Concentration of the internal standard spiking mixture, ppbv

$\overline{RRF}$ = Mean relative response factor from the initial calibration.

DF is the dilution factor as described in 12.6.7

14.2 Percent Recovery (% R)

$$\%\ R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

14.3 Relative Percent Difference (RPD)

$$RPD = \frac{|\ SC - SDC\ |}{(1/2)\ (SC+SDC)} \times 100$$

Where: SC = Sample Concentration
SDC = Sample Duplicate Concentration

14.4 Relative response factor (RRF)

$$RRF = \frac{As \times Cis}{Ais \times Cs}$$

Where: As = Area of the characteristic ion for the compound being measured.

Ais = Area of the characteristic ion for the specific internal standard.

Cs = Concentration of the compound being measured (ppbv).

Cis = Concentration of the specific internal standard (ppbv).

14.5 Mean Relative Response Factor

$$\overline{RRF} = \sum_{i=1}^{n} \frac{x_i}{n}$$

where:

$\overline{RRF}$ = Mean relative response factor.
xi = RRF of the compound at concentration i.
n = Number of concentration values, (5 to 7 points in curve).

14.6 Percent relative Standard Deviation (%RSD)

$$\%RSD = \frac{SD_{RRF}}{\overline{RRF}} \times 100$$

and

$$SD_{RRF} = \sqrt{\sum_{i=1}^{N} \frac{(RRF_i - \overline{RRF})^2}{N - 1}}$$

where: SD_{RRF} = Standard deviation of initial response factors (per compound).

RRF_i = Relative response factor at a concentration level i.

$\overline{RRF}$ = Mean of initial relative response factors (per compound).

14.7 Relative Retention Time (RRT)

$$RRT = \frac{RT_c}{RT_{is}}$$

where: RT_c = Retention time of the target compound, seconds
RT_{is} = Retention time of the internal standard, seconds.

14.8 Mean Relative Retention Time

$$\overline{RRT} = \sum_{i=1}^{n} \frac{RRT}{n}$$

where: $\overline{RRT}$ = Mean relative retention time for the target compound for each initial calibration standard.
RRT = Relative retention time for the target compound at each calibration level.

14.9 Percent Difference (%D)

$$\%D = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

where: RRF_c = RRF of the compound in the continuing calibration standard.
$\overline{RRF_i}$ = Mean RRF of the compound in the most recent initial calibration.

15.0 DOCUMENTATION

15.1 The Analytical Logbooks records the analysis sequence; the logbook must be completed daily. Each instrument has a separate logbook.

15.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in the comment section.

15.2 The Standards Preparation Logbook must be completed for all standard preparations. All information must be completed. The page must be signed and dated by the appropriate person.

15.2.1 The SGS Accutest lot number must be cross-referenced on the standard canister.

15.3 Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

15.4 Canister Shipping and Receiving Logbook must be completed.

16.0 DATA REVIEW & INTERPRETATION

16.1 Qualitative identification

16.1.1 Analyst shall identify the targeted compounds by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound. The criteria required for a positive identification are:

16.1.2 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criteria are the RRT of sample component must be within ± 0.06 RRT units of the standard.

16.1.3 All ions present in the standard mass spectra at a relative intensity greater than 10 % (major abundant ion in the spectrum equals 100 %) must be present in the sample spectrum.

16.1.4 The relative intensities of these ions must agree within ± 30 % between the daily standard and sample spectra. (Example: For an ion with an abundance of 50 % in the standard spectra, the corresponding sample abundance must be between 20 and 80 %. Matrix interferences may skew ion ratios where criteria are exceeded. In this case, analyst's judgment with supervisor's approval is required.

16.1.5 Structural isomers (dichlorobenzenes, trimethylbenzenes, and o-xylene) that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25 % of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs (m,p-xylene).

16.2 Quantitative analysis

16.2.1 When a target compound has been identified, concentration (see section 16.1) is based on the integrated area of the primary quantitation ion (see Table 4).

16.2.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate (see Table 4). This is characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. If a secondary ion is used for quantitation, new calibration response factors must be generated for this secondary ion.

16.2.3 Targets will be reported down to the MDL, with the following exceptions: Methylene chloride, ethanol, hexane, isopropanol, and acetone. These compounds will be reported to the RL in samples, blanks, and canister cert blanks to account for lab background levels.

16.3 Library search for tentatively identified compounds.

If a library search is requested, the analyst performs a forward library search of NIST mass spectral library to tentatively identify 15 non-reported compounds. Guidelines for making tentative identification are listed below.

16.3.1 These compounds must have a response greater than 10 % of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).

16.3.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.

16.3.3 Molecular ions present in the reference spectrum must be present in the sample spectrum.

16.3.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) must be present in the sample spectrum.

16.3.5 The relative intensities the major ions must agree within ± 20 %.

16.3.6 Ions present in the sample spectrum but not in the reference spectrum are reviewed for possible background contamination or presence of co-eluting compounds.

16.3.7 Ions present in the reference spectrum but not in the sample spectrum are verified by performing further manual background subtraction to eliminate the interference created by co-eluting peaks and/or matrix interference.

16.3.8 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.

16.3.9 Quantitation is performed on the nearest internal standard.

17.0 POLLUTION PREVENTION & WASTE MANAGEMENT

17.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 17.2.

17.2 Waste Management. All laboratory waste must be managed, accumulated, and disposed in accordance with all federal or state laws and regulations. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

17.2.1 Non hazardous aqueous wastes.
17.2.2 Hazardous aqueous wastes
17.2.3 Chlorinated organic solvents
17.2.4 Non-chlorinated organic solvents
17.2.5 Hazardous solid wastes
17.2.6 Non-hazardous solid wastes

18.0 METHOD AND OTHER SOP REFERENCES

18.1 USEPA METHOD TO-15, 2nd edition, 03/18/1999 “Methods for the Determination of Toxic Organic Compounds in Air”

18.2 SGS Accutest SOP EAT002 – “Canister Cleaning and Certification SOP”

18.3 TO15 NJDEP Low Level

TABLE 1

BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
50	8-40% of mass 95
75	30-66% of mass 95
95	Base peak, 100% relative abundance
96	5-9% of mass 95
173	< 2% of mass 174
174	> 50% and <120% of mass 95
175	4-9% of mass 174
176	>93% and <101% of mass 174
177	5-9% of mass 176

TABLE 2

INTERNAL STANDARD IONS

Internal Standard	Prim/Sec. Ions
Bromochloromethane	128 / 49, 130, 51
1,4-Difluorobenzene	114 / 63,88
Chlorobenzene-d5	117 / 82, 119

TABLE 3

OMITTED

TABLE 4
TARGET COMPOUND IONS

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Acetone	58	43
Benzene	78	77, 52
Benzyl chloride	91	126, 65
1,3-Butadiene	39	54, 53
Bromodichloromethane	83	85, 122
Bromoform	173	175, 254
Bromoethene	106	108, 81
Bromomethane	94	96, 95
Carbon disulfide	76	78, 44
Carbon tetrachloride	117	119, 121
Chlorobenzene	112	77, 114
Cyclohexane	84	56, 69
Chloroethane	64	66, 49
Chloroform	83	85, 47
Chloromethane	50	52, 32
Chlorotrifluoroethene	116	118,85
3-Chloropropene	76	41, 39, 78
2-Chlorotoluene	91	126, 63
Dibromochloromethane	129	127, 31
1,2-Dibromoethane	107	109, 88
1,2-Dichlorobenzene	146	111, 148
1,3-Dichlorobenzene	146	111, 148
1,4-Dichlorobenzene	146	111, 148
Dichlorodifluoromethane	85	87, 50
1,1-Dichlorethane	63	65, 83
1,2-Dichloroethane	62	64, 98
1,1-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61,98
Trans-1,2-Dichloroethene	96	61, 98
1,2-Dichloropropane	63	65
1,4-Dioxane	88	57, 58, 43
cis-1,3-Dichloropropene	75	77, 39
Trans-1,3-Dichloropropene	75	77, 39
Ethanol	45	46, 42
Ethyl Acetate	43	61,88
4-Ethyltoluene	105	120, 91
Ethylbenzene	91	106, 77
Freon 113	151	101, 103
Freon 114	85	135, 87
Freon 123a	117	67,85
Hexachlorobutadiene	225	223, 227
Heptane	43	71, 57

TABLE 4-CONTINUED
TARGET COMPOUND IONS

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Hexane	57	47, 41
2-Hexanone	43	58,100
Isopropyl Alcohol	45	43, 59
Methyl-t-butyl ether	73	57,43
Methylene chloride	84	86,49
Methyl ethyl ketone	72	43, 57
Propylene	41	39, 42
Styrene	104	78, 103
Tetrahydrofuran	42	71, 72
1,2,4-Trichlorobenzene	180	182, 145
1,1,2,2-Tetrachloroethane	83	85, 131
Tetrachloroethene	164	129, 131, 166
Toluene	92	91, 65
1,1,1-Trichloroethane	97	99, 61
1,1,2-Trichloroethane	83	97, 85
Trichloroethene	95	97, 130, 132
Trichlorofluoromethane	101	103, 105
1,2,4-Trimethylbenzene	105	120, 119
1,3,5-Trimethylbenzene	105	120, 119
2,2,4-Trimethylpentane	57	56, 99
Vinyl acetate	43	86, 44
Vinyl chloride	62	64, 61
o-Xylene	106	91, 77
m-Xylene	106	91, 77
p-Xylene	106	91, 77
Pentane (1)	42	41, 57
Nonane (1)	43	71, 128
Isopropylbenzene(Cumene)	105	120, 77
Tertiary Butyl Alcohol	59	41, 43
Naphthalene	128	127,129
Acrylonitrile	52	53
Acetonitrile	41	40
n-Butylbenzene	134	91
n-Propylbenzene	120	105
1,1,1,2 Tetrachloroethane	131	95
Total Volatiles as Pentane	Total Peak Area	
Total Volatiles as Heptane	Total Peak Area	
Sec-Butylbenzene	134	105

(1) NELAC accreditation is not offered for this compound.

TABLE 5

REPORTING LIMITS

Compound	TO15 Canister RDL(ppbv)
Propylene	0.5
Freon-12 (Dichlorodifluoromethane)	0.2
Chloromethane	0.2
Freon-114	0.2
Vinyl Chloride	0.2
1,3-Butadiene	0.2
Bromomethane	0.2
Chloroethane	0.2
Carbon Disulfide	0.2
Ethanol	0.5
Acetone	0.2
Freon-11 (Trichlorofluoromethane)	0.2
Isopropyl Alcohol	0.2
1,1-Dichloroethene	0.2
Methylene Chloride	0.2
Freon-113	0.2
Trans-1,2-Dichloroethene	0.2
1,1-Dichloroethane	0.2
Methyl Tertiary Butyl Ether	0.2
Tetrahydrofuran	0.2
Methyl Ethyl Ketone (2-Butanone)	0.2
Cis-1,2-Dichloroethene	0.2
Hexane	0.2
Chloroform	0.2
Ethyl Acetate	0.2
Vinyl Acetate	0.2
1,2-Dichloroethane	0.2
1,1,1-Trichloroethane	0.2
Benzene	0.2
Carbon Tetrachloride	0.2
Cyclohexane	0.2
1,2-Dichloropropane	0.2
Trichloroethylene	0.04
Bromodichloromethane	0.2
1,4-Dioxane	0.2

TABLE 5 (CONT'D)

Compound	TO15 Canister RDL(ppbv)
Heptane	0.2
Cis-1,3-Dichloropropene	0.2
Trans-1,3-Dichloropropene	0.2
1,1,2-Trichloroethane	0.2
Toluene	0.2
Methyl IsoButyl Ketone (2-Hexanone)	0.2
Dibromochloromethane	0.2
1,2-Dibromomethane (EDB)	0.2
Tetrachloroethylene	0.04
Chlorobenzene	0.2
Ethylbenzene	0.2
M,p-Xylene	0.2
o-xylene	0.2
1,1,2,2-Tetrachloroethane	0.2
Bromoform	0.2
Styrene	0.2
4-Ethyltoluene	0.2
1,3,5-Trimethylbenzene	0.2
1,2,4-Trimethylbenzene	0.2
1,3-Dichlorobenzene(m)	0.2
1,4-Dichlorobenzene(p)	0.2
1,2-Dichlorobenzene(o)	0.2
Benzyl Chloride (a-Chlorotoluene)	0.2
1,2,4-Trichlorobenzene	0.2
Hexachloro-1,3-butadiene	0.2
Bromoethene	0.2
3-Chloropropene	0.2
2-Chlorotoluene	0.2
2,2,4-Trimethylpentane	0.2
Pentane	0.2

TABLE 5 (CONT'D)

Compound	TO15 Canister RDL(ppbv)
Nonane	0.2
Isopropylbenzene(Cumene)	0.2
Tertiary Butyl Alcohol	0.2
Naphthalene	0.2
Total Volatiles as Pentane	10
Total Volatiles as Heptane	10
Acrylonitrile	0.2
Acetonitrile	0.2
n-Butylbenzene	0.2
n-Propylbenzene	0.2
1,1,2,2-Tetrachloroethane	0.2
Freon 123a	0.2
Chlorotrifluoroethene	0.2
Sec-Butylbenzene	0.2

TABLE 6

CANISTER PRESSURIZATION CALCULATIONS													
CANISTER PRESSURE RECEIVED						CANISTER FINAL PRESSURE					DILUTION	SAMPLING	
"Hg (vac)	"Hg	Atm	psia	Vol. (L)		"Hg	psia	Vol. (L)	psig		Factor	Volume (cc)	
0.0	29.92	1.00	14.7	6.0		29.92	14.7	6.0	0.0		1	**400**	
0.5	29.42	0.98	14.5	5.9		29.42	14.5	5.9	-0.2		1	**400**	
1.0	28.92	0.97	14.2	5.8		28.92	14.2	5.8	-0.5		1	**400**	
1.5	28.42	0.95	14.0	5.7		28.42	14.0	5.7	-0.7		1	**400**	
2.0	27.92	0.93	13.7	5.6		27.92	13.7	5.6	-1.0		1	**400**	
2.5	27.42	0.92	13.5	5.5		27.42	13.5	5.5	-1.2		1	**400**	
3.0	26.92	0.90	13.2	5.4		26.92	13.2	5.4	-1.5		1	**400**	
3.5	26.42	0.88	13.0	5.3		26.42	13.0	5.3	-1.7		1	**400**	
4.0	25.92	0.87	12.7	5.2		25.92	12.7	5.2	-2.0		1	**400**	
4.5	25.42	0.85	12.5	5.1		25.42	12.5	5.1	-2.2		1	**400**	
5.0	24.92	0.83	12.2	5.0		24.92	12.2	5.0	-2.5		1	**400**	
5.5	24.42	0.82	12.0	4.9		24.42	12.0	4.9	-2.7		1	**400**	
6.0	23.92	0.80	11.7	4.8		23.92	11.7	4.8	-3.0		1	**400**	
6.5	23.42	0.78	11.5	4.7		23.42	11.5	4.7	-3.2		1	**400**	
7.0	22.92	0.77	11.3	4.6		22.92	11.3	4.6	-3.4		1	**400**	
7.5	22.42	0.75	11.0	4.5		22.42	11.0	4.5	-3.7		1	**400**	"Hg(vac)
8.0	21.92	0.73	10.8	4.4		32.33	15.9	6.5	1.2		1.48	**590**	**8.0**
8.5	21.42	0.72	10.5	4.3		32.67	16.0	6.5	1.3		1.53	**610**	**8.5**
9.0	20.92	0.70	10.3	4.2		32.43	15.9	6.5	1.2		1.55	**620**	**9.0**
9.5	20.42	0.68	10.0	4.1		32.16	15.8	6.4	1.1		1.58	**630**	**9.5**
10.0	19.92	0.67	9.8	4.0		31.87	15.7	6.4	1.0		1.60	**640**	**10.0**
10.5	19.42	0.65	9.5	3.9		32.04	15.7	6.4	1.0		1.65	**660**	**10.5**
11.0	18.92	0.63	9.3	3.8		32.16	15.8	6.4	1.1		1.70	**680**	**11.0**
11.5	18.42	0.62	9.0	3.7		32.24	15.8	6.5	1.1		1.75	**700**	**11.5**
12.0	17.92	0.60	8.8	3.6		32.26	15.8	6.5	1.1		1.80	**720**	**12.0**
12.5	17.42	0.58	8.6	3.5		32.23	15.8	6.5	1.1		1.85	**740**	**12.5**
13.0	16.92	0.57	8.3	3.4		32.15	15.8	6.4	1.1		1.90	**760**	**13.0**
13.5	16.42	0.55	8.1	3.3		32.02	15.7	6.4	1.0		1.95	**780**	**13.5**
14.0	15.92	0.53	7.8	3.2		32.64	16.0	6.5	1.3		2.05	**820**	**14.0**
14.5	15.42	0.52	7.6	3.1		32.38	15.9	6.5	1.2		2.10	**840**	**14.5**
15.0	14.92	0.50	7.3	3.0		32.08	15.8	6.4	1.1		2.15	**860**	**15.0**

Note: Dilution factors are typically compensated for by concentrating more sample volume. This results in a quantitation factor of 1.

Calculations: psia(rec) x DF = psia(final)

psia(final) - 14.7 = psig(final)

DF x Volume(rec) = Volume(final) in cc

DF x 400 = Volume(cc) introduced into concentrator for a quant factor of 1

<u>Conversion Equivalents</u>

0"Hg(vac) = 29.9"Hg = 1atm = 14.7psia = 0psig

TABLE 7

CANISTER SECONDARY DILUTION LOG															
ORIGINAL CANISER DILUTION								SECONDARY CANISTER DILUTION							
Date	Initials	SGS Accutest Sample ID	Canister ID	Vacuum in "Hg at time of Dilution	Final Pressure Psig	Dilution Factor		Canister ID	Canister Volume CC	Sample Volume Added CC	Final Pressure psig	Equiv Total Volume CC	Dilution Factor		Final Canister Dilution Factor

Comments:	
Note:	For secondary dilutions into 375cc mincans, a 1psig final pressure is equivalent to a 400cc final volume
Definition:	Final DF = (Original Canister DF) x (Secondary Canister DF)
	Dilution Factor at Instrument = $\frac{\text{(Final Canister Dilution Factor) x (Normal Sampling Volume in cc)}}{\text{(Sample Volume in cc Injected)}}$
Example:	Original Canister is diluted 1.2x for manual sample draw due to the 3" Hg(vac). 40cc from this canister is added to a 375cc minican and brought to 1.0 psig or 400cc equiv volume. This results in an additional dilution of 400/40 or 10. The final canister dilution factor is 1.2 x 10 = 12. From the dilution canister 40cc is injected at the instrument where normal volume is 400cc. This is an additional instrument dilution factor of 10. The final dilution multiplier is 12(from canister dilution) x 10(from instrument dilution) = 120

TABLE 8

SECONDARY DILUTION CONVERSION CHART FOR 6-LITER CANISTERS

INITIAL				FINAL					INITIAL				FINAL			
"Hg (vac)	"Hg	Psia	Vol. (L)	psia	psig	Vol (L)	DF		"Hg (vac)	"Hg	psia	Vol. (L)	psia	psig	Vol (L)	DF
0.0	29.9	14.7	6.0	15.4	0.7	6.30	**1.05**		**7.6**	22.3	11.0	4.5	15.9	1.2	6.49	**1.45**
0.2	29.7	14.6	6.0	15.3	0.6	6.26	**1.05**		**7.8**	22.1	10.9	4.4	15.8	1.1	6.43	**1.45**
0.4	29.5	14.5	5.9	15.2	0.5	6.21	**1.05**		**8.0**	21.9	10.8	4.4	15.6	0.9	6.37	**1.45**
0.6	29.3	14.4	5.9	15.8	1.1	6.47	**1.10**		**8.2**	21.7	10.7	4.4	15.5	0.8	6.31	**1.45**
0.8	29.1	14.3	5.8	15.7	1.0	6.42	**1.10**		**8.4**	21.5	10.6	4.3	15.9	1.2	6.47	**1.50**
1.0	28.9	14.2	5.8	15.6	0.9	6.38	**1.10**		**8.6**	21.3	10.5	4.3	15.7	1.0	6.41	**1.50**
1.2	28.7	14.1	5.8	15.5	0.8	6.33	**1.10**		**8.8**	21.1	10.4	4.2	15.6	0.9	6.35	**1.50**
1.4	28.5	14.0	5.7	15.4	0.7	6.29	**1.10**		**9.0**	20.9	10.3	4.2	15.9	1.2	6.50	**1.55**
1.6	28.3	13.9	5.7	15.3	0.6	6.25	**1.10**		**9.2**	20.7	10.2	4.2	15.8	1.1	6.44	**1.55**
1.8	28.1	13.8	5.6	15.9	1.2	6.48	**1.15**		**9.4**	20.5	10.1	4.1	15.6	0.9	6.38	**1.55**
2.0	27.9	13.7	5.6	15.8	1.1	6.44	**1.15**		**9.6**	20.3	10.0	4.1	15.5	0.8	6.31	**1.55**
2.2	27.7	13.6	5.6	15.7	1.0	6.39	**1.15**		**9.8**	20.1	9.9	4.0	15.8	1.1	6.45	**1.60**
2.4	27.5	13.5	5.5	15.5	0.8	6.35	**1.15**		**10.0**	19.9	9.8	4.0	15.7	1.0	6.39	**1.60**
2.6	27.3	13.4	5.5	15.4	0.7	6.30	**1.15**		**10.2**	19.7	9.7	4.0	15.5	0.8	6.33	**1.60**
2.8	27.1	13.3	5.4	15.3	0.6	6.25	**1.15**		**10.4**	19.5	9.6	3.9	15.8	1.1	6.46	**1.65**
3.0	26.9	13.2	5.4	15.9	1.2	6.48	**1.20**		**10.6**	19.3	9.5	3.9	15.7	1.0	6.39	**1.65**
3.2	26.7	13.1	5.4	15.7	1.0	6.43	**1.20**		**10.8**	19.1	9.4	3.8	15.5	0.8	6.33	**1.65**
3.4	26.5	13.0	5.3	15.6	0.9	6.38	**1.20**		**11.0**	18.9	9.3	3.8	15.8	1.1	6.45	**1.70**
3.6	26.3	12.9	5.3	15.5	0.8	6.33	**1.20**		**11.2**	18.7	9.2	3.8	15.6	0.9	6.38	**1.70**
3.8	26.1	12.8	5.2	15.4	0.7	6.28	**1.20**		**11.4**	18.5	9.1	3.7	15.9	1.2	6.50	**1.75**
4.0	25.9	12.7	5.2	15.9	1.2	6.50	**1.25**		**11.6**	18.3	9.0	3.7	15.7	1.0	6.43	**1.75**
4.2	25.7	12.6	5.2	15.8	1.1	6.45	**1.25**		**11.8**	18.1	8.9	3.6	15.6	0.9	6.36	**1.75**
4.4	25.5	12.5	5.1	15.7	1.0	6.40	**1.25**		**12.0**	17.9	8.8	3.6	15.8	1.1	6.47	**1.80**
4.6	25.3	12.4	5.1	15.5	0.8	6.35	**1.25**		**12.2**	17.7	8.7	3.6	15.7	1.0	6.39	**1.80**
4.8	25.1	12.3	5.0	15.4	0.7	6.30	**1.25**		**12.4**	17.5	8.6	3.5	15.9	1.2	6.50	**1.85**
5.0	24.9	12.2	5.0	15.9	1.2	6.50	**1.30**		**12.6**	17.3	8.5	3.5	15.7	1.0	6.42	**1.85**
5.2	24.7	12.1	5.0	15.8	1.1	6.44	**1.30**		**12.8**	17.1	8.4	3.4	15.6	0.9	6.35	**1.85**
5.4	24.5	12.0	4.9	15.7	1.0	6.39	**1.30**		**13.0**	16.9	8.3	3.4	15.8	1.1	6.45	**1.90**
5.6	24.3	11.9	4.9	15.5	0.8	6.34	**1.30**		**13.2**	16.7	8.2	3.4	15.6	0.9	6.37	**1.90**
5.8	24.1	11.8	4.8	15.4	0.7	6.29	**1.30**		**13.4**	16.5	8.1	3.3	15.8	1.1	6.46	**1.95**
6.0	23.9	11.7	4.8	15.9	1.2	6.47	**1.35**		**13.6**	16.3	8.0	3.3	15.6	0.9	6.38	**1.95**
6.2	23.7	11.7	4.8	15.7	1.0	6.42	**1.35**		**13.8**	16.1	7.9	3.2	15.8	1.1	6.46	**2.00**
6.4	23.5	11.6	4.7	15.6	0.9	6.37	**1.35**		**14.0**	15.9	7.8	3.2	15.6	0.9	6.38	**2.00**
6.6	23.3	11.5	4.7	15.5	0.8	6.31	**1.35**		**14.2**	15.7	7.7	3.2	15.4	0.7	6.30	**2.00**
6.8	23.1	11.4	4.6	15.9	1.2	6.49	**1.40**		**14.4**	15.5	7.6	3.1	15.2	0.5	6.22	**2.00**
7.0	22.9	11.3	4.6	15.8	1.1	6.43	**1.40**		**14.6**	15.3	7.5	3.1	15.1	0.4	6.14	**2.00**
7.2	22.7	11.2	4.6	15.6	0.9	6.38	**1.40**		**14.8**	15.1	7.4	3.0	14.9	0.2	6.06	**2.00**
7.4	22.5	11.1	4.5	15.5	0.8	6.32	**1.40**		**15.0**	14.9	7.3	3.0	14.7	0.0	5.98	**2.00**

Calculations: Psia(rec) x DF = psia(final)
Psia(final) - 14.7 = psig(final)

Conversion Equivalents

0"Hg(vac) = 29.9"Hg = 1atm = 14.7psia = 0psig

TABLE 9

ENTECH 4560SL DYNAMIC STANDARDS DILUTER
MASS FLOW CONTROLLER CALIBRATION

MFC #1 - DILUTION GAS			MFC #2- STANDARD GAS MIX						MFC #3 – STANDARD GAS MIX							
Target Flow cc/min	Flow Measured cc/min	Software Readout cc/min	Target Flow cc/min	Flow Measured cc/min	Software Readout cc/min	Target Flow cc/min	Flow Measured cc/min	Software Readout cc/min	Target Flow cc/min	Flow Measured cc/min	Software Readout cc/min	Target Flow cc/min	Flow Measured cc/min	Software Readout cc/min	Date	Init.
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
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1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				
1000			40			5.0			40			5.0				

Comments:

TABLE 10 A

FLOW CONTROLLER CALIBRATION TABLE 80% CAPACITY

Restrictor Type	Restrictor Orifice ID (inches)	Sampling Time	6-Liter Canister Flow Rate (CC/MIN)	1-Liter Canister Flow Rate (CC/MIN)
#1	0.0080	5 Minutes	NA	167.0
#1	0.0080	30 Minutes	167.0	26.7
#1	0.0080	1 Hour	83.0	13.3
#2	0.0050	2 Hour	41.0	6.7
#2	0.0050	3 Hour	27.7	4.4
#2	0.0050	4 Hour	20.8	3.4
#3	0.0035	6 Hour	13.8	NA
#3	0.0035	8 Hour	10.4	NA
#3	0.0035	12 Hour	6.9	NA
#4	0.0020	24 Hour	3.4	NA

TABLE 10 B

FLOW CONTROLLER CALIBRATION TABLE 90% CAPACITY

Restrictor Type	Restrictor Orifice ID (inches)	Sampling Time	6-Liter Canister Flow Rate (CC/MIN)	1-Liter Canister Flow Rate (CC/MIN)
#1	0.0080	5 Minutes	NA	180.0
#1	0.0080	30 Minutes	180.0	30.0
#1	0.0080	1 Hour	90.0	15.0
#2	0.0050	2 Hour	45.0	7.5
#2	0.0050	3 Hour	30.0	5.0
#2	0.0050	4 Hour	22.5	3.8
#3	0.0035	6 Hour	15.0	NA
#3	0.0035	8 Hour	11.3	NA
#3	0.0035	12 Hour	7.5	NA
#4	0.0020	24 Hour	3.8	NA

Brooke Ann Briganti
Senior Project Manager

OVERVIEW
Ms. Briganti has over 12 years of broad-based professional experience in environmental applications for both public and private sector clients. Her technical experience includes Compliance, Corporate Health and Safety, Due Diligence, Phase I, Phase II, Preliminary Assessments, Site Investigations, Background Investigation Reports, Ecological Evaluations, Remedial Investigation, Remedial Alternatives Analysis, Construction Management, Geographic Information Systems, Subpart X Permitting, Asbestos Management. Ms. Briganti has managed numerous soil and groundwater remediation projects many of which involved Brownfield sites. She has worked with an extensive client base ranging from individual homeowners to large chemical and petroleum companies to redevelopers to government agencies, including the New Jersey Department of Transportation (NJDOT) and Port Authority of NY/NJ.

EDUCATION
- Bachelors of Science in Biology with a Concentration in Molecular Cell Biology, Monmouth, University, West Long Branch, New Jersey

CAREER POSITIONS
- Environmental Logic, LLC Senior (2015-Present
- EWMA, Senior Project Manager (2011 – 2015)
- Hill Environmental Group, Project Manager (2010)
- Groundwater &Environmental Services, Senior Staff Scientist (2008-2010)
- PMK Group/Birdsall Engineering Group, Staff Scientist(2006-2008)
- URS Corporation, Environmental Scientist (2004-2006)
- United States Navy, Environmental Intern GIS Specialist (2001-2004)

PROFESSIONAL CERTIFICATIONS AND SPECIAL TRAINING
- USEPA – AHERA,NY State Accredited Asbestos Inspector # 09767, 2001
- Nitron XRF Spectrum Analyzer, Nitron Calibration, 2001
- Managing Hazardous Waste, United States Navy, 2001
- United States Naval Training Spill Management Training, 24 hours, 2003
- ASTM -E1527-00/05 – Phase I Environmental Site Assessment, 2003 and 2005
- ASTM E1527-13 – Phase I Environmental Site Assessment (2013 and 2015)
- Chem Master, October 2005s

- NJDEP Air Monitoring and Permitting Requirements, 2005
- US EPA QA/QC Manager Training, 2005
- NJDEP RADIUS, 2006
- Army Corp. of Engineers Wetland Delineation Training, Cook College, Rutgers University 2007
- ExxonMobil LPS Safety Program, 2008
- Conoco Philips SHAIC Safety Training for Refineries, 2008
- GEMs of BP Safety Program, 2008

KEY PROJECTS

- Former Asphalt Plants Old Bridge and Brick, New Jersey- Former Asphalt Plants and Concrete Part B Recycling Facilities Project manager of multi-phase Remedial Investigation of former asphalt plants and concrete recycling facilities. Oversaw supplemental remedial investigation, and ground water monitoring. During the course of the project, the NJDEP elevated the resource values of the adjacent and on-site sensitive receptors to a C-1 stream and established a nature preserve on the opposing properties river bank. The former operations of the plant was suspected to have impacted adjacent Riverine and Forested wetland area on Property from historic operations requiring an ecological impact assessment. Conducted community/habitat assessments to support ecological evaluation to support closure. Received LSRP restricted RAO for entire site.

- Bayway Refinery - Managed as the lead field scientist/field safety officer for eleven landfill areas. Conducted a subsurface evaluation and remediation of the former ExxonMobil Areas of Concern. Activities included oversight of geophysical survey, utility clearing, soil boring and test pit installations, soil and groundwater sampling, community air monitoring and preparation of a report including three dimensional modeling of the subsurface lithology. Data was used as input parameters in assessing compliance with regulatory requirements and evaluating the effectiveness of an innovative soil and groundwater recovery and treatment remedial systems. Additionally worked with the project manager to document dissolved oxygen and temperature contours at the facilities biowall.

- Atlantic City #3001 Terminal – Project Manager for a multimillion dollar remediation and demolition project. Worked with the Project Engineer to create and then later modify a NJDEP Permit by Rule (PBR) to use and spray biosolve in order to abate petroleum odors and vapors in a residential area. Created an additional PBR to conduct a pilot test for a chemical oxidation onsite. Supervised the demolition and dismantling of the former terminal’s 16 Petroleum Tanks. Conducted a 6 acres excavation.

- Brownfield Redevelopment Project (Red Bull Soccer Stadium) – Project Manager for a 14-acre former warehouse facility. Responsible for the implementation of the NJDEP approved Remedial Investigation Work plan. Prepared portions of the HDSRF Grant. Responsible for 22 areas of concern and 15 excavation areas. Responsible and managed the removal of a 15,000 gallon diesel UST and collected the appropriate amount of post excavation samples in accordance with NJDEP UST regulations. Managed the removal of contaminated soil, groundwater and concrete debris. Coordinated and managed a crew during an Emergency Response release of petroleum into the Passaic River. Worked with the, NJDEP, US Coast Guard, Clean Harbors to effectively manage and clean up an oil release prior to it mobilizing into a waterway.

- Preliminary Assessment Reports - As part of the City of Linden's and the City of Rahway's Redevelopment Project, conducted/prepared 36 preliminary assessments at a number of commercial/industrial facilities, and prepared reports. These reports were used to identify environmental liabilities associated with prior and adjacent land use as well as pre-existing site contamination conditions.

- UST Closure North Bergen NJ- Provided management for the closure of 5 kerosene and gasoline underground storage tanks. Removed the USTs under the direct supervision of a NJDEP Cleanup Star and the NJDEP Technical Regulations. Completed the facility questionnaire and 14 day notification prior to completing the work. Submitted the NJDEP closure report and received a No Further Action required letter by the NJDEP.

- Various Retail Gas Service Stations, New Jersey/New York – Project Manager/Case Manager for 27 Retail Gasoline Service Stations in the New Jersey/New York Area. Remedial Investigation of sites with multiphase contamination. Program included soil and groundwater sampling and analysis to characterize site conditions, baseline ecological evaluation and hydrogeologic evaluation related to former gasoline underground storage tanks. Initiated total fluids remediation system installation utilizing vapor extraction and groundwater/separate phase product recover and operation and maintenance to address elevated residual soil impact, groundwater impact and separate phase product identified at the site.

- Overpeck Park Landfill, Overland Park, Bergen County, NJ – Field Scientist Developed and created a Remedial Action Work plan for Overland Park in preparation for the landfill closure plan. Managed the removal of contaminated soil, groundwater and concrete debris. Worked closely with Senior Project Manager and managed field crew of 5.

- Middlesex Sampling Plant, New Jersey - Participated in field collection efforts for this 30-acre USACE FUSRAP/Superfund site. Participated in writing the US EPA Record of Decision for soil remediation.

- Chevron Texaco Asphalt Refinery, New Jersey. - Acted as the site safety supervisor for field operations. Ensured that all team members were always wearing the proper PPE while on terminal property. Conducted daily toolbox talks including specific safety hazards for working with tetraethyl lead contamination. Constructed a regulatory agency review and completed soil boring logs related to ongoing ISRA and RCRA RFI projects at the site.

- State Psychiatric Facility, Parsippany, New Jersey - Conducted asbestos and lead-based paint remediation planning prior to demolition of former office building and in patient psychiatric hospital, observation of sub-slab demolition of laboratory drain lines and post-demolition soil sampling and analysis.

- Pharmaceutical Facility, Pennsylvania - Conducted an AHERA asbestos and lead-based paint remediation planning prior to demolition of former office building and research and development laboratory, observation of sub-slab demolition of laboratory drain lines and post-demolition soil sampling and analysis.

- Former Dry Cleaner, Mount Holly, New Jersey - Remedial Investigation of a former dry cleaning facility surrounding properties to delineate groundwater impacts. Site Investigation included the completion of a comprehensive soil and groundwater investigation in response to a dry cleaning spill. Installation of soil borings and monitor wells to delineate chlorinated compound impact and determine a viable remedial strategy. Subsequent to the investigation a Remedial Investigation report was submitted to the New Jersey Department of Environmental Protection (NJDEP).

- Naval Weapons Station Earle, New Jersey – Federal Intern in the -Environmental Department of a major military installation. Provided comprehensive support to all Program Managers for diverse environmental projects. Analyzed reports developed by military contractors; visited project sites; reviewed results to develop accurate timelines. Developed a working knowledge of hazardous waste operations at on-site facilities; observed loading and unloading of hazardous material; acquired an understanding of EPA, NJDEP, and Navy regulations. Participated in water sampling project; analyzed five streams leaving Station's property to determine pollution levels; used GIS to identify suitable sample location; identified pesticides, RCRA metals, and total suspended solutes; measured coliform levels; prepared written reports. Worked in conjunction with Forester to plan and conduct a gypsy moth survey; performed visual inspection to determine defoliation; developed a thorough understanding of various wetland species. Managed a database for Ozone Depleting Substances for Air Program Manager in conjunction with Title V. Participated in the response to a mock spill at Sandy Hook Bay. Responsible for the inventory of all storm drains on Station for Monmouth County Infrastructure upgrade.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
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Prepared by: ROBERT REINHART Digitally signed by ROBERT REINHART Date: 2017.09.19 16:15:38 -04'00'
(Robert Reinhart, Quality Assurance Unit) Date

Approved by: JOHN SMALDONE Digitally signed by JOHN SMALDONE Date: 2017.09.20 15:11:00 -04'00'
(John Smaldone, Quality Assurance Unit) Date

Revision Page

Date	Rev #	Summary of changes	Sections
7/30/96	1	Finalized	
01/19/10	2	Updated	All sections
3/23/17	3	Updated	All sections
9/20/17	4	Updated	Section 7.0

Table of Contents

1.0 USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Potentiometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the "Monitoring Indicator Field Parameters" section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

2.0 SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.

3.0 BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

4.0 HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

5.0 CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convection cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

6.0 PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

7.0 EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®) are preferred. PTFE, however, should not be used when sampling for per- and polyfluoroalkyl substances (PFAS) as it is likely to contain these substances.

Note: If extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A. If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

PTFE (Teflon®) or PTFE-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. As discussed in the previous section, PTFE tubing should not be used when sampling for PFAS. In this case, a suitable alternative such as high-density polyethylene tubing should be used.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

Note: If tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic "tape", pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level "tape" at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A "T" connector coupled with a valve is connected between the pump's tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

8.0 EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

9.0 PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed, lay out a sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

10.0 PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. <u>Note: during the early phase of purging, emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:</u>

Turbidity (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). Throughout the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods (e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 µm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a "silting" problem or if confirmation of well identity is needed.

Secure the well.

11.0 DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well, and then following sampling of each subsequent well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

12.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

13.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

14.0 DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

15.0 REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods*; Washington, DC (EPA/540/P-87/001).

U.S Environmental Protection Agency, Region 1, *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017 or latest version.

U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A

PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases, (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could affect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or discolored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or discolored water is usually from the well-being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take a while (pump may be removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note:

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note: at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

Turbidity (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

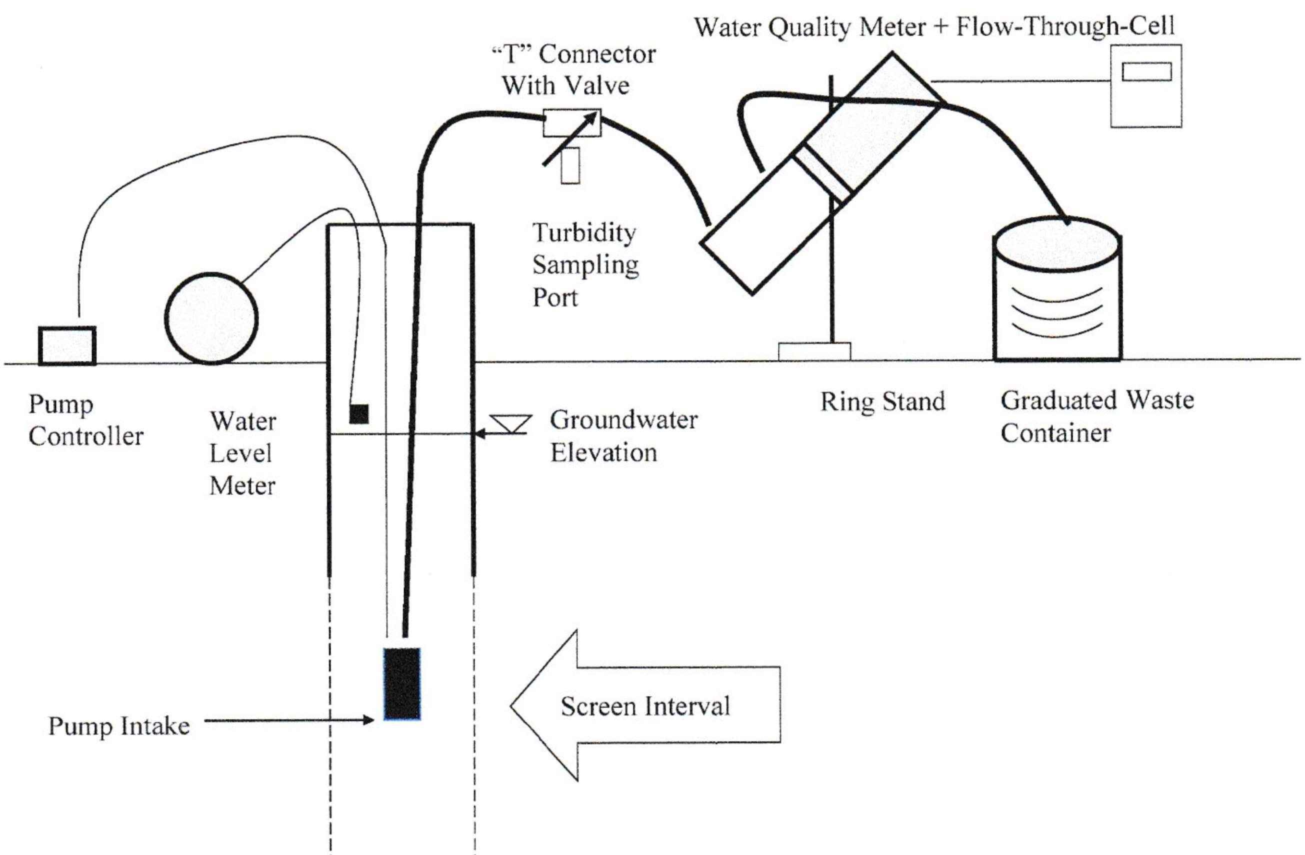
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)________________________________
Well Number________________ Date________________________
Field Personnel____
Sampling Organization__________________________________
Identify MP____

Depth to _______/________ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)_________
Purging Device; (pump type)__________
Total Volume Purged _______________

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Tur-bidity NTU	Comments
Stabilization Criteria					3%	3%	±0.1	±10 mv	10%	10%	

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)

FARMINGDALE ANNUAL INSPECTION FORM

SITE ID:

DATE:

INSPECTOR:

COMPANY:

All monitoring/inspections reports will include, at a minimum;

- Date of the event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photos or sketches showing the approximate location of any problems or incidents noted (include either on the checklist/form or an attached sheet);
- Type of samples collected;
- Copies of all field forms completed;
- 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 samples (to be submitted electronically in the NYSDEC- identified forma);
- Any observations, conclusions, or recommendations; and, A determination as to whether contaminant conditions have changed since the last reporting event.
- Compliance with all ICs, including Site usage. The Institutional Control requires only commercial use, is the property used for commercial tenants, if so list the commercial tenants located on site:
- An evaluation of the condition and continued effectiveness of ECs; The engineering control is the SVE system, is it running and in good condition.
- An evaluation of the exterior cap of Property and Deed Notice area; Are there any changes to the condition of asphalt and concrete surfaces? Are the surfaces intact with cracks properly sealed?
- General Site conditions at the time of the inspection; Are there any changes to the site in terms of surfaces/buildings/installations?
- The Site management activities being conducted; and; What activities have been performed during the course of the year and on what frequency? Ie. vapor monitoring
- Confirm that the Site records are up to date. Are all the logs and forms located on-site in a binder?
- Compliance with the requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and;

Treatment System Performance Summary Field Sampling Form

Date:	Job Number:16-0005	Location:Farmingdale	Employee Name:

Please see attached document for the complete list of tasks.

Maintenance/equiptment failure notes: **Alarm?**

Type failure notes here or write N/A if it is not applicable

	Number of days				
Reporting Period Number of Days the system operated for the reporting period					**Comments: (list below)**
Flow rate per day The average high and low flows per day		High Flow	Average Flow	Low Flow	
Description of breakdown and/or repairs Explanation for any significant downtime					**Conclusion: (list below)**
Description of: Resolution of performance problems					
The Containment Mass Removed: List out if applies or write N/A if not applicable.	N/A				**Recommendations:(list below)**

SVE System Operation and Maintainace Logs
Former Farmingdale Plaza Cleaners
450 Mian St.

Date	**Blower Flow Rate** CFM (From port before SVE-1 after	**Moisture Seperator Condensate vol. Gal.**	**PID Influent** PPB/PPM	**PID MID-CARBON** PPB/PPM	**PID POST-CARBON** (EFFLUENT) PPB/PPM	**INFLUENT AIR FLOW** (PORT AFTER SVE-5) CFM	**AIR FLOW SVE-3** CFM	**AIR FLOW SVE-5** CFM	**PRESSURE INFLUENT PORT** (BEFORE K.O.	**PRESSURE SVE-3** INCHES OF WATER	**PRESSURE SVE-5** INCHES OF WATER	**PRESSURE PI-102** INCHES OF WATER	**PRESSURE VI-105** INCHES OF WATER	**PRESSURE INFLUENT PRE-CARBON** INCHES	**PRESSURE MID-CARBON** INCHES OF WATER	**PRESSURE POST-CARBON** INCHES OF WATER	**MAGNEHELIC FI-101**	**MAGNEHELIC FI-102**	**PID Corrected for response factor** PPMv	**Removal Rate** lbs/hr	**Treatment Efficiency** %	**Blower Hours**	**PI-101** PSI	**VI-106** PSI	**VI-104** PSI	**VI-105** IW	**TI-101** Farenhiet	**TI-102** Farenhiet	**Comment**

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: Farmingdale Plaza cleaners Site Code: 130107 Operable Unit: 01

Building Code: Building Name: Site Building

Address: 450 Main Street Apt/Suite No: A,B

City: Famingdale State: NY Zip: 11735 County: Nassau

Contact Information

Preparer's Name: Alex Fromme Phone No: (908) 328-3680

Preparer's Affiliation: Environmental Logic Company Code:

Purpose of Investigation: VI Sampling Date of Inspection: Jul 7, 2016

Contact Name: Affiliation:

Phone No: Alt. Phone No: Email:

Number of Occupants (total): Number of Children:

☐ Occupant Interviewed? ☐ Owner Occupied? ☐ Owner Interviewed?

Owner Name (if different): Owner Phone:

Owner Mailing Address:

Building Details

Bldg Type (Res/Com/Ind/Mixed): COMMERCIAL/MIXED Bldg Size (S/M/L): MEDIUM

If Commercial or Industrial Facility, Select Operations: VACANT

If Residential Select Structure Type:

Number of Floors: 1 Approx. Year Construction: 1983 ☒ Building Insulated? ☐ Attached Garage?

Describe Overall Building 'Tightness' and Airflows(e.g., results of smoke tests):

Not Tight

Foundation Description

Foundation Type: UNKNOWN Foundation Depth (bgs): Unit: FEET

Foundation Floor Material: POURED CONCRETE

Foundation Wall Material: CONCRETE BLOCK

Foundation Floor Thickness:

Foundation Wall Thickness:

Unit: INCHES

☐ Floor penetrations? Describe Floor Penetrations:

☐ Wall penetrations? Describe Wall Penetrations:

Basement is: Basement is: ☐ Sumps/Drains? Water In Sump?:

Describe Foundation Condition (cracks, seepage, etc.) :

☐ Radon Mitigation System Installed? ☒ VOC Mitigation System Installed? ☐ Mitigation System On?

Heating/Cooling/Ventilation Systems

Heating System: Heat Fuel Type: ☐ Central A/C Present?

Vented Appliances

Water Heater Fuel Type: Clothes Dryer Fuel Type:

Water Htr Vent Location: Dryer Vent Location:

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

PRODUCT INVENTORY

Building Name: Site Building Bldg Code: Date: Jul 7, 2016

Bldg Address: 450 Main Street Apt/Suite No: A,B

Bldg City/State/Zip: Famingdale NY, 11735

Make and Model of PID: Mini rae Date of Calibration: Jul 7, 2016

Location	Product Name/Description	Size (oz)	Condition *	Chemical Ingredients	PID Reading	COC Y/N?
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐

* Describe the condition of the product containers as **Unopened (UO)**, **Used (U)**, or **Deteriorated (D)**

** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Product Inventory Complete? ☐ Were there any elevated PID readings taken on site? ☐ ☐ Products with COC?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: Farmingdale Plaza cleaners Site Code: 130107 Operable Unit: 01

Building Code: Building Name: Site Building

Address: 450 Main Street Apt/Suite No: A,B

City: Famingdale State: NY Zip: 11735 County: Nassau

Factors Affecting Indoor Air Quailty

Frequency Basement/Lowest Level is Occupied?: FULL TIME Floor Material:

☐ Inhabited? ☐ HVAC System On? ☐ Bathroom Exhaust Fan? ☐ Kitchen Exhaust Fan?

Alternate Heat Source: ☐ Is there smoking in the building?

☐ Air Fresheners? Description/Location of Air Freshener:

☒ Cleaning Products Used Recently?: Description of Cleaning Products: Bleach

☐ Cosmetic Products Used Recently?: Description of Cosmetic Products:

☐ New Carpet or Furniture? Location of New Carpet/Furniture:

☐ Recent Dry Cleaning? Location of Recently Dry Cleaned Fabrics:

☐ Recent Painting/Staining? Location of New Painting:

☐ Solvent or Chemical Odors? Describe Odors (if any):

☐ Do Any Occupants Use Solvents At Work? If So, List Solvents Used:

☐ Recent Pesticide/Rodenticide? Description of Last Use:

Describe Any Household Activities (chemical use,/storage, unvented appliances, hobbies, etc.) That May Affect Indoor Air Quality:

☐ Any Prior Testing For Radon? If So, When?:

☒ Any Prior Testing For VOCs? If So, When?: 2010-2015

Sampling Conditions

Weather Conditions: Outdoor Temperature: °F

Current Building Use: VACANT Barometric Pressure: in(hg)

Product Inventory Complete? ☐ Building Questionnaire Completed?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Building Code: ____________ Address: 450 Main Street A,B Famingdale, NY 11735

Sampling Information

Sampler Name(s): Alex Fromme

Sampler Company Code:

Sample Collection Date: Jul 8, 2016

Date Samples Sent To Lab: Jul 8, 2016

Sample Chain of Custody Number: JC23674

Outdoor Air Sample Location ID:

SUMMA Canister Information

Sample ID:	IA-1	IA-2	IA-3	Amb	
Location Code:					
Location Type:					
Canister ID:	A467	A1205	A1058	A848	
Regulator ID:	FC435	FC521	FC723	FC332	
Matrix:	Indoor Air	Indoor Air	Indoor Air	Ambient Outd	
Sampling Method:	SUMMA AIR SAMPLI	SUMMA AIR SA	SUMMA AIR SA	SUMMA AIR SA	

Sampling Area Info

Slab Thickness (inches):					
Sub-Slab Material:					
Sub-Slab Moisture:					
Seal Type:					
Seal Adequate?:	☐	☐	☐	☐	☐

Sample Times and Vacuum Readings

Sample Start Date/Time:	07/07/2016 7:40	07/07/2016	07/07/2016	07/07/2016	
Vacuum Gauge Start:	-30	-29	-30	-30	
Sample End Date/Time:	07/08/2016 7:40	07/08/2016	07/05/2016	07/05/2016	
Vacuum Gauge End:	-5	-10	-8	-9	
Sample Duration (hrs):	24	24	24	24	
Vacuum Gauge Unit:	in(hg)	in(hg)	in(hg)	in(hg)	

Sample QA/QC Readings

Vapor Port Purge:	☐	☐	☐	☐	☐
Purge PID Reading:					
Purge PID Unit:					
Tracer Test Pass:	☐	☐	☐	☐	☐

Sample start and end times should be entered using the following format: MM/DD/YYYY HH:MM

LOWEST BUILDING LEVEL LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the lowest building level .
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

FIRST FLOOR BUILDING LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the first floor of the building.
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

OUTDOOR PLOT LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the outdoor plot of the building as well as the surrounding area. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sket(
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B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: Farmingdale Plaza cleaners　Site Code: 130107　Operable Unit: 01

Building Code: ______　Building Name: Site Building

Address: 450 Main Street　Apt/Suite No: A,B

City: Famingdale　State: NY　Zip: 11735　County: Nassau

Contact Information

Preparer's Name: Sean Collins　Phone No: (267) 391-8517

Preparer's Affiliation: Environmental Logic　Company Code: ______

Purpose of Investigation: VI Sampling　Date of Inspection: Apr 27, 2016

Contact Name: ______　Affiliation: ______

Phone No: ______　Alt. Phone No: ______　Email: ______

Number of Occupants (total): ______　Number of Children: ______

☐ Occupant Interviewed?　☐ Owner Occupied?　☐ Owner Interviewed?

Owner Name (if different): ______　Owner Phone: ______

Owner Mailing Address: ______

Building Details

Bldg Type (Res/Com/Ind/Mixed): COMMERCIAL/MIXED　Bldg Size (S/M/L): MEDIUM

If Commercial or Industrial Facility, Select Operations: VACANT

If Residential Select Structure Type:

Number of Floors: 1　Approx. Year Construction: 1983　☒ Building Insulated?　☐ Attached Garage?

Describe Overall Building 'Tightness' and Airflows(e.g., results of smoke tests):

Not Tight

Foundation Description

Foundation Type: UNKNOWN　Foundation Depth (bgs): ______　Unit: FEET

Foundation Floor Material: POURED CONCRETE　Foundation Floor Thickness: ______

Foundation Wall Material: CONCRETE BLOCK　Foundation Wall Thickness: ______　Unit: INCHES

☐ Floor penetrations?　Describe Floor Penetrations: ______

☐ Wall penetrations?　Describe Wall Penetrations: ______

Basement is: ______　Basement is: ______　☐ Sumps/Drains?　Water In Sump?: ______

Describe Foundation Condition (cracks, seepage, etc.) : ______

☐ Radon Mitigation System Installed?　☒ VOC Mitigation System Installed?　☐ Mitigation System On?

Heating/Cooling/Ventilation Systems

Heating System: ______　Heat Fuel Type: ______　☐ Central A/C Present?

Vented Appliances

Water Heater Fuel Type: ______　Clothes Dryer Fuel Type: ______

Water Htr Vent Location: ______　Dryer Vent Location: ______

Structure Sampling Questionnaire and Building Inventory
New York State Department of Environmental Conservation

PRODUCT INVENTORY

Building Name: Site Building   Bldg Code: ____   Date: Apr 27, 2016

Bldg Address: 450 Main Street   Apt/Suite No: A,B

Bldg City/State/Zip: Famingdale NY, 11735

Make and Model of PID: Mini rae 2000   Date of Calibration: Apr 27, 2016

Location	Product Name/Description	Size (oz)	Condition *	Chemical Ingredients	PID Reading	COC Y/N?
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐

* Describe the condition of the product containers as **Unopened (UO)**, **Used (U)**, or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Product Inventory Complete? ☐   Were there any elevated PID readings taken on site? ☐   ☐ Products with COC?

Structure Sampling Questionnaire and Building Inventory
New York State Department of Environmental Conservation

Site Name: Farmingdale Plaza cleaners Site Code: 130107 Operable Unit: 01

Building Code: Building Name: Site Building

Address: 450 Main Street Apt/Suite No: A,B

City: Famingdale State: NY Zip: 11735 County: Nassau

Factors Affecting Indoor Air Quailty

Frequency Basement/Lowest Level is Occupied?: FULL TIME Floor Material:

- [ ] Inhabited?
- [ ] HVAC System On?
- [ ] Bathroom Exhaust Fan?
- [ ] Kitchen Exhaust Fan?

Alternate Heat Source:

- [ ] Is there smoking in the building?
- [ ] Air Fresheners? Description/Location of Air Freshener:
- [x] Cleaning Products Used Recently?: Description of Cleaning Products: Bleach
- [ ] Cosmetic Products Used Recently?: Description of Cosmetic Products:
- [ ] New Carpet or Furniture? Location of New Carpet/Furniture:
- [ ] Recent Dry Cleaning? Location of Recently Dry Cleaned Fabrics:
- [ ] Recent Painting/Staining? Location of New Painting:
- [ ] Solvent or Chemical Odors? Describe Odors (if any):
- [ ] Do Any Occupants Use Solvents At Work? If So, List Solvents Used:
- [ ] Recent Pesticide/Rodenticide? Description of Last Use:

Describe Any Household Activities (chemical use,/storage, unvented appliances, hobbies, etc.) That May Affect Indoor Air Quality:

- [ ] Any Prior Testing For Radon? If So, When?:
- [x] Any Prior Testing For VOCs? If So, When?: 2010-2015

Sampling Conditions

Weather Conditions: Outdoor Temperature: °F

Current Building Use: VACANT Barometric Pressure: in(hg)

Product Inventory Complete?

- [ ] Building Questionnaire Completed?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Building Code: ____________ Address: 450 Main Street A,B Famingdale, NY 11735

Sampling Information

Sampler Name(s): Sean Collins

Sampler Company Code: ____________

Sample Collection Date: Apr 27, 2016

Date Samples Sent To Lab: Apr 27, 2016

Sample Chain of Custody Number: JC19338

Outdoor Air Sample Location ID: ____________

SUMMA Canister Information

Sample ID:	IA-1	IA-2	SS-1	SS-2	SS-3
Location Code:					
Location Type:	FIRST FLOOR	FIRST FLOOR	FIRST FLOOR	FIRST FLOOR	FIRST FLOOR
Canister ID:	A637	M308	A569	A598	A513
Regulator ID:	FC250	FC282	FC173	FC366	FC354
Matrix:	Indoor Air	Indoor Air	Subslab Soil	Subslab Soil	Subslab Soil
Sampling Method:	SUMMA AIR SAMPLI	SUMMA AIR SA	SUMMA AIR SA	SUMMA AIR SA	SUMMA AIR SA

Sampling Area Info

Slab Thickness (inches):					
Sub-Slab Material:					
Sub-Slab Moisture:					
Seal Type:					
Seal Adequate?:	☐	☐	☐	☐	☐

Sample Times and Vacuum Readings

Sample Start Date/Time:	04/26/2016 13:	04/26/2016 1	04/26/2016 1	04/26/2016 1	04/26/2016 1
Vacuum Gauge Start:	-27	-28	-29	-27	-29
Sample End Date/Time:	04/27/2016 14:	04/27/2016 1	04/27/2016 1	04/27/2016 1	04/27/2016 1
Vacuum Gauge End:	-5	-5	-14	-6	-7
Sample Duration (hrs):	24	24	24	24	24
Vacuum Gauge Unit:	in(hg)	in(hg)	in(hg)	in(hg)	in(hg)

Sample QA/QC Readings

Vapor Port Purge:	☐	☐	☐	☐	☐
Purge PID Reading:					
Purge PID Unit:					
Tracer Test Pass:	☐	☐	☐	☐	☐

Sample start and end times should be entered using the following format: MM/DD/YYYY HH:MM

LOWEST BUILDING LEVEL LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the lowest building level .
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
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- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
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WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory
New York State Department of Environmental Conservation

FIRST FLOOR BUILDING LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the first floor of the building.
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

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@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

OUTDOOR PLOT LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the outdoor plot of the building as well as the surrounding area. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
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HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
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WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
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S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: Farmingdale Plaza cleaners Site Code: 130107 Operable Unit: 01

Building Code: Building Name: Site Building

Address: 450 Main Street Apt/Suite No: A,B

City: Famingdale State: NY Zip: 11735 County: Nassau

Contact Information

Preparer's Name: Sean Collins Phone No: (267) 391-8517

Preparer's Affiliation: Environmental Logic Company Code:

Purpose of Investigation: VI Sampling Date of Inspection: Sep 1, 2016

Contact Name: Affiliation:

Phone No: Alt. Phone No: Email:

Number of Occupants (total): Number of Children:

☐ Occupant Interviewed? ☐ Owner Occupied? ☐ Owner Interviewed?

Owner Name (if different): Owner Phone:

Owner Mailing Address:

Building Details

Bldg Type (Res/Com/Ind/Mixed): COMMERCIAL/MIXED Bldg Size (S/M/L): MEDIUM

If Commercial or Industrial Facility, Select Operations: VACANT

If Residential Select Structure Type:

Number of Floors: 1 Approx. Year Construction: 1983 ☒ Building Insulated? ☐ Attached Garage?

Describe Overall Building 'Tightness' and Airflows(e.g., results of smoke tests):

Not Tight

Foundation Description

Foundation Type: UNKNOWN Foundation Depth (bgs): Unit: FEET

Foundation Floor Material: POURED CONCRETE Foundation Floor Thickness:

Foundation Wall Material: CONCRETE BLOCK Foundation Wall Thickness: Unit: INCHES

☐ Floor penetrations? Describe Floor Penetrations:

☐ Wall penetrations? Describe Wall Penetrations:

Basement is: Basement is: ☐ Sumps/Drains? Water In Sump?:

Describe Foundation Condition (cracks, seepage, etc.) :

☐ Radon Mitigation System Installed? ☒ VOC Mitigation System Installed? ☐ Mitigation System On?

Heating/Cooling/Ventilation Systems

Heating System: Heat Fuel Type: ☐ Central A/C Present?

Vented Appliances

Water Heater Fuel Type: Clothes Dryer Fuel Type:

Water Htr Vent Location: Dryer Vent Location:

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

PRODUCT INVENTORY

Building Name: Site Building Bldg Code: ______ Date: Sep 1, 2016

Bldg Address: 450 Main Street Apt/Suite No: A,B

Bldg City/State/Zip: Famingdale NY, 11735

Make and Model of PID: Mini rae Date of Calibration: Sep 1, 2016

Location	Product Name/Description	Size (oz)	Condition *	Chemical Ingredients	PID Reading	COC Y/N?
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐

* Describe the condition of the product containers as **Unopened (UO)**, **Used (U)**, or **Deteriorated (D)**

** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Product Inventory Complete? ☐ Were there any elevated PID readings taken on site? ☐ ☐ Products with COC?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: Farmingdale Plaza cleaners Site Code: 130107 Operable Unit: 01

Building Code: Building Name: Site Building

Address: 450 Main Street Apt/Suite No: A,B

City: Famingdale State: NY Zip: 11735 County: Nassau

Factors Affecting Indoor Air Quailty

Frequency Basement/Lowest Level is Occupied?: FULL TIME Floor Material:

☐ Inhabited? ☐ HVAC System On? ☐ Bathroom Exhaust Fan? ☐ Kitchen Exhaust Fan?

Alternate Heat Source: ☐ Is there smoking in the building?

☐ Air Fresheners? Description/Location of Air Freshener:

☒ Cleaning Products Used Recently?: Description of Cleaning Products: Bleach

☐ Cosmetic Products Used Recently?: Description of Cosmetic Products:

☐ New Carpet or Furniture? Location of New Carpet/Furniture:

☐ Recent Dry Cleaning? Location of Recently Dry Cleaned Fabrics:

☐ Recent Painting/Staining? Location of New Painting:

☐ Solvent or Chemical Odors? Describe Odors (if any):

☐ Do Any Occupants Use Solvents At Work? If So, List Solvents Used:

☐ Recent Pesticide/Rodenticide? Description of Last Use:

Describe Any Household Activities (chemical use,/storage, unvented appliances, hobbies, etc.) That May Affect Indoor Air Quality:

☐ Any Prior Testing For Radon? If So, When?:

☒ Any Prior Testing For VOCs? If So, When?: 2010-2015

Sampling Conditions

Weather Conditions: Outdoor Temperature: °F

Current Building Use: VACANT Barometric Pressure: in(hg)

Product Inventory Complete? ☐ Building Questionnaire Completed?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Building Code: ______ Address: 450 Main Street A,B Famingdale, NY 11735

Sampling Information

Sampler Name(s): Sean Collins, Alex Fromme, Dennis

Sampler Company Code: ______

Sample Collection Date: Sep 1, 2016

Date Samples Sent To Lab: Sep 2, 2016

Sample Chain of Custody Number: JC27085

Outdoor Air Sample Location ID: ______

SUMMA Canister Information

Sample ID:	IA-1	IA-2	IA-3	IA-4	Amb
Location Code:					
Location Type:	FIRST FLOOR	FIRST FLOOR	FIRST FLOOR	FIRST FLOOR	
Canister ID:	A442	A878	A361	M407	A211
Regulator ID:	FC386	FC109	FC548	MC211	MC109
Matrix:	Indoor Air	Indoor Air	Indoor Air	Indoor Air	Ambient Outd
Sampling Method:	SUMMA AIR SAMPLI	SUMMA AIR SA	SUMMA AIR SA	SUMMA AIR SA	SUMMA AIR SA

Sampling Area Info

Slab Thickness (inches):					
Sub-Slab Material:					
Sub-Slab Moisture:					
Seal Type:					
Seal Adequate?:	☐	☐	☐	☐	☐

Sample Times and Vacuum Readings

Sample Start Date/Time:	09/01/2016 15:0	09/01/2016 1	09/01/2016 1	09/01/2016 1	09/01/2016 1
Vacuum Gauge Start:	-30	-30	-30	-30	-29
Sample End Date/Time:	09/02/2016 15:0	09/02/2016 1	09/02/2016 1	09/02/2016 1	09/02/2016 1
Vacuum Gauge End:	-6	-7	-10	-10	-5
Sample Duration (hrs):	24	24	24	24	24
Vacuum Gauge Unit:	in(hg)	in(hg)	in(hg)	in(hg)	in(hg)

Sample QA/QC Readings

Vapor Port Purge:	☐	☐	☐	☐	☐
Purge PID Reading:					
Purge PID Unit:					
Tracer Test Pass:	☐	☐	☐	☐	☐

Sample start and end times should be entered using the following format: MM/DD/YYYY HH:MM

LOWEST BUILDING LEVEL LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the lowest building level .
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sket
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or F	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

FIRST FLOOR BUILDING LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the first floor of the building.
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sket(
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

OUTDOOR PLOT LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the outdoor plot of the building as well as the surrounding area. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

SVE SYSTEM OPERATION & MAINTENANCE MANUAL

FARMINGDALE PLAZA CLEANERS

450-480 MAIN STREET

FARMINGDALE, NEW YORK 11735

SITE#: 1-30-107

Prepared For:

New York State - Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233

Prepared By:

Environmental Assessment & Remediations
225 Atlantic Avenue
Patchogue, NY 11772

TABLE OF CONTENTS

1.0 INTRODUCTION

This document represents the Operation & Maintenance (O&M) Manual for the soil vapor extraction (SVE) system at the Farmingdale Plaza Cleaners Site (Site No. 130107) at 450-480 Main Street, Farmingdale, NY.

The site is a former dry cleaner located in the Farmingdale Plaza shopping center, listed by the New York State Department of Environmental Conservation as a Class 2 Inactive Hazardous Waste Site in December 2002. Surrounding the shopping center is a mixed neighborhood of residential apartments, restaurants, and other retail businesses. Depth to water at this site is approximately 20 feet below grade surface. Site investigations have revealed the presence of tetrachloroethylene (PCE) and related degradation products (trichloroethene and 1,2-dichloroethene) in the site soil, groundwater, and soil vapors.

2.0 PROJECT CONTACT DIRECTORY

2.1 NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NYSDEC
Remedial Bureau E, Section A
Division of Environmental Remediation
625 Broadway, 12th floor
Albany, NY 12233-7017

Project Manager:
Brian Jankauskas
Ph: 518.402.9620

2.2 O&M CONTRACTOR

Environmental Assessment & Remediations
225 Atlantic Avenue
Patchogue, NY 11772
Ph: 631.447.6400
Fax: 631.447.6497

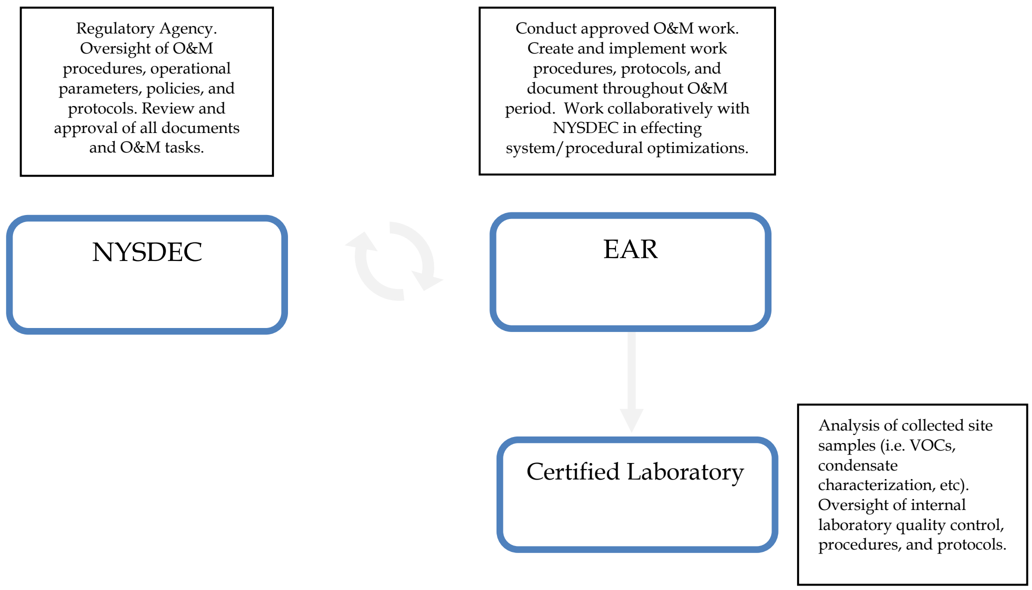
Project Manager:
Ian Hofmann
Cell: 631.241.8741

2.3 SVE SYSTEM MANUFACTURER

NES, Inc.
84 Dunham Street
Attleboro, MA 02703
Ph: 508.226.1100
Fax: 508.226.1180

3.0 O&M ORGANIZATION STRUCTURE

Environmental Assessment & Remediations (EAR) will be handling the operation and maintenance of the SVE System under the direction and guidance of the NYSDEC. The following figure provides the organizational structure and collaboration for this project:



4.0 HEALTH & SAFETY

EAR personnel are required to follow guidance set forth in the Health & Safety Plan, Traffic Safety Plan, Materials Handling Plan, Quality Assurance Project Plan (QAPP), and Contingency Plan submittals. Any additional, task-specific safety guidelines, as put forth in this document, are to be followed as well.

Please note that hearing protection and protective eyewear is to be worn at all times when working inside the system container when system is operating.

The system is equipped with two emergency stop buttons. One emergency stop is located on the rear, exterior of the system container (near fused disconnect box). The other emergency stop is located inside the system container, below the light switch. All project field personnel shall note the locations of both emergency stop buttons prior to beginning any work.

4.1 INJURY OR MEDICAL EMERGENCY

In the event of injury or medical emergency the following procedures will be implemented immediately:

- The local Emergency Medical Response Team (EMRT) and police will be notified of the situation via the 911 system.

- Personnel will render first aid within the limits of their training. One person will remain with the injured party at all times unless required to call the EMRT.

- After the EMRT arrives they will be notified of all pertinent site information, including nature of contaminants known or suspected to be on site and all information relating to the nature of the injury.

The Environmental Assessment & Remediations (EAR) office and the New York State Department of Environmental Conservation (NYSDEC) will be notified immediately in the event of an emergency/accident. Within two working days of any reportable accident, EAR will prepare and submit an Accident/Incident Report (see Health & Safety Plan submittal) to NYSDEC.

4.2 EMERGENCY CONTACTS

GENERAL

- Fire Department: **911**
- Police Department: **911**
- Ambulance: **911**
- Poison Control Center: **(212) 340-4494**
- Chemtrec: **800-424-9300**
- New York City and Long Island One Call System: **1-800-272-4480 (or 811)**

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

24-Hour Contact: ***1-888-EAR-6789 (option-2 for emergency)***

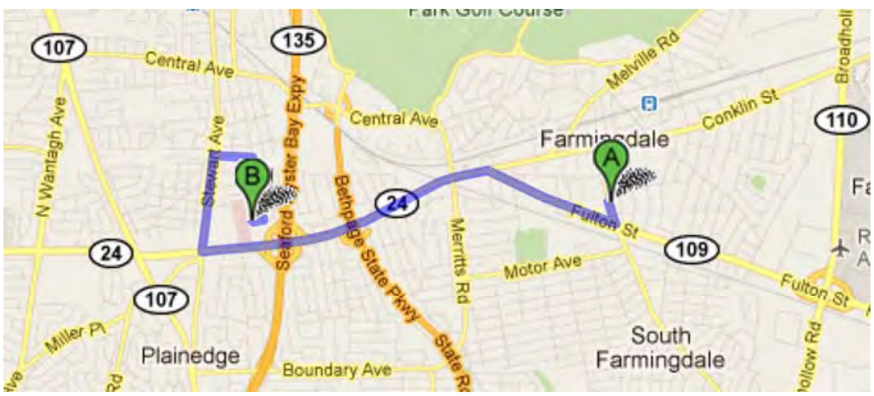
- David Vigliotta (Owner, President) (24 hour on-call for emergencies via above number)
  Work: **(631) 447-6400**
  Home: **(631) 363-0732**
  Cell: **(632) 872-2824**
- John Hofmann (Health & Safety Officer) (24 hour on-call for emergencies via above number)
  Work: **(631) 447-6400 x113**
  Home: **(631) 475-7206**
  Cell: **(516) 924-1382**
- Ian Hofmann (Project Manager)
  Work: **(631) 241.8741**
  Home: **(504) 858-2481 (no land based home line available)**
  Cell: **(504) 858-2481**

NYSDEC

- Brian Jankauskas (Project Manager)
  Work: **(518) 402-9620**

4.3 HOSPITAL INFORMATION

The nearest hospital from the Farmingdale Plaza Cleaners site is the St. Joseph Hospital at 4295 Hempstead Turnpike. The phone number for the hospital is (516) 579-6000. A map and directions to the hospital from the site location are provided below.



450 Main St, Farmingdale, NY 11735

1.	Head **south** on **Main St** toward **Richard St**	go 0.1 mi total 0.1 mi
2.	Take the 1st right onto **Fulton St** About 2 mins	go 0.9 mi total 1.0 mi
3.	**Fulton St** turns slightly left and becomes **Hempstead Turnpike** About 2 mins	go 1.3 mi total 2.3 mi
4.	Turn right onto **Stewart Ave** About 1 min	go 0.5 mi total 2.7 mi
5.	Take the 2nd right onto **Arthur Ave**	go 0.2 mi total 2.9 mi
6.	Turn right onto **Broadway** About 1 min	go 0.3 mi total 3.2 mi
7.	Turn right onto **Windhorst Ave** Destination will be on the left	go 295 ft total 3.3 mi

St. Joseph Hospital
4295 Hempstead Turnpike, Bethpage, NY 11714 - (516) 520-5507

5.0 SYSTEM DESCRIPTION

The SVE system at this site is comprised of a “packaged” system, manufactured by National Environmental Systems, Inc. (NES), wherein all equipment, hardware, and controls have been mounted and plumbed inside a cargo container. A layout of the system equipment is provided as Figure 1. The purpose of the SVE system at this site is to prevent exposure to contaminated soil vapors and treat residual soil contamination.

The system is plumbed via subsurface piping to three SVE wells, SVE-1, SVE-3, and SVE-5. A site map showing the locations of the SVE wells and other pertinent site features is provided as Figure 2. A fourth, auxiliary, subsurface header piping run was installed from the SVE system compound enclosure, to just outside of the SVE-5 manhole where it terminates.

The system operates by inducing a vacuum at extraction wells SVE-1, SVE-3, or SVE-5 (or any combination thereof) utilizing a 10 horsepower (hp) regenerative blower. Captured soil vapors are transported, via subsurface piping, to the system compound. Moisture is removed from the airstream at a 60-gallon moisture separator tank prior to reaching the blower. Two 140 lb granular activated carbon vessels are piped in series such that exhaust can be treated prior to discharge to the atmosphere. These vessels are currently bypassed.

A process and instrumentation diagram (P&ID) is included as Figure 3. A summary of the major system components is provided as Appendix A.

The system is equipped with two emergency stop buttons. One emergency stop is located on the rear, exterior wall of the system container (near fused disconnect box). The other emergency stop is located inside the system container, below the light switch. All project field personnel shall note the locations of both emergency stop buttons prior to beginning any work.

5.1 SYSTEM ENCLOSURE

The system is enclosed in a 20′ x 8′ x 8′ steel cargo container. The container is equipped with interior lighting, heating, and ventilation. Product data for the system enclosure components is provided as Appendix B.

5.2 ELECTRICAL

Electrical power to the SVE system consists of a three-phase 208 volt, 100 amp overhead service. Control panel drawings and electrical line diagrams are provided as Figures 4 through 6. Product data for the system electrical components is provided as Appendix C.

5.2.1 COMMUNICATIONS AND CONTROL SYSTEMS

This system features an EOS Procontrol (EOS) programmable logic control system and Sensaphone autodialer. The EOS system allows users to access and view system status as well as select operational data, in addition to alerting designated parties of alarm conditions, and managing alarm response/sequencing. An input/output list for the EOS system is also provided as Appendix D. The EOS ProControl manual is included in Appendix C.

Separate “land-based” phone lines provide access to/from the EOS system and autodialer:

Phone number: **516.249.2740** - EOS system modem access (for remote access/connection)[1]
Phone number: **516.249.2650** - dedicated autodialer line

Service for both lines is provided by Verizon.

Remote users must have a dial-up modem, ProView software (available for download from the EOS website at http://www.eosresearch.com/Site/ProView.html), and the ProView site file (available from NES, Inc., and EAR).

5.3 SVE

Product data for the SVE components, including blower, level switches and vacuum/flow/temperature transmitters, is provided as Appendix E.

5.4 GRANULAR ACTIVATED CARBON SYSTEM[2]

The blower effluent airstream is treated at two 140 lb granular activated carbon (GAC) vessels (TetraSolv VR-140 w/ 4x10 mesh GAC) prior to discharge to the atmosphere. Product data is provided as Appendix F.

5.5 PERFORMANCE OBJECTIVES

The system performance objectives are as follows:

- The system is currently operated with vapor extraction at SVE-3 and SVE-5. SVE-1 is currently offline.
- Maintain an air flow rate of approximately 215-250 cubic feet per minute (CFM) at an approximate vacuum of -30 inches of water column ("WC).
- Maintain a minimum airflow of 100 CFM at SVE-3 and 115 CFM at SVE-5.
- Carbon treatment of the system exhaust is currently bypassed.

[1] This line is currently disconnected.

[2] Based on the results of DAR-1 emissions compliance and air quality impact analyses conducted by EAR in 2013, it was determined that the combined potential emissions from SVE-1, SVE-3, and SVE-5 would not require treatment. As such, the carbon vessels are currently bypassed.

6.0 SYSTEM TESTING & ACTIVATION

Prior to system activation, all process, mechanical, and electrical components and instruments should be individually visually inspected and tested to ensure proper installation, functionality, and proper operation. Equipment and system testing is to be conducted using non-impacted, ambient air. As such, the flex hose connecting the SVE header pipes to the equipment container should be disconnected. Valve positions for equipment and system testing are illustrated in Figure 7.

Except where indicated otherwise, the below testing procedures should be repeated whenever the system has remained off in excess of 5 days, or whenever the system has been moved or re-wired.

6.1 VISUAL INSPECTION

Prior to beginning the visual inspection activities, check that the system is NOT energized. The main power should be in the "off" position and locked & tagged. A qualified electrician will check that all electrical circuit breakers for the process equipment are locked and tagged.

Utilize the process and instrumentation diagram provided as Figure 3 to verify that all components are present, configured properly, and securely piped. In doing so, begin inspection at the SVE piping manifold, continuing along the treatment process. Check all instrumentation, equipment, and process piping connections. Check that all equipment and instrumentation components are properly labeled/identified. Check that all process piping and piping connections are true and free of cracks or other visible damage/defects. An inspection checklist is provided as Appendix G.

Should any damaged or out of place items be found, notify the project manager (PM) immediately. In addition, all defects and/or damages are to be individually logged on a deficiency report form. A sample deficiency report form is provided as Appendix H.

In the event damages and/or defects are observed, they will be reported to NYSDEC, and a proper corrective action(s) will be determined and implemented.

6.2 ELECTRICAL INSPECTION

Prior to beginning visual inspection of electrical components, check that the system is NOT energized. The main power should be in the "off" position and locked & tagged. A qualified electrician shall be onsite to check that all electrical circuit breakers for the process equipment are locked and tagged prior to conducting the inspection activities described in this section. All electrical inspections will be conducted by a qualified electrician.

Visually inspect control panel interior and all other electrical cabinets to ensure proper connections. Check that all cabinets are free of dirt, debris, or water.

Visually inspect all wiring for insulation flaws or defects. This includes visual inspection of all conduit, junction boxes, telephone conduits, and equipment connections.

Should any damaged or out of place items be found, notify the PM immediately. In addition, all defects and/or damages are to be individually logged. A sample deficiency report form is provided as Appendix H.

In the event damages and/or defects are observed, they will be reported to NYSDEC, and a proper corrective action(s) will be determined and implemented.

6.3 EQUIPMENT TEST

This section details the procedures for testing the individual equipment components to ensure proper installation and satisfactory performance.

Before energizing the system, ensure all components are set to "off" at the control panel. These components are:

- Control Power
- SVE Blower
- Moisture Separator Transfer Pump

After a qualified electrician energizes the system, turn the Control Power switch to "on" at the control panel.

6.3.1 SVE BLOWER

Operate the SVE blower (B-101) in "hand" for approx. 5-10 minutes. While operating check and record the vacuum, pressure, and airflow rates at instruments VI-102, VI-104, VI-106, PI-101, FI-101, and FI-102. Check that the direction of rotation is as indicated on the blower motor fan cowling, and that a positive pressure is indicated on effluent pressure gauges.

In the event any equipment is found not operational, notify the PM immediately. Defects are to be logged accordingly on a deficiency report form (Appendix H). Should an incorrect rotational direction be observed at the SVE blower, the power supply leads will need to be re-wired accordingly by a qualified electrician.

6.3.2 MOISTURE SEPARATOR PUMP

Operate the moisture separator transfer pump (TP-101) in "hand" to ensure operation. As the moisture separator tank will be dry, do not operate the pump in excess of 1 minute. Check that the motor starts and pump turns. Check rotational direction (should be clockwise when viewed from motor end).

In the event any equipment is found not operational, notify the PM immediately. Defects are to be logged accordingly on a deficiency report form (Appendix H). Should an incorrect rotational direction be observed at the transfer pump, the power supply leads will need to be re-wired accordingly by a qualified electrician.

6.4 SYSTEM TESTING

Prior to connection to the SVE well(s) and system activation, the system shall be operated in order to demonstrate that all equipment, sensors, controls, and programming are properly installed and coordinated to perform satisfactorily as a complete system. Testing will be conducted using non-impacted, ambient air.

During system testing, valving should be configured as illustrated in Figure 7.

6.5 CONTROL TESTING

In order to ensure proper installation and operation of the EOS system controls and programming, alarm conditions are to be manually triggered/activated with the system operating. Following each alarm condition simulation and confirmation of the proper response, the system is to be reset and restarted prior to the next alarm condition simulation. System alarms should also be tested regularly during normal operation, at a quarterly frequency, to ensure proper operation. The alarm conditions and their respective responses are provided in the following table:

Instrument/Sensor	Alarm Condition	System Response	Panel Indicator Light?	Autodialer Call?	Autodialer Fax Report?
LSHH-101	Moisture separator high-level	Shutdown	Yes	Yes (alarm condition 1)	Yes
VT-101	Low vacuum level	Shutdown	Yes	Yes (alarm condition 4)	Yes
TIT-101	High discharge temp	Shutdown	Yes	Yes (alarm condition 2)	Yes
N/A	VFD fault	Shutdown	Yes	Yes (alarm condition 3)	Yes
N/A	Emergency stop active	Shutdown	Yes	Yes (alarm condition 4)	Yes

The system operator is to coordinate each alarm condition simulation with the PM so that autodialer function can be testing. Operator is to wait until PM confirms autodialer response (call & fax) for each alarm condition prior to proceeding further.

Should any of the above listed alarm conditions fail to result in the proper response (as listed above), or if any shutdown notifications are not transmitted by the autodialer, EAR will troubleshoot the errors as necessary. Defects are to be logged accordingly on a deficiency report form (Appendix H). Any necessary corrective actions are to be implemented, and the alarm retested and deemed satisfactory prior to continuing further.

6.6 ACTIVATING THE SYSTEM

Prior activating the system, the operator shall check that all valves are positioned as shown in Figure 8 for normal system operation, and that SVE header pipes are reconnected to the manifold.

1. Ensure the above listed inspection & testing procedures have been implemented and that any defects have been corrected.
2. Check that the control panel has power.
3. Turn the SVE Blower control (at control Panel) to the “AUTO” position.
4. Check and record the system influent vacuum and air flow. Slowly adjust the blower operation to the desired vacuum/airflow by increasing or decreasing the operating frequency (Hz) at the VFD.

7.0 SYSTEM MONITORING

During each site visit, monitoring data (collected both before and after any system adjustments) should be recorded on a site data information sheet (SDI). A site specific SDI sheet is provided as Appendix I.

Where gauges or other indicating instruments are not present/applicable, system data should be measured using the following instruments (or equivalents):

Parameter	Instrument	Model
Air flow	Air Velocity Meter	VelociCalc® 8345 or equivalent
Vacuum	Digital Manometer	Digimano® 2000 or equivalent
Volatile Organic Compounds (VOC)	Photo-Ionization Detector	PhotoVac® 2220 Pro / Pro Plus or Minirae® 2000 or equivalent
Temperature	Air Velocity Meter	VelociCalc® 8345 or equivalent

Site checks are currently conducted on a bi-weekly basis (once every other week). Additional visits may be warranted based on changing system operational/maintenance demands and as requested by NYSDEC.

7.1 AIR SAMPLES FOR LABORATORY ANALYSIS

In order to identify and quantify contaminant concentrations and recovery rates, air samples are be collected periodically from the system influent air stream(s) and submitted for laboratory analysis. Air samples collected for laboratory analysis shall be collected in 6-liter, passivated Summa® canisters, and submitted to a certified lab for analysis via EPA method TO-15. Samples will be analyzed for parameters as listed in the QAPP.

Typical sample locations and frequencies (unless noted otherwise by NYSDEC) are as follows:

Sample Location	Initial Collection Frequency	Collection Frequency as of 10/2014
SVE-1 Influent	Monthly	-
SVE-3 Influent	Monthly	-
SVE-5 Influent	Monthly	-
System Influent (or Pre-Carbon as applicable)	Monthly	-
System Effluent (or Post-Carbon as applicable)	Monthly	Quarterly

Sampling frequencies should be re-evaluated following significant system adjustments.

8.0 EMISSIONS COMPLIANCE

Although an air permit is not required for this site, air emissions from the SVE system are subject to regulations as set forth by DAR-1[3]. Should emissions exceed the Annual Guidance Concentration (AGC) or Short-term Guidance Concentration (SGC) for any given contaminant, actions will be taken immediately to reduce emissions contaminant concentrations to below their respective AGC/SGC. These actions may include, but are not limited to: carbon vessel changeout, adjustment of system operating parameters, implementation of additional remedial controls, system shutdown, or a combination of these actions.

Based upon a nominal system airflow rate of 300 CFM, an actual exhaust stack height of 18-feet, and an actual exhaust stack inner diameter of 3.826-inches, the **maximum** allowable emission rates per contaminant are as follows:

Contaminant	AGC (ug/M^3)	SGC (ug/M^3)	Maximum Allowable Emission Rate (lbs/hr)
Tetrachloroethylene	1.0	1,000	0.01269
Trichloroethylene	0.45	54,000	0.00444
1,2-Dichloroethylene	1,900	n/a	24.13593

The above listed maximum allowable emission rates will be considered action levels. NYSDEC and AECOM will be notified immediately should lab analytical results suggest that the above values are being exceeded. The required corrective action(s) will be implemented following discussion and approval from AECOM and/or NYSDEC.

Any additional contaminants reported in the discharge airstream are to be evaluated as they are encountered.

8.1 AIR SAMPLING

In order to ensure compliance with the above listed emissions rates, air samples should be collected from the system effluent at a frequency of once per quarter (as noted in Section 7.1).

Air samples shall be collected in 6-liter, passivated Summa® canisters, and submitted to a certified lab for analysis via EPA method TO-15. Samples will be analyzed for parameters as listed in the QAPP.

8.2 PID MONITORING

A comparison of laboratory reported contaminant concentrations against total VOC concentrations as reported in the field using a PID revealed a poor correlation between the two. However, should field screening of the effluent (post-carbon) airstream yield a PID reading of 10ppm or greater, NYSDEC should be notified immediately such that a determination to shut down the system pending further evaluation can be made.

[3] NYSDEC Division of Air Resources, DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants

9.0 INSPECTION & MAINTENANCE

Regular inspection and maintenance items, with their respective, suggested frequencies, are provided in the inspection, maintenance, and lubrication schedule (IMLS), provided here as Appendix J. Maintenance activities should be conducted following guidance provided in the manufacturer's product data sheets (Appendices B through F), implementing any additional safety precautions set forth therein.

IMLS sheets shall be completed in the field by the system operators, and denote the date, if the inspection/maintenance item was conducted, and date when the inspection/maintenance item was last conducted.

Site visits are currently conducted on a bi-weekly basis (once every other week). Additional visits may be warranted based on changing system operational/maintenance demands and as requested by NYSDEC.

9.1 SYSTEM ALARMS

9.1.1 ALARM RESPONSE

In the event an alarm notification has been received, EAR will dispatch a technician to the site in order to investigate the cause and restart the system within 24 hours of receiving the notification.

NYSDEC is to be notified of any instance where the system will not be operating for a period of 72 hours or greater. The notification shall be transmitted via email and include the date/time of shutdown, reason for shutdown, corrective action(s), and anticipated duration of shutdown.

9.1.2 ALARM TESTING

During system operation, the alarms should be tested quarterly to ensure functionality. Alarm testing should be conducted following the guidance provided in Section 6.5.

9.2 CONDENSATE MANAGEMENT

9.2.1 DRAINING THE MOISTURE SEPARATOR

Depending on site conditions, the moisture separator tank will require periodic draining to prevent a system shutdown caused by high liquid levels in the separator. Draining the separator tank should be conducted whenever the liquid level in the sight tube is greater than 50% of the length of the sight tube.

The moisture separator is equipped with a 1.5-inch diameter drainage line connected to a 0.5 hp transfer pump. In order to drain the moisture separator, follow these steps:

1. Ensure transfer pump outlet hose is positioned to empty to a 55-gallon drum.
2. Open valve at transfer pump outlet.
3. At the control panel, turn the M/S Effluent switch to the "hand" position. This will operate the pump. Hold the switch in "hand" until liquid levels in the separator are below the sight tube. DO NOT run the transfer pump dry. Return the switch to the "off" position.
4. Close valve at the transfer pump outlet.

5. Seal and label the 55-gallon condensate storage drum. If the drum is not full, the drum can be used again for moisture separator drainage as necessary. Notify the project manager when any storage drums are nearing capacity so that disposal can be arranged accordingly.

9.2.2 CLEARING HEADER PIPING OF MOISTURE

Depending on site conditions, moisture may accumulate in the header piping and/or system manifold, resulting in decreased system performance. This system has been configured such that the SVE blower, drawing ambient air, can induce positive pressure at the header piping and SVE wells, thus clearing the lines of moisture by "blowing" moisture back to the SVE wells where it can drain back into the unsaturated zone.

This procedure is to be conducted as necessary, following these steps:

1. Shut down blower by turning the SVE Blower switch at the control panel to the "off" position.
2. Reconfigure valves as indicated in Figure 9. ***It is imperative that the valves are positioned correctly in order to avoid damaging the instrumentation.***
3. Double check that valves are correctly positioned and that the dilution valve is open 100%.
4. If only one SVE header line is affected, close the valve at the manifold to the unaffected line(s).
5. Operate the blower in "hand" for no more than 10 minutes, then return the blower switch to the "off" position
6. Return valves to normal operating positions (see Figure 8).
7. Keep system off for approximately 30 minutes to allow moisture to drain back to the vadose zone.
8. Restart system following guidelines provided in Section 6.6.

9.2.3 CONDENSATE DISPOSAL

Condensate is to be disposed of offsite. Transportation and disposal of condensate is to be conducted by **Island Pump & Tank (40 Doyle Court, East Northport, NY 11731. Phone: 631.462.2226).** Island Pump & Tank has already been provided with analytical results from a condensate sample collected at this site. The laboratory analytical report is also provided here as Appendix K.

9.3 CARBON CHANGEOUTS[4]

As necessary, spent carbon media will need to be replaced. The frequency of carbon changeouts will be dependent on contaminant loading/humidity/air temperature. Changeouts will be conducted as deemed necessary when monitoring indicates that system effluent air is not meeting emissions requirements.

Carbon changeouts are to be conducted by a subcontractor, **General Carbon Corp. (33 Paterson Street, Paterson, NJ, 07501. Phone: 973.523.2223)**. General Carbon Corp will be responsible for the removal of spent carbon (via vacuum), transport & reactivation or disposal of spent carbon, and the installation of replacement carbon.

[4] Based on the results of DAR-1 emissions compliance and air quality impact analyses conducted by EAR in 2013, it was determined that the combined potential emissions from SVE-1, SVE-3, and SVE-5 would not require treatment. As such, the carbon vessels are currently bypassed.

Replacement carbon shall be a virgin, 4x10 mesh activated media specifically for removal of volatile organic compounds. During changeouts, the carbon vessel interiors are to be visually inspected by EAR personnel for any rusting or other fouling prior to installation of the replacement carbon. Dust masks are to be worn by all personnel conducting carbon changeouts.

Prior to the *first* carbon changeout, a sample of the spent media must be collected for profiling as follows:

ANALYSES	SAMPLE CONTAINER
TCLP Volatiles	1x 2oz glass jar w/ septa (unpreserved)
TCLP Metals & Flashpoint	1x 8oz glass jar (unpreserved)

Carbon samples are to be submitted to a certified laboratory for the above listed analyses.

9.4 EXTENDED SYSTEM SHUTDOWNS

This system should not be stored for longer than 1 month without operating, as blowers and pumps may rust and seize if not run once per month.

Should the system be idle for longer than 1 month with no means of intermittent operation, follow the manufacturers' guidelines for extended storage (Appendices B through F).

10.0 DOCUMENTATION & REPORTING

10.1 DOCUMENTATION

A "project folder" (three-ring binder) is to be kept onsite, within the system container, at all times. The project folder shall include:

- Testing logs
- Inspection, maintenance, and lubrication logs
- Copies of any permits
- Documentation of carbon change-outs and pickup/disposal of any condensate
- Boring logs

A separate log book will be kept onsite which will contain all system data as observed during each site visit, as well as details of any system adjustments made. The log book will be updated during each site visit, prior to departure from the site.

10.2 MONTHLY REPORTS

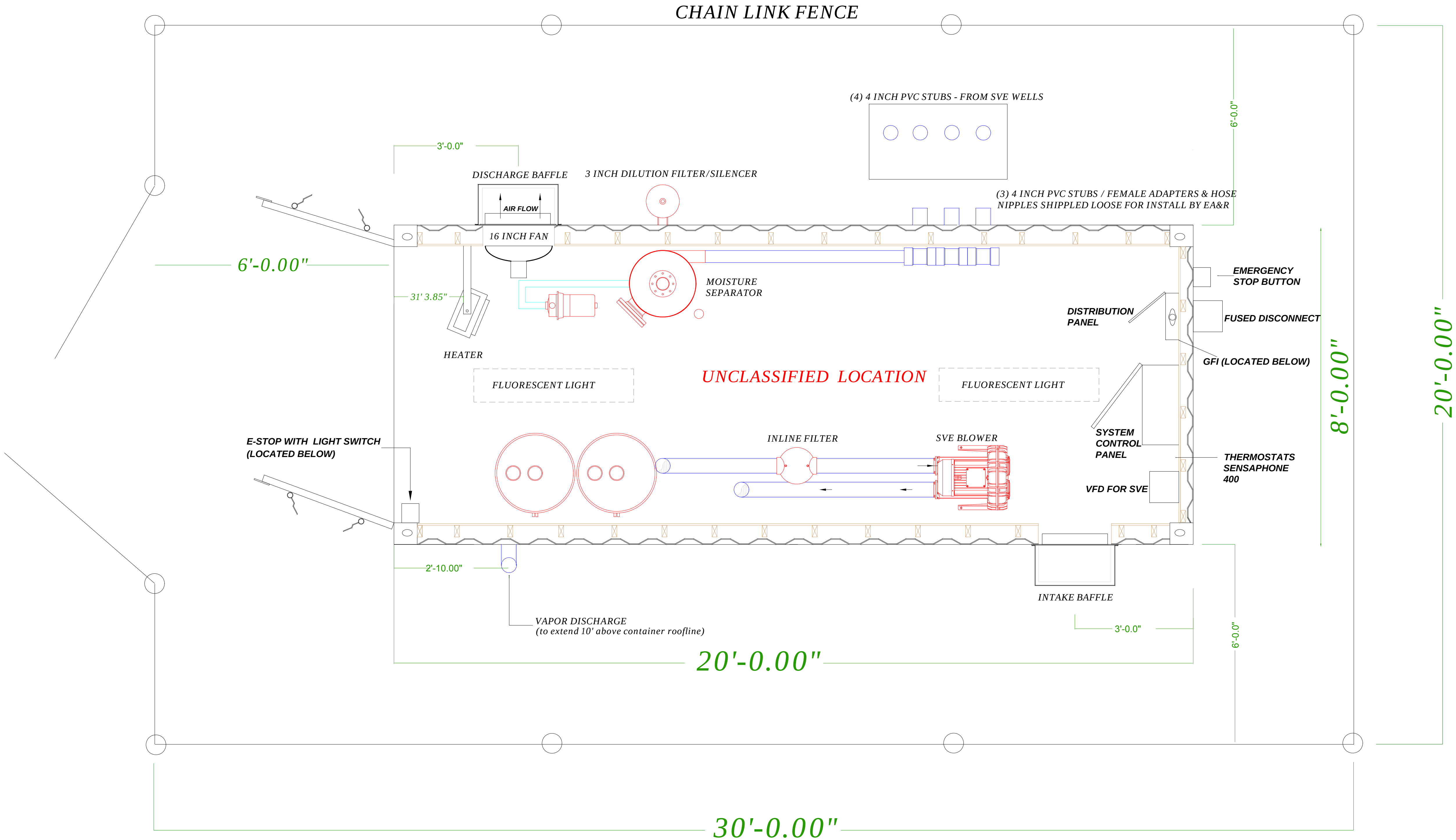
Monthly reports will be submitted to NYSDEC in both a *.pdf and tabular format (*.xls) within three weeks of the end of the reporting month. The monthly reports will provide the observed system data, detail any system adjustments and maintenance activities, and provide estimated vapor recovery and emissions rates.

11.0 WARRANTY

The packaged SVE system carries a manufacturer's (NES, Inc.) warranty of up to 12 months from the date of manufacture and invoice (9/22/11). A copy of the manufacturer's warranty is provided as Appendix L.

FIGURES

Figure 1



REVISION:	DESCRIPTION:	DATE:	APPROVED:

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

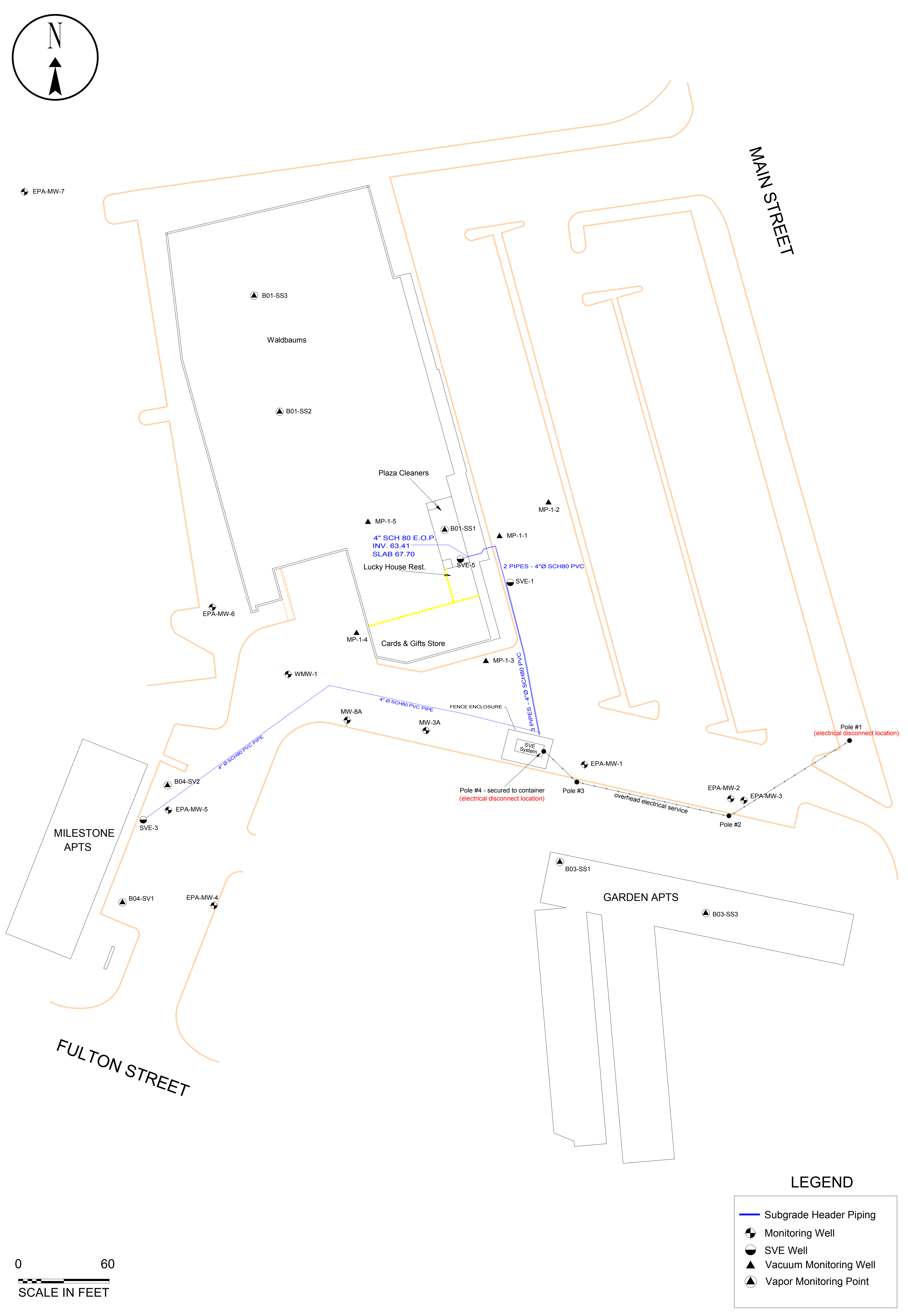
JOB SITE IDENTIFICATION:

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
Site No. 130107

DRAWING IDENTIFICATION:

SVE SYSTEM LAYOUT

DESIGNED BY:		DATE:
DRAWN BY:		DRAWING NO:
CHECKED BY:		
APPROVED BY:		REVISION: 3/25/15



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

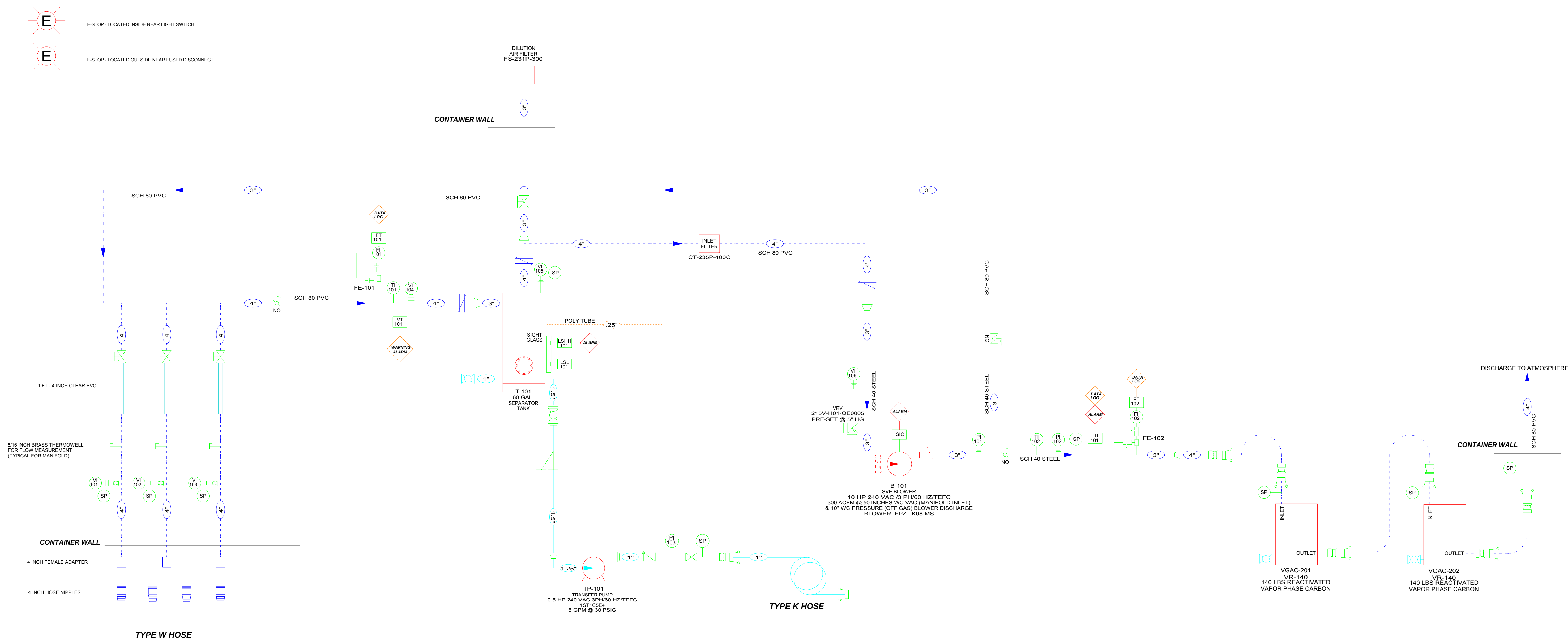
Figure 2

Site Map

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
Site No. 130107

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	(LSHH-101)	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	(TIT-101)	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	(VT-101)	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 3

SVE Process & Instrumentation Diagram

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

INSTRUMENTATION ABBREVIATIONS

CC	CYCLE COUNTER
CF	COALESCING FILTER
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIT	FLOW INDICATING TRANSMITTER
FM	FLOW METER
PF	PARTICULATE FILTER
PI	PRESSURE INDICATOR
PS	PRESSURE SWITCH
SP	SAMPLE PORT
SV	SOLENOID VALVE
TI	TEMPERATURE INDICATOR
VI	VACUUM INDICATOR
DPG	DIFFERENTIAL PRESSURE GAUGE
FS	FLOW SWITCH OR SENSOR
VSH	VACUUM SWITCH HIGH
VSL	VACUUM SWITCH LOW
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
LSHH	LEVEL SWITCH HIGH HIGH
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW LOW
PS	PRESSURE SWITCH
TIT	TEMPERATURE INDICATING TRANSMITTER
TE	TEMPERATURE ELEMENT
HOL	HIGH OIL LEVEL
LOL	LOW OIL LEVEL

INSTRUMENTATION LABELING

INSTRUMENT TYPE
INSTRUMENT DESIGNATION
PI 101
REMOTE DISPLAY

INSTRUMENT TYPE
INSTRUMENT DESIGNATION
PI 101
LOCAL DISPLAY

INSTRUMENT TYPE
LSH 101
SWITCH

PIPE DESIGNATION

- AIR LINE
- WATER LINE
- CONTROL LINE
- INTRINSICALLY SAFE LINE
- ANALOG LINE
- BREAK
- FLOW DIRECTION
- X" PIPE SIZE

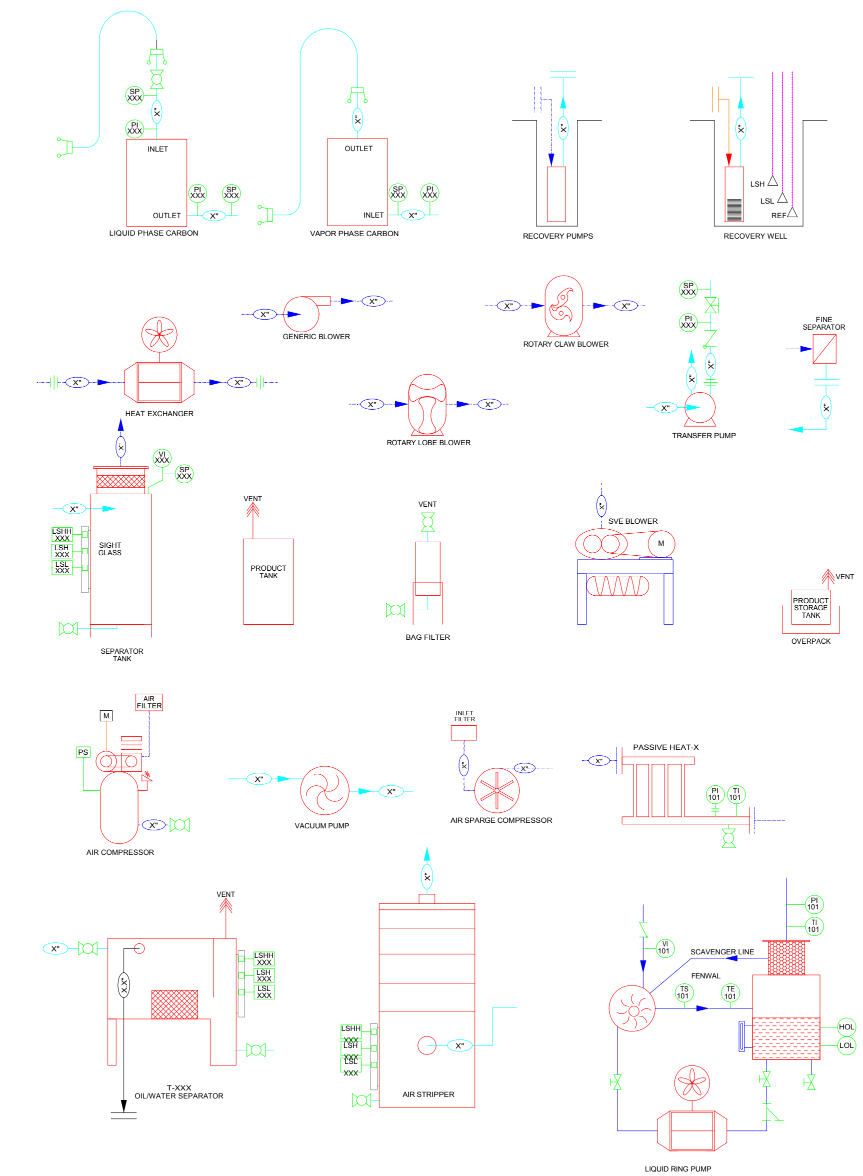
SYMBOLS

- ROTAMETER
- FM XXX FLOW METER
- ETM ELAPSED TIME METER
- AD AUTO DIALER
- T TIMER
- M MOTOR
- A AMP METER
- RTS REMOTE TELEMETRY SYSTEM
- SIC VARIABLE FREQUENCY DRIVE
- STATIC MIXER
- DISCHARGE SILENCER
- DILUTION AIR FILTER
- INLET/INLINE FILTER
- CF COALESCING FILTER
- PF PARTICULATE FILTER

SYMBOLS CONTINUED

- FR FILTER REGULATOR
- MP METERING PUMP
- GLOBE VALVE
- GATE VALVE
- BALL VALVE/DRAIN VALVE
- CHECK VALVE
- RAIN CAP
- BUTTERFLY VALVE
- WYE STRAINER
- RELIEF VALVE
- M&F CAMLOCK
- S SOLENOID VALVE
- PRESSURE REGULATOR
- SIPHON BREAK
- UNION
- CLEAR PVC
- MECHANICAL FLOAT
- PULSE-DAMPING SNUBBER
- PITOT TUBE
- SIGHT GLASS
- X AL ALARM LIGHT
- R RUN LIGHT
- E E-STOP
- NEEDLE VALVE

SYMBOLS CONTINUED



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 3a
SVE Process & Instrumentation Diagram

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

FIGURE 4

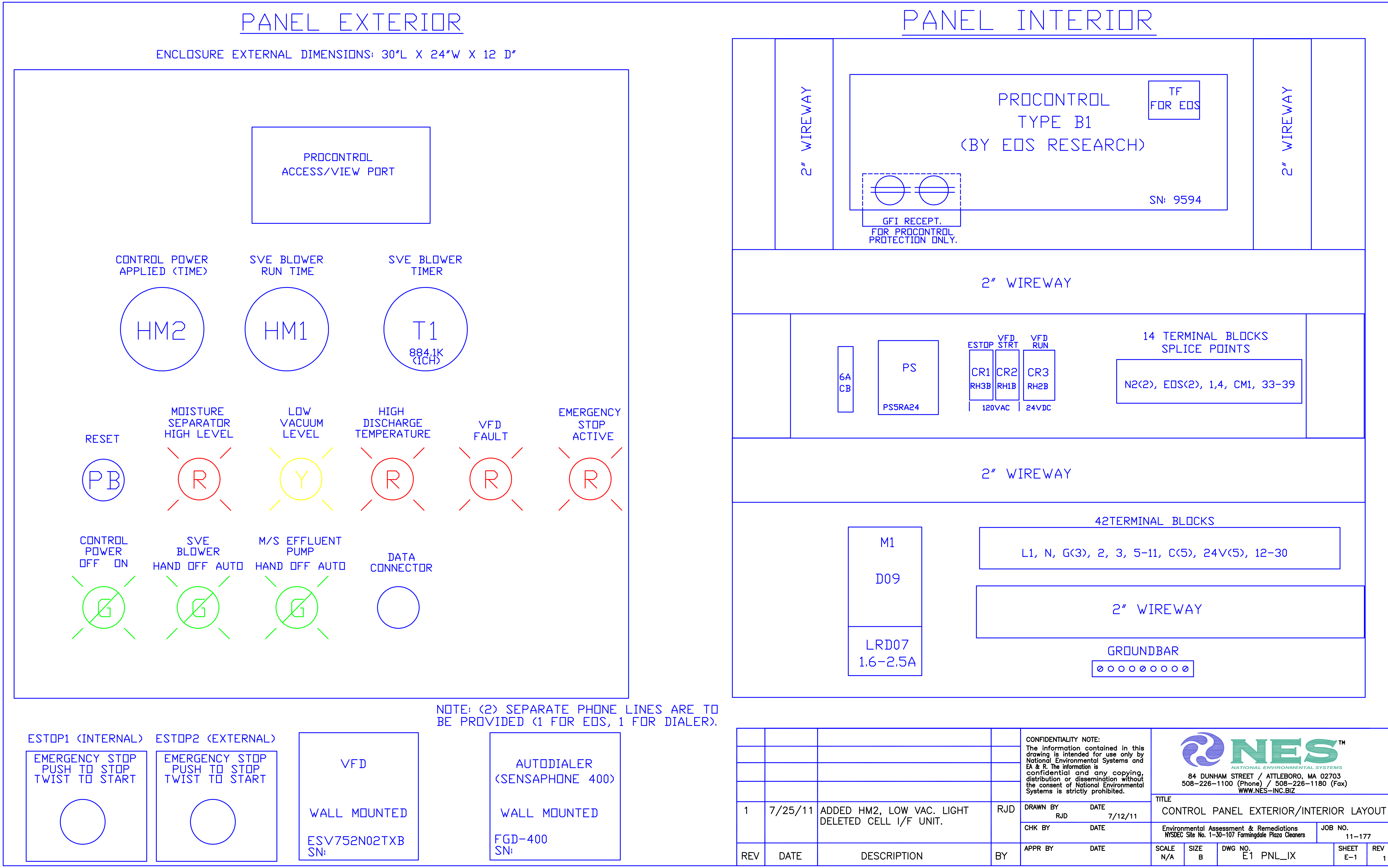
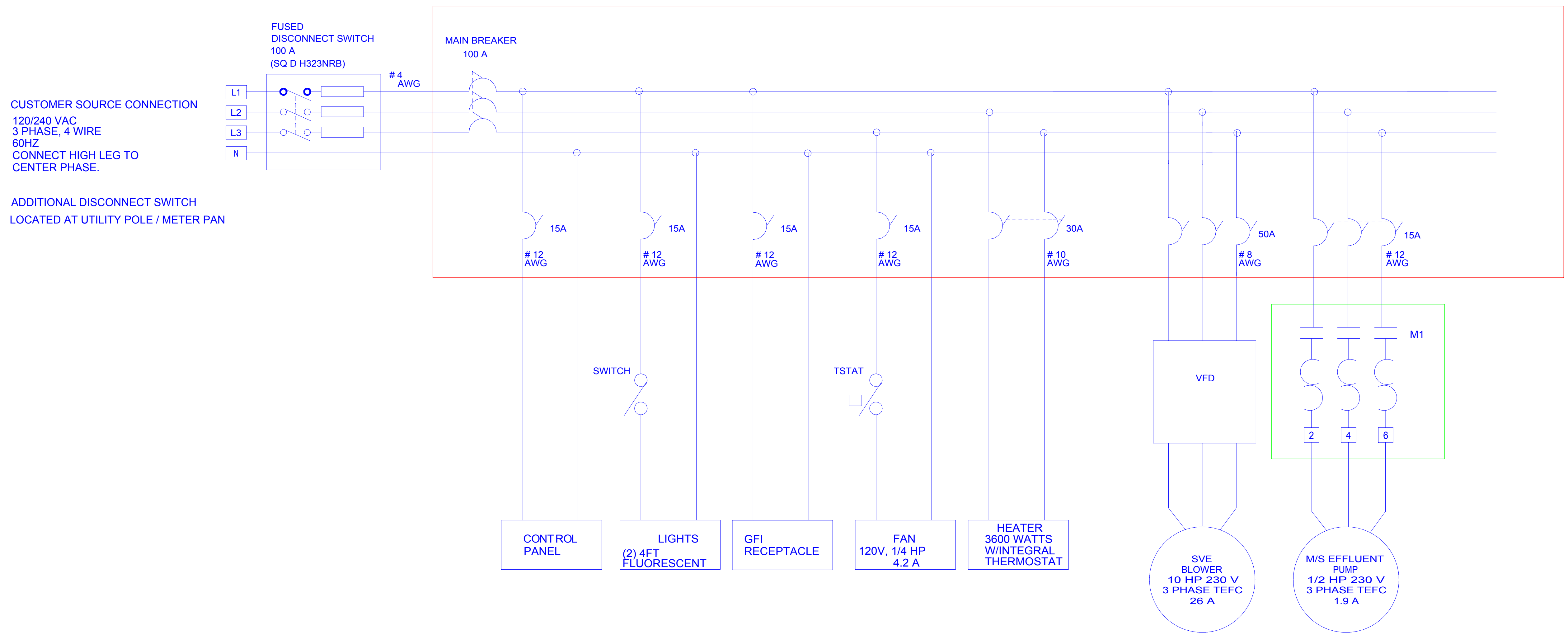

PANEL EXTERIOR
ENCLOSURE EXTERNAL DIMENSIONS: 30"L X 24"W X 12 D"
PROCONTROL ACCESS/VIEW PORT
CONTROL POWER APPLIED (TIME)
HM2
SVE BLOWER RUN TIME
HM1
SVE BLOWER TIMER
T1
884.1K (1CH)
RESET
PB
MOISTURE SEPARATOR HIGH LEVEL
R
LOW VACUUM LEVEL
Y
HIGH DISCHARGE TEMPERATURE
R
VFD FAULT
R
EMERGENCY STOP ACTIVE
R
CONTROL POWER
OFF ON
G
SVE BLOWER
HAND OFF AUTO
G
M/S EFFLUENT PUMP
HAND OFF AUTO
G
DATA CONNECTOR
PANEL INTERIOR
2" WIREWAY
PROCONTROL
TYPE B1
(BY EOS RESEARCH)
TF FOR EOS
SN: 9594
GFI RECEPT. FOR PROCONTROL PROTECTION ONLY.
2" WIREWAY
2" WIREWAY
6A CB
PS
PS5RA24
ESTOP
VFD STRT
VFD RUN
CR1 RH3B
CR2 RH1B
CR3 RH2B
120VAC
24VDC
14 TERMINAL BLOCKS SPLICE POINTS
N2(2), EOS(2), 1,4, CM1, 33-39
2" WIREWAY
M1
D09
LRD07 1.6-2.5A
42TERMINAL BLOCKS
L1, N, G(3), 2, 3, 5-11, C(5), 24V(5), 12-30
2" WIREWAY
GROUNDBAR
NOTE: (2) SEPARATE PHONE LINES ARE TO BE PROVIDED (1 FOR EOS, 1 FOR DIALER).
ESTOP1 (INTERNAL)
EMERGENCY STOP PUSH TO STOP TWIST TO START
ESTOP2 (EXTERNAL)
EMERGENCY STOP PUSH TO STOP TWIST TO START
VFD
WALL MOUNTED
ESV752N02TXB
SN:
AUTODIALER (SENSAPHONE 400)
WALL MOUNTED
FGD-400
SN:
1
7/25/11
ADDED HM2, LOW VAC. LIGHT DELETED CELL I/F UNIT.
RJD
REV
DATE
DESCRIPTION
BY
CONFIDENTIALITY NOTE:
The information contained in this drawing is intended for use only by National Environmental Systems and EA & R. The information is confidential and any copying, distribution or dissemination without the consent of National Environmental Systems is strictly prohibited.
DRAWN BY RJD
DATE 7/12/11
CHK BY
DATE
APPR BY
DATE
NES
NATIONAL ENVIRONMENTAL SYSTEMS
84 DUNHAM STREET / ATTLEBORO, MA 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)
WWW.NES-INC.BIZ
TITLE
CONTROL PANEL EXTERIOR/INTERIOR LAYOUT
Environmental Assessment & Remediations
NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners
JOB NO. 11-177
SCALE N/A
SIZE B
DWG NO. E1 PNL_IX
SHEET E-1
REV 1

FIGURE 5



NOTES: 1. CONTROL PANEL UL 508 LISTED

LEGEND

ABBREV.	DESCRIPTION
M	MOTOR STARTER
MDS	MAIN DISCONNECT SWITCH
CB	CIRCUIT BREAKER
TSTAT	THERMOSTAT
OL	OVER LOAD
AWG	AMERICAN WIRE GAGE
	DISTRIBUTION PANEL LIMIT
	CONTROL PANEL LIMIT

REV	DESCRIPTION	DATE	INIT
A	AS BUILT	9/8/11	EMB

CONFIDENTIALITY NOTE:

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

DRWN BY: RJD	DATE: 07/12/11
CHK BY	DATE
APPR BY	DATE

TITLE: LINE DIAGRAM

Environmental Assessment & Remediations
NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners

JOB NO. 11-177

SCALE	SIZE	DWG NO.	SHEET	REV
N/A	B	E2 LINE	E-2	A

THREE PHASE DISTRIBUTION PANEL

120/208 VAC, 100 AMP, 4-WIRE

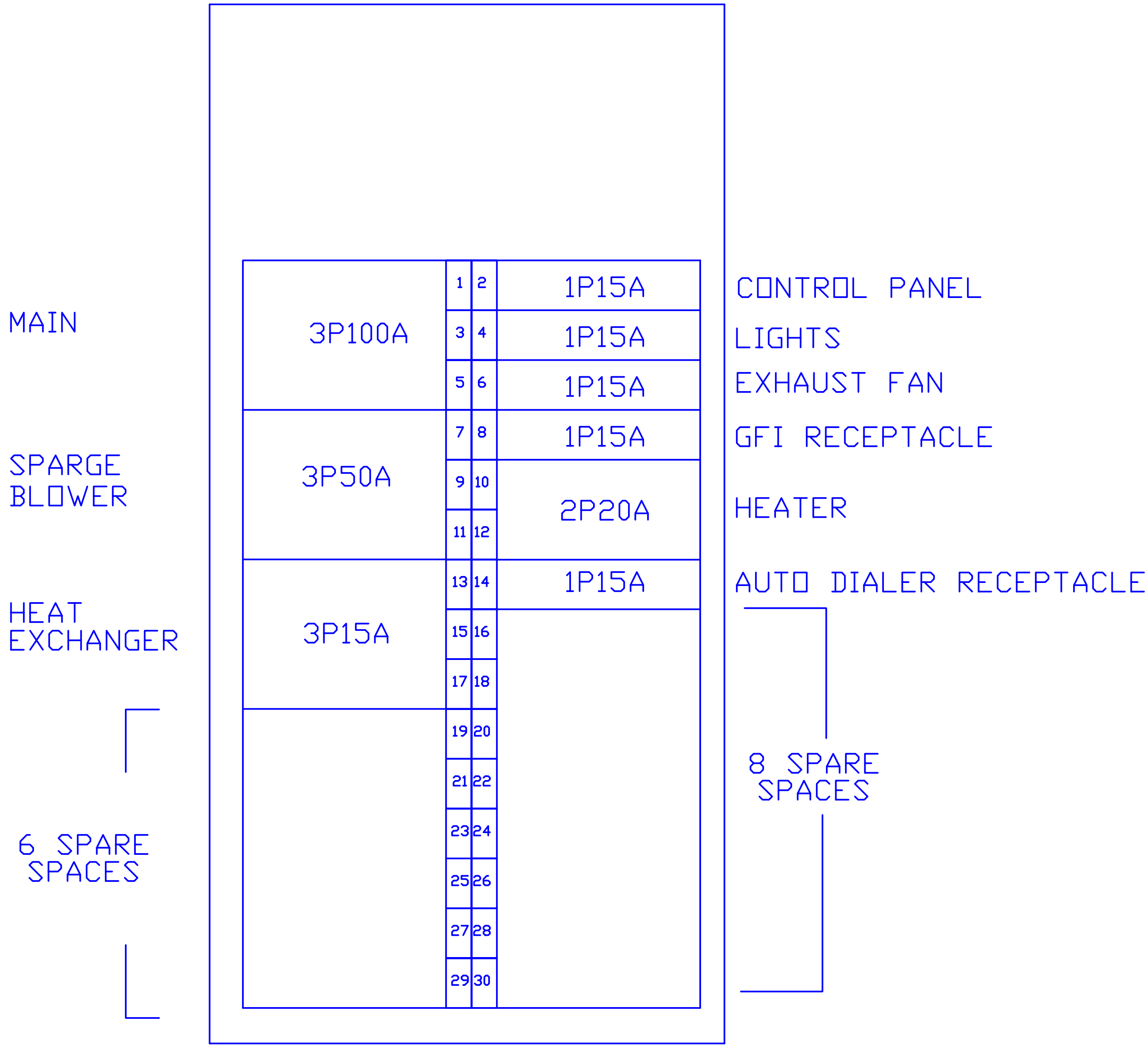


FIGURE 6

NOTES:

1.) BREAKERS INDICATED BY POLE AND AMPERAGE.
(I.E. 3P20A INDICATES A 3 POLE 20 AMP BREAKER)

2.) ONLY PANEL INTERIOR SHOWN. EXTERIOR IS BLANK.

JOB SPECIFIC INFORMATION:

EXTERNAL DIMENSIONS: 30"L X 15"W X 5"D

MANUFACTURER: SQUARE D PHASE: 3

PART NUMBER: QO327M100RB MAX AMPS: 100

OF BUS SECTION

REV	DESCRIPTION	DATE	APPR
A	AS BUILT	7/8/11	EMB

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

DRWN BY RJD DATE 5/16/11

TITLE DISTRIBITION PANEL LAYOUT

CHK BY DATE

CAMERON BAYONNE URBAN RENEWAL
BAYONNE, NJ

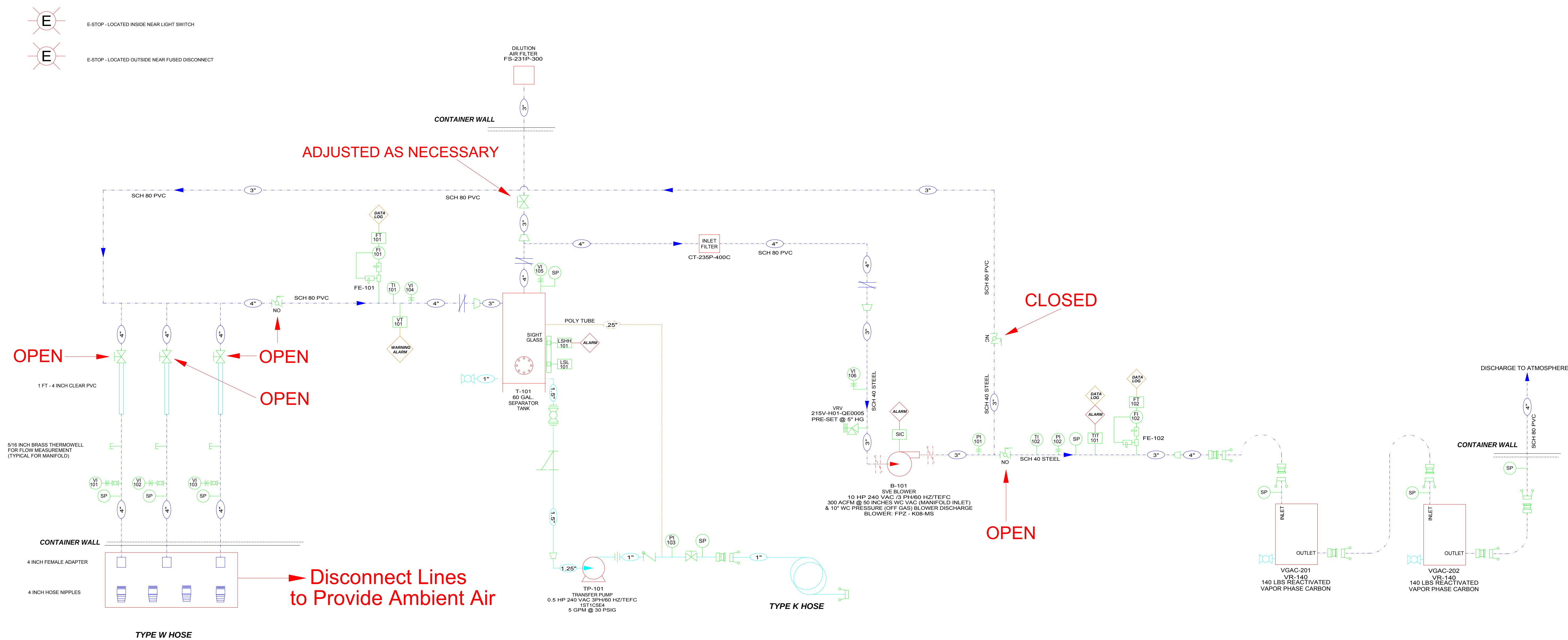
JOB NO. 11–136

APPR BY DATE

SCALE N/A SIZE A DWG NO. E5 DIST–A SHEET E–5 REV A

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	(LSHH-101)	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	(TIT-101)	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	(VT-101)	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

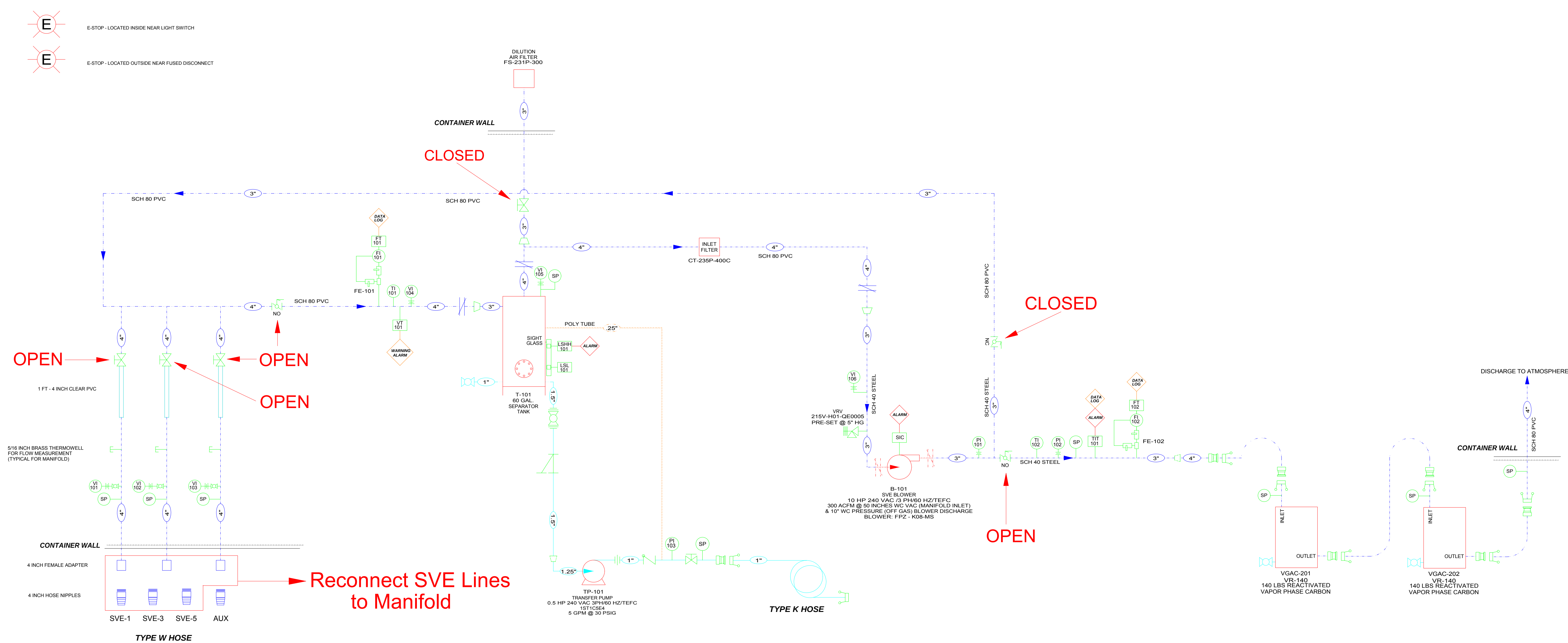
Figure 7

Valve Positions for Equip/System Testing

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	(LSHH-101)	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	(TIT-101)	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	(VT-101)	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN



ENVIRONMENTAL
ASSESSMENT &
REMEDIATIONS

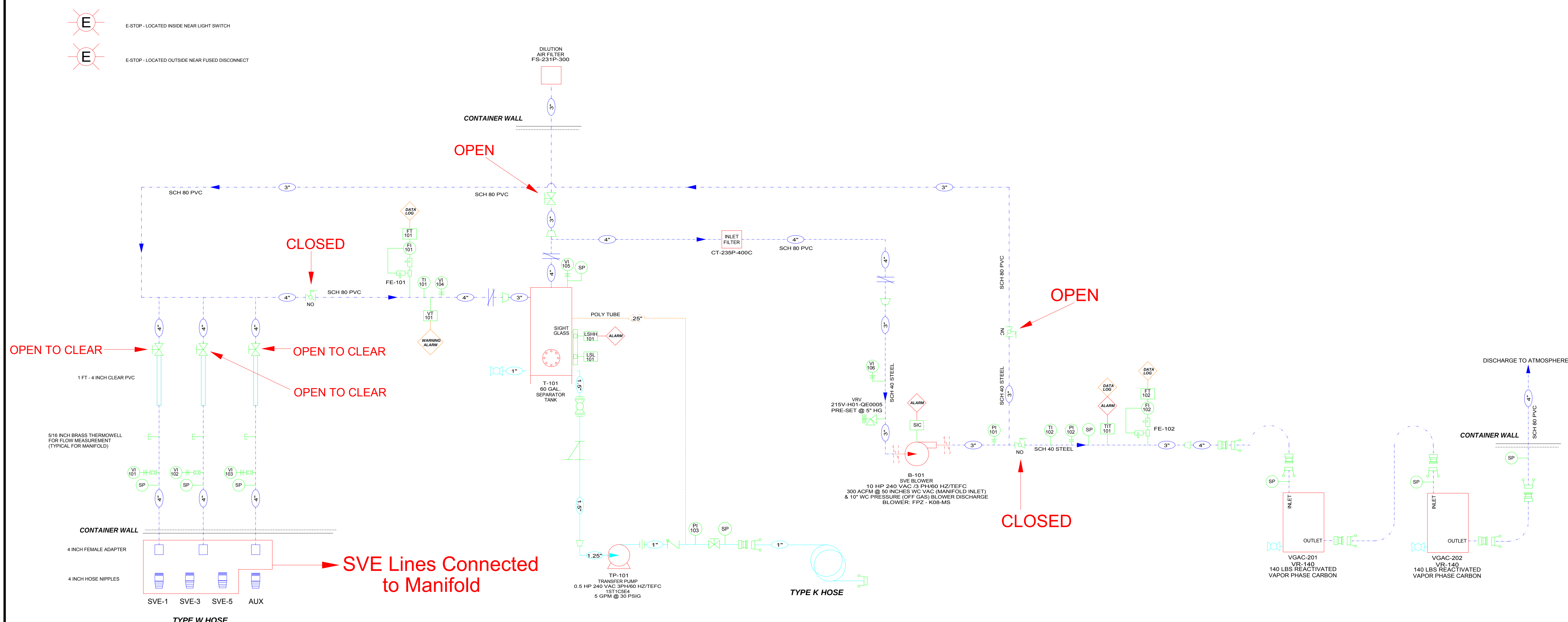
Figure 8

Valve Positions for Normal Operation

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

ALARMS

MOISTURE SEPARATOR - HIGH/HIGH LEVEL	(LSHH-101)	SYSTEM SHUTDOWN - RESET TO PUMP DOWN AND RESTART
SVE BLOWER - HIGH DISCHARGE TEMPERATURE	(TIT-101)	SYSTEM SHUTDOWN
SVE BLOWER - LOW VACUUM	(VT-101)	WARNING ONLY
VFD - GENERAL FAULT		SYSTEM SHUTDOWN
EMERGENCY STOP ENGAGED		SYSTEM SHUTDOWN



ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Figure 9

Valve Positions for Reverse Airflow - Header Pipe Clearing

Farmingdale Plaza Cleaners
450-480 Main Street
Farmingdale, NY
NYSDEC Site No. 130107

APPENDIX A: SUMMARY OF MAJOR COMPONENTS

National Environmental Systems
84 Dunham Street
Attleboro, MA 02703

MAJOR COMPONENT SUMMARY

Project No.: 11-177 (September 2011)

Project: EA&R - SVE Integrated Cargo Box System - NYSDEC Site No.: 1-30-107 Farmingdale, NY Cleaners

Component	Qty.	Manufacturer	Model	Serial Number(s) if Applicable
Control Panel	1	NES		UL:
Panel Enclosure	1	Hoffman	C-SD302412	
Programmable Logic Controller (PLC)	1	EOS	B1 Series 2+	
Telemetry System	1	Sensaphone	FGD-400	
SVE Blower Motor Hour Meter	2	ENM	T-50	
SVE Blower Timer	1	Diehl	TA4353	
Power Distribution Panel	1	Square D	QO327M100RB	
Fused Disconnect	1	Square D	H323NRB	
Variable Frequency Drive (VFD)	1	AC Tech	ESV752N02TXB	
SVE Components				
Moisture Separator, Tank Style	1	NES	60gal	
MS Level Switch	1	NES	P500	
MS Centrifugal Transfer Pump, 0.5hp	1	Goulds	1ST1C5E4	
SVE Blower, 10hp - Specifications	1	FPZ	Model K08-MS-10	
Inline Filter	1	Solberg	CT-235P-400C	
Dilution Filter/Silencer	1	Solberg	FS-231P-300	
Vacuum Relief Valve	1	Tyco-Kunkle	215V-H01-QE0005	
Influent 4in Pitot Tube	1	Dwyer	DS-300-4	
Discharge 3in Pitot Tube	1	Dwyer	DS-300-3	
Pitot Tube Magnehelic Gauges	2	Dwyer	2010	
Flow Transmitters	2	Dwyer	616-3C	
Influent Vacuum Transmitter	2	Dwyer	626-00-GH-P1-E2-S1	
Discharge Temperature Transmitter	1	Pyromation	R1T185L483-004-SL-6HN31T-440	
Vapor Phase Carbon Vessels	2	Tetrasolv	VR 140	
Carbon Media		Tetrasolv	4x10 Re-activated	
Enclosure Components				
Enclosure Exhaust Fan, 16in	1	Dayton	4C163	
Fan Thermostat - Honeywell Model T6031A	1	White Rodgers	2E834/T6031A	
Interior Lights	1	New England Lighting	VT240EBO-UV	
Enclosure Heater	1	Dayton	3UF62	

APPENDIX B: SYSTEM ENCLOSURE COMPONENTS - PRODUCT DATA

GRAINGER.
FOR THE ONES WHO GET IT DONE

Exhaust Fan, 16 In.

Exhaust Fan, Heavy Duty Direct Drive, Propeller Dia 16 In, CFM @ 0.000-In SP 2657, @ 0.125-In SP 2430, @ 0.250-In SP 1960, Sones @ 0.000-In SP @ 5 Ft 17.4, 115 Volts, 60 Hz, 1 Phase, Operating Amps 4.4, Motor RPM 1725, 1/4 HP, Motor Type Split Phase, Height 20 In, Width 20 In, Max Depth 10 1/4 In, Vertical Mounting Position, Frame Material Steel, Propeller Material Fabricated Aluminum, Number of Blades 4, Guard Material Steel Wire, For Use With General Ventilation Applications

Grainger Item #	4C163
Your Price (ea.)	
Brand	DAYTON
Mfr. Model #	4C163
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	26.0
Usually Ships	Today
Catalog Page No.	4210

Additional Info

Direct-Drive Venturi Exhaust Fans

Fans are UL and C-UL Listed.

- Mount: vertical or horizontal, except vertical only Nos. 4C361 and 4C007 (with sleeve bearings)
- Motors: totally enclosed
- Ball bearings
- Max. inlet/ambient temp.: 104°F
- Aluminum blades
- Optional speed controls sold separately

Industrial Units

Welded blades exhaust larger volumes of air at higher static pressures. For use in factories, foundries, and other industrial environments.

Tech Specs

Item: Exhaust Fan
Type: Heavy Duty Direct Drive
Propeller Dia. (In.): 16
CFM @ 0.000-In. SP: 2657
CFM @ 0.125-In. SP: 2430
CFM @ 0.250-In. SP: 1960
CFM @ 0.375-In. SP: 1400
CFM @ 0.500-In. SP: 1150
Sones @ 0.000-In. SP @ 5 Ft.: 17.4
Sones @ 0.125-In. SP @ 5 Ft.: 16.5
Voltage: 115
Hz: 60
Phase: 1
Full Load Amps: 4.4
Motor HP: 1/4
Motor Type: Split Phase
Motor Enclosure: Totally Enclosed Air-Over
Motor Insulation: Class A
Motor RPM: 1725
Watts: 365
Max. Ambient Temp. (F): 104
Height (In.): 20
Width (In.): 20
Max. Depth (In.): 10 1/4

Outside Dia. (In.): 20
Inside Dia. (In.): 16 7/16
Flange Width (In.): 1
Venturi Depth (In.): 1 3/4
Venturi Clearance Dia. (In.): 16 7/16
Mounting Position: Vertical
Frame Material: Steel
Frame Finish: Baked On Gray Polyester
Guard Material: Steel Wire
Wire Guard Finish: Baked On Polyester Finish
Propeller Material: Fabricated Aluminum
Number of Blades: 4
Agency Compliance: UL Listed, CUL Listed, AMCA
Speed Control: No
Aluminum Wall Shutter No.: 4C557
Fiberglass Wall Shutter No.: 5C212
Galvanized Wall Shutter No.: 1C743
Dimension A (In.): 20
Dimension B (In.): 10-1/4
Dimension C (In.): 3-5/8
Dimension D (In.): 16-7/16
For Use With: General Ventilation Applications

Notes & Restrictions

Note: Automatic shutters recommended; see Index under "Shutters". On Grainger.com®, search by Grainger Item Number and click the Optional Accessories tab. Note: OSHA complying guards (included with select models) are required when a fan is installed within 8 ft. of floor, working level, or within reach of personnel. Review OSHA codes and UL standards. See Index under "Guards, Fan".

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Repair Parts

Repair Parts Information is available for this item.

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

Dayton® Heavy-Duty Direct Drive Exhaust Fans

Description

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

Dayton 12" to 24" heavy duty direct drive exhaust fans have wire intake guards that comply with OSHA 1/2" max. opening requirements and baked-on charcoal grey metallic polyester finish to resist corrosion. All units are supplied with aluminum propeller with a corrosion resistant spider. Fans are powered by a 115V, 60 Hz., totally enclosed motor. Shipped completely assembled.

U.L. Listed

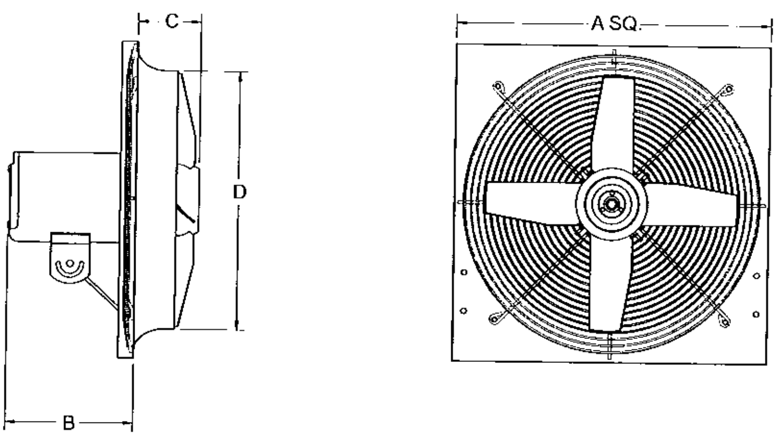


Figure 1 - Dimensions

Model	Propeller Dia.	A. Sq.	B	C	D
4YC81F	12"	16"	7 ¾"	1 ½"	12 ⅜"
4C163F	16	20	7 ¾	1 ¾	16 7/16
4C164F	18	22	7 ¾	1 15/16	18 7/16
4C367F	20	24	7 ¾	2 3/16	20 ½
4C127F	20	24	7 ¾	2 3/16	20 ½
4C165F	20	24	7 ¾	2 3/16	20 ½
4C059F	24	28	7 ¾	2 ⅝	24 ⅜
4C167F	24	28	7 ¾	2 ⅝	24 ⅜

Unpacking

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

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

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

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

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

⚠ CAUTION ***Do not lift by the fan hood. Fans with special coatings or paints must be protected in handling to prevent damage.***

Form 5S5230

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610909
January 2009

Dayton®

Dayton® Heavy-Duty Direct Drive Exhaust Fans

Performance

Model	Propeller Dia. (in.)	CFM Air Delivery @ Static Pressure Shown* 0.0" S.P.	0.125 S.P.	0.250" S.P.	0.375" S.P.	0.500" S.P.	Sones** 5' @ 0.0	Motor RPM	Operating Amps	Watts	HP
4YC81	12	1275	1160	1000	755	460	13.3	1725	3.4	210	1/4
4C163	16	2657	2430	1960	1400	1150	17.4	1725	4.4	365	1/4
4C164	18	2792	2495	2110	1725	1320	17.9	1725	4.3	330	1/4
4C367	20	2935	2640	2340	1990	1580	23	1725	4.3	366	1/4
4C127	20	3558	3290	2905	2520	2050	22	1725	4.5	410	1/3
4C165	20	4169	3860	3570	3130	2620	21	1725	5.9	540	1/2
4C059	24	3710	3255	2750	2240	1655	28	1725	4.3	370	1/3
4C167	24	5180	4700	4150	3610	2920	26	1725	6.6	600	1/2

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

Unpacking (Continued)

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

Indoor Storage. The ideal storage environment for fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained at between 70°F and 105°F (wide temperature swings may cause condensation and "sweating" of metal parts). Windows should be covered to prevent temperature variations caused by sunlight. Provide thermometers and humidity indicators at several points and maintain the atmosphere at 40% relative humidity, or lower.

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

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

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

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

a. Propeller wall fans not in wall housings.
b. Any fan protected by a cardboard carton.
c. Motors dismounted from fans.
d. Spare wheels or propellers.
e. Belts, sheaves, bushings and other parts when not mounted on fan.
f. Boxes, bags or cartons of hardware.
g. Curbs
h. Shutters

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

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

Store at least 3 ½" above the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Provide aisles between parts and along all walls to permit air circulation and space for inspection.

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

Models Heavy-Duty Direct Drive Exhaust Fans

Unpacking (Continued)

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

a. Fans intended for outdoor use that are crated in wood.

b. Wall fans installed in wall housings.

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

Locate pieces far enough apart to permit air circulation, sunlight, and space for periodic inspection. Place all parts on their supports so that rain water will run off, or to minimize water accumulation.
IMPORTANT: Do not cover parts with plastic film or tarps — these cause condensation of moisture from the air passing through heating and cooling cycles.

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

Inspection and Maintenance During Storage. Inspect fans and accessories at least once per month, while in storage. Log results of inspection and maintenance performed. A typical log entry should include the following:

a. Date

b. Inspector's Name

c. Name of Fan

d. Location

e. Condition of Paint or Coating

f. Is moisture present?

g. Is dirt accumulated?

h. Corrective steps taken?

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

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

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. The most critical items are pulleys, shafts and bearing locking collars. At the first sign of rusting on any of the above parts, remove the original rust preventive coating with petroleum solvent and clean lint-free cloths. Polish any remaining rust from surfaces with crocus cloth or fine emery paper and oil. **IMPORTANT:** Do not destroy the continuity of the surfaces. Wipe clean with lint-free cloths and recoat surfaces evenly and thoroughly with Tectly 506 (Ashland Oil Company) or equal. For hard to reach internal surfaces or for occasional use, consider using Tectly 511M Rust Preventive or WD40 or equal.

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

General Safety Information

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

Installation

1. The unit should be securely mounted in a rigid framework.
2. Connect power to motor, using an approved wiring method.
3. Install any auxiliary components.
4. Before activating the fan, double-check to ensure that there are no obstructions (framing, stud, shutter, etc.) which would interfere with proper fan operation.

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

Dayton®

Dayton® Heavy-Duty Direct Drive Exhaust Fans

Installation (Continued)

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

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

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

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

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

⚠WARNING Operation in the wrong direction will deliver air but will overload the motor to the extent of blowing fuses and seriously damaging the motor. In the case of three phase motors, the direction can be changed by interchanging any two of the three motor leads. In the case of single phase motors, the reversing instructions will appear on the wiring diagram in the motor wiring compartment.

Maintenance

1. Periodically clean the propeller and motor of any excessive accumulation of dirt.
2. Under normal usage, no spare parts are recommended for one year of operation. Motor bearings are prelubricated. Consult information printed on motor for lubrication instructions.

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

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

Set Screw Tightening Schedule

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

Procedure for Tightening Set Screws in Bearings and Hubs

One Set Screw Application

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

Two Set Screw Application

1. Using a torque wrench, tighten one set screw to half of the torque recommended in Table 1.
2. Tighten the second set screw to the full recommended torque.
3. Tighten the first set screw to the full recommended torque.

Table 1. Recommended Tightening Torque for Set Screws

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

Variable Frequency Drives and Motors

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

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

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

For Repair Parts, call 1-800-323-0620

24 hours a day - 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part descriptions and number as shown in parts list

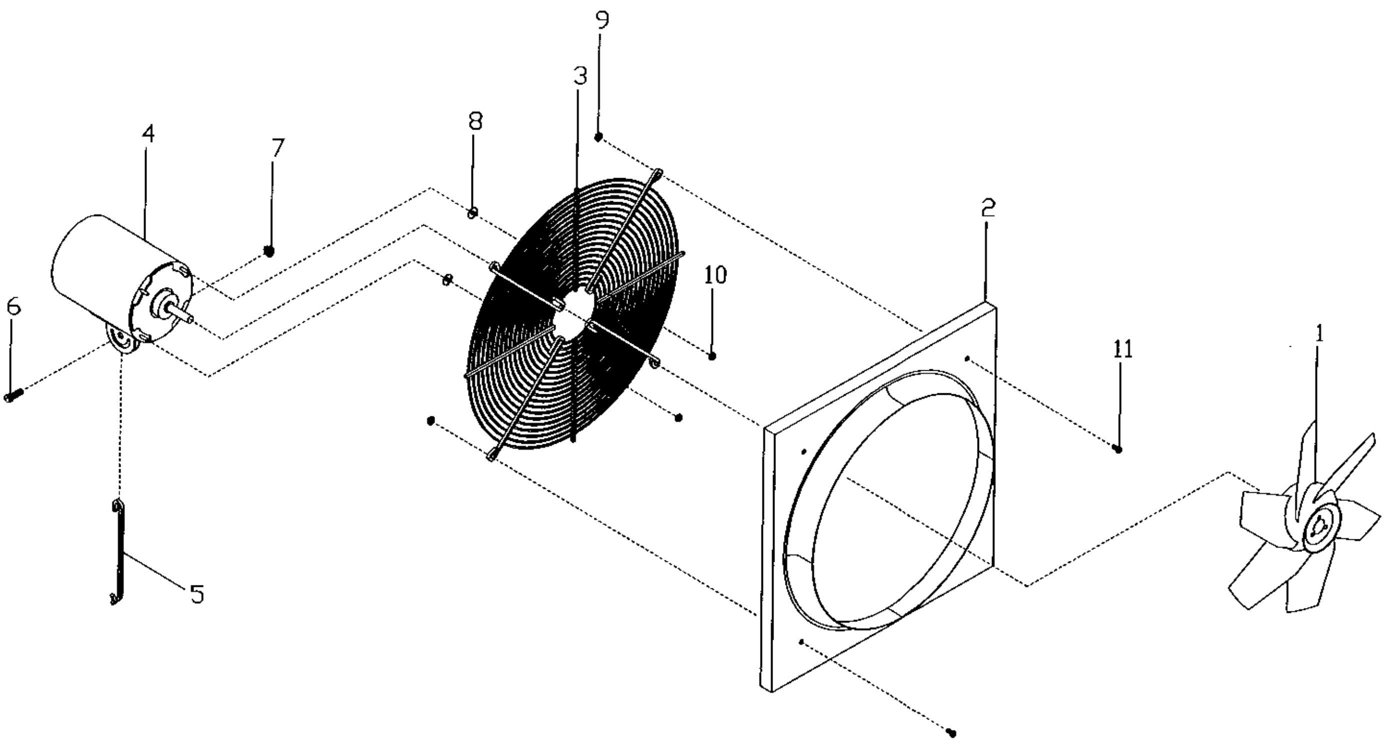

Figure 2 - Repair Parts Illustration

Ref. No.	Description	4YC81F	4C163F	4C164F	4C367F	4C127F	4C165F	4C059F	4C167F	Qty.
		Part Numbers for Models								
1	Prop	506524	506525	506526	506527	506528	506529	506530	506531	1
2	Orifice	506000	506001	506002	506003	506003	506003	506004	506004	1
3	Guard	993814	993815	993818	993819	993819	993819	993821	993821	1
4	Motor	994208G	994207G	994207G	994207G	994209G	994223G	994209G	994223G	1
5	Motor Support Strut	993813	993810	993810	993810	993810	993810	993811	993811	1
6	Hex Bolt	*	*	*	*	*	*	*	*	1
7	Washered Nut	*	*	*	*	*	*	*	*	1
8	Washer	*	*	*	*	*	*	*	*	4
9	Washered Nut	*	*	*	*	*	*	*	*	4
10	Washered Nut	*	*	*	*	*	*	*	*	4
11	Hex Bolt	*	*	*	*	*	*	*	*	4

(*)Standard hardware item available locally.

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Dayton® Heavy-Duty Direct Drive Exhaust Fans

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *DAYTON® HEAVY-DUTY DIRECT DRIVE EXHAUST FAN MODELS COVERED IN THIS MANUAL, ARE WARRANTED BY DAYTON ELECTRIC MFG. CO. (DAYTON) TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE YEAR AFTER DATE OF PURCHASE. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.*

LIMITATION OF LIABILITY. *TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, DAYTON'S LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES IS EXPRESSLY DISCLAIMED. DAYTON'S LIABILITY IN ALL EVENTS IS LIMITED TO AND SHALL NOT EXCEED THE PURCHASE PRICE PAID.*

WARRANTY DISCLAIMER. *A DILIGENT EFFORT HAS BEEN MADE TO PROVIDE PRODUCT INFORMATION AND ILLUSTRATE THE PRODUCTS IN THIS LITERATURE ACCURATELY; HOWEVER, SUCH INFORMATION AND ILLUSTRATIONS ARE FOR THE SOLE PURPOSE OF IDENTIFICATION, AND DO NOT EXPRESS OR IMPLY A WARRANTY THAT THE PRODUCTS ARE MERCHANTABLE, OR FIT FOR A PARTICULAR PURPOSE, OR THAT THE PRODUCTS WILL NECESSARILY CONFORM TO THE ILLUSTRATIONS OR DESCRIPTIONS. EXCEPT AS PROVIDED BELOW, NO WARRANTY OR AFFIRMATION OF FACT, EXPRESSED OR IMPLIED, OTHER THAN AS STATED IN THE "LIMITED WARRANTY" ABOVE IS MADE OR AUTHORIZED BY DAYTON.*

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Product Suitability. *Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While attempts are made to assure that Dayton products comply with such codes, Dayton cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.*

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

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

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

T6031A1136

T4031A,B,P; T6031A,B Refrigeration Temperature Controllers

PRODUCT DATA

GENERAL

The T4031A,B,P and T6031A,B are temperature controllers used in a variety of cooling applications where remote mounting of the sensing element in the controlled medium is required.

FEATURES

- **Wide control temperature range is suitable for controlling ducts, tanks, freezers, coolers, display cases. and defrost termination.**
- **Universal mounting bracket is available for easy replacement of other controllers.**
- **Models are available with various control ranges.**
- **Control setpoint is dial-knob adjustable.**
- **Models are available with fixed or adjustable temperature differentials.**
- **Capillary lengths are 5, 8, or 20 ft (1.5, 2.4, 6.1m) depending on model.**
- **Reliable snap-acting spst or spdt switch.**
- **Ambient temperature compensated.**
- **Insert supplied with TRADELINE® models replaces setpoint knob to discourage tampering.**

Contents

SPECIFICATIONS

IMPORTANT
The specifications given in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the specifications listed. Also, this product is tested and calibrated under closely controlled conditions, and some minor differences in performance can be expected if those conditions are changed.

TRADELINE® Models

TRADELINE® models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. TRADELINE® model specifications are the same as those of standard models except as noted below.

TRADELINE® Model Available:
T6031A Refrigeration Temperature Controller-spdt switch, adjustable temperature differential, tamper-resistant insert.

Capillary Length:
8 ft (2.4m)

Additional Features:
TRADELINE® pack with cross reference label and special instructions

Standard Models

T4031A Refrigeration Temperature Controller-spst switch makes on temperature rise; fixed differential
T4031B Refrigeration Temperature Controller—same as T4031A but less case
T4031P Refrigeration Temperature Controller—same as T4031A but uses screw, not knob, to adjust setpoint
T6031A Refrigeration Temperature Controller-spdt switch, fixed or adjustable temperature differential
T6031B Refrigeration Temperature Controller—same as T6031A but less case

Switch Action:
T4031A,B,P spst switch makes R to W on temperature rise
T6031A,B spdt switch makes R to W on temperature rise, R to B on temperature fall

Capillary Lengths and Temperature Ranges:

Model	Copper Capillary Tube Length		Setting Range[a]		Differential	
	ft	m	°F	°C	°F	°C
T4031A,B	5	1.5	-30 to 50	-34 to 10	Fixed at 3.5	Fixed at 1.6
	20	6.1				
T4031P	8	2.4	-30 to +90	-34 to +32	3.5 to 16	1.6 to 9
T6031A,B	5	1.5	-15 to +90	-9 to +32	Fixed at 3.5 or Adjust. from 3.5 to 12	Fixed at 1.6 or Adjust. from 1.6 to 7
	20	6.1				
	5	1.5	-30 to +50	-34 to +10		
	20	6.1				
	8	2.4	-30 to +90	-34 to +32		

[a] Dial scale markings in degrees Fahrenheit

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or your distributor, refer to the TRADELINE® catalog or price sheets for complete ordering number, or specify:

1. Order number.
2. Setting range.
3. Fixed or adjustable differential (T6031).
4. Length of copper capillary tube.
5. Accessories, if desired.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Home and Building Control Sales office (check white pages of your phone directory).
2. Home and Building Control Customer Relations
   Honeywell, 1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9. International Sales and Service Offices in all principal cities of the world.

Electrical Ratings:

	120 Vac		240 Vac	
	Normally Closed	Normally Open[a]	Normally Closed	Normally Open[a]
Full Load Amp	8	16	5.1	8
Locked Rotor Amp	48	80	30.6	40

[a] Makes on temperature rise.

Pilot Duty:
125 VA

Dimensions:
See Fig. 1

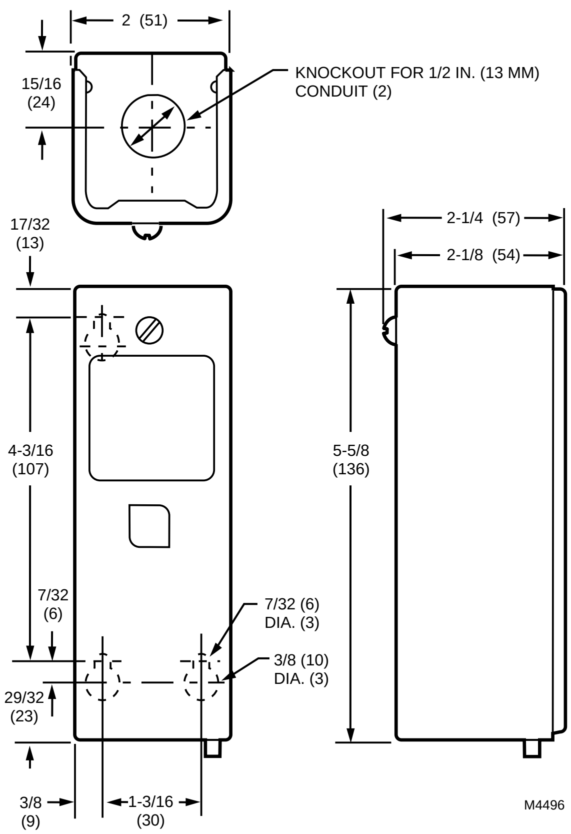


Fig. 1. Dimensions of T4031, T6031 in in. (mm).

Underwriters Laboratories Inc.:
Listed

Maximum Ambient Operating Temperature:
125°F (52°C)

Accessories:
112622AA Immersion Well—short-necked, 1/2 in. NPT, copper
7617ABY Compression Fitting—50 psi water, 15 psi air
107324A Bulb Holder—for duct installation
105900 T-strap—for strapping bulb to pipe
7617ABZ Bag Assembly—for mounting controller to fan coil units
801534 Calibration Wrench
7640HY Standoff Bracket Bag Assembly—to mount controller to an insulated duct
130883 Universal Mounting Bracket
194899 Tamper-resisting Insert Button
Celsius Scaleplates:
194486 D: -15°C to +35°C replaces (0°F to 100°F) scaleplate
194486H: 15°C to 75°C replaces (55°F to 175°F)
194486F: 75°C to 125°C replaces (160°F to 260°F)

INSTALLATION

When Installing this Product…

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

- Disconnect power supply before installation to prevent electrical shock and equipment damage.
- Do not damage or change shape of capsule. Deformed capsule will cause calibration offset.

Mounting

Install controller in any convenient location. Make sure that the sensing bulb reaches the system to be controlled. The ambient temperature must not exceed 125°F (52°C) in the area where the controller is installed.

Install the sensing element where it can sense the average temperature. Avoid sharp bends or kinks in the capillary tubing that can affect the accuracy of the controller. Carefully coil the excess capillary tubing and leave it directly beneath the controller.

The 130883 Mounting Plate furnished with TRADELINE® models allows the control to be mounted in existing mounting holes.

Duct Installation

Position the sensing bulb in the duct to sense the average air temperature. Avoid mounting the bulb close to hot pipes, cooling coils, etc.

The 107324A Bulb Holder is available for suspending the bulb in a duct. See Fig. 2.

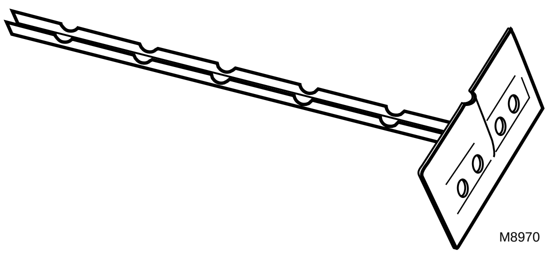


Fig. 2. 107324A bulb holder.

To install duct:

1. Make a hole in duct wall to admit sensing bulb into holder.
2. Using holder as template, mark and drill mounting holes.
3. Break off bulb holder to required length. (Be sure holder is long enough to hold sensing bulb away from duct wall and in freely circulating air.)
4. Place capillary tubing in bulb holder channel, with bulb at inner end of holder. Pinch together top edges of channel segments.
5. Insert assembled bulb and holder into duct, and fasten to duct wall with screws supplied.

Tank Installation

The sensing bulb can be inserted directly into a tank using a compression fitting; or the bulb can be inserted into an immersion well (order separately), which is screwed into a tank or boiler.

Select a location where liquid of average temperature can circulate freely around the sensing bulb.

Using Compression Fitting (Fig. 3)

1. Drain system. Screw boiler plug into properly sized and threaded boiler or pipe tapping.
2. Place packing nut on capillary tubing.
3. Slide sensing bulb completely through boiler plug.
4. Place composition disc and the four slotted brass washers on capillary tubing.
5. Slide assembly into boiler plug and tighten packing nut.
6. Refill system and check for leaks. Neatly coil excess capillary tubing.

Using Immersion Well (Fig. 4)

1. Drain system. Screw the well into threaded fitting.
2. Refill system and check for leaks.
3. Insert sensing bulb into well until it bottoms.
4. Fit bulb retaining clamp over immersion well flange and capillary tubing, and tighten screw.

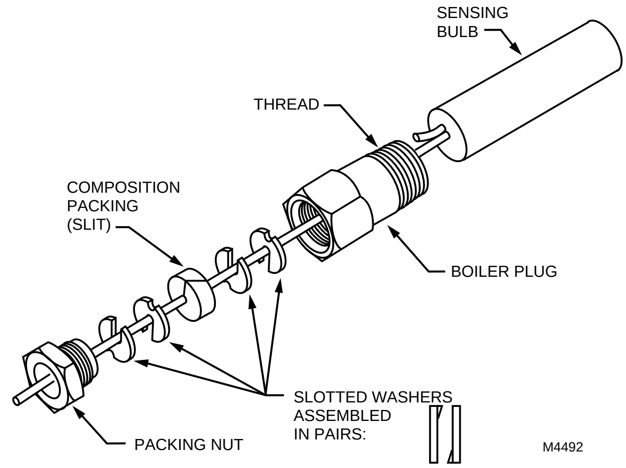


Fig. 3. Compression fitting installation.

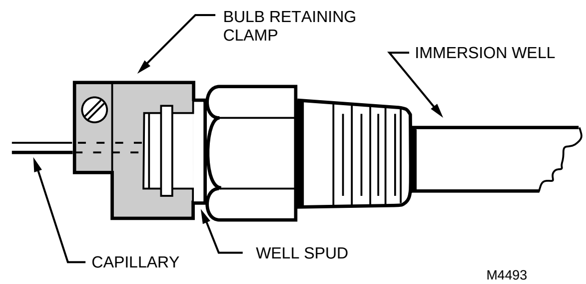


Fig. 4. Immersion well installation.

Cold Room Installation

Locate the bulb in freely circulating air in the controlled area or on the suction side of a refrigerant line, and secure the bulb in position.

Wiring (Fig. 5)

All wiring must comply with local electrical codes and ordinances.

Two knockouts are provided, one at the top and one at the bottom of the case for 1/2 in. conduit. Follow the wiring instructions furnished with the heating or cooling system. For replacement, make sure the new control is wired into the system to operate the same as the old control.

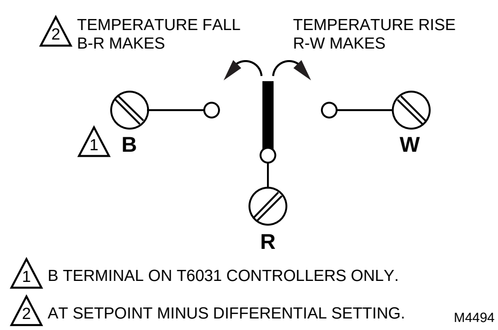


Fig. 5. Wiring terminals on T4031 and T6031 temperature controllers.

OPERATION AND CHECKOUT

When the temperature at the sensing bulb rises above the controller setpoint, a circuit is made between the R-W terminals. During a temperature fall, the R-W circuit breaks at the setpoint temperature *minus* the switch differential. Controllers with a B terminal break the B-R terminal circuit on a temperature rise to the setpoint. B-R makes again when R-W breaks on a temperature drop. See Fig. 6.

For example, if a controller with a 3°F (1.7°C) differential is set at 39°F (3.9°C), R-W makes when the bulb temperature rises to 39°F. Then during a temperature fall, R-W breaks when the temperature drops to 35°F (1.7°C) (39°F minus the 3°F differential [3.9°C minus the 1.7°C differential]).

On models with a B terminal, B-R makes when R-W breaks. Then the temperature has to climb past the control differential to the set point of 39°F (3.9°C) before the B-R circuit breaks and the R-W circuit makes.

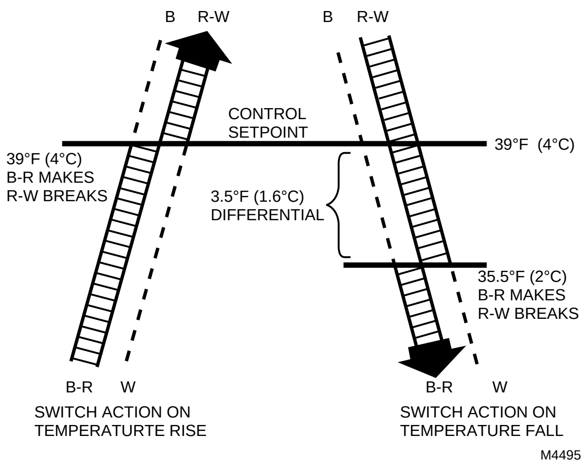


Fig. 6. Operation of switch on temperature rise and fall.

SETTING

Set the controller to the system manufacturer's recommended settings, if available.

Temperature Setpoint Knob—Turn the knob on the front of the case until the pointer indicates the temperature to be maintained in the controlled medium.

Screw—Insert a flatheaded screwdriver into the slot on the shaft, which is located in the center of the scaleplate. Turn the screwdriver clockwise to increase the temperature control point. Turn the screwdriver counterclockwise to decrease the temperature control point.

Adjustable Differential—With the cover off, turn the differential adjustment wheel (marked 3-6-9-12°F) until the desired differential is aligned with the notch in the frame. See Fig. 7.

Fixed differential models are 3.5°F at midscale.

Calibration

All controllers are carefully tested and calibrated at the factory under controlled conditions. If the controller is not operating at a temperature corresponding to the scale and differential setting, verify that the bulb senses the average temperature of the medium. If the temperature of the controlled medium is changing rapidly, the differential will appear wider than its setting.

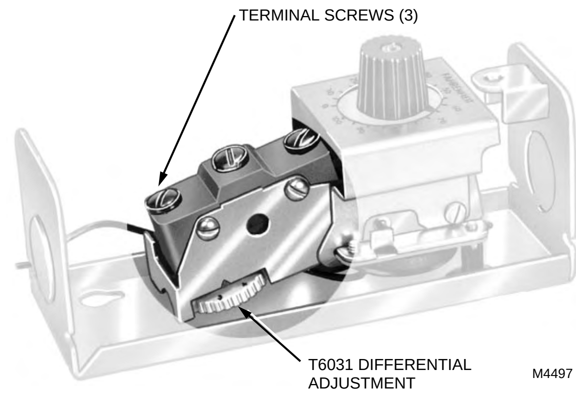


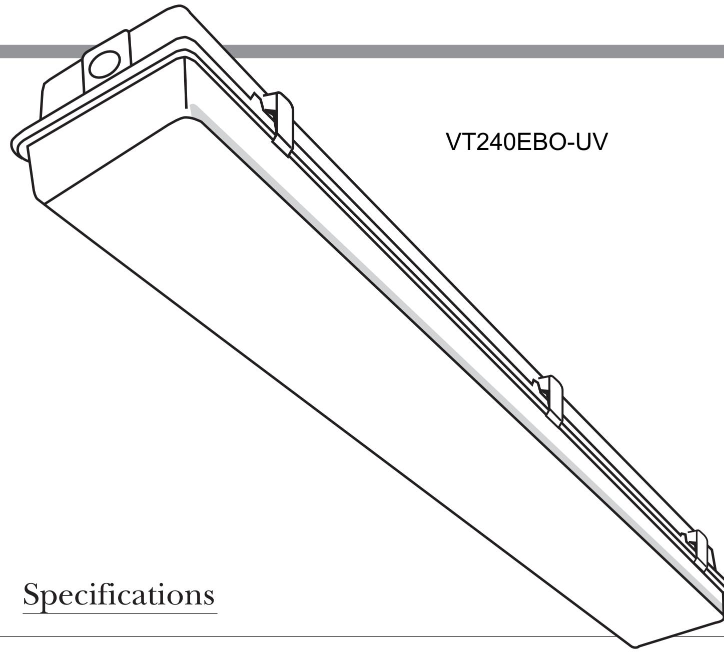
Fig. 7. Internal view showing differential adjustment wheel (applicable models).

For calibration, take an accurate temperature reading of the controlled medium. Place an accurate thermometer near the bulb of the controller, or refer to a thermometer installed as part of the system. If the bulb of the controller is installed in an inaccessible area, or if the controlled medium is unstable, remove the bulb and place in a controlled bath for accurate calibration.

These controllers are calibrated so the dial setting is the point at which the R-W switch contacts make (B-R contacts break) on a temperature rise. Measure the temperature at the bulb. Rotate the dial counterclockwise from the top of the scale, simulating a temperature rise, until the R-W switch contacts make. Note the dial reading. If it differs from the setpoint, calibrate the dial as follows:

1. Determine the number of degrees difference between the set point and the point at which the contacts make.
2. Remove the dial knob and slip the fingers of the calibration wrench into the slots of the dial. Rotate the dial until the fingers of the wrench drop into the slots of the calibration nut under the dial. Note the dial indication at this point. Turn the dial and the calibration nut up or down scale the number of degrees that the set point differs from the point at which the contacts make (determined in step 1). For example, move the dial from 45 to 65 degrees for a 20 degree change in calibration.
3. Check the calibration adjustment by moving the dial up and down the scale while watching the contacts make and break. If dial is still out of calibration, repeat calibration procedure.
4. To install tamper-resisting insert on TRADELINE® model, remove screw from adjustment knob, remove knob, and install insert.

VT SERIES



VT240EBO-UV

VT Series is designed for heavy duty service in areas subjected to moisture and chemicals. Ideally suited for food processing areas also.

Ordering Information

Magnetic

CATALOG#	*LAMP*	*NOMINAL LENGTH*
	430 MA	
VT120	1-F20T12	2'
VT220	2-F20T12	2'
VT140ES	1-F40	4'
VT240ES	2-F40	4'
VT240TES	4-F40	8'
VT196	1-F96T12	8'
VT296ES	2-F96T12	8'
	800 MA	
VT124HO	1-F24T12HO	2'
VT224HO	2-F24T12HO	2'
VT148HO	1-F48T12HO	4'
VT248HO	2-F48T12HO	4'
VT196HO	1-F96T12HO	8'
VT296HO	2-F96T12HO	8'

All Ballast Standard Low Temperature (-20 F)

Electronic Octron

CATALOG#	*LAMP*	*NOMINAL LENGTH*
VT120EBO	1-FO17T8	2'
VT220EBO	2-FO17T8	2'
VT140EBO	1-FO32T8	4'
VT240EBO	2-FO32T8	4'
VT240TEBO	4-FO32T8	8'
VT196EBO	1-FO96T8	8'
VT296EBO	2-FO96T8	8'

Consult Factory for other options

Specifications

Mounting: Units may be either surface or pendant mounted. Housing provided with adequate amount of knockouts which must be drilled on job site to insure proper sealing.

Construction: A one piece housing molded from ABS material with a smooth white exterior. ABS cam-lock latches provide both a positive lock between lens and housing and self hinging for lamp replacement. A self-adhesive, closed-cell polyethylene gasket on housing forms a continuous seal with diffuser. Internal metal is die-formed from heavy gauge cold-rolled steel.

Finish: External housing to be smooth white. All internal metal parts are cleaned and treated to prevent rust with a phosphate coating applied automatically in a five-stage process. Surfaces are then sprayed with high quality baked white enamel to provide a minimum reflectance of 87%.

Diffuser: Lens is crepe acrylic.

Wiring: Standard ballast are ETL-CBM, Class “P” 120 volt. All 800 MA and 1500 ballast are low temperature (-20°F).

Approval: All units are Underwriter’s Laboratories (UL) approved.

NEW ENGLAND LIGHTING INCORPORATED

311 Eastern Ave. Chelsea, MA 02150 Phone 617-887-1515 Fax 617-889-6529 www.newenglandlighting.com (Eastern, MA) 800-698-3737 (New England) 800-247-3230

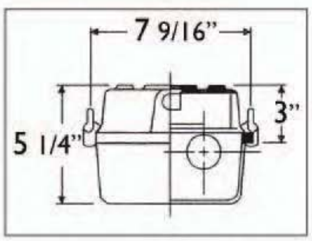
VT SERIES

Options and Accessories

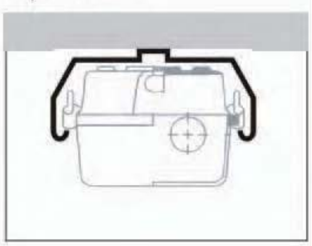
EB	Electronic T12	**PA**	Prismatic Lens
***CW**	Low Temperature (0) Ballast	**RFI**	Radio Interference Filter
***DIM**	Dimming Ballast	**FS**	External Fuse and Holder
EM	Emergency Ballast (1 lamp)	**REF**	Internal Polished Aluminum Reflector
•EM/2	Emergency Ballast (2 lamp)	**REFS**	Internal Specular Silver Reflector
HOEBO	800MA Electronic T8	**SSL**	Stainless Steel Latches
HUBS	Fitting Assembly for 1/2” Rigid Contour	**SSLTP**	Stainless Steel Latches Tamper Proof
LEX	Polycarbonite lens	**WL**	Wet Location Rating
		BRK	Mounting Bracket

*Available Magnetic T12 or Electronic T8
•Note: Consult Factory on Compatibility EM/2 Option

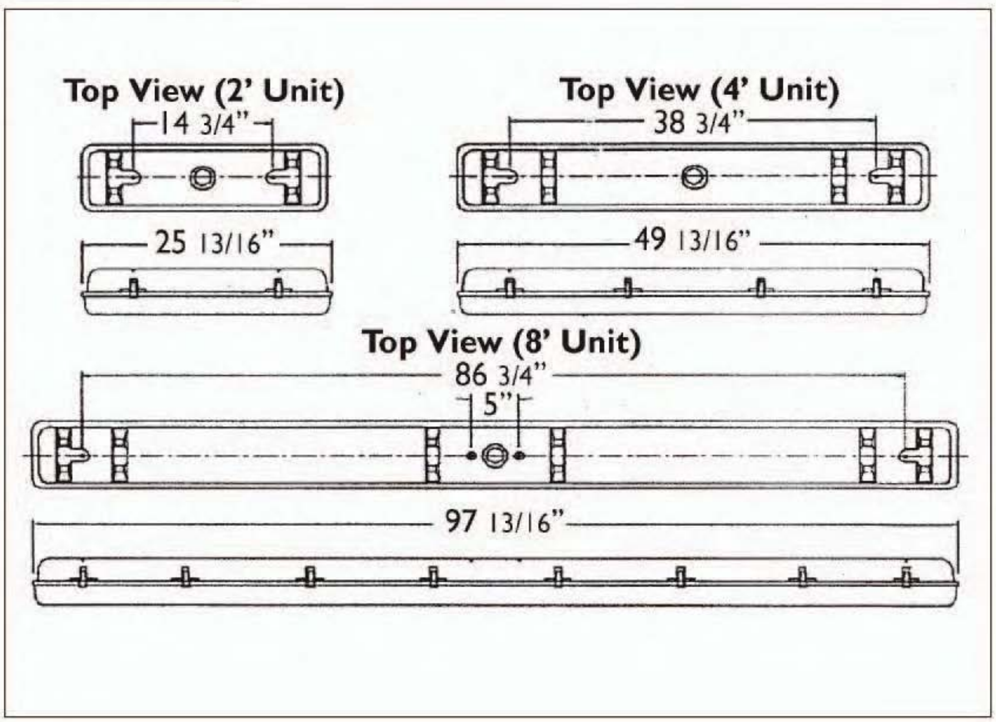
Dimensional Data



Mounting Bracket-
Optional



Installation Data



Photometrics

Photometric Information available upon request.

NEW ENGLAND LIGHTING INCORPORATED
311 Eastern Ave. Chelsea, MA 02150 Phone 617-887-1515 Fax 617-889-6529 www.newenglandlighting.com (Eastern, MA) 800-698-3737 (New England) 800-247-3230

Heater, Wall, with Built in Thermostat

Heater, Wall, with Built in Thermostat

Wall Heater, Current Rating 17.3/20.0 Amps, Power Rating 3600/4800 Watts, BtuH 10287/16382, Voltage @ 60 Hz 208/240 Volts, Enamel Finish White, Architectural and Commercial Grade, With Built In Thermostat

Grainger Item #	3UF62
Your Price (ea.)	
Brand	DAYTON
Mfr. Model #	3UF62
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	22.0
Usually Ships	Today
Catalog Page No.	4385

Additional Info

Electric Wall Heaters

Provide fast space heating. Units use 1-phase power except where noted, and have a built-in thermostat except where noted. Mounting frames sold separately. UL and C-UL Listed, except shallow-wall models are ETL Listed.

Commercial

Aesthetically designed to suit public areas or residential settings. Small models are good for locations with limited wall space.

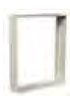
Tech Specs

Item: Electric Wall Heater
Type: Residental, Light Commercial
Voltage: 208/240
Hz: 60
Phase: 1
Amps AC: 17.2/20.0
Watts: 3600/4800
BtuH: 10,287/16,382
Wall Opening Height (In.): 18-1/4
Wall Opening Width (In.): 14-3/8
Wall Opening Depth (In.): 3-3/4
Grille Height (In.): 19-1/4
Grille Width (In.): 15-3/4
Grille Depth (In.): 1-1/2
Housing Height (In.): 18-1/4
Housing Width (In.): 14-5/16
Housing Depth (In.): 3-3/4
Grille Material: Heavy Gauge Steel
Finish: Powder Paint
Color: Northern White
Mounting Location: Wall
Mount Type: Recessed or Surface
Built-In Features: Double Pole Single Throw Disconnect Switch, Impedance Protected, Permanently Lubricated Totally Enclosed Motor, Thermostat with 40 to 90 Range, Thermal Overheat Protector
Requires: Proper Gauge Wire for Distance From Heater to Breaker Panel for Load
Warranty (Years): 5 On Element, 1 All ther parts
Agency Compliance: UL

Optional Accessories

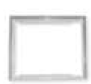
Frame, Semi Recessed

Item #: 3UF64
Brand: DAYTON
Usually Ships: 1-3 Days
Your Price (ea): $71.87



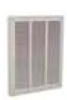
Frame, Semi Recessed

Item #: 3UF65
Brand: DAYTON
Usually Ships: Today
Your Price (ea): $71.87



Frame, Surface Mount

Item #: 3UF66
Brand: DAYTON
Usually Ships: Today
Your Price (ea): $69.53



Security Front Cover

Item #: 3UG58
Brand: DAYTON
Usually Ships: Today
Your Price (ea): $92.88

Alternate Products

Heater, Tamper Proof

Item #: 5E183
Brand: DAYTON
Usually Ships: Today

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

Dayton® Fan Forced Wall Heaters

ENGLISH

Description

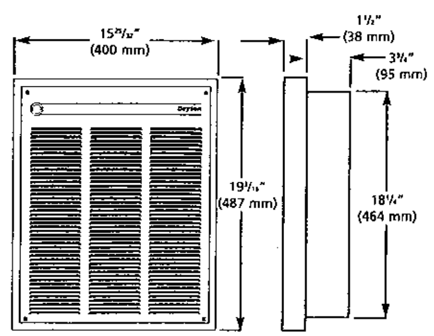
Dayton fan-forced large wall heaters provide electric heat for offices, reception rooms, game rooms, family rooms and similar light-duty commercial and residential applications. These heaters have an integral thermostat so a separate thermostat is not necessary. Heaters include a built-in power disconnect switch for added safety during maintenance and can be surface mounted using optional surface frame.

Specifications

Model Number	Volts	Phase	Watts	Amps	Wire Gauge
2HAD7	120	1	1500	12.5	12
2HAD8	120	1	1800	15.0	12
3UF59D*	277	1	3000/1500	10.8/5.4	14
3UF60D*	240/208	1	4000/3000	16.7/14.5	10
			2000/1500	8.3/7.2	12
3UF61D*	277/240	1	4000/3000	14.5/12.5	12
			2000/1500	7.2/6.3	12
3UF62D	208/240	1	3600/4800	17.3/20.0	10
3UF63D	240/277	1	3600/4800	15.0/17.3	10
3END1	208	1	4000/2000	19.3/9.7	10

(*) Factory wired for higher wattage. Field convertible to half wattage.

Dimensions



General Safety Information

⚠WARNING ***Read Carefully - These instructions are written to help you prevent difficulties that might arise during installation of heaters. Studying the instructions first may save you considerable time and money later. Observe the following procedures and cut your installation time to a minimum. <u>TO REDUCE RISK OF FIRE OR ELECTRIC SHOCK:</u>***

1. Disconnect all power coming to heater at main service panel before wiring or servicing.
2. All wiring must be in accordance with the National and Local Electrical Codes and the heater must be grounded.
3. Verify the power supply voltage coming to heater matches the ratings printed on the heater nameplate before energizing.
4. This heater is hot when in use. To avoid burns, do not let bare skin touch hot surfaces.
5. Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock, fire, or damage to the heater.
6. Do not block air intakes or exhaust in any manner. Keep combustible materials, such as crates, drapes, etc., away from heater. Do not install behind doors, furniture, towels, or boxes.
7. A heater has hot and arcing (sparking) parts inside. Do not use it in areas where gasoline, paint, or flammable liquids are used or stored.
8. Use this heater only as described in this manual. Any other use not recommended by the manufacturer may cause fire, electric shock, or injury to persons.

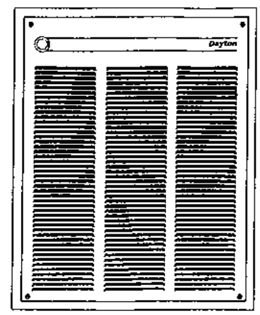


Figure 1

c UL us
File #E154218

9. This heater is not approved for use in corrosive atmospheres, such as marine, green house, or chemical storage areas.
10. Do not install heater upside down or sideways. Do not use heater without grille.
11. For wall mounting only. Do not install heater closer than 8" (203 mm) to the floor or any adjacent wall surface. Do not install closer than 36" (915 mm) to the ceiling.

SAVE THESE INSTRUCTIONS

NOTE: This heater has a continuous fan-only feature. See page 4 for details.

ESPAÑOL

Installation

RECESSED BACK BOX IN NEW CONSTRUCTION

1. Mounting Back Box (See Figure 2, page 2).
   a. Place the back box between two 16" (406 mm) center-to-center wall studs at the desired mounting height but no closer than 8" (203 mm) to adjacent wall or floor.
   b. Align back box such that the bottom and sides will be flush with finished wall surface (top flange of back box should protrude approximately 1/2" [12.7 mm] from finished wall surface).

FRANÇAIS

Form 5S5987

Printed in China
09663
0508/127/VCPVP

MEP100
07/09
Form #89

Dayton®

Dayton® Fan Forced Wall Heaters

ENGLISH

Installation (Continued)

c. Secure the back box in position with wood screws or nails as shown in Figure 2.

2. Power Supply Wiring (See Figure 2).

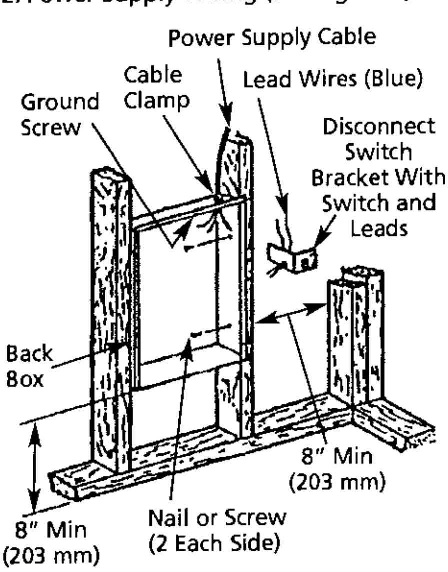


Figure 2 - Locating Recessed Back Box in New Construction

NOTE: Wire compartment volume – 119 in.^{3} (1950 cm^3).

a. Run a power supply cable into the knockout area in the upper right hand corner of the back box. All wiring must be in accordance with National and Local Electrical Codes. Refer to Specifications for correct wire size.

b. Remove disconnect switch bracket by loosening two screws on the right side.

c. Install a cable clamp in the "knock-out" in the top of the back box.

d. Insert power supply cable through cable clamp, allowing at least 6" (152 mm) of leads to extend inside the back box. Connect the blue lead wires of disconnect switch to the supply wire leads using wire connectors (See Wiring Diagram, page 4).

e. Ground the back box by connecting the supply ground lead wire to the green ground screw located in the inside top of the back box.

f. Secure disconnect switch bracket in place by tightening screws.

RECESSED BACK BOX IN EXISTING CONSTRUCTION

1. Provide a wall opening 14½" (362 mm) wide by 18½" (470 mm) high at the desired mounting height, but no closer than 8" (203 mm) (See Figure 3).

2. Power Supply Wiring

NOTE: Wiring Compartment Volume – 119 in.^{3} (1950 cm^3).

a. Run a power supply cable into the area above the top of the wall opening. All wiring must be in accordance with National and Local electrical codes. Refer to Specifications for correct wire size.

b. Remove disconnect switch bracket by loosening the two screws on the right side.

c. Install a cable clamp in the "knockout" in the top of wall back box.

d. Insert power supply cable through cable clamp, allowing approximately 6" (152 mm) of cable length to remain inside the back box to facilitate connections.

3. Mounting Back Box

a. Place the back box into wall opening flush with finished wall surface on bottom and sides of box. (Top flange of backbox should protrude approximately 1/2" [12.7 mm] from finished wall surface.)

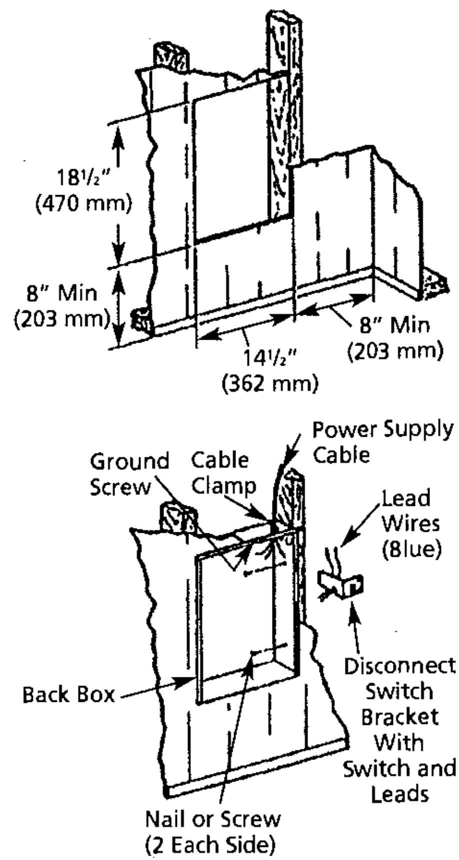


Figure 3 - Locating Recessed Back Box in Existing Construction

b. Secure the back box in place with wood screws or nails.

4. Wiring Disconnect Switch

a. Connect the power supply wires to the blue wires of the disconnect switch using wire connectors (See Wiring Diagram, page 4).

b. Ground the back box connecting the supply ground lead wire to the green ground screw located in the inside top of the back box.

c. Secure disconnect switch bracket in place by tightening screws.

Models 2HAD7, 2HAD8, 3UF59D thru 3UF63D and 3END1

Installation (Continued)

BACK BOX WITH SURFACE-MOUNTING FRAME 3UF66D

(See Figure 4)

1. Secure back box to wall with knock-outs in upper right hand corner using screws and anchors.
2. Hang the surface-mounting frame on the back box. Ensure that the back edge of the surface-mounting frame is flush against the wall.

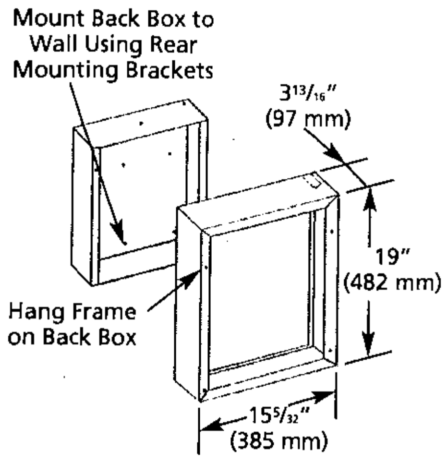


Figure 4 – Surface Mounting Installation

NOTE: If heater is located in a high traffic area where it may be subjected to vandalism or abuse, take extreme care to see that the box is firmly attached to the wall.

3. Power Supply Wiring

NOTE: Wiring Compartment Volume – 119 in.^{3} (1950 cm^3).

a. Run a power supply cable into the area of the upper right corner of the mounting frame. Arrangement of wiring to this point must be in accordance with National and Local codes. Refer to Specifications for proper wire size.

NOTE: If the wiring is to run through the wall, cut a hole in the area of the top of the wall box. Run the supply wire through this hole. Then remove the "knockout" from the top of the box and proceed to step C.

b. Remove the "knockout" on the top side of the frame.

c. Remove disconnect switch bracket by loosening the two screws on the right side.

d. Feed the power supply cable through the frame allowing 6" (152 mm) of lead to remain inside the back box.

e. Secure the power supply cable to the back box (using cable clamp, connector, or other suitable strain relief) allowing 6" (152 mm) of lead to remain inside the back box.

f. Connect supply wires to blue wires of disconnect switch using wiring connectors (See Wiring Diagram, page 4).

g. Ground the back box by connecting the supply ground leadwire to the green ground screw located in the inside top of the back box.

h. Secure disconnect switch bracket in place.

HEATER ASSEMBLY AND GRILLE

After back box is completely installed and no further construction dirt is expected, clean debris from back box, remove heater assembly from its carton, then refer to Figure 5 and proceed as follows:

1. Insert the heater assembly into back box, placing the four mounting holes (with key-hole slots) over the screws in the back box. Tighten all screws securely.
2. If surface-mounting frame is used, ensure that the frame is even with all four heater assembly tabs before tightening screws.

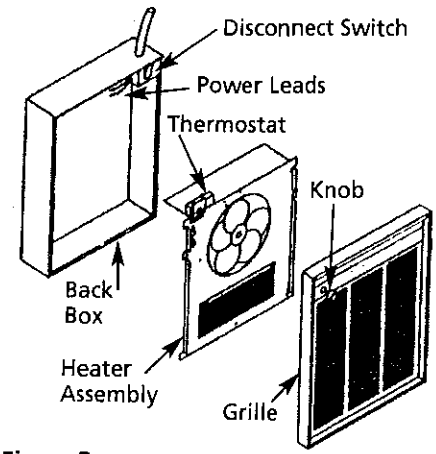


Figure 5

3. Connect the two disconnected switch wires to the heater control switch (thermostat) leads using wire nuts. After connection, push wires back into the opening.
4. Turn thermostat to the extreme counterclockwise position.
5. Push disconnect switch into ON position.
6. Mount the grille using the four (4) long screws provided. The screws thread into holes located in the side flanges of the back box.
7. Push thermostat knob onto thermostat shaft.

NOTE TO INSTALLER: Converting heater to half wattage

The 3UF59D thru 3UF63D wall heaters are manufactured and shipped at the higher rated wattage (See Specifications, page1). Full wattage heaters can be converted to half wattage by doing the following steps:

1. Remove the red jumper wire as shown in Figure 6, page 4 and discard.
2. To permanently make the heater half wattage, cut the male terminal spade, carefully not to damage the cold pin and discard.
3. Mark the wattage of the heater on the white label inside the backbox.

Dayton® Fan Forced Wall Heaters

Installation (Continued)

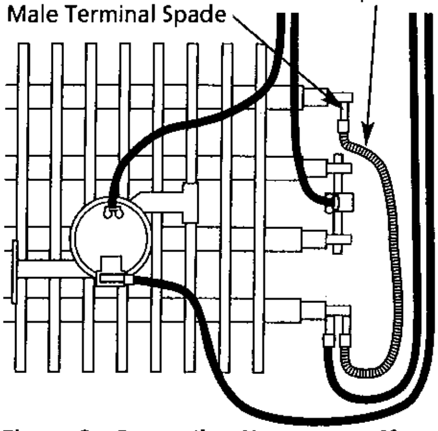


Figure 6 – Converting Heater to Half Wattage

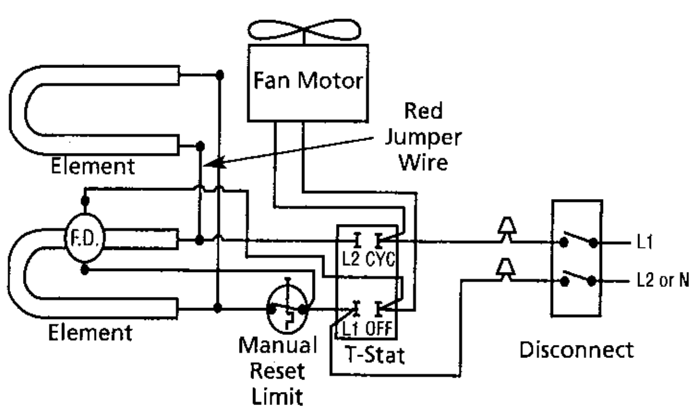
Operation

1. Rotate the thermostat knob fully clockwise. This should energize the heating elements and fan causing warm air to flow from the hot air discharge at the openings in the bottom of the grille.
2. After the operation check, rotate the thermostat knob to the desired position to obtain room comfort.
3. For continuous fan-only operation (elements will not be energized) rotate thermostat knob where indicator dot on knob is aligned with FAN.
4. There will be a short delay from the time the unit is turned on until the fan engages. This is to allow the elements time to warm up. The fan will also continue to run once the unit is turned off to allow the elements time to cool.

NOTE: For best results, the heater should be left "ON" constantly during the heating season because the thermostat, when properly set, will maintain the desired temperature.

⚠CAUTION ***Operation of the manual reset safety thermal limit control is an indication that the heater has been subjected to some abnormal condition. It is recommended that the heater be checked by a reputable electrician or repair service to ensure the heater has not been damaged.***

Wiring Diagram



208V, 240V, or 277V (Full wattage heaters can be converted to half wattage by removing the red jumper wire connecting the top and bottom element terminals.)

Diagram 1 – 1500, 1800, 4800, 4000 & 3000 Watt Heaters

Maintenance

TO RESET MANUAL RESET LIMIT

Your heater is equipped with a manual reset safety thermal limit control that will automatically turn the heater off to prevent a fire if the heater overheats. This control is located on the fan panel assembly between the element and fan blade and marked "reset". The red reset button can be seen through the front grille when the heater is installed. To reset, allow the heater to cool, then push the red button that is visible through the hole in the fan panel. The heater should immediately return to normal operation.

Once each year the heater should be cleaned to remove dust and other foreign material which has collected during the heating season. This is a simple operation when performed as follows:

1. Turn off the electric power at main line switch (or remove all fuses) to disconnect electric power from the heater. THIS IS IMPORTANT.
2. Remove the grille (Figure 5, page 3) and turn the disconnect switch to the OFF position.

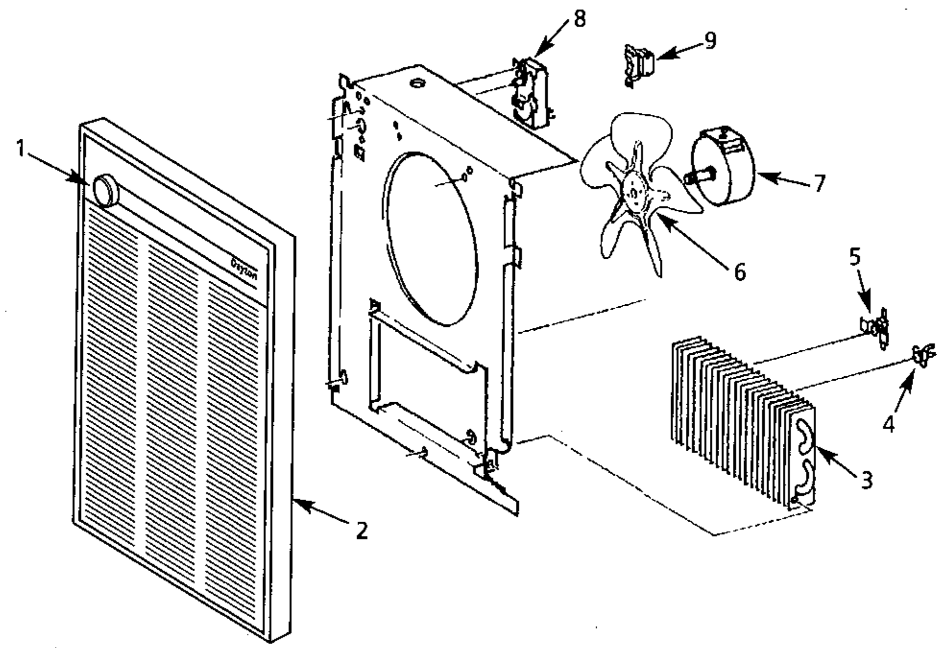
⚠CAUTION ***DO NOT use water or damp cloth for cleaning and DO NOT disturb the heating element.***

3. With a vacuum cleaner nozzle or dust cloth, remove dust and other foreign material.
4. After cleaning, turn disconnect switch to ON position and reinstall the grille.
5. Turn on the main line switch (or replace fuses) to restore power to the heater. The heater is now ready for another season of operation.

For Repair Parts, call 1-800-323-0620

24 hours a day – 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list



Reference Data

Catalog Number	Volts	Ph.	Watts
2HAD7	120	1	1500
2HAD8	120	1	1800
3UF59D	277	1	3000
3UF60D	208/240	1	3000/4000
3UF61D	240/277	1	3000/4000
3UF62D	208/240	1	3600/4800
3UF63D	240/277	1	3600/4800
3END1	208	1	4000/2000

Figure 7 – Repair Parts Illustration for Fan Forced Wall Heaters

Repair Parts List for Fan Forced Wall Heaters

Reference Number	Description	Part Number for Models: 2HAD7	2HAD8	3UF59D	3UF60D	Quantity
1	Knob	HV33012016001G	HV33012016001G	HV33012016001G	HV33012016001G	1
2	Grille	HV25012068000G	HV25012068000G	HV25012068000G	HV25012068000G	1
3	Element	302012827	302012828	302012806	302012808	1
4	High Limit	—	—	—	—	1
	Manual Limit	4520-2027-000	4520-2027-000	4520-2027-000	4520-2027-000	1
5	Fan Delay	410074000	410074000	410074000	410074000	1
6	Fan Blade	490030103	490030103	490030103	490030103	1
7	Motor	3900-2010-003	3900-2010-003	3900-2010-001	3900-2010-000	1
8	Thermostat	5813-2059-000	5813-2059-000	5813-2059-000	5813-2059-000	1
9	Disconnect	410170001	410170001	410170001	410170001	1

Reference Number	Description	Part Number for Models: 3UF61D	3UF62D	3UF63D	3END1	Quantity
1	Knob	HV33012016001G	HV33012016001G	HV33012016001G	HV33012016001G	1
2	Grille	HV25012068000G	HV25012068000G	HV25012068000G	HV25012068000G	1
3	Element	302012809	302012810	302012811	302012807	1
4	High Limit	—	—	—	—	1
	Manual Limit	4520-2027-000	4520-2027-000	4520-2027-000	4520-2027-000	1
5	Fan Delay	410074000	410074000	410074000	410074000	1
6	Fan Blade	490030103	490030103	490030103	490030103	1
7	Motor	3900-2010-001	3900-2010-000	3900-2010-001	3900-2010-000	1
8	Thermostat	5813-2059-000	5813-2059-000	5813-2059-000	5813-2059-000	1
9	Disconnect	410170001	410170001	410170001	410170001	1

Dayton® Fan Forced Wall Heaters

E N G L I S H

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *DAYTON® FAN FORCED WALL HEATERS, MODELS COVERED IN THIS MANUAL, ARE WARRANTED BY DAYTON ELECTRIC MFG. CO. (DAYTON) TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE YEAR AFTER DATE OF PURCHASE. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.*

LIMITATION OF LIABILITY. *TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, DAYTON'S LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES IS EXPRESSLY DISCLAIMED. DAYTON'S LIABILITY IN ALL EVENTS IS LIMITED TO AND SHALL NOT EXCEED THE PURCHASE PRICE PAID.*

WARRANTY DISCLAIMER. *A DILIGENT EFFORT HAS BEEN MADE TO PROVIDE PRODUCT INFORMATION AND ILLUSTRATE THE PRODUCTS IN THIS LITERATURE ACCURATELY; HOWEVER, SUCH INFORMATION AND ILLUSTRATIONS ARE FOR THE SOLE PURPOSE OF IDENTIFICATION, AND DO NOT EXPRESS OR IMPLY A WARRANTY THAT THE PRODUCTS ARE MERCHANTABLE, OR FIT FOR A PARTICULAR PURPOSE, OR THAT THE PRODUCTS WILL NECESSARILY CONFORM TO THE ILLUSTRATIONS OR DESCRIPTIONS. EXCEPT AS PROVIDED BELOW, NO WARRANTY OR AFFIRMATION OF FACT, EXPRESSED OR IMPLIED, OTHER THAN AS STATED IN THE "LIMITED WARRANTY" ABOVE IS MADE OR AUTHORIZED BY DAYTON.*

Technical Advice and Recommendations, Disclaimer. *Notwithstanding any past practice or dealings or trade custom, sales shall not include the furnishing of technical advice or assistance or system design. Dayton assumes no obligations or liability on account of any unauthorized recommendations, opinions or advice as to the choice, installation or use of products.*

Product Suitability. *Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While attempts are made to assure that Dayton products comply with such codes, Dayton cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.*

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

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

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

APPENDIX C: SYSTEM ELECTRICAL COMPONENTS – PRODUCT DATA

CONCEPT® Wall-Mount Enclosures

CONCEPT®, Type 4 and 12

Industry Standards

Wall-mounting brackets required to maintain UL/CSA external mounting requirement.

CONCEPT solid single-door, door with window and flush-mount models

UL 508A Listed; Type 4, 12; File No. E61997 cUL Listed per CSA C22.2 No. 94; Type 4, 12; File No. E61997

NEMA/EEMAC Type 4, 12, 13
CSA, File No. 42186: Type 4, 12
VDE IP66
IEC 60529, IP66

CONCEPT two-door models

UL 508A Listed; Type 12; File No. E61997 cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997

NEMA/EEMAC Type 12
CSA, File No. 42186, Type 12
VDE IP 55
IEC 60529, IP55

Application

CONCEPT® Enclosures are ideal for machine control applications. With streamlined styling, flush quarter-turn latches and an attractive, durable finish. Available in solid or window single-door and two-door landscape, flush-mount and sloped-top versions for application and mounting flexibility. Two-door landscape models provide full-width access and easy panel installation.

Specifications

- 14, 16 or 18 gauge steel (see table)
- Seams continuously welded and ground smooth
- Corner-formed doors
- Simple easy-to-remove and install hinge pins with built-in captivation clip
- High-torque threadless studs and fasteners on door
- Minimum-width body flange provides maximum door opening (210 degrees)
- External formed body flange
- Panel mounting studs fit optional CONCEPT panels and other accessories
- Mounting holes in back of body for optional external wall-mount brackets
- Hidden hinges
- Doors are interchangeable and easily removed by pulling clip-style hinge pins
- Seamless foam-in-place gasket
- Quarter-turn slotted latch(es)
- Door alignment device on doors wider than 30 in.
- Four hinges on 60-in.-high enclosures
- Grounding stud on body; bonding provision on door (except window-door models)
- Provisions for thermoplastic data pocket (right-hand hinged door on two-door models)
- Hardware kit with panel mounting nuts, panel grounding hardware and sealing washers
- Single-door enclosures have a three-point latch system on enclosures where A is equal to or greater than 42-in. with quarter-turn, slotted latch
- Window-door enclosures have a clear polycarbonate window flush with door surface
- Mounting frame on flush-mount enclosures extends completely around enclosure
- Two-door enclosures have a overlapping door design which provides full-width access
- Two door enclosures have a three-point latch system on right-hand hinged door furnished with flush slotted insert
- Illustrated instruction sheet

Finish

Two standard finishes are available: ANSI 61 gray or RAL 7035 textured light-gray polyester powder paint inside and out.

Accessories

Door Stop Kit
Handles
Lock Inserts
CONCEPT® Panels
Mounting-Bracket Kits

Modification and Customization

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

Bulletin: CW1

Hoffman®
A PENTAIR COMPANY

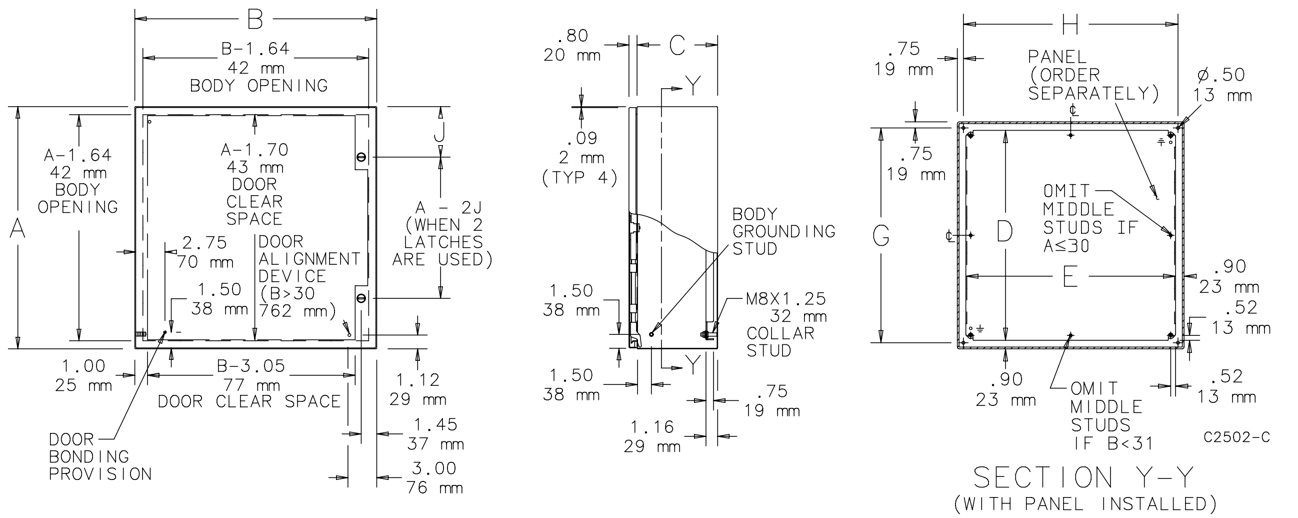
CONCEPT® Wall-Mount Enclosures

Catalog Number	AxBxC in./mm	Finish	Door Ga.	Body Ga.	CONCEPT Panel	Conductive CONCEPT Panel	Panel Size D x E in./mm	Mounting G x H in./mm	Latches qty.	Latches style	J in./mm
CSD24308LG	24.00 x 30.00 x 8.00 610 x 762 x 203	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127
CSD30208	30.00 x 20.00 x 8.00 762 x 508 x 203	ANSI 61 Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD30208LG	30.00 x 20.00 x 8.00 762 x 508 x 203	RAL 7035 Lt. Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD30248	30.00 x 24.00 x 8.00 762 x 610 x 203	ANSI 61 Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD30248LG	30.00 x 24.00 x 8.00 762 x 610 x 203	RAL 7035 Lt. Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD30308	30.00 x 30.00 x 8.00 762 x 762 x 203	ANSI 61 Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127
CSD30308LG	30.00 x 30.00 x 8.00 762 x 762 x 203	RAL 7035 Lt. Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127
CSD36248	36.00 x 24.00 x 8.00 914 x 610 x 203	ANSI 61 Gray	14	16	CP3624	CP3624G	34.20 x 22.20 869 x 564	34.50 x 22.50 876 x 572	2	Quarter-turn	5.00 127
CSD36248LG	36.00 x 24.00 x 8.00 914 x 610 x 203	RAL 7035 Lt. Gray	14	16	CP3624	CP3624G	34.20 x 22.20 869 x 564	34.50 x 22.50 876 x 572	2	Quarter-turn	5.00 127
CSD36308	36.00 x 30.00 x 8.00 914 x 762 x 203	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD36308LG	36.00 x 30.00 x 8.00 914 x 762 x 203	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD36368	36.00 x 36.00 x 8.00 914 x 914 x 203	ANSI 61 Gray	14	14	CP3636	CP3636G	34.20 x 34.20 869 x 869	34.50 x 34.50 876 x 876	2	Quarter-turn	5.00 127
CSD36368LG	36.00 x 36.00 x 8.00 914 x 914 x 203	RAL 7035 Lt. Gray	14	14	CP3636	CP3636G	34.20 x 34.20 869 x 869	34.50 x 34.50 876 x 876	2	Quarter-turn	5.00 127
CSD161210	16.00 x 12.00 x 10.00 406 x 305 x 254	ANSI 61 Gray	16	18	CP1612	CP1612G	14.20 x 10.20 361 x 259	14.50 x 10.50 368 x 267	1	Quarter-turn	8.00 203
CSD161210LG	16.00 x 12.00 x 10.00 406 x 305 x 254	ANSI 61 Gray	16	18	CP1612	CP1612G	14.20 x 10.20 361 x 259	14.50 x 10.50 368 x 267	1	Quarter-turn	8.00 203
CSD161610	16.00 x 16.00 x 10.00 406 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP1616	CP1616G	14.20 x 14.20 361 x 361	14.50 x 14.50 368 x 368	1	Quarter-turn	8.00 203
CSD161610LG	16.00 x 16.00 x 10.00 406 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP1616	CP1616G	14.20 x 14.20 361 x 361	14.50 x 14.50 368 x 368	1	Quarter-turn	8.00 203
CSD162010	16.00 x 20.00 x 10.00 406 x 508 x 254	ANSI 61 Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	14.50 x 18.50 368 x 470	1	Quarter-turn	8.00 203
CSD162010LG	16.00 x 20.00 x 10.00 406 x 508 x 254	RAL 7035 Lt. Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	14.50 x 18.50 368 x 470	1	Quarter-turn	8.00 203
CSD201610	20.00 x 16.00 x 10.00 508 x 406 x 254	ANSI 61 Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	18.50 x 14.50 470 x 368	1	Quarter-turn	10.00 254
CSD201610LG	20.00 x 16.00 x 10.00 508 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP2016	CP2016G	18.20 x 14.20 462 x 361	18.50 x 14.50 470 x 368	1	Quarter-turn	10.00 254
CSD202010	20.00 x 20.00 x 10.00 508 x 508 x 254	ANSI 61 Gray	16	18	CP2020	CP2020G	18.20 x 18.20 462 x 462	18.50 x 18.50 470 x 470	1	Quarter-turn	10.00 254
CSD202010LG	20.00 x 20.00 x 10.00 508 x 508 x 254	RAL 7035 Lt. Gray	16	18	CP2020	CP2020G	18.20 x 18.20 462 x 462	18.50 x 18.50 470 x 470	1	Quarter-turn	10.00 254
CSD202410	20.00 x 24.00 x 10.00 508 x 610 x 254	ANSI 61 Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	18.50 x 22.50 470 x 572	1	Quarter-turn	10.00 254
CSD202410LG	20.00 x 24.00 x 10.00 508 x 610 x 254	RAL 7035 Lt. Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	18.50 x 22.50 470 x 572	1	Quarter-turn	10.00 254
CSD241610	24.00 x 16.00 x 10.00 610 x 406 x 254	ANSI 61 Gray	16	18	CP2416	CP2416G	22.20 x 14.20 564 x 361	22.50 x 14.50 572 x 368	1	Quarter-turn	12.00 305
CSD241610LG	24.00 x 16.00 x 10.00 610 x 406 x 254	RAL 7035 Lt. Gray	16	18	CP2416	CP2416G	22.20 x 14.20 564 x 361	22.50 x 14.50 572 x 368	1	Quarter-turn	12.00 305
CSD242010	24.00 x 20.00 x 10.00 610 x 508 x 254	ANSI 61 Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	22.50 x 18.50 572 x 470	1	Quarter-turn	12.00 305
CSD242010LG	24.00 x 20.00 x 10.00 610 x 508 x 254	RAL 7035 Lt. Gray	16	18	CP2420	CP2420G	22.20 x 18.20 564 x 462	22.50 x 18.50 572 x 470	1	Quarter-turn	12.00 305
CSD242410	24.00 x 24.00 x 10.00 610 x 610 x 254	ANSI 61 Gray	14	16	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD242410LG	24.00 x 24.00 x 10.00 610 x 610 x 254	RAL 7035 Lt. Gray	14	16	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD243010	24.00 x 30.00 x 10.00 610 x 762 x 254	ANSI 61 Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127
CSD243010LG	24.00 x 30.00 x 10.00 610 x 762 x 254	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127
CSD302010	30.00 x 20.00 x 10.00 762 x 508 x 254	ANSI 61 Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD302010LG	30.00 x 20.00 x 10.00 762 x 508 x 254	RAL 7035 Lt. Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127
CSD302410	30.00 x 24.00 x 10.00 762 x 610 x 254	ANSI 61 Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD302410LG	30.00 x 24.00 x 10.00 762 x 610 x 254	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD303010	30.00 x 30.00 x 10.00 762 x 762 x 254	ANSI 61 Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127

CONCEPT® Wall-Mount Enclosures

Catalog Number	AxBxC in./mm	Finish	Door Ga.	Body Ga.	CONCEPT Panel	Conductive CONCEPT Panel	Panel Size D x E in./mm	Mounting G x H in./mm	Latches qty.	Latches style	J in./mm
CSD603612LG	60.00 x 36.00 x 12.00 1524 x 914 x 305	RAL 7035 Lt. Gray	14	14	CP6036	CP6036G	58.20 x 34.20 1478 x 869	58.50 x 34.50 1486 x 876	1	3-point	30.00 762
CSD242416	24.00 x 24.00 x 16.00 610 x 610 x 406	ANSI 61 Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD242416LG	24.00 x 24.00 x 16.00 610 x 610 x 406	RAL 7035 Lt. Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD363016	36.00 x 30.00 x 16.00 914 x 762 x 406	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD363016LG	36.00 x 30.00 x 16.00 914 x 762 x 406	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD483616	48.00 x 36.00 x 16.00 1219 x 914 x 406	ANSI 61 Gray	14	14	CP4836	CP4836G	46.20 x 34.20 1173 x 869	46.50 x 34.50 1181 x 876	1	3-point	24.00 610
CSD483616LG	48.00 x 36.00 x 16.00 1219 x 914 x 406	RAL 7035 Lt. Gray	14	14	CP4836	CP4836G	46.20 x 34.20 1173 x 869	46.50 x 34.50 1181 x 876	1	3-point	24.00 610
CSD242420	24.00 x 24.00 x 20.00 610 x 610 x 508	ANSI 61 Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD242420LG	24.00 x 24.00 x 20.00 610 x 610 x 508	RAL 7035 Lt. Gray	14	14	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127
CSD302420	30.00 x 24.00 x 20.00 762 x 610 x 508	ANSI 61 Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD302420LG	30.00 x 24.00 x 20.00 762 x 610 x 508	RAL 7035 Lt. Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127
CSD363020	36.00 x 30.00 x 20.00 914 x 762 x 508	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127
CSD363020LG	36.00 x 30.00 x 20.00 914 x 762 x 508	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127

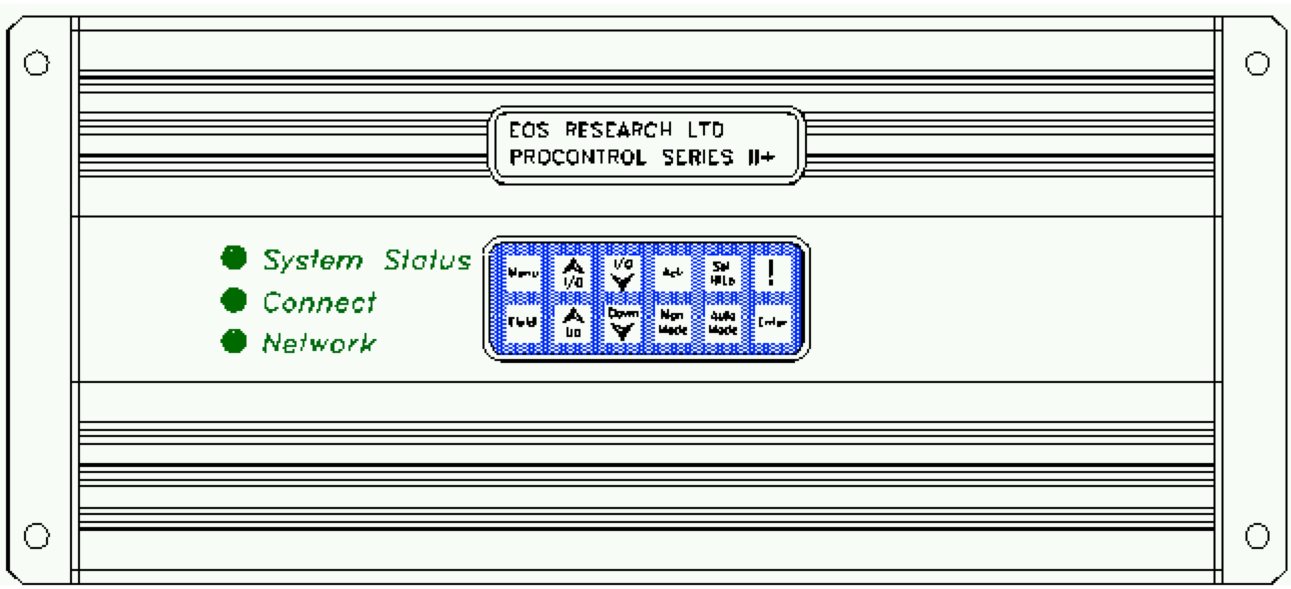
Purchase panels separately.
Optional NEMA-size panels require conversion kit Catalog Number CCPM4.



PROCONTROL SERIES 2^{plus}

Type B

Product Specification



The next generation **Type B** ProControl features a capacity of up to 51 industrially-hardened inputs and outputs in a small and easy-to-use package. The **Series 2**^{plus} contains everything you need for the core of your control/telemetry system, including the ability to connect directly to 120V inputs, and to drive motor starters, solenoids and other devices directly from built-in relay outputs. The **Type B** includes expanded datalogging and reporting capability, a built-in power supply for your instruments and transducers, as well as pluggable connectors for all I/O. It's a truly capable SCADA system for your operation.

	Model B1	Model B2
Inputs		
Discrete	Twelve (12) protected discrete inputs. Support for 4 flowmeters or pulse accumulators with rates to 200Hz.	Fourteen (14) protected discrete inputs. Eight (8) optically isolated inputs. Support for 6 flowmeters or pulse accumulators with rates to 200Hz.
Analog	Eight (8) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected and may also be used as discrete inputs	Ten (10) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected and may also be used as discrete inputs
Outputs		
Discrete	Fourteen (14) relay outputs rated at 1/2A, 120VAC	Fourteen (14) relay outputs rated at 1/2A, 120VAC
Analog		Five (5) 4-20ma outputs. PID loop control.

<table>
<tr><th></th><th>Model B1</th><th>Model B2</th></tr>
<tr><td>Datalogging</td><td></td><td></td></tr>
<tr><td>Discrete</td><td>2,000 points standard. 30,000 points optional. All logging occurs on change of state.</td><td>2,000 points standard. 30,000 points optional. All logging occurs on change of state.</td></tr>
<tr><td>Analog</td><td>16,000 points standard (2000 per channel). 40,000 points optional.</td><td>20,000 points standard (2000 per channel). 50,000 points optional.</td></tr>
<tr><td>Event</td><td>2,000 points standard. 10,000 points optional.</td><td>2,000 points standard. 10,000 points optional.</td></tr>
<tr><td>Totalizers</td><td>50 points per channel.</td><td>50 points per channel.</td></tr>
<tr><td>Communications</td><td colspan="2"></td></tr>
<tr><td>Modem</td><td colspan="2">ProView Software, PC to ProControl Interface - 9600 baud.</td></tr>
<tr><td>FAX</td><td colspan="2">Alarm and Status Reports. Group 3, Class 2 FAX reporting at 9600 baud</td></tr>
<tr><td>Pager</td><td colspan="2">TAP standard numeric and alphanumeric paging at 300 to 2400 baud.</td></tr>
<tr><td>Local</td><td colspan="2">Direct RS-232 Serial interface with automatic local/remote switching.</td></tr>
<tr><td>e-mail</td><td colspan="2">Via third-party service, alarm and status reports</td></tr>
<tr><td>Network</td><td colspan="2">Optional - Types B1 and B2 can be linked via RS-485 for distributed control or higher I/O counts</td></tr>
<tr><td>User Interface</td><td colspan="2"></td></tr>
<tr><td>LCD</td><td colspan="2">2 x 20 character display</td></tr>
<tr><td>Keypad</td><td colspan="2">2 x 6 membrane keypad</td></tr>
<tr><td>LEDs</td><td colspan="2">LEDs: System Status, Communications Link, Networking</td></tr>
<tr><td>Process Control</td><td colspan="2"></td></tr>
<tr><td>System</td><td colspan="2">Up to 32 regular system processes total with 8 startup and 8 shutdown processes. Processes run every 0.35 seconds.</td></tr>
<tr><td>Alarms</td><td colspan="2">Generate shutdowns, two FAX reports and/or two Pager messages.</td></tr>
<tr><td>Loops</td><td colspan="2">PID loop control with user control of setpoint, proportional, integral and differential gains and max change per calculation. Also open loop proportional algorithm.</td></tr>
<tr><td>Power</td><td colspan="2"></td></tr>
<tr><td>System</td><td colspan="2">10VAC, 30VA, external transformer provided</td></tr>
<tr><td>I/O Supply</td><td colspan="2">24 VDC, 15V and 9V available for powering sensors/instruments.</td></tr>
<tr><td>Environmental</td><td colspan="2"></td></tr>
<tr><td>Dimensions</td><td colspan="2">13.5” long x 6” wide x 3.5” high.</td></tr>
<tr><td>Weight</td><td colspan="2">6 lbs.</td></tr>
<tr><td>Power Dissipation</td><td colspan="2">25W</td></tr>
<tr><td>Operating Temp.</td><td colspan="2">-20C to +50C</td></tr>
<tr><td>Humidity</td><td colspan="2">95% R.H. non-condensing</td></tr>
</table>

EOS research

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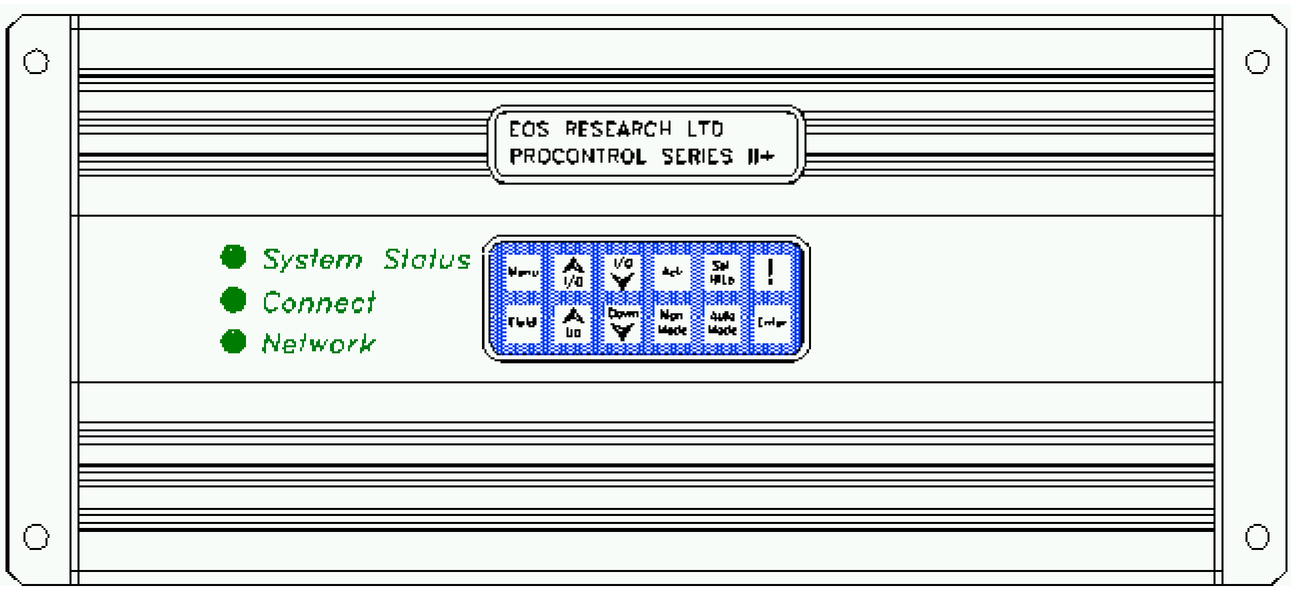
Specifications subject to change without notice.

PROCONTROL

SERIES 2*plus* USER MANUAL



Version 2.X

LIMITED WARRANTY

EOS Research Ltd. (EOS) warrants its products to be free from defects in materials and workmanship for a period of one year from the date of purchase. Its obligation under this warranty is limited to repairing or replacing, at its sole option, any such defective products. This warranty includes parts and labor. This warranty does not apply to equipment which has been damaged by accident, negligence or misapplication or has been altered or modified in any way.

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This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

IMPORTANT SAFETY PRECAUTIONS

Any complex hardware or software may be difficult to document, explain or understand. It is important to consider the consequences or unexpected or abnormal behavior which may be caused by a defect or human failure to comprehend. In order to protect people and property from damage, a thorough safety analysis should always be performed. When the consequences of a failure are serious, it is essential to protect life and property against such a failure with redundant backup systems or safety devices. It is agreed between the purchaser and EOS Research Ltd. that protection against and the consequences of any such failure are entirely the purchaser's responsibility.

This device is not approved for use in life support or medical systems.

As installed, this product may be part of a system which is required to meet various electrical, fire, safety or other codes and regulations. Compliance with these code is the purchaser's responsibility.

Specifications subject to change without notice.

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TABLE OF CONTENTS

Please see the ProView manual for operation of the remote access software which is supplied with the ProControl Series **2***plus*.

1.0 SYSTEM OVERVIEW

1.1 General

The *ProControl Series* **2*plus*** is a small but powerful microprocessor based control/ telemonitoring system. By combining a control panel and remote monitor in one unit, the Series **2*plus*** can act as a central supervisory and data management tool for any stand-alone operation. The *ProControl Series* **2*plus*** can perform multiple tasks:

- **Stand-Alone Control:** The *ProControl Series* **2*plus*** is a sophisticated programmable logic controller that will efficiently supervise and control your operation. It can interface with up to 70 electrical devices (float switches, pressure transducers, pH transmitters, flow meters, pumps, blowers, etc.), and execute numerous control functions simultaneously. Automatic shutdown routines can be programmed in to protect you operation during alarm conditions. It is extremely versatile in terms of the control algorithms it can execute.

- **Remote Control and Monitoring:** The *ProControl Series* **2*plus*** gives you a window into your operation from any remote location, using the easy-to-use Windows-based software supplied with the system. You communicate with the ProControl over a modem link, which allows you to view all of your system's operating conditions, while also providing the same access to control functions that you would have if you were at the site (e.g., turning pumps on and off, adjusting alarm setpoints, etc.). No other telemonitoring device gives you the ProControl's level of remote control capability.

- **Reporting:** The *ProControl Series* **2*plus*** will keep you informed. It will send you periodic fax status reports of your project operations on a schedule specified by you, and will alert you immediately either by fax or by numeric or alpha-numeric pager if an alarm condition warrants attention. No longer do you have to assume what's happening at your remote operation.....the ProControl will tell you exactly.

- **Datalogging:** The *ProControl Series* **2*plus*** is your information manager. It is a powerful datalogger that automatically records all operating conditions in its battery-backed memory. You can access your logged data remotely at any time, and download it to your office computer for further processing. The datalogging capability is an invaluable tool for reporting purposes, troubleshooting, and trend graphing.

One or more of these features can be used in your installation; they are standard in every ProControl unit.

1.2 Key Concepts

The following are the building blocks of any Series **2***plus* monitoring and control system.

Inputs and Outputs (I/O's)

No system can be effective in the real world without communication and one of the principal ways the ProControl communicates is by responding to information collected by sensors and by issuing "commands" to other electronic or electrical devices. Sensor information constitutes an *Input* while a "command" to another device constitutes an *Output*. The Series **2***plus* works with all of the more important types of I/O devices in general use. Appendix A demonstrates how a variety of I/O devices are connected to the ProControl.

Digital Inputs

These inputs are designed to detect the closure of switch contacts such as those found on float switches or overpressure sensors. They can respond to any normally open or normally closed dry contact. The Series **2***plus* provides its own wetting (supply) voltage of 5 volts DC for each digital input circuit. The Series **2***plus* can respond to changes in state as fast as 4 Hz or 3 Hz (cycles per second) depending on the model purchased. Digital inputs are "debounced" for 125 or 150 milliseconds, respectively. This means that a switch or other input that changes state (becomes open or closed) must stay in that state for 125 or 150 milliseconds before the Series **2***plus* will respond to the change.

Eight high-speed digital inputs can also be used for traditional digital (pulse-output) flow meters. These inputs can detect signal changes at up to a 200/500 Hz rate. All high-speed digital inputs are "debounced" for 1250/500 microseconds. The faster rate applies only to those systems containing the 18.432 MHz processor.

Analog Inputs

These inputs are compatible with sensors which send out a 4 - 20 milliamp (mA) signal. Most analog sensors are available with this type of signal, examples being pressure transducers, pH transmitters, and many flow meters. These inputs allow the operator to read the actual "value" of a parameter, such as pressure, instead of an on/off signal.

Digital Outputs

Digital outputs turn things like pumps, solenoid valves, and alarm lights on and off. The Series **2***plus* digital outputs are relay outputs designed to switch small loads directly, such as motor starters, lamps, and solenoid valves.

Analog Outputs

Analog outputs are typically used in process control schemes where a controlled piece of equipment can accept a signal which is variable over a range. This output is expressed as a percentage (0 - 100%) and is used to control pump speeds, chemical dosing rates, etc., instead of conventional on/off operation. The equipment that the ProControl sends the analog output to must accept a 4 - 20 mA signal. Often, an analog output is used in conjunction with an analog input such as a pH transmitter to form a control scheme known as *feedback control*. In essence, the input and output will work together to maintain a user set input level. This concept is described further in the next section under *Analog Output Processes*.

Tagnames

Each input and output is given a descriptive *Tagname* by the user that uniquely identifies it to the system operator. For instance, a digital input could be called "TANKHI", an analog input could be called "AIRFLO" and a digital output could be called "PUMP_1". This tagname is used by the local LCD display, the FAX report and by the ProView software. The analog inputs are also given a *Units Tagname* which identifies the unit of measure associated with the input sensor. Each tagname can be up to six characters long and each units tagname can be up to three characters long ("PSI", for instance). The tagnames can include the uppercase letters A-Z, the numbers 0-9, a blank space, and the underscore (_) character.

1.3 Control Basics

The status of all inputs or outputs can easily be monitored both locally and remotely. What gives the Series **2*plus*** its real power, however, is the ability to automatically initiate actions based on the status of the inputs and your pre-programmed instructions (this is often called *Process Control*). These actions can include switching certain outputs, faxing back a report, sending an alphanumeric or numeric page, shutting down the entire system or sounding the local alarm. Process control functions are programmed into your ProControl by EOS Research or one of our technology partners according to your specifications.

Active State

Central to the use of control on the Series **2*plus*** is the concept of *Active State*. Each input on the ProControl receives certain signals from a sensor which constitute "normal" operation and other signals which constitute an exception to normal operation.

A digital input can monitor only two states, ON or OFF (alternatively, CLOSED or OPEN). The *Active State* would be the state in which the controller would respond to the digital input, and perform certain actions or generate an alarm. For example, if a high level float switch in a tank is tripped (turned ON) by rising fluid level, we can say that its *Active State* correlates to a situation in which the fluid level is high. The active state of the float switch could cause the Series **2*plus*** to trigger an alarm, turn off a pump, or initiate some other action. The Series **2*plus*** can be set up so that either ON or OFF is the active state.

An analog input sensor can take on many states (or values) between the minimum and maximum of its measurement range. The ProControl operator, however, can set two threshold values which divide the total input span into two functional regions. These threshold values are more commonly called the *Low Alarm Limit* and the *High Alarm Limit*, although on the Series **2*plus*** these thresholds are somewhat more flexible in use than those names imply. An analog input which has transcended either its Low Alarm Limit or High Alarm Limit is said to be in its active state.

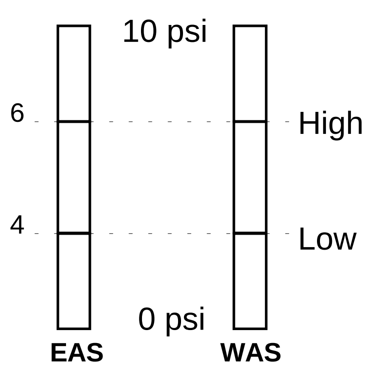


Figure 1. Active State

For instance, consider an analog input sensor which measures pressure from 0 to 10 PSI. The system operator could set the low limit to 4 PSI and the high limit to 6 PSI. In this case the *Active State* would usually be considered as the input state greater than 6 PSI or less than 4 PSI. This interpretation is called *Endpoint Active State* (EAS) on the Series **2*plus*** because the endpoints of the range are the areas which need to trigger action or generate alarms. The opposite interpretation is also possible and is called *Window Active State* (WAS). Any input values between 4 PSI and 6 PSI would trigger action or generate alarms.

If the ProControl has *Alarms Set*, when any input enters its active state, a local beeper will sound on the ProControl. The word *Alarm* here applies only to the sounding of a local beeper and is not associated with any process control. The active state condition is indicated on the LCD display and can be acknowledged by the operator. The beeper is silenced when it has been acknowledged or after 30 seconds have elapsed. The beeper only operates when the system is operating in Manual mode.

Startup Sequence

The *Startup Sequence* is a series of control algorithms or steps which run in succession and which are designed to place the system in its normal operating mode. It can be as simple as turning all the outputs on simultaneously, or as complex as a multi-stage delay with many conditions. Up to 8 or 16 individual startup steps can be declared depending on the model of the controller. The ProControl can be configured to automatically run this sequence when the unit is powered up.

Process Tasks

A *Process Task* is an ongoing control algorithm which runs continuously. Think of each process task as an IF-THEN statement, in which an action is initiated if a certain condition or combination of conditions exists. Some examples are:

- IF Tank Level Sensor 2 is on, THEN turn Pump 2 off
- IF Air Flow Rate < 10 cfm AND Reactor Temperature > 250^{o}, THEN open Bleed Valve 2

Up to 16 or 64 separate process tasks can be run simultaneously depending on the model of the controller. Process tasks can trigger FAX reports, pager alerts, and system shutdowns.

Shutdown Sequence

The *Shutdown Sequence* is a series of control steps which run in succession and which are designed to shut your system down in a manner which is best for the equipment or treatment processes involved. The shutdown sequence can be activated manually or automatically due to an alarm condition. Here is a typical shutdown sequence:

- Turn off Well Pumps 1 and 2
- Wait 5 minutes, then turn off Stripper Blower
- Open Bleed Valve 2
- When Oxidizer Temperature < 150^{o}, turn off SVE Blower

Automatic Operation

The use of the startup sequence, process tasks, and the shutdown sequence constitutes *Automatic Operation* of your system with the ProControl Series **2*plus*** (otherwise known as *Auto Mode*). The Series **2*plus*** will be placed into auto mode (automatically) when your system has been started up using the programmed startup sequence. If one condition of the programmed startup sequence is not met during the startup process, your system will be completely shut down by the ProControl as a safety measure. Once the startup sequence has been successfully completed, the ProControl begins running the process tasks continuously. **PROCESS TASKS WILL RUN ONLY WHEN IN AUTO MODE**. Please note that the audible beeper will <u>not</u> sound even if the ProControl has *Alarms Set* when it is in Auto Mode, since the process tasks will control these situations as the user has specified.

Manual Operation

You can override the Series **2*plus*** programmed control functions by operating in *Manual Mode*. In manual mode, your process will respond only to operator input from the keypad of the ProControl, or to commands issued from the ProView software. **PLEASE NOTE THAT PROCESS TASKS AND THEIR ERROR-CHECKING MECHANISMS DO NOT RUN DURING MANUAL MODE!** Manual mode is useful when you wish to troubleshoot your system, but none of the system safeguards built into auto mode are available. You can place your operation into auto mode any time by issuing the command from the keypad.

Analog Output Processes

In some cases, you may want to use an analog output to control equipment that maintains an analog input at a certain constant level. For example, you may wish to automatically maintain a pH of 8.5 in a reaction tank by varying the dosing rate of a chemical feed pump. The pH you wish to maintain (8.5) is called the *SetPoint* of the analog output process. An analog input to the ProControl (in this case, a pH transmitter) is said to provide *feedback* to the unit, and combined with an analog output, constitute *feedback control*.

PID Loops

A reliable type of feedback control can be obtained through a *PID Loop*. PID stands for *Proportional-Integral-Derivative*, and is a commonly-used process control technique. We'll skip the details of the mathematics involved, but suffice it to say that a PID loop is the favored control technique for most analog output processes. With only a *Proportional* term applied in the equation, the analog output is controlled based on an error signal generated from the difference between the SetPoint and the actual analog input. The PID loop can also improve its performance as it continues to run if an *Integral* term is used and can respond to quick changes in the controlling analog input if a *Derivative* term is used. EOS Research will configure your PID loops for you and can provide further information if necessary.

Proportional Outputs

In some cases, it may be desirable to base an analog output signal on an analog input value. In this situation, no specific SetPoint is used because there is a direct relationship between the output and input values. For example, if you wanted to base the output of a metering pump on some flow rate, you might use a proportional output to relate the amount of chemical metered to the flow rate.

2.0 ON-SITE OPERATION

2.1 LCD Display

If your unit did not come with an LCD display, the following sections *do not* apply.

The 2 line x 20 character LCD display is used to display and control system operations. The display is divided into separate areas or fields, as outlined below.

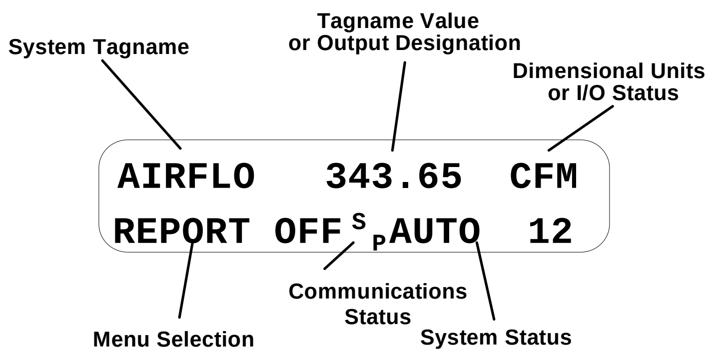


Figure 2. Display Fields

System Tagname This six-character field is used to identify the I/O point displayed. Descriptive names such as WELL1 or BLOWER are used.

Tagname Value For analog inputs, this field displays the value of the input, the high alarm limit, or the low alarm limit. For digital outputs, OUTPUT is displayed. For digital inputs, this field is unused. For analog outputs, this field displays the output percentage, the output level, or the associated input setpoint.

Dimensional Units or I/O Status For analog inputs, this three-character field displays the dimensional units associated with the input sensor, such as GPM or PSI. For digital inputs and outputs, this field displays either ON or OFF. For analog outputs, this field abbreviates percent with PCT. In the case of digital outputs, if the particular output displayed has been designated a lamp output (*see ProView manual*), and a lamp test is currently running, an asterisk (*) will appear before ON or OFF to indicate the lamp is illuminated despite the indicated output status (the output will return to this indicated status once the lamp test has been completed).

Menu Selection This field displays the current menu selection.

Communications Status

This field displays one of five different descriptors which indicate any of several special functions of the ProControl. If no communications action is being taken, ">" will appear. Communications messages include: **SP** (Sending Page) - indicates that the unit is attempting to send either an alphanumeric or numeric page; **EF** (Encoding Fax) - indicates that the unit is presently encoding a facsimile report as a result of a request by either the operator or the unit itself; **SF** (Sending Fax) - indicates that the unit is attempting to send a fax report; and **DC** (Data Communications) - indicates that the unit is presently interfaced with ProView.

System Status

This area displays the current system status: AUTO, MANUAL, START, or SHUTD and an associated process task number indicating the last successfully completed Auto process, current Startup process, or current Shutdown process.

2.2 Keypad

The Series **2*plus*** keypad contains 12 buttons which are used along with the LCD Display to control the operations of the system.

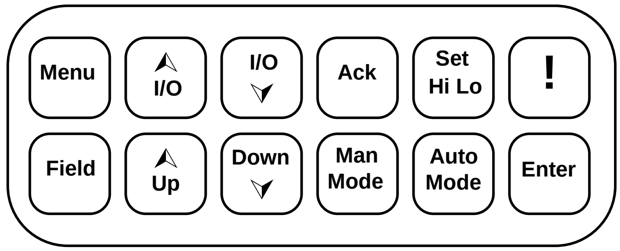
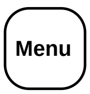
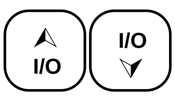


Figure 3. Series 2plus Keypad



This key is used to scroll through a series of options which are displayed on the LCD screen, and which allow the user to configure various aspects of system behavior.

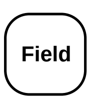


These keys are used to display information about particular I/O points on the LCD Screen. The keys allow the user to scroll through all of the system I/O points either forward or backward.

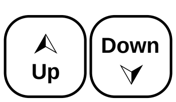
The Acknowledge key is used to silence the audible beeper or to acknowledge a memo sent from a remote ProView user.

The Set Hi Lo key allows the user to change the high and low alarm limits for analog inputs or to toggle the display in the I/O Summary.

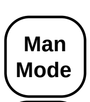
The Emergency Shutdown key is used to turn off all outputs and return the system to manual mode. The programmed shutdown sequence is not executed using this key.



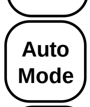
The Field key is used to select a character position to be edited. It is used in conjunction with any direct alphanumeric entry.



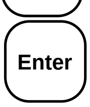
These keys are used to toggle system variables from one state to the next or to scroll through possible character entries when used in conjunction with the Field key.



This key is used to place the system in manual mode.



This key is used to place the system in auto mode.



The Enter key is used to initiate certain actions selected by other keys or to confirm alphanumeric editing done using other keys.

2.3 Password

When the system is first turned on the password screen is displayed and the user is prompted to enter the password to gain access to the system. "EOS" is the default password. The password on the Series **2*plus*** was designed as a *low-level* security feature. It is not sufficient in and of itself to withstand a determined effort at system entry. The ProControl unit can be configured to bypass the password screen when the unit is powered up.

Up Down

```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

Use the Up and Down keys to change the character displayed above the cursor.

Field

```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

The Field key is used to move the cursor to the next character to be edited.

Enter

```
CUSTOMER ID TAGNAME
ENTER PASSWORD: EOS
```

The enter key submits the password for approval.

If the password was entered correctly, the following screen will be displayed for about a second before the operations screen is displayed:

```
Password Accepted
VER 2.XXX   : 1
```

ROM Version #   User Setup Version #

Otherwise, the following message will be displayed for a second and the user will be returned to the password menu:

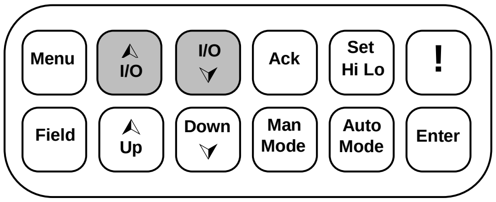
```
Incorrect Password
```

2.4 Operations Screen

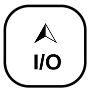
After the password has been entered correctly, the operations screen is displayed. The operations screen allows the user to set system parameters and to review the status of all system inputs and outputs.

```
WELL1              OFF
ALARMS SET >MANUAL
```

2.5 I/O Keys

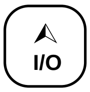


Pressing the I/O Up or I/O Down keys will scroll through the operational I/O points in the system. Data relevant to a particular I/O point will be displayed to right of the point's Tagname.



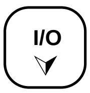

```
WELL2                ON
ALARMS SET >MANUAL
```

Forward scroll through I/O points




```
WELL3               OFF
ALARMS SET >MANUAL
```

Forward scroll through I/O points




```
WELL2                ON
ALARMS SET >MANUAL
```

Backward scroll through I/O points

2.6 Digital Input Menu

Input Tagname   Input Status

```
WELL2                ON
ALARMS SET >MANUAL
```

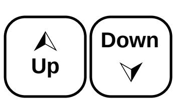
A digital input displayed in the operations screen will be displayed as shown. When the input is in its Active State "ON" will be displayed in the Input Status area. Otherwise, "OFF" will be displayed.

2.7 Digital Output Menu

Output Tagname   Lamp Status   Output Status

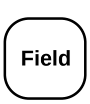
```
PUMP1    OUTPUT  *OFF
ALARMS SET >MANUAL
```

A digital output displayed in the operations screen will appear as shown. When the output has been turned on, "ON" will be displayed in the Output Status area. Otherwise, "OFF" will be displayed. The cursor is displayed under the first character in the status field to indicate that it can be changed. The Lamp Status character (*) will be shown for a lamp output if a *lamp test* is running regardless of the output's true state.




```
PUMP1    OUTPUT   ON
ALARMS SET >MANUAL
```

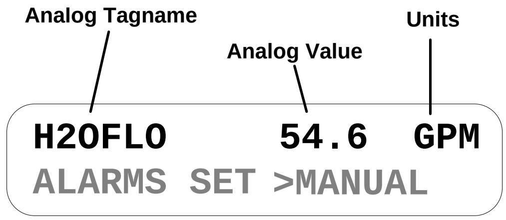
Pressing the Up or Down key will toggle the digital output state and turn the corresponding relay OFF or ON.




```
PUMP1    OUTPUT   ON
ALARMS SET >MANUAL
```

Pressing the Field key will move the cursor to the Menu selection field.

2.8 Analog Input Menu



An analog input displayed in the operations screen will be displayed as shown to the left. The value of the analog input will be shown along with the dimensional units. In the case of a pulse accumulator (totalizer only), you will see only TOT where units is normally displayed.

Set Hi Lo

```
H2OFLO      20.0  GPM
LOW ALARM  >MANUAL
```

Use the Set Hi Lo key to set the low alarm limit.

Set Hi Lo

```
H2OFLO      80.0  GPM
HIGH ALARM >MANUAL
```

Press the Set Hi Lo key again to set the high alarm limit.

Set Hi Lo

```
H2OFLO    120817  GAL
TOTAL FLOW >MANUAL
```

Press the Set Hi Lo key again to see the total flow on a flow type input, and once more to return.

Up **Down**

```
H2OFLO      30.0  GPM
LOW ALARM  >MANUAL
```

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

Field

```
H2OFLO      30.0  GPM
LOW ALARM  >MANUAL
```

The Field key is used to move to the next character to be edited.

Enter

```
H2OFLO      30.0  GPM
LOW ALARM  >MANUAL
```

To save the low alarm limit changes, press the enter key.

2.9 Analog Output Menu

Analog Tagname

Percentage

```
VRPUMP    25.0  PCT
ALARMS SET >MANUAL
```

An analog output displayed in the operations screen will be displayed as shown to the left. The percentage of full scale output will be displayed as well.

Set Hi Lo

```
VRPUMP    25.0  PCT
OUTPUT LVL >MANUAL
```

The Set Hi Lo key can be used to set the output percentage.

Set Hi Lo

```
WTRLVL    33.0  FT
SETPOINT   >MANUAL
```

Press the Set Hi Lo key again to declare the SetPoint of an associated analog input. The SetPoint is used only if a PID control loop is in use as an analog output process.

Pressing Set Hi Lo again returns to the original menu.

Up Down

```
VRPUMP    35.0  PCT
OUTPUT LVL >MANUAL
```

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

Field

```
VRPUMP    35.0  PCT
OUTPUT LVL >MANUAL
```

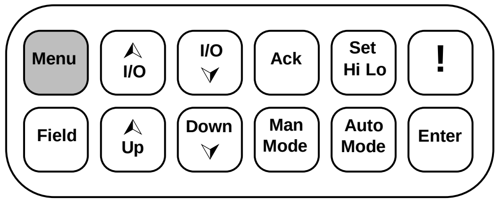
The Field key is used to move to the next character to be edited.

Enter

```
VRPUMP    35.0  PCT
OUTPUT LVL >MANUAL
```

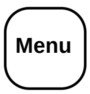
To save the output level changes, press the enter key.

2.10 Menu Key



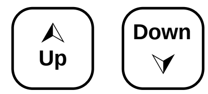
When pressed, the Menu key will scroll through a series of items which allow the user to configure various aspects of system behavior. A description of these items appear in a 10 character field at the bottom left of the display. Either the Up and Down keys or the Enter key is used to change the item.

ALARMS Use the Up and Down keys to enable or disable Alarms.

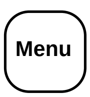



```
TAGNAM              DIM
ALARMS OFF >MANUAL
```

```
TAGNAM              DIM
ALARMS SET >MANUAL
```

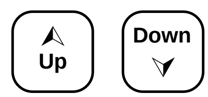


REPORT Use the Up and Down keys to enable or disable the unit's reporting capabilities (fax or page).

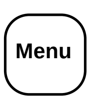



```
TAGNAM              DIM
REPORT OFF >MANUAL
```

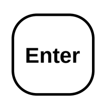
```
TAGNAM              DIM
REPORT ON  >MANUAL
```



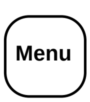
FAX NOW Use the Enter key to send a FAX report immediately.



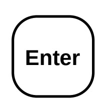

```
TAGNAM              DIM
FAX NOW    >MANUAL
```



STARTUP Use the Enter key to run the Startup Sequence.




```
TAGNAM              DIM
STARTUP    >MANUAL
```



SHUTDOWN Use the Enter key to run the Shutdown Sequence.

Menu

```
TAGNAM          DIM
SHUTDOWN   >MANUAL
```

Enter

LAST SHUTDOWN This display item shows what input or output caused the last shutdown.

Menu

```
TAGNAM          DIM
SDN TAGNAM >MANUAL
```

LOG OFF Use the Enter key to Log Off the system and return to the password menu.

Menu

```
TAGNAM          DIM
LOGOFF     >MANUAL
```

Enter

LAST MEMO Use the Enter key to see the last memo sent from the remote ProView user. Up and Down are used to scroll through the message, and Ack is used to return to the ProControl menus. If you hit any other key you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be acknowledged before the 3-second period by pressing either the Ack or Enter keys.

Menu

```
TAGNAM          DIM
LAST MEMO  >MANUAL
```

Enter

```
HEY BULLWINKLE,
REMEMBER TO SHUT THE
```

Down

```
LIGHTS OFF!
PUSH <ACK> TO RETURN
```

Field

```
UP & DOWN TO SCROLL
OR <ACK>NOWLEDGE
```

Ack

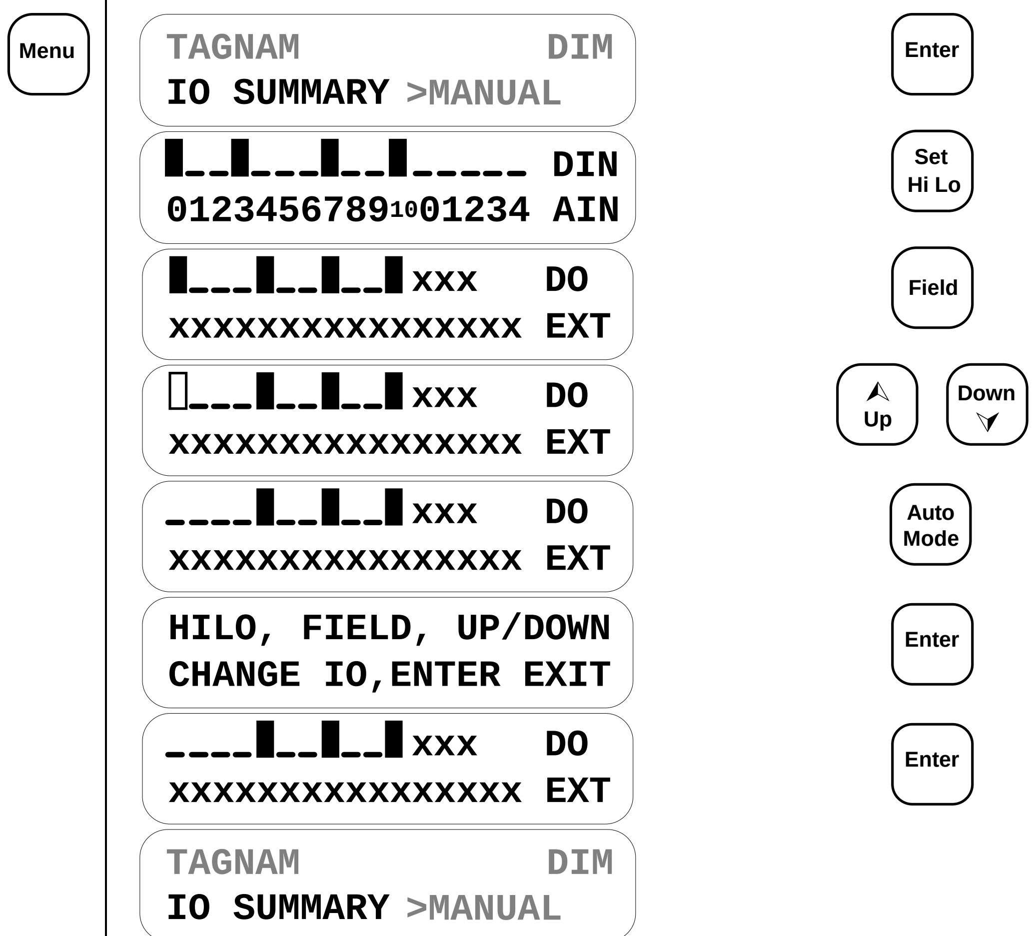
```
LIGHTS OFF!
PUSH <ACK> TO RETURN
```

Ack

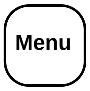
```
TAGNAM          DIM
LAST MEMO  >MANUAL
```

IO SUMMARY

Use the Enter key to enter the I/O summary. The analog input values 0-10 represent a percentage of full scale (i.e. 0 ≅ 4 mA, 5 ≅ 12 mA). Set HiLo is used to toggle between input/output summaries. An underscore represents an open input or an unswitched output. A block indicates a closed input or a switched output. An **x** or **X** is displayed when an output is not enabled and is unswitched or switched, respectively. An asterisk (*****) will be displayed if an output is declared as a lamp and a lamp test is currently being performed. The Field key can be used to move the blinking cursor through the outputs. The Up/Down keys can be used to toggle the state of the output whose position is covered by the blinking cursor. The Enter key will return the ProControl back to its standard menus. If you press any other keys you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be interrupted before the 3-second period by pressing the Enter key.



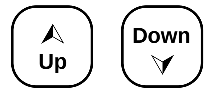
MODES Use the Up and Down keys to toggle an Analog Output from Manual control to PID control or Proportional control, depending on which analog output process is being used. This selection will only appear if an analog output tagname is displayed and the analog output is part of an analog output process.




```
TAGNAM   100.0  PCT
MODE MAN   >MANUAL
```

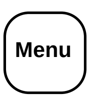
```
TAGNAM    96.3  PCT
MODE PID   >MANUAL
```

```
TAGNAM    25.0  PCT
MODE PRO   >MANUAL
```



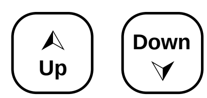
GROUP The ProControl allows outputs to be assigned to different *Groups* to allow greater process control flexibility. In some cases, you may wish to be able to specify alternate process tasks for a given output. For instance, you can have the operation of a pump be controlled by a series of level switches in a tank, or alternately, the pump can be run on a timed cycle. By selecting the appropriate process Group, you can change the control strategy for that piece of equipment. EOS Research will configure the groups for you according to your specifications

Use the Up and Down keys to select a Group for the displayed output. This menu item is displayed only for outputs that have been configured by EOS to have alternate process Groups.




```
TAGNAM   OUTPUT  DIM
GROUP 1    >MANUAL
```

```
TAGNAM   OUTPUT  DIM
GROUP 2    >MANUAL
```



2.11 LED Indicators

Your ProControl unit has three status LEDs to the left of the keypad, which are used to indicate the following:

System Status:	Normally ON when unit is powered. One blink - The system has internally reset. Two blinks - An internal error has occurred.
Connect:	ON if user is remotely or locally connected. ON if system is faxing or paging. Slow blink - last fax or page failed, press ACK to clear. Fast blink - local connect cable inadvertantly left plugged in, press ACK to clear.
Network:	Rapid blinking indicates an active network connection.

3.0 Reporting Features

3.1 Fax Report

The ProControl unit will keep you informed of your system's operations with facsimile status reports. With the supplied ProView software you can configure the unit to send fax reports to up to two different numbers. You can also have these reports sent on a daily basis, at regular intervals during the day, or when triggered by specific process tasks. You can send one at any time by using the *Fax Now* option either from the menu on the ProControl's display, or through the ProView software.

The fax report you receive will contain several fields, each denoted by a shadow box. The number of fields will depend on the configuration of your system. For instance, you would not see a field indicating *Analog Outputs* if your system does not contain any of these.

The fields as you will see them are shown below. All information enclosed in brackets is variable and depends on your particular system configuration.

To:

```
<FAX RECIPIENT>
```

will indicate the intended fax recipient's name.

From:

```
THE <SYSTEM NAME>        SYSTEM IN <SITE LOCATION>   AT <TIME> ON <DATE>
SETUP VERSION X       :  ROM VERSION 2.x          :  MODEL B1
```

will indicate the name and location of your system, the date and time at which the fax report was initiated, your current ProView setup version, and the current on-board software version 2.X.

System Status:

```
<MODE><PXX>  :   LAST SHUTDOWN AT <TIME> ON <DATE> BY <SHUTDOWN CAUSE>
                 FAX REPORT INITIATED BY <FAX CAUSE>
```

will indicate the current <MODE> of the controller and associated process. For example, if the controller is running the startup or shutdown sequence, you would see either START or SHUTD followed by the current algorithm. Similarly, in auto mode, you would see AUTO followed by the last successfully completed process task.

The LAST SHUTDOWN indicates when the system last initiated the shutdown sequence and what caused it to happen. For example, if the shutdown sequence were initiated by a key press, the cause you would see would be KEYPAD. Similarly, if the shutdown sequence were caused by a process task such as a high pressure sensor whose tagname was HIPRES, you would see HIPRES as the <SHUTDOWN CAUSE>. If multiple inputs or outputs caused the shutdown (i.e. a process task was dependent on more than one input being in the active state and/or multiple outputs being ON), the most recent one which changed will appear as the cause.

Similarly, the FAX REPORT INITIATED BY line will indicate the tagname of the I/O point which caused the fax to be sent, provided there was only one I/O point responsible. If multiple I/O points were responsible, the process itself will be indicated. Consider, for example, a process task where a shutdown was caused by HIPRES and BLOWER, and a fax was also generated. The <FAX CAUSE> would be PROCESS XX, where *XX* is the number from 1 - 64 of this process task. In the case where *Fax Now* was selected from the menu option on the LCD, the <FAX CAUSE> would be KEYPAD. The <FAX CAUSE> from a ProView generated *Fax Now* command would be REMOTE. This line will <u>not</u> appear on daily or interval scheduled fax reports.

Discrete Inputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital inputs in four columns. Inputs which are in the active state will appear as `ON` and those which are in their normal state will appear as `OFF`.

Discrete Outputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital outputs in four columns.

Analog Inputs:

```
<TAGNAME> is <VALUE> <DIM> LIMITS are L: <LO-LIM> <DIM> H: <HI-LIM> <DIM>
<TAGNAME> is <VALUE> <DIM> TOTAL FLOW is <FLOW>   <DIM>
<TAGNAME>                  TOTAL FLOW is <FLOW>   <DIM>
...
```

will indicate the current value, dimensional units, low alarm limit, and high alarm limit for all analog inputs which are not flow-type inputs. The precision of the values displayed can be selected through ProView. Any flow-type analog input which is responsible for maintaining a total flow will display that flow in place of the alarm limits. Any pulse-type digital input used for a digital flow meter will appear here since the information being obtained by that type of flow meter is analog in nature. In addition, pulse accumulators (volume totalizers) will appear here.

Analog Outputs:

```
<TAGNAME>   <PCT>  PCT  <MODE>      <TAGNAME>   <PCT>  PCT  <MODE>
...
```

will indicate the output percentage and mode of operation of all analog outputs. The precision is fixed to one decimal place and will range from 0.0 to 100.0, expressed as a percentage. The <`MODE`> of operation will be `PID` if the analog output is currently being used in a PID loop, or PRO if the analog output is currently being used in a Proportional scheme, otherwise it will be `MAN` indicating that the analog output is under manual control.

The next two pages contain examples of scheduled and alarm fax reports.

3.2 Page Alerts

The ProControl unit can alert you to important conditions at your site via a page alert. Any system that is not in manual mode, that is, executing process tasks or the startup or shutdown sequences, can send a message up to eighty characters in length to an alphanumeric pager or up to nineteen digits in length to a numeric pager. If you are out of the office and away from a fax machine, you will still be alerted to any trouble at your site. With ProView you can select up to two pager numbers to be called. Each process task or startup/shutdown algorithm is capable of sending a message to either or both of these pagers. The pager messages are configured by EOS Research according to your specifications.

An example message for an alphanumeric pager would be:

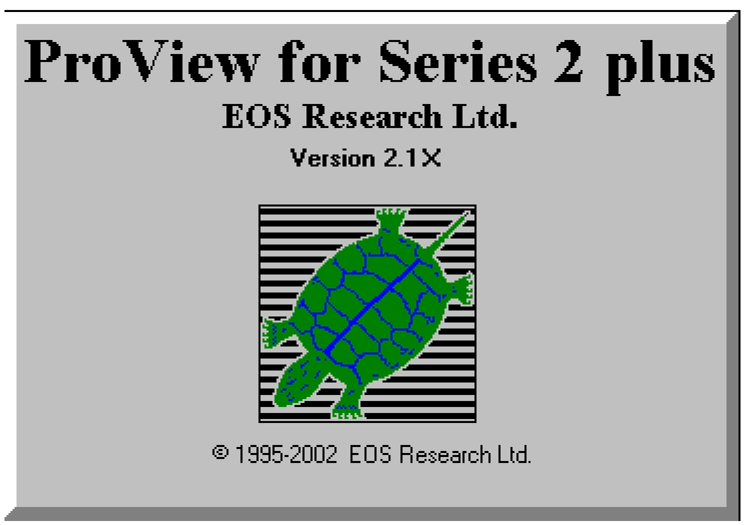
```
ANYTOWN SITE
High water level EQ Tank
System shut down!
Call Fred to fix: 555-6789
```

APPENDIX A

ProView™

for ProControl Series 2^{plus}

USER'S GUIDE



Version 2.1x

EOS Research, Ltd.

EOS RESEARCH, LTD.

SOFTWARE LICENSE AGREEMENT

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND INSTALLATION

This chapter provides a brief introduction to ProView features, system requirements for running the program, and instructions for installing it.

Introduction to PROVIEW

ProView is a powerful but straightforward software package used in conjunction with the ProControl system to provide integrated stand-alone control and remote telemetry for your operation. ProView versions 2.1 and higher can serve as an on-site or remote human-machine interface (HMI) for both the Series II and Series **2**^{plus} ProControls. With ProView you can:

- Monitor system sensors
- Control equipment that are outputs on the ProControl
- Change the way the system operates
- View and change system setpoints, alarm levels, etc.
- Extract datalogged system information

In short, ProView can be used to remotely gain the same level of control over your operation as if you were at the site. Although many system parameters can be set with the ProControl's display and keypad (if included), ProView allows a more comprehensive, easy-to-access view into system operations.

In order for ProView to function, your PC must be connected to the ProControl unit. It can be connected in one of two ways. The first way is with a cable (provided with your ProControl system) that connects your PC's serial port with the ProControl unit. This method of connection is most often used at the system site using a laptop PC. The second method is via dial-up modem from your office or from anywhere that a connection to the telephone system can be established.

You should be familiar with the operation of the ProControl unit and have read the ProControl User Manual before using ProView.

System Requirements

COMPUTER: You will need an PC or compatible with a 486 (minimum) or greater microprocessor with 4MB RAM and Microsoft Windows version 3.1 or later. A minimum of 4MB of Hard Disk space needs to be available. A mouse or similar pointing device is also required.

!

Several functions in ProView require the use of the right mouse button. Make sure the right mouse button is not assigned to some other function such as double-click. See your mouse driver software for details.

MODEM: You need a Hayes compatible (AT) Modem that supports a data rate of 9600 baud (this means almost any commonly-available modem). The modem can be external or internal. It must be connected to COM Port 1, 2, 3 or 4.

! *Some PCs are now being supplied with so-called "WinModems", which are not true hardware modems and will **not** work with ProView for communication with a ProControl system. A true Hayes-compatible hardware modem is an inexpensive investment in reliable communications.*

How to Install ProView from Windows Explorer

1. Close **all** open programs before beginning the ProView installation procedure. Close any task bars for software packages like Microsoft Office that may be lurking at the edge of your screen. *If a ProView installation fails, it is almost always the result of having other programs open at the time of installation. Certain programs, when included in the Windows Startup group, may cause the ProView installation to fail, and must be removed temporarily from the Startup group prior to installing ProView.*

2. Open the Windows Explorer and insert Disk 1 of the ProView diskettes in your **a:** drive.

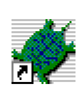
3. Click on the **a:** drive, then double-click on the **setup.exe** file *Or* click on the Windows **Start** button, choose **Run…** and type in **a:setup.exe**.

4. The ProView installation program will begin and will guide you through the rest of the installation process.

After the appropriate files from Disk #1 have been installed, you will be asked to insert Disk #2, and then Disk #3. ProView uses a default folder of C:\ProView for the program installation, but you can specify a different one if you'd like.

You will also be provided with configuration files (or ***site files***) for every ProControl unit you need to access. At a minimum, you will have a configuration file with a ".pvs" extension and one with a ".not" extension (these are normally supplied pre-configured for you on a separate diskette). Using Windows Explorer, copy these site files to the folder in which your ProView software was installed. Depending on your site configuration, you may have other files included along with the two standard site files. The files will have the extensions of .pid or .pvg. You must copy these files to the ProView folder as well.

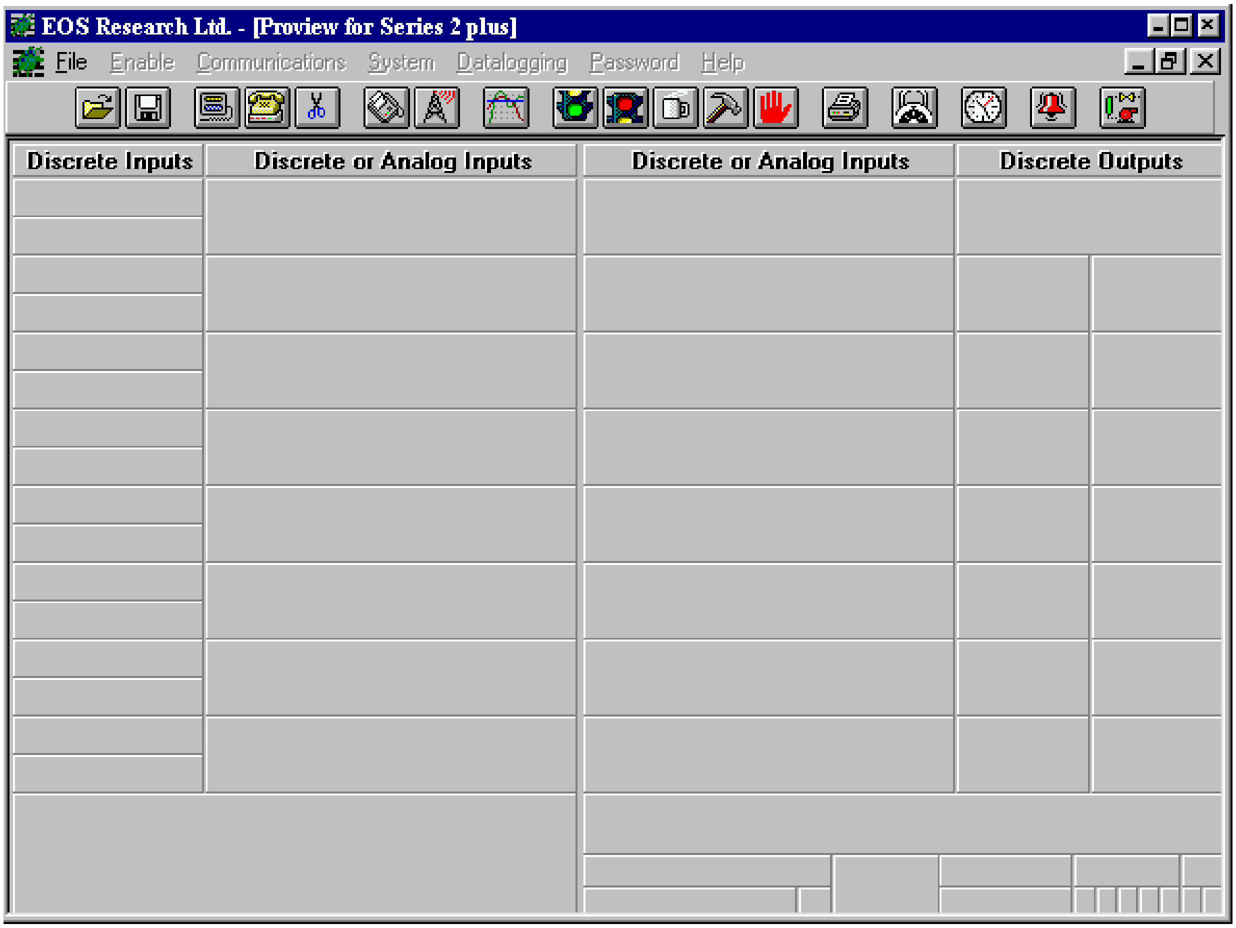
When the installation is complete, you will see the ProView program group and icon. We recommend making a shortcut to ProView that you can then move to your main Windows screen. *Right*-click on the ProView turtle icon in the program group, then click on **Create Shortcut**. Drag your new shortcut to a prominent position on your Windows main screen.



Shortcut to
ProView 2.153

Running ProView

After installing ProView as described above, double-click on the ProView icon. After an introduction screen, you will see the ProView Main screen.



The main screen contains a series of pull-down menus and a ***Toolbar*** that provides shortcut buttons for commonly-used commands. Placing the cursor over a Toolbar button and leaving it there for a short while produces a "balloon". A ***balloon*** is a small pop-up message that describes the action to be taken if the Toolbar button is "pushed".

Right now, since no site file has been loaded, the main screen is blank, and the toolbar is disabled. All menus except the **File** menu have been "ghosted". A selection is ghosted when the operation represented by the selection is unavailable.

Below the Toolbar are four columns of information arranged in a standard format. These columns are filled in based on the system setup and the current system status. The **Discrete Inputs** column contains information about the switches or sensors connected to inputs 1 through 16 on the ProControl unit. The two columns labeled **Discrete or Analog Inputs** contain information about the 4-20 milliamp (mA) sensors or discrete switches connected to ProControl inputs 17 through 32 (examples include analog instruments such as flow meters or pressure transducers and digital devices such as float switches). The **Analog Outputs** area resides behind the third column, and is accessed by clicking on the **Discrete or Analog Inputs** label at the top of the column. The **Discrete Outputs** column contains information regarding the devices connected to the ProControl's output relays. The **Extended Outputs** area, behind the **Discrete Outputs** column, contains information regarding any outputs configured beyond the first 14, if available on the ProControl model you are using.

At the bottom of the screen are a series of information boxes. These show the status of certain important system parameters when ProView is connected to a ProControl unit.

A Word About Changing Settings

ProView has been designed to make it easy to view and change the settings that govern the way your system works. However, ProView must always be *connected* to the ProControl unit in order for these changes to take effect. It is important to remember that ProView itself is only a window into the operation of the ProControl unit. It does not provide any control functionality on its own. Chapter 3 discusses how to connect to the ProControl.

When a setting is changed in ProView (e.g., alarm level, password, datalog interval), a "?" is temporarily appended to the description or title of the information to indicate that the new value has been sent to the ProControl. When the "?" disappears, the data has been received by the ProControl and confirmed by ProView.

While many of the controls that change information in ProView are represented graphically, much of the information is displayed in text form. To edit text-based information, click on it and make your changes as you would in any Windows application. When you click on the text, it is highlighted to show that it has the current focus.

! *After completing your text editing the changes must be saved by first pressing the **ENTER** key while the cursor is still within the text box being edited, and then clicking on the "OK" button for the current form.*

CHAPTER 2: GETTING STARTED

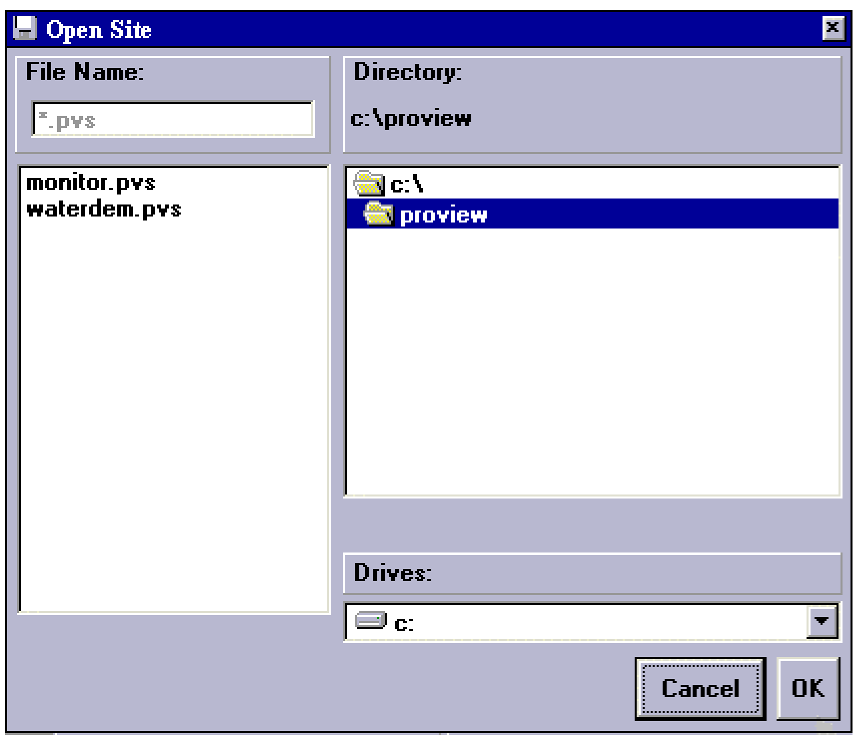
This chapter explains how to open a ProView site file, describes what's in all those little boxes on the screen, and shows you how to print the system configuration to a file.

Opening a Site File

Every ProControl unit has a ***site file*** that tells the unit which inputs or outputs are enabled, what their descriptive ***Tagnames*** are and how they should respond to changes in input status. This same file is used by ProView to provide a window into what is going on within the remote ProControl unit and, by extension, with the site operation. To open a site file:

1. Click on the **File** menu, then click **Open Site**. You will see the **Open Site** dialog box. You can also use the ALT-Key combination represented by the first underlined character in the menu name. In this case, use ALT-F.

*For opening subsequent site files, you can use the **Open Site** Toolbar button at the top of the main screen. ProView will also list the last four site files that you accessed at the bottom of the **File** menu. If you wish to open one of these, just click on the appropriate file name.*



2. In the **Drives** area of the dialog box click once on the down arrow to pull down the Drives list, then click on the drive that contains the file you wish to open.

3. In the **Directory** area of the dialog box, click on the folder that contains the file. To move "up" in the directory tree, double-click on the level to which you want to move. To move "down" in the directory structure, double-click on the appropriate folder.

4. In the **File** area you will see all files in the selected drive and folder that have the extension **.pvs** or **.pvg**. Only files with these extensions can be opened. Select the file you wish to open by clicking on the file name in the file list box, then click the **OK** button to open the selected file.

The title bar of the main screen will change to include the file name and version number. The file name and version number are enclosed within brackets.

5. In the **Security** dialog box, enter the password for your site file, and click on the **OK** button or hit Enter.

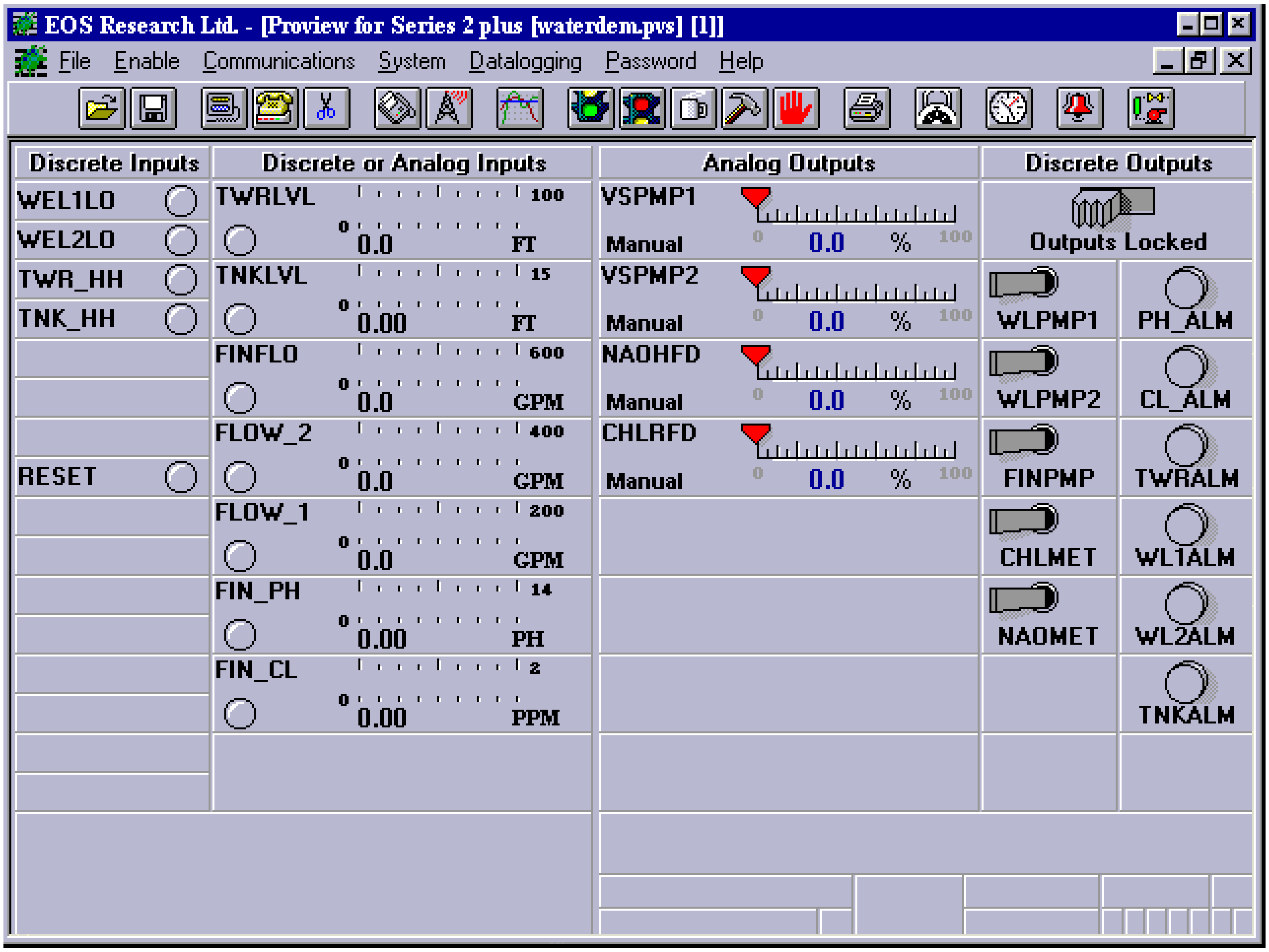
A word about passwords: *The password used in ProView can be different than the one used to access the ProControl unit through its on-board display. In either case the valid characters are 0-9 and A-Z, upper case only. Up to three characters are permitted. The password was designed as a low-level security feature sufficient to prevent inadvertent operation and to deter tampering. It is* ***NOT*** *sufficient in and of itself to withstand a* ***determined*** *effort at system entry. The default password is supplied to you with your ProControl unit by your system integrator.*

6. If the password is incorrect, the dialog box will disappear and a beep will sound. No system configuration information will be shown. You will need to select the **Password** menu and re-enter it.

7. If the password is correct, the **Security** dialog box will disappear and the system configuration information will be shown on the main screen.

FYI

ProView is supplied with a View-Only Mode password, "VOM", which may be used to connect to the ProControl to observe the system status and obtain logged data; however, no changes to any ProControl operating settings may be made when in this mode.



Examining the Main Screen

This particular site file shows five discrete inputs, seven analog inputs, eleven discrete outputs, and four analog outputs.

Discrete Inputs

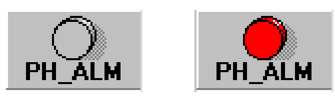
On the left side of the screen below the heading **Discrete Inputs** are shown the tagnames of enabled discrete (or digital) inputs. To the right of the tagname is a virtual "LED". This LED's color or shape will change based on the status of the input. If a discrete input is "OFF", the LED next to the tagname is gray in color. If a discrete input is "ON", then the LED is green. If the discrete input is "ON" and has been set up as an alarm input the LED becomes a red "Alarm Bell". Some panels are blank because those inputs have not been enabled in this particular site configuration.

Analog Inputs

In the second column below the heading **Analog or Discrete Inputs** are shown the enabled analog inputs. Analog inputs can also be configured as simple discrete inputs. Below the tagname is another LED. This LED behaves in a similar fashion to those for discrete inputs; it is gray when the input is not "active", and green or red when it is in the active state (see the definition for Active State in the ProControl User Manual). A small bar graph provides a visual indication of the value of the analog input. At the left and right ends of the bar graph are numbers that represent the lower and upper limits, respectively, of the analog input values (corresponding to 4 and 20 mA). In this case FLOW_1 has been set up with a range of 0 to 200 GPM. Below the bar graph is a numerical representation of the current value of FLOW_1.

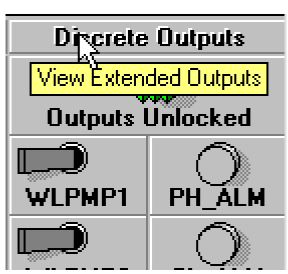
Discrete Outputs

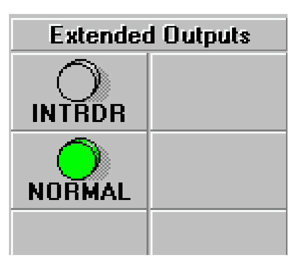
On the right side of the screen below the heading **Discrete Outputs** are shown the enabled discrete outputs, corresponding to the relay outputs in the ProControl. In this site configuration there are 11 outputs. Above the tagname of the output is either a virtual "Toggle Switch" or lamp/button representation. By its position and/or its color it shows the state of discrete output: if the switch is left-leaning and gray the output is "OFF"; if the switch is right-leaning and green then the output is "ON".



Discrete outputs can be configured as an alarm lamp or button when this would be more appropriate. If the lamp/button appears gray then the output is "OFF". If the lamp/button appears red or green then the output is "ON".

Your system may also have **Extended Outputs**, which are located on a panel behind the discrete outputs. To access these outputs, point your mouse at the words **Discrete Outputs** at the top of the column and click the left mouse button.

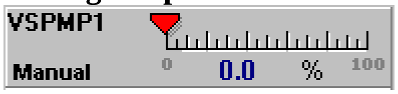




FYI

Regardless of what the discrete outputs look like in ProView, they all behave the same way on the ProControl itself – namely, the associated relay output is energized when the output is ON.

Analog Outputs



The third column contains the **Analog Outputs** area. It may be concealed by the second column of **Discrete or Analog Inputs**. To pull the analog outputs to the front, click on the title **Discrete or Analog Inputs** at the top of the third column of the ProView screen.

To the right of the tagname there is a slide-scale that indicates the current percentage of full-scale output (0% to 100%), displayed both graphically and with text. Below the tagname is the current mode of the output. This mode can be changed from **Manual**, which indicates the output is under user control, to **PID** or **PRO**, which would indicate that the output is involved in an output control scheme and is under automatic control. These output control schemes are described in Chapter 5 under <u>Analog Output Options</u>.

<u>Printing the Setup to File</u>

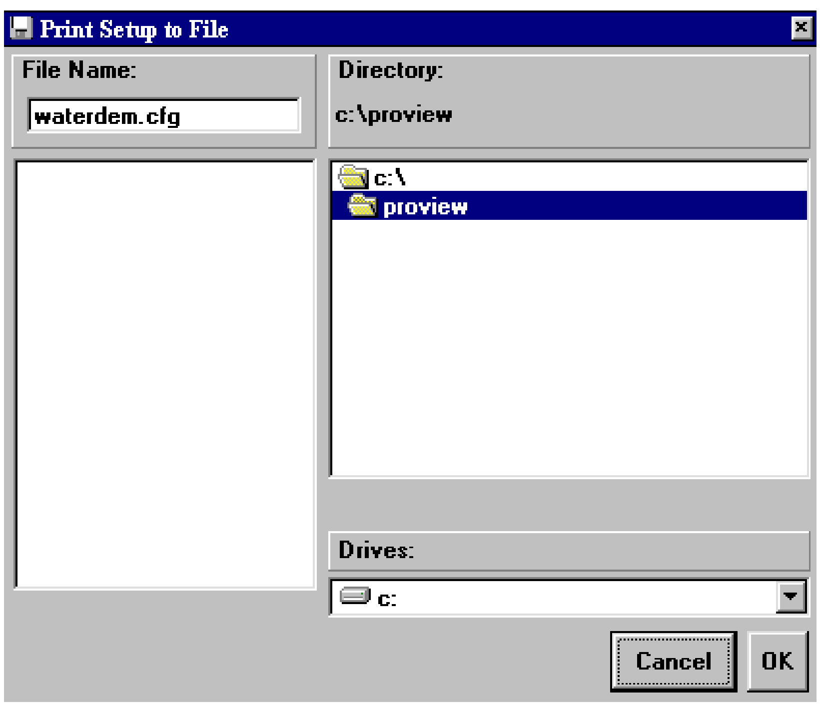
A more detailed listing of the site configuration can be made by printing the setup data to a text file. To print the setup, do the following:

1. Click on **Print Setup** in the **File** menu.

Or

Click on the Print Setup button. 

2. You will see the **Print Setup to File** dialog box.

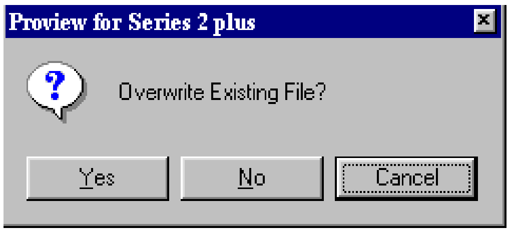


3. Specify the drive and folder in which the text file will be saved.

4. ProView will select a default file name for you, with the extension **.cfg**. However, you can give the file another name if you wish. You can also select an existing .cfg file name by clicking on the file name in the file list box.

5. Click on the OK button to print the setup to the selected file.

If you are overwriting an existing file, a message box pops up to make sure that you don't make a mistake.



A word about Files:
Do not confuse the site configuration file (.pvs), which is a binary file, with the printed setup file (.cfg), which is a text file. A text file can be viewed with a word processing program while a binary file typically cannot.

Examining the Setup File

To examine your site configuration file, use a text editor or word processor such as Notepad or Word to open the file you have just created.

The file produced by our sample site is shown below. The first section consists of identifying information about the ProControl unit and information about the inputs and outputs wired to it.

```
                     EOS RESEARCH LTD.
                   ProControl Series II+

           ProView Configuration File Information


*********************************************************
***** FAX Recipient:     BULLWINKLE MOOSE          *****
***** Customer:          MAYBERRY WATER DEPT       *****
***** Site Location:     MAYBERRY RFD              *****
*********************************************************
***** Setup:             1                         *****
***** Option:            B                         *****
***** Type:              102                       *****
***** Serial Number:     7421                      *****
***** Date:              09/06/2000                *****
***** Time:              10:17:01                  *****
***** ProView:           Version 2.153             *****
*********************************************************
```

THE INPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*	RANGE
1	WEL1LO	Well 1 Low Level	D,NO,AL	
2	WEL2LO	Well 2 Low Level	D,NO,AL	
3	TWR_HH	Water Tower High Alarm Level	D,NO,AL	
4	TNK_HH	Clearwell Tank High Alarm Level	D,NO,AL	
8	RESET	Reset Switch	D,NO,ST,SU	
17	TWRLVL	Water Tower Level	A,EP,ST	0-100 FT
18	TNKLVL	Clearwell Tank Water Level	A,EP,AL	0-15 FT
19	FINFLO	Finish Flow Rate	A,EP,ST	0-600 GPM
20	FLOW_2	Well 2 Flow Rate	A,EP,ST	0-400 GPM
21	FLOW_1	Well 1 Flow Rate	A,EP,ST	0-200 GPM
22	FIN_PH	Finish Water pH	A,EP,AL	0-14 PH
23	FIN_CL	Finish Water Chlorine Residual	A,EP,AL	0-2 PPM

```
*INPUT SETUP NOTES
------------------
D - This input is a (Discrete) or ON/OFF Input.
A - This input is a (Analog) or Variable Input.
C - This input is a Pulse Flowmeter Input.
P - This input is a Pulse Accumulator Input.
UPP - Units per Pulse. Number of units (i.e. Gallons) to record for each pulse
NO-This input is a (Normally Open) Discrete Input.
NC-This input is a (Normally Closed) Discrete Input.
EP-(Endpoint) This input is "Active" when its value is outside the low to high alarm levels.
WD-(Window)   This input is "Active" when its value is between the low and high alarm levels.
ST-(Status)   This input shows a green LED in ProView when it is in its Active State.
AL-(Alarm)    This input shows a red alarm bell in ProView when it is in its Active State.
SU-(Startup)  This is a menu function input. When activated it will run the startup routine.
SD-(Shutdown) This is a menu function input. When activated it will run an emergency shutdown.
MN-(Manual)   This is a menu function input. When activated it place the unit in Manual Mode.
AU-(Auto)     This is a menu function input. When activated it place the unit in Auto Mode.
SQ-(Square Root) This analog channel's reading is proportional to the square root of the input.
LT-(Lamp Test)This is a Lamp Test input. When activated it will turn on all Alarm Light outputs.
```

THE DISCRETE OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*
1	WLPMP1	Well 1 Pump	
2	WLPMP2	Well 2 Pump	
3	FINPMP	Finish Water Pump	
4	CHLMET	Chlorine Metering Pump	
5	NAOMET	Sodium Hydroxide Metering Pump	
8	PH_ALM	pH Alarm	AI
9	CL_ALM	Chlorine Alarm	AI
10	TWRALM	Water Tower High Alarm	AI
11	WL1ALM	Well 1 Low Level Alarm	AI
12	WL2ALM	Well 2 Low Level Alarm	AI
13	TNKALM	Clearwell Tank High Level Alarm	AI

```
*OUTPUT SETUP NOTES
-------------------
G1-(Group 1)- This output will not respond to processes 17-32.
G2-(Group 2)- This output will not respond to processes 01-16.
LT-(Lamp Test) - This output has been declared as an alarm light.
AI-(Alternate Image) - This output is displayed as an icon other than the default switch.
```

```
THE ANALOG OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#  TAGNAME                TAGNAME DESCRIPTION                   SETUP*   INPUT
-- ------- ------------------------------------------------- ---------- ------
1  VSPMP1  Variable Speed Drive for Finish Water Pump         PID,FOR    TWRLVL
2  VSPMP2  Variable Speed Drive for Well 2 Pump               PID,FOR    TNKLVL
3  NAOHFD  Caustic Soda Feed Rate                             PID,FOR    FIN_PH
4  CHLRFD  Chlorine Feed Rate                                 PRO,FOR    FLOW_2

*ANALOG OUTPUT SETUP NOTES
--------------------------
PID  -This output is involved in a PID (Proportional,Integral,Derivative) control loop.
PRO  -This output is involved in an open (Proportional) control loop.
FOR  -The PID or PRO loop will run in the (Forward) direction.
REV  -The PID or PRO loop will run in the (Reverse) direction.
INPUT-This Tagname will serve as the input to the control loop.
```

Input and Output Configuration

The `INPUTS` section identifies all enabled system inputs from 1 to 32 and describes how they are configured. the input number is followed by its `TAGNAME` and the `TAGNAME DESCRIPTION`, which is taken from the Notes file (more on that in Chapter 5). In addition, a `SETUP` section further identifies each input in terms of its signal nature, analog (A) or discrete (D); its configuration if discrete as Normally Open (NO) or Normally Closed (NC); and its alarm display nature when active, Alarm (AL) or Status (ST). Discrete Inputs can also be configured as functions such as Startup (SU) or Emergency Shutdown (SD), and can be used as a lamp tester (LT) which will illuminate any Discrete Outputs that are configured as lamps. A `RANGE` is specified for all Analog Inputs as well as the Active State region, denoted Endpoint (EP) or Window (WD).

FYI

See the ProControl User Manual for a further explanation of Normally Open, Normally Closed, and related terminology and a description of Endpoint and Window Active States.

The `DISCRETE OUTPUTS` section is similar except that there are some different `SETUP` codes. Some outputs may be assigned to groups (G1,G2) that affect the way they are viewed by the process tasks. Outputs which display an Alternate Image (lamp image) than the standard switch image are designated AI.

The `ANALOG OUTPUTS` section details the setup of any enabled 4-20 mA output loops. The `SETUP` codes PID and PRO indicate whether or not the output is involved in one of two analog output control schemes known as PID loops or open loop Proportional control. The direction of the analog output control scheme is indicated by forward (FOR) or reverse (REV). The input that provides the reference signal upon which the analog output scheme is based is designated under the `INPUT` heading.

FYI

For a further explanation of PID or open loop Proportional control please see the <u>Analog Output Options</u> section in Chapter 5.

In this particular setup, `TWRLVL` is the input to the PID control loop that operates on the variable speed pump `VSPMP1`, with `VSPMP1` maintaining a "setpoint" for the value of `TWRLVL`. The chlorine feed rate `CHLRFD` will be varied in proportion to the flow rate `FLOW_2` under open loop proportional control.

Process Tasks

The next section of the setup file is a listing of PROCESS CONTROL TASKS. These determine how the ProControl unit responds to input changes while in Auto, Startup or Shutdown modes. It is important to note that the ProView software does not take any independent action itself. All automated control decisions are made by the ProControl unit, although you can change many operating parameters via ProView.

```
THE PROCESS CONTROL TASKS EXERCISED BY THIS SYSTEM ARE:

Process 01: If WEL1LO is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;Page #1],
            Switch WLPMP1 OFF
            Page Message: 'Well 1 Low Level Mayberry North '

Process 02: If WLPMP1 is OFF AND PH_ALM is OFF AND
               CL_ALM is OFF AND TWRALM is OFF AND TNKALM is OFF
            THEN Delay for 30 Seconds, Switch WLPMP1 ON

Process 03: If FIN_PH is High
            THEN Delay for 5 Seconds, Switch NAOMET OFF AND PH_ALM ON

Process 04: If FIN_CL is High
            THEN Delay for 5 Seconds, Switch CHLMET OFF AND CL_ALM ON

Process 05: If TWR_HH is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Initiate Shutdown, Switch TWRALM ON
            Page Message: 'Tower's about to overflow, Bullwinkle - COME OUT NOW! '

Process 06: If TNK_HH is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Switch TNKALM ON
            Page Message: 'Clearwell Tank High Mayberry North '

Process 07: If TWRLVL is High
            THEN Delay for 5 Seconds, Switch TWRALM ON

Process 08: If TWRLVL is NOT High or Low
            THEN Delay for 5 Seconds, Switch TWRALM OFF

Process 09: If TNKLVL is High
            THEN Delay for 5 Seconds, Switch TNKALM ON

Process 10: If TNKLVL is NOT High or Low
            THEN Delay for 5 Seconds, Switch TNKALM OFF

Process 11: If FIN_PH is High or Low
            THEN Delay for 5 Seconds, Send Report[FAX #1;Page #1],
            Switch PH_ALM ON
            Page Message: 'Finish Water pH Alarm Mayberry North '

Process 12: If FIN_PH is NOT High or Low
            THEN Delay for 5 Seconds, Switch NAOMET ON AND PH_ALM OFF

Process 13: If FIN_CL is High or Low
            THEN Delay for 5 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Switch CL_ALM ON
            Page Message: 'Finish Water Chlorine Alarm Mayberry North '

Process 14: If FIN_CL is NOT High or Low
            THEN Delay for 5 Seconds, Switch CHLMET ON AND CL_ALM OFF
```

```
Startup 01: Switch WLPMP1 ON AND PH_ALM OFF AND CL_ALM OFF AND TWRALM OFF AND WL1ALM OFF AND
WL2ALM OFF AND TNKALM OFF

Startup 02: Delay for 2 Seconds, Switch WLPMP2 ON

Startup 03: Delay for 2 Seconds, Switch FINPMP ON

Startup 04: Delay for 5 Seconds, Switch CHLMET ON AND NAOMET ON


Shutdown 01: Switch CHLMET OFF AND NAOMET OFF

Shutdown 02: Delay for 2 Seconds, Switch WLPMP1 OFF AND WLPMP2 OFF

Shutdown 03: Delay for 2 Seconds, Switch FINPMP OFF
```

This sample configuration has a fairly straightforward process flow. On startup, some of the system outputs are switched on sequentially and all alarm indicators are switched off. On shutdown, all pump outputs and chemical metering devices are turned off. The process tasks are mostly self-explanatory. Some process tasks include fax and pager reporting functions. It is important to remember how and when the process tasks are run:

- Process tasks are run continuously while the ProControl unit is in AUTO mode. Process control tasks are ***event-driven***, i.e., they occur <u>once</u> when the "IF…" conditions are true (subject to any delays). No automatic action is taken in MANUAL mode.

- Startup and Shutdown processes are run in sequence. When the Startup sequence is finished, the unit is placed in AUTO mode and the **Process Tasks** are run. If any Startup process in the sequence fails, then all the non-lamp outputs are turned "OFF" and the unit reverts to MANUAL mode. A Startup process fails when any IF condition is not satisfied for 60 seconds after the Startup process begins (there may not be any IF conditions in your Startup sequence). The Startup sequence begins when the ProControl or ProView operator initiates it. The Startup sequence can also begin when power is first applied to the ProControl unit if the "Auto Startup" option has been enabled.

- The Shutdown sequence works in a similar manner. When the Shutdown sequence is finished, the ProControl unit reverts to MANUAL mode. If any Shutdown process in the sequence fails (is not run after 60 seconds), then all the non-lamp outputs are immediately turned "OFF" and the unit reverts to MANUAL mode. The Shutdown sequence can be initiated either by the ProControl or ProView operator or by a process task (Process 5 does this in our example).

Process Capability

The ProControl runs process tasks which are based on Boolean IF ___ AND ___ THEN ___ logic. There are 64 available processes, 16 of which can be used as part of a startup sequence, and 16 of which can be used as part of a shutdown sequence. Each process can:

- be based on several, simultaneously existing I/O conditions
- include short or long delays for de-bouncing or simple time delay
- use memory variables (registers) for linking processes
- cycle outputs with timers or during certain times of the day
- perform system shutdowns

- send reports to fax and/or pagers

FYI

If you wish to modify the ProControl programming, please contact your Control System Integrator for assistance.

CHAPTER 3: ESTABLISHING COMMUNICATION

This chapter explains how to connect to the ProControl unit using ProView by local serial cable and by remote modem.

By itself, ProView does not reveal very much about your site's operation. It must be connected to the ProControl unit in order to yield any data.

Local Connection

To establish a local connection, perform the following:

1. Use the local serial cable supplied with the ProControl to connect the computer you are using to a ProControl unit. One end of the cable terminates with a female 9-pin connector. Use this end to plug into the serial port on your computer. The other end of the serial cable is terminated with a 9-pin RJ-45 "Ethernet" connector. Use this connector to plug into the "RS-232/Serial" port on the right hand side of the ProControl unit.

! *Be sure to disconnect the serial cable from the ProControl unit after you are finished. If you do not, remote communications and alarm reporting will **not** be possible.*

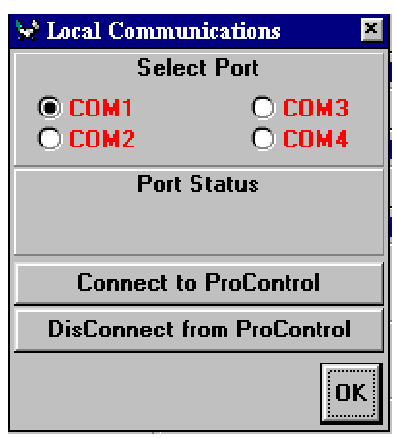
! *If the ProControl unit is powered OFF for any reason, wait 45 seconds after power up before plugging in the cable to attempt a local connection. Otherwise, the ProControl's modem may not be properly configured.*

2. Click on **Local Connection** in the **Communications** menu. You can also use ALT-C.

Or

Click on the **Local Connection** toolbar button. 

You will see the **Local Communications** dialog box.



3. Select the COM port to which the ProControl is connected by clicking on the "radio button" next to the COM port you want to use. COM ports 1 through 4 are supported.

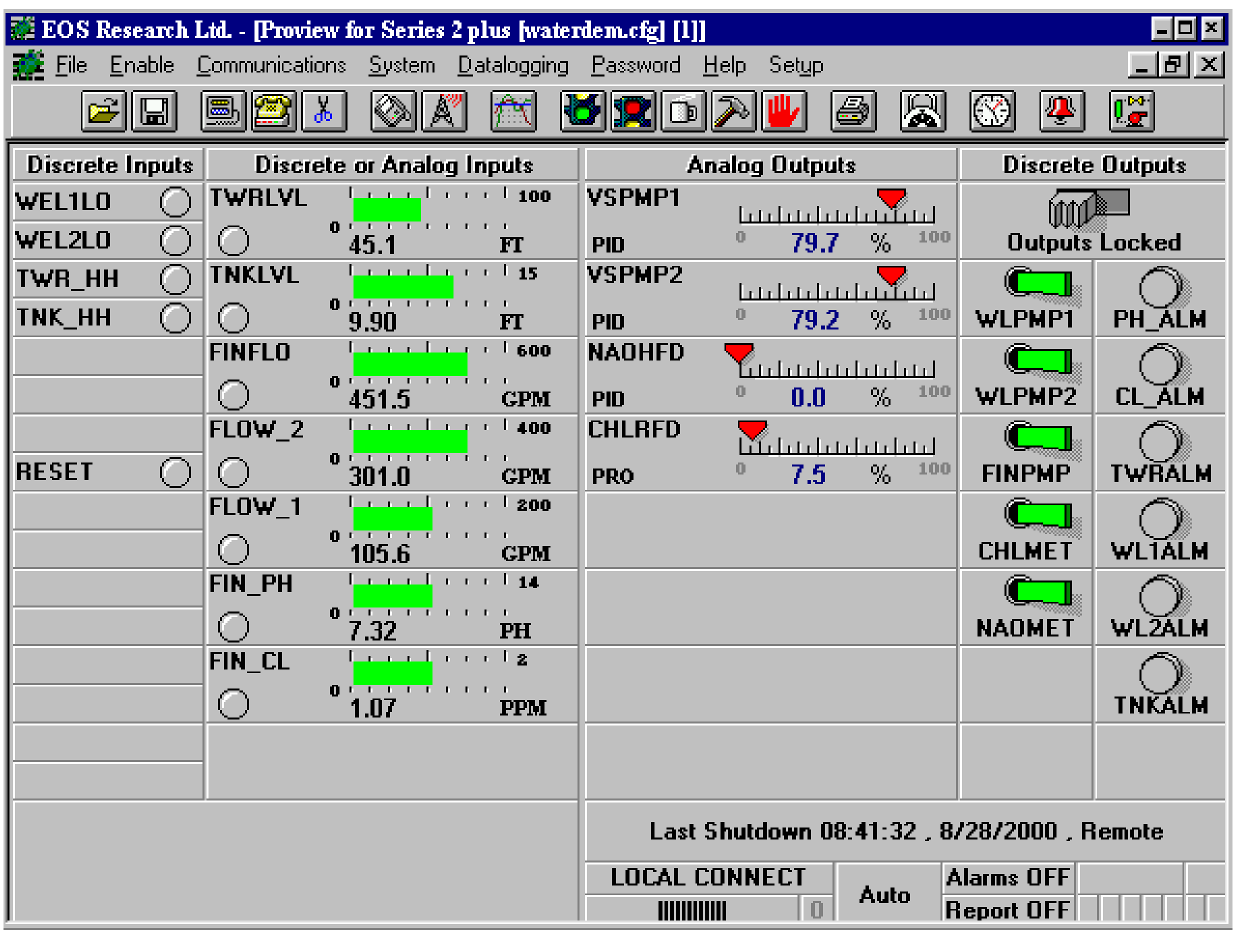
4. Click on the **Connect to ProControl** button.

5. You will see status messages in both the **Port Status** area of the **Local Communications** dialog box and in a small information box near the bottom of the main screen. Usually you will see "Trying Local..." followed by "LOCAL CONNECT" if the attempt is successful. If the attempt is unsuccessful you will see message boxes outlining the suspected problem.

6. After connecting, click on the **OK** button to hide the **Local Communications** dialog box.

After establishing a local connection, ProView will perform an initial scan of site conditions. This will take a few moments during which time the mouse pointer will turn into an hourglass. After the initial scan, data will be updated on the screen every second or so.

Here is a view of the main screen after a local connection has been established:



Note that the screen has been updated to reflect the current operating conditions at the site. At the bottom of the screen, various message panels have been filled in as well.

Remote Connection

For a remote connection, the procedure is a little different. Follow these steps:

1. Make sure that your modem has been installed properly and that the phone line is plugged in to the proper port on the modem.

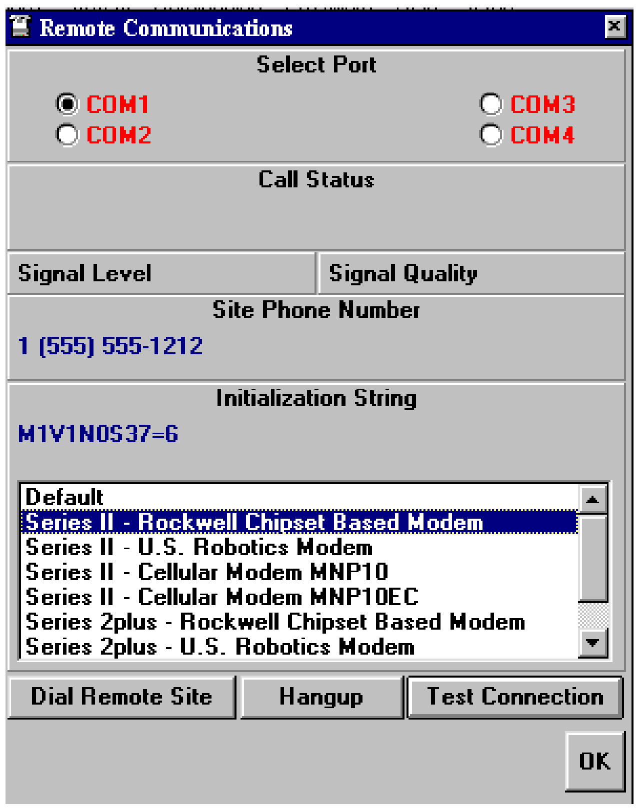
Your modem must be Hayes (AT) compatible and capable of operation at 9600 baud.

2. Click on **Remote Connection** in the **Communications** menu. You can also use ALT-C.

Or

Click on the **Remote Connection** toolbar button. 

You will see the **Remote Communications** dialog box.



3. Select the COM port to which your modem is connected by clicking on the "radio button" next to the COM port you want to use. COM ports 1 through 4 are supported.

4. Check to see that the **Site Phone Number** is the one you want to dial. If not, click on the phone number and change it. If you need to dial an 8, 9 or some other prefix first to get an outside line, add

a comma or two after the prefix to obtain a pause before dialing the main number (e.g., 8,555-1212). Do not add parentheses or dashes.

5. Examine the **Initialization String** to see if it is correct for your type of modem. For Series 2*plus* systems, you will usually use the **Initialization String** for Rockwell Chipset or U.S. Robotics modems. If these do not work, use the Default string instead.

6. Click on the **Dial Remote Site** button.

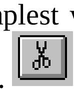
7. You will see status messages in both the **Call Status** area of the **Remote Communications** dialog box and in the lower portion of the main screen. Usually you will see the following messages:

Trying Remote...	ProView is attempting to contact your PC's modem
OK	ProView has successfully connected to the modem
Setup...	ProView is sending the initialization string to the modem
Dialing...	ProView is dialing the site phone number
CONNECT 9600	Connection has been established with the remote modem
REMOTE CONNECT	Connection has been established with the remote ProControl unit

8. If the attempt is unsuccessful you will see message boxes outlining the suspected problem.

9. After connecting, click on the **OK** button to hide the **Local Communications** dialog box.

Ending a Connection

The simplest way to end a connection, to hang up in essence, is to click on the **Disconnect** button on the Toolbar.  This works for either a local or remote connection.

Alternatively, you can re-open the **Local** or **Remote Communications** dialog box and click on either the **Disconnect from ProControl** button (Local) or the **Hangup** button (Remote). After ending the connection, you should see **NOT CONNECTED** in a message box near the bottom of the screen. 

Sending a Memo

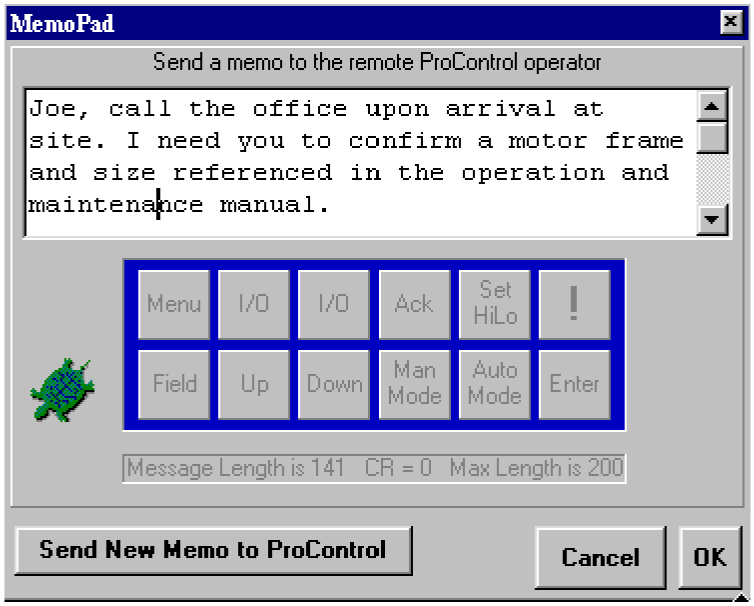
A useful feature of the ProControl is the ability to transmit short memos to a site operator. From ProView, you can send a message of up to 160 characters to the display of the ProControl unit. The site operator must acknowledge your memo before returning to his normal display. This feature is useful in communicating with a person at the remote site while the phone line is in use for a connection to the ProControl.

To send a memo, follow these steps:

1. From the **Communications** menu, select **Send Memo**.

2. Type your memo onto the screen of the **MemoPad**. It will appear on the ProControl's display exactly as it appears to you on the MemoPad, two lines at a time. Words will automatically wrap around to the next line, but you may hit Enter (Carriage Return or CR) to jump to the next line if necessary. However, the fewer <CR> characters you use, the longer the text message you can type, since each <CR> represents 20 characters. The **Message Length** counter will keep track of the number of characters you have used. The **Max Length** counter will decrease to let you know how many more characters can be entered.

3. By clicking the right mouse button when the pointer is over the text window, the text window will become larger, allowing you to view more text without having to scroll up and down.



4. Click the **Send New Memo to ProControl** button to send the memo to the ProControl's display, **OK** to temporarily save the memo but not transmit it, or **Cancel** to abort the entire procedure.

5. The **Ack** button on the MemoPad will flash red and your PC will beep to indicate when the ProControl operator has acknowledged your memo.

CHAPTER 4: MANAGING YOUR SITE

This chapter explains how to change the way your ProControl system operates by switching between Manual and Automatic modes, initiating a startup or shutdown sequence, and changing other general system settings.

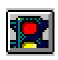
Switching Between System Modes

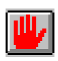
There are four modes of operation for the ProControl: Manual, Automatic, Startup and Shutdown. To initiate a switch to a different mode, simply click on the appropriate Toolbar button  or click on **Process Operations** in the **System** menu.

Goto AUTO Mode:  Clicking on the coffee cup will place the ProControl into Automatic mode.

Goto MANUAL Mode:  Clicking on the hammer will place the ProControl into Manual mode.

STARTUP System:  Clicking on the green traffic light causes the ProControl to initiate a Startup sequence.

SHUTDOWN System:  Clicking on the red traffic light causes the ProControl to initiate a Shutdown sequence.

Emergency OFF:  Clicking on the red hand will cause an Emergency Shutdown, which turns off all outputs immediately and places the ProControl in Manual mode.

!

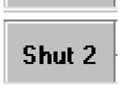
*Be sure you understand the safety risks and other implications of issuing these commands. When the icons are clicked, the actions are **immediate** and equipment may start up or shut down automatically. **Most importantly, switching the ProControl to Manual mode will defeat any safeguards programmed into the system and allow equipment to continue running without any process control.** Manual mode should only be used on a short-term basis for system troubleshooting or clearing alarm conditions, preferably with de-powered equipment circuits.*

You can monitor the current system mode by looking at the message panel at the bottom of the main screen.

The system is currently in Manual mode.

The system is currently in Auto mode.

The system is currently in Startup mode, the last startup task run was startup task #2.



The system is currently in Shutdown mode, the last shutdown task run was shutdown task #2.

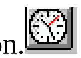
The last action to initiate a Shutdown is listed in another message panel at the bottom of the screen. In the example below, the shutdown was initiated by a remote user.

System Operations

Following are several other operational parameters that can be set by ProView.

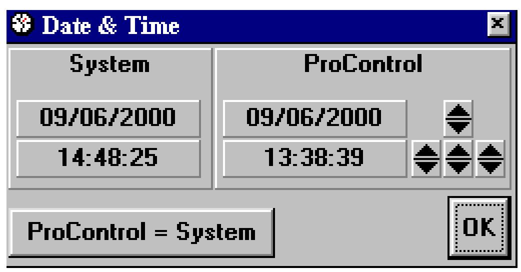
Date & Time

The ProControl unit maintains an internal real-time clock which it uses to time-stamp datalogged information and control other important system functions. To set the **Date & Time**:

1. Click on the **System Time** toolbar button. 

   Or

   Choose **System Operations** from the **System** menu and click **System Time**. You will see the **Date & Time** dialog box.



2. The left side of the dialog box displays the current date and time kept on your PC. The right side of the dialog box is the date and time according to the ProControl unit. Follow the procedure outlined below if you need to change the time.

3. To set the ProControl's clock equal to the PC's clock click on the **ProControl = System** button. To set the ProControl's clock to a specific time use the time spinners . The upper spinner changes the date and lower set of three spinners change the hour, minute and second (left to right, respectively).

4. To set your PC's time (System time) use the Windows Control Panel.

FYI

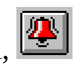
Daylight Savings Time is not supported by the ProControl's clock. You will need to make any necessary changes manually.

! *Changing the time by a large amount can lead to discontinuities in the datalogging history of your ProControl unit, particularly if you move the ProControl's time forward. See the section on Datalogging Setup in Chapter 5 to check on your system's datalogging status.*

Alarms

An alarm is only an **audible** indication to the operator that an input signal is in its ***active state***. On the ProControl unit, the beeper sounds if the **Alarms** are **Set**, the unit is in Manual mode and an input is in the active state. The Alarm continues to sound until it either is acknowledged by the operator or times out by itself. In ProView, a "Beep" sounds from the PC if the **Alarms** are **Set**, and an input that has been configured as an **Alarm Input** enters the active state. No acknowledgment is necessary.

The current status of the alarm feature is displayed in a message box at the bottom of the main screen.


To enable or disable Alarms, click on the **Alarms** toolbar button,  which toggles this feature on and off.

Or

Click on **Set Alarms** in the **Enable** menu.

Remote Reporting

A report is a fax or a pager message sent by the ProControl unit. In order for any reporting to occur, **Remote Reporting** must be enabled. The current status of the reporting feature is indicated in a message box at the bottom of the main screen. 

To enable or disable remote reporting, click on **Remote Reporting** under the **Enable** menu. A check mark is displayed if reporting is enabled.

Log Off Remote User

This function is used occasionally to reset the remote ProControl's display to the password menu. It is often used to ensure that an on-site user does not change any ProControl settings while you are remotely connected, and to ensure that password protection is restored if the last user did not Log Off locally.

To Log Off the remote user, choose **System Operations** from the **Systems** menu, and click on **Log Off Remote User**.

Initiate FAX NOW!

This function is the equivalent of pressing FAX NOW on the ProControl unit. It is used to generate and send a current fax status report to the currently enabled fax numbers. Fax reports must be enabled in the **FAX Report Setup** dialog box and ProView must be connected via modem (remotely) for this command to proceed.

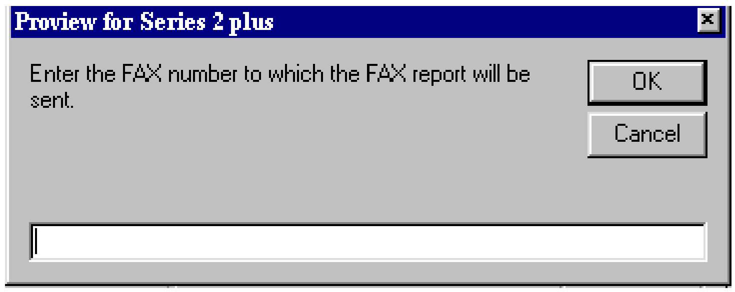
ProView will disconnect from the ProControl unit (hang up) after issuing this command to free the remote phone line for fax use. Normal FAX back operations and times will not be affected.

To initiate the fax, choose **System Operations** from the **Systems** menu, and click on **Initiate FAX NOW!**

Initiate New FAX NOW!

This function is identical to **Initiate FAX NOW!** except that you can specify a number that is not currently enabled to receive faxes from the ProControl. You can use this for testing the fax capabilities or to send a fax update to a third party.

To initiate the fax, choose **System Operations** from the **Systems** menu, and click on **Initiate New FAX NOW!**



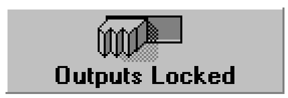
ProView will alert you first that you will be disconnected from the system in order for the fax to proceed. Enter the FAX number to which the fax report will be sent, making sure you include a prefix or the numeral 1 and the area code, if necessary. Click the OK button to send the fax report.

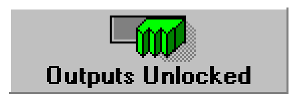
CHAPTER 5: CHANGING SYSTEM PARAMETERS

This chapter explains how to change the settings that govern much of the operation of your system, such as the state of a discrete output, analog alarm levels and fax and datalogging setups.

Switching an Output State

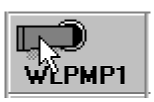
The state of a discrete output can be changed manually by clicking on the "switch" associated with its tagname. ProView includes a "locking" feature for discrete outputs as a safety measure to prevent inadvertent output changes; you must "unlock" the outputs in order to turn them on or off. The outputs are locked and unlocked by clicking on the "slide switch" at the top of the **Discrete Outputs** section of the main screen.



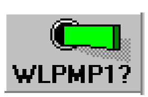


You should leave the slide switch in the **Locked** position whenever possible.

Bear in mind that if the ProControl unit is in Auto mode, any discrete output change you make may be "overridden" by a process control task. Do not turn outputs on or off unless you are familiar with the process control in effect for your system.

1. 

To change the state of a discrete output, click on the toggle switch.

2. 

The toggle switch will change positions, and a "?" will appear for a moment after the tagname. This indicates that the command was sent to the ProControl unit but that confirmation of the state change has not yet been received.

3. 

The "?" will disappear after confirmation of the state change has been received from the ProControl unit.

Depending on your site configuration, you may be able to change certain parameters that affect how the discrete outputs in your system operate in Auto mode.

Process Groups

The ability to set a ***Process Group*** is a rarely-used feature that prevents an individual output from being switched by certain process tasks when in Auto mode. If your ProControl has been configured for Process Groups, you can switch between Group 1 (ignore processes 17 – 32) and Group 2 (ignore processes 1 – 16).

! ***Do NOT enable process groups unless your ProControl has been configured specifically to use this feature!*** *Be sure you understand the safety risks and other implications of issuing these commands.*

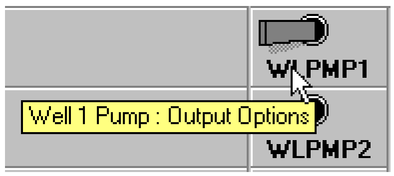
Output Cycle

Some of your outputs may have been configured as "Switched" outputs, where the output is turned on and off according to a timed cycle, or during a specific time of day.

Output Options

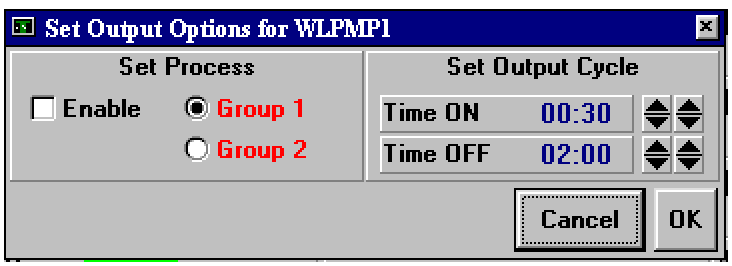
To change an output option, do the following:

1. Place your mouse pointer over the output's tagname until a balloon appears. Click the *right* mouse button until you see **Output Options**.



2. Click the *left* mouse button.

3. You will see the **Set Output Options** dialog box. The **Set Process** or **Set Output Cycle** panels may not be visible if those options do not apply. Both panels will be disabled if ProView is not connected to a ProControl unit.



4. To enable a Process Group click on the **Enable** check box and click either the **Group 1** or **Group 2** radio buttons in the **Set Process** panel. Once again, ***Do NOT enable process groups unless your ProControl has been configured specifically to use this feature!***

5. If the output has been configured to run in a switched mode, you will be able to change the **Output Cycle** times by clicking on the value you want to change and entering the new time in an **hours:minutes** format (be sure to hit Enter after you type in the new time). Alternatively, click on the up or down spinners to increase or decrease the time you want to change.

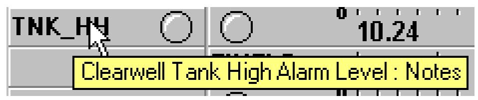
6. Click on the **OK** button to confirm the changes and send them to the ProControl unit. Click on **Cancel** to get rid of any changes.

Notes

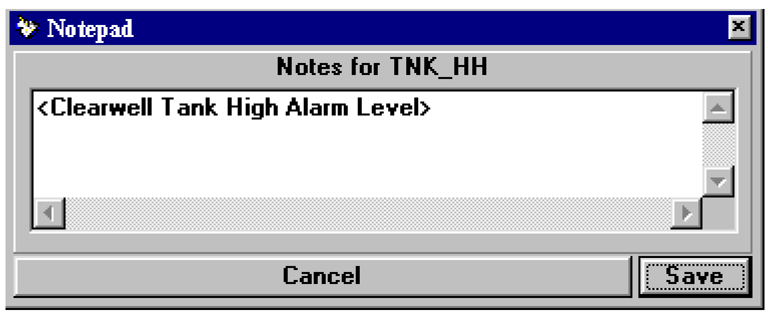
Each I/O point can have its own set of associated ***Notes***. The notes are stored on your PC in a file with a **.not** extension along with your **.pvs** file. You can attach notes which explain the functional purpose of the I/O point or define the I/O point in more detail. This can eliminate uncertainty that may result from the limitation of six characters in each point's tagname.

To edit an I/O point's notes do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, and *right*-click until you see **Notes**.



2. Click the left mouse button to enter the "Notes" feature. The **Notepad** dialog box appears.



3. Click in the **Notes** window to edit or add descriptive text. Any notes enclosed in angle-brackets (i.e. <note>) will appear within the balloon when you position the mouse pointer over the tagname, and at the top of the main screen.

4. Click the **Save** button to save your notes and/or definitions or press **Cancel** to exit without saving. You must also save the site file before exiting ProView to retain any changes made in Notes.

FYI

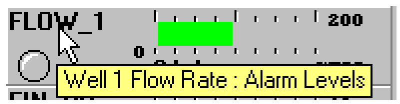
Sometimes it is a good idea to provide a more complete description of what an input or output does in the Notes; e.g., "Causes System Shutdown" or "Turns ON when Tank is Full". Feel free to customize the notes to suit your purposes; they are stored locally on your PC and do not affect the operation of the ProControl itself.

Analog Alarm Levels

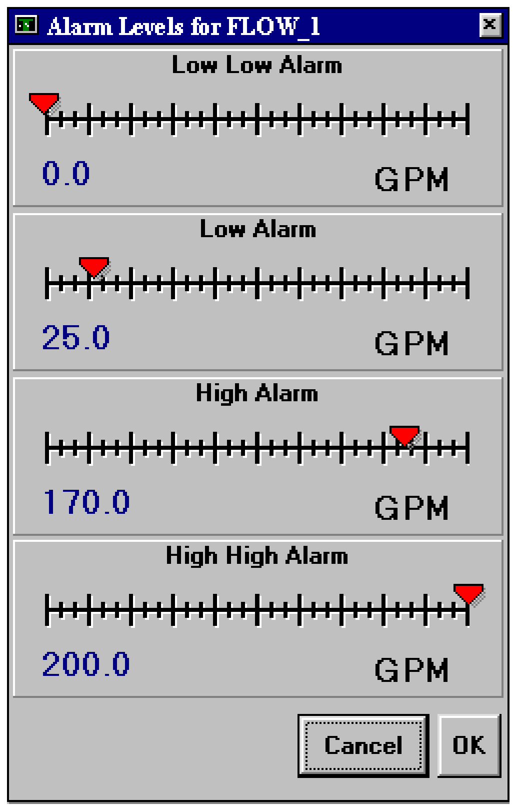
The analog alarm levels define what parts of an analog input's range are considered "active" and which are not. This affects not only the color of LED's and bar graphs on the main screen but also can affect process control if the analog input is used in a process task. Depending on how your system has been configured, you will be able to set up to four "activation levels" that define when an input becomes active. Some ProControl configurations allow you to set a ***Low Alarm Limit*** and a ***High Alarm Limit***, while others allow you to additionally define a ***Low-Low Alarm Limit*** and a ***High-High Alarm Limit***. These activation levels are somewhat more flexible in use than their names imply, in that they are not only used to trigger alarms. If an alarm limit value is exceeded, it could be used to simply turn on a pump or reset a switch, for example.

To set an analog alarm level, do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, *right*-click until you see **Alarm Levels**.

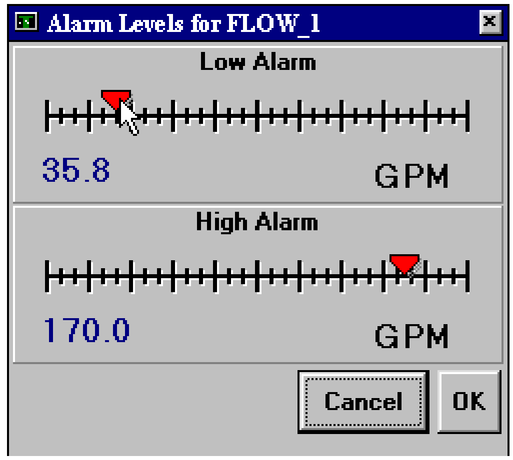


2. Left-click and the **Alarm Levels** dialog box appears.

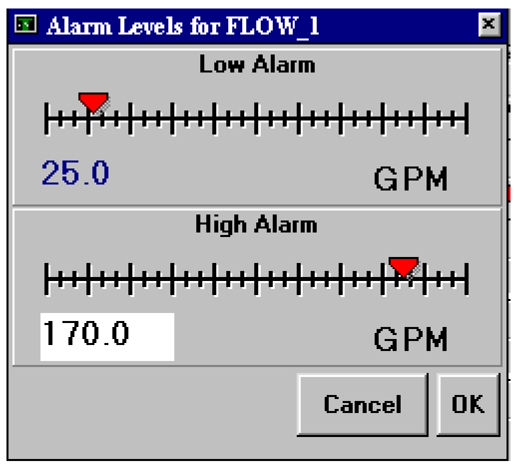


3. The present alarm levels are shown in text as well as in the position of the sliders. Note that the **High Alarm** value must be greater than the **Low Alarm** value, and the **High High Alarm** value must be greater than the **Low Low Alarm** value.

4. You may adjust the alarm values by clicking and holding a red slider and moving it to the left or right. As you move the slider the numeric value is updated to reflect the change you are making. The alarm level will be set to a new value when you release the mouse button.



5. Alternatively, you may click on the alarm level text and edit the value for the alarm level. This is usually a better way to input a precise value. Be sure to hit the Enter key to send the new value to the ProControl unit. Click on the **OK** button to hide the **Alarm Levels** dialog box.



!

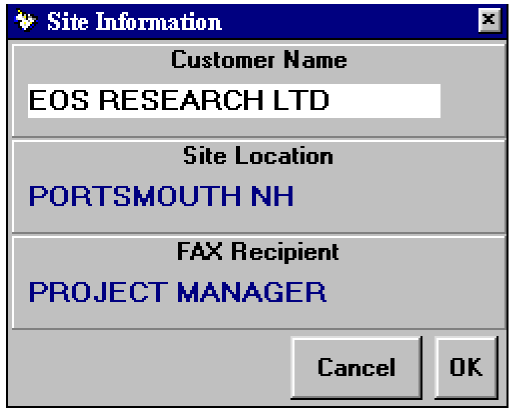
Remember that any changes you make to the alarm levels are ***immediate*** *and may impact the process control for your system. Be sure you understand the safety risks and other implications of issuing these commands.*

Site Information

Site Information refers to data used in the fax report and in the various files printed by ProView.

To view or change the Site Information do the following:

1. Click on **Site Information** in the **File** menu. The **Site Information** dialog box appears.



2. To change the **Customer Name**, **Site Location** or **FAX Recipient** click on the text you want to change and edit it. Only uppercase letters, numbers and blank spaces are allowed. The **Customer Name** field also appears on the main screen of the ProControl unit's display.

3. Click on the **OK** button to confirm the changes and send them to the ProControl unit. Click on **Cancel** to get rid of any changes.

FAX Report Setup

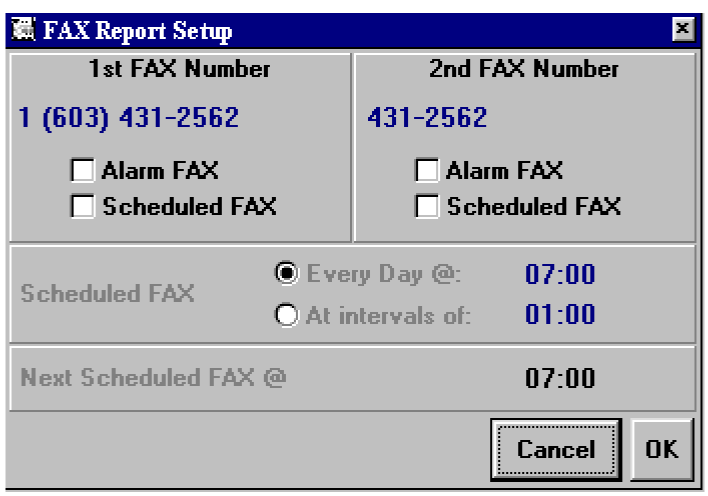
This setup screen is used to change when and where the ProControl's fax report is sent, and whether individual fax recipients are enabled.

To view or change the FAX Report Setup, do the following:

1. Click on **FAX Report Setup** in the **Communications** menu.

Or

Click on the **FAX Report Setup** toolbar button.  You will see the **FAX Report Setup** dialog box.



2. If **Remote Reporting** is not enabled, the contents of the dialog box will appear "grayed out" or disabled.

3. The first and second FAX number panels determine what kinds of fax reports are sent by the ProControl unit and where they will be delivered. There are two kinds of fax reports generated by the ProControl. A **Scheduled FAX** report occurs on a regular basis to provide a status report, while an **Alarm FAX** report will be sent when issued by a Process Task that has been configured to do so (usually to report an alarm condition). To enable either type of fax report click on the **Alarm FAX** or **Scheduled FAX** check boxes. If you enable Scheduled FAX reports the Alarm FAX reports for that same number are automatically enabled as well. You cannot enable only Scheduled FAX reports.

4. To change the phone number to which the ProControl will fax reports click on the phone number and edit it. The ProControl can fax to two different phone numbers. It will make up to three attempts to send the fax. If the first try is unsuccessful, the second try will be initiated 5 minutes later, and a third attempt will be made 5 minutes after that. If the third try is unsuccessful the fax attempt will be abandoned and the ProControl will enter a fax failure into the Events log (see Chapter 6). The ProControl will try both phone numbers (if they are both enabled) on the first try before moving on to a second attempt.

5. In the **Scheduled FAX** panel, you can select when the regularly scheduled faxes are sent. Choose the **Every Day @** button and edit the time to the right of it to have a report sent at the same time every day (24-hour clock). To have a report sent at a specific time *interval*, choose the **At intervals of** button and enter the time interval in HH:MM format. When you hit Enter, the data will be sent to the ProControl unit.

6. The **Next Scheduled FAX** variable indicates when the next *scheduled* fax report will be sent. You can also change it yourself if, for instance, the ProControl is set to fax every hour but you would like it to skip a few hours before resuming. To set the **Next Scheduled FAX** time click on the time in that panel and enter the new time in 24 hour format. Note that if you enter a Next Scheduled FAX time that is earlier than the current time as determined by the ProControl's clock, you will prevent any scheduled faxes from being sent until the next day at that time.

7. Click on the **OK** button to confirm the changes and send them to the ProControl unit.

Paging Setup

This setup screen is used to change where the ProControl's alarm pager messages are sent, and whether individual page recipients are enabled. You will need to contact your paging service directly to obtain some of the information necessary for proper paging setup. The paging capability is similar to the ProControl's fax capability in that you can send information to two pagers and it will make three attempts at reaching each number.

!

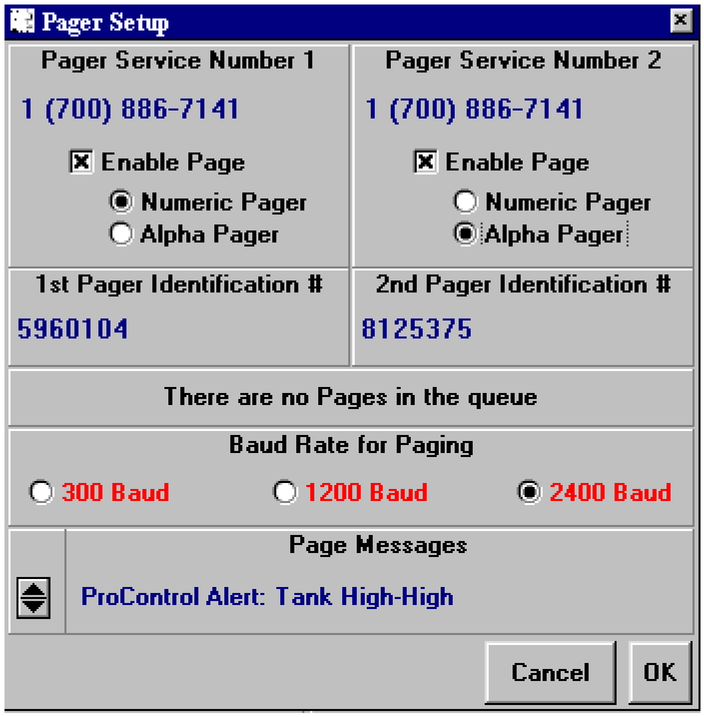
You will need to obtain your pager company's modem dial-up phone number and your pager's modem dial-up ID (this is often different than your regular pager ID). This information is generally not available from the customer service staff at the pager company. You may need to ask for someone in technical support who is familiar with pager modem dial-up.

To view or change the **Paging Setup** do the following:

1. Click on **Paging Setup** in the **<u>C</u>ommunications** menu.

Or

Click on the **Paging Setup** toolbar button.  You will see the **Pager Setup** dialog box.



2. In the **Pager Service Number** panels, enter the telephone number for your pager company's modem dial-up.

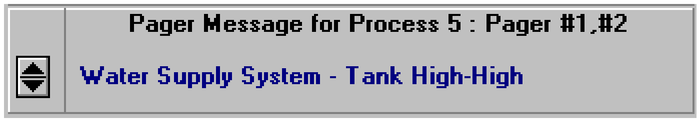
3. Click on the **Enable Page** check box, and choose **Numeric Pager** or **Alpha Pager** (text).

4. Enter the pager ID number you obtained from the pager company in the **Pager Identification #** panels.

5. The next panel indicates whether there are any queued pages. In other words, if a page has not yet been successfully completed and you have dialed into the ProControl with ProView, you may be interfering with the ProControl's attempts to send a page.

6. Select the baud rate in the **Baud Rate for Paging** panel, which is the speed at which the page information is sent to your paging company. It is generally recommended that you use 300 baud for the greatest reliability. Even at 300 baud, the ProControl takes only a few seconds to transmit the information to your pager company.

7. The **Pager Message** field allows you to view and/or change the information which will be transmitted to your pager from specific events. If you are using a numeric pager, this message cannot exceed nineteen digits in length and may contain only numerals. If you are using an alphanumeric pager, this message can be up to 80 characters in length. After you edit the message, hit Enter to send the updated message to the ProControl unit. Use the up and down spinners to view the other Process Tasks that cause pages to be sent. You should be familiar with the process control of your system before attempting to make changes to these messages.



8. Once you have finished making your changes click **OK** to close the dialog box.

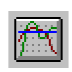
Datalogging Setup

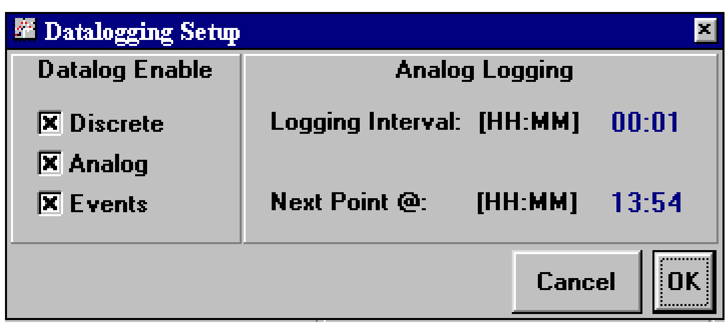
There are three different types of datalogging on the ProControl. Discrete input and output changes are logged as they happen. Events are also logged as they happen, and include changes in control mode (e.g., Auto, Manual), local and remote connections to the ProControl, system startup/shutdowns, fax or page failures, and execution of *Process Tasks*. Analog input and output values are logged at specific time intervals determined by the user. The **Datalogging Setup** dialog box is used to determine how datalogging is carried out in the ProControl unit.

To view or change the **Datalogging Setup** do the following:

1. Click on **Datalogging Setup** in the **Datalogging** menu.

Or

Click on the **Datalogging Setup** toolbar button.  You will see the **Datalogging Setup** dialog box.



2. To enable a type of datalogging click on the **Discrete**, **Analog** or **Event** check boxes located in the **Datalog Enable** panel.

3. To change the logging interval for analog inputs click on the time value indicated for **Logging Interval** and edit it. This interval can range from 1 second to 24 hours, expressed in minute/second

format or hour/minute format (default). Clicking on the **HH:MM** adjacent to the **Logging Interval** will toggle between hour/minute format and minute/second format.

4. The **Next Point @** variable is set by the ProControl every time a data point is logged to show you when the next analog data points will be logged. You can change this value if you wish the ProControl to delay before resuming analog datalogging. Click on the time associated with **Next Point @** and enter the new time in either HH:MM or MM:SS format. Note that if you enter a **Next Point @** time that is earlier than the current time *as determined by the ProControl's clock*, you will prevent any analog datalogging from occurring until the next day at that time (or next hour if using MM:SS format).

4. Once you have finished making your changes click **OK** to close the dialog box.

FYI

When setting your analog logging interval, be aware of the available memory in the ProControl unit you are using. If, for instance, your ProControl has a capacity of 5,000 analog data points per input channel and you specify a 5-minute logging interval, there will be available memory for approximately 17 days worth of analog data. Changing the log interval to 10 minutes will make the memory last twice that long. Once the memory is full, the oldest data is purged to make room for the current data.

Changing the Password

You can change the password for opening a site file in ProView or for access to the ProControl unit from its keypad. The passwords do not have to be the same. If you change the password while ProView is connected to a ProControl unit, the new password will be used for both ProView and the ProControl unit. If you change the password while not connected to a ProControl unit, the new password will be used only for that site file in ProView. In order to save the new password for the site file in ProView, you must save the site file (**File…Save Site**). However, any change to the password in the ProControl unit itself is immediate.

To change the password, follow these steps:

1. Click on the **Password** menu.

Or

Click on the **Password** toolbar button.  You will see the **Security** dialog box.

2. Click on the **Change Password** button. You will prompted to enter the **Old Password** in the text box. Click the **OK** button or hit the enter key. If you do not enter the password correctly, a beep sounds and the security dialog box disappears.

3. You will then be prompted to enter the **New Password** in the text box. Recall that the password can be up to three characters consisting of the numbers 0-9 and the letters A-Z. After clicking on the **OK** button or hitting the enter key, you will be prompted for the new password again.

4. If both new password attempts were identical, the new password will be accepted and the **Security** dialog box will disappear. If ProView is connected to the ProControl, the new password will be in effect for both ProView and the ProControl unit.

Analog Output Options

If your ProControl system is configured with analog outputs, you will be able to adjust the output level, or the parameters used in a control algorithm associated with that output. Your system integrator should have already configured your analog outputs with these algorithms if they apply to your process. Analog outputs can be involved in one of two different types of control scheme: **PID** or **Proportional** control. A **PID** (Proportional-Integral-Derivative) Loop is a feedback-based loop that maintains an analog input at a user-defined ***Setpoint***. The ProControl automatically adjusts the analog output using a mathematical formula that includes ***Gains*** for the proportional, integral and derivative terms. PID control is a commonly-used process control technique, descriptions of which can be found in most control theory texts.

FYI

If you are familiar with PID control terms, note that the PID gains used by the ProControl are defined differently than some of the terms in traditional use. **Proportional Gain** *on the ProControl corresponds with the classic definition of* **proportional band**. *However, the* **Integral Gain** *and* **Derivative Gain** *are the* ***inverse*** *of* **integral (or reset) time** *and* **derivative time**. *Hence, an* ***increase*** *in any of these gains tends to* ***increase*** *the corresponding proportional, integral and derivative action.*

A **PRO** (Open-loop Proportional) algorithm generates an analog output signal that is directly proportional to the value of an analog input. The analog output percentage is computed by multiplying a constant of proportionality by the associated input's percentage of full-scale.

If a control scheme is not assigned to an analog output (or if the output has been placed in **Manual** mode), you can change the output value by clicking on the slider for that output and dragging it up or down, or by highlighting the number beneath the slider scale and typing a new value.

You can modify the PID parameters of a PID-controlled analog output (the **P**, **I** and **D Gains**) if your analog output is not responding smoothly or quickly enough to changes in its associated input. The proportional (**P**) gain specifies the output level based on the error between the **Set Point** (desired input level) and the actual input level. Integral (**I**) gain smoothes the output level based on the tracking history of the input to the **Set Point** and provides a means of better steady state control. Derivative (**D**) gain will allow the output to respond to quick changes in the input and provides a means of establishing good transient or instantaneous control.

In the case of a **PRO** output, you can modify the **P Gain** to alter how much the output value changes as the associated input changes. A value of 100 indicates that the output will be 100% when the input is at full scale. A value of 50 indicates that the output will be 50% when the input is at full scale

The **Max Change** parameter allows you to regulate how much the analog output can change in one control cycle (one control cycle is about 1/4 of a second).

!

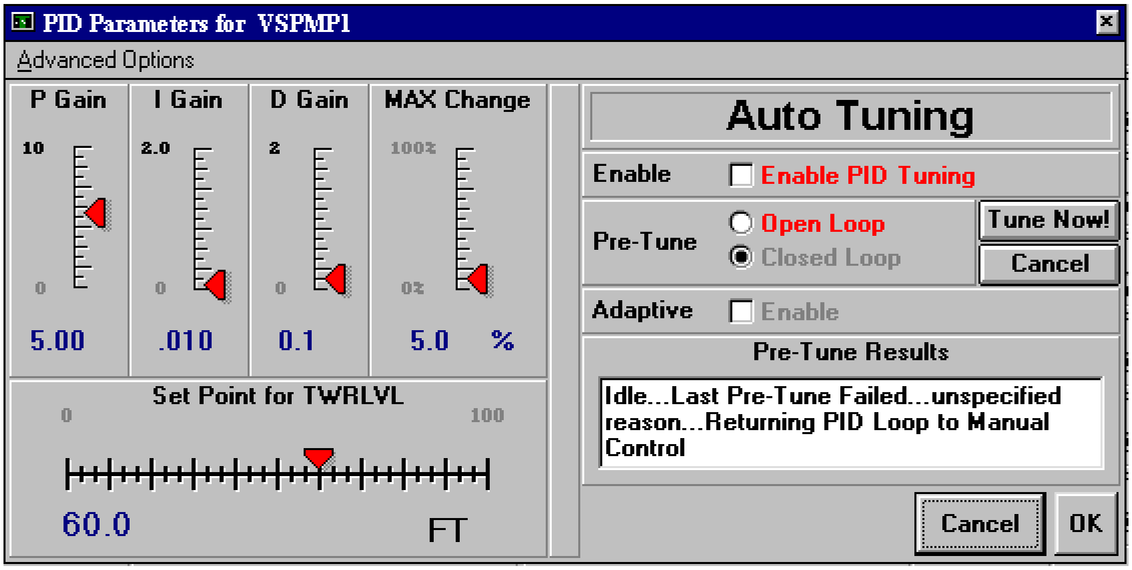
Be sure you fully understand PID and proportional control concepts before adjusting any of these parameters. Large changes in output can result from changing the gains or the set point, which can cause equipment damage or unforeseen safety hazards. For help in choosing appropriate gains for your process, contact EOS Research technical support.

To change the **PRO** or **PID** parameters, **Set Point**, or **Max Change** parameters:

1. It is highly recommended to first place your analog output into **Manual** mode. Click on the **PID** (or **PRO**) beneath the Tagname and wait a second for it to change to **Manual**.

2. Position the mouse pointer over the analog output's tagname until a balloon appears, and *right*-click until you see **PID Options**.

3. Left-click and the **PID Parameters** dialog box appears.



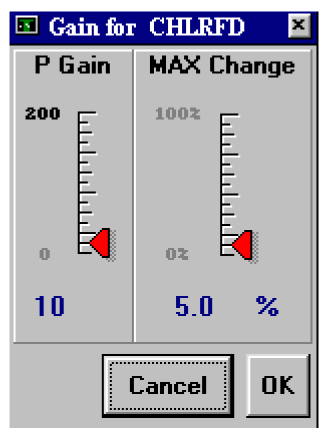
4. To change any of these parameters, you can either click and drag the sliding scale or click the numerical text and enter the value through the keyboard. You can also change the upper limit on all of the gain scales.

5. Click the **OK** button to save your changes. If not, click the **Cancel** button.

6. To restart your PID loop, click the word **Manual** underneath the Tagname and wait a second for it to change to **PID**. Your new parameters are now in use by the ProControl.

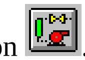
One type of auto-tuning algorithm is provided with ProView, and can be used to calculate optimal PID parameters for certain types of process loops. Contact EOS Research technical support to see if auto-tuning may benefit your process.

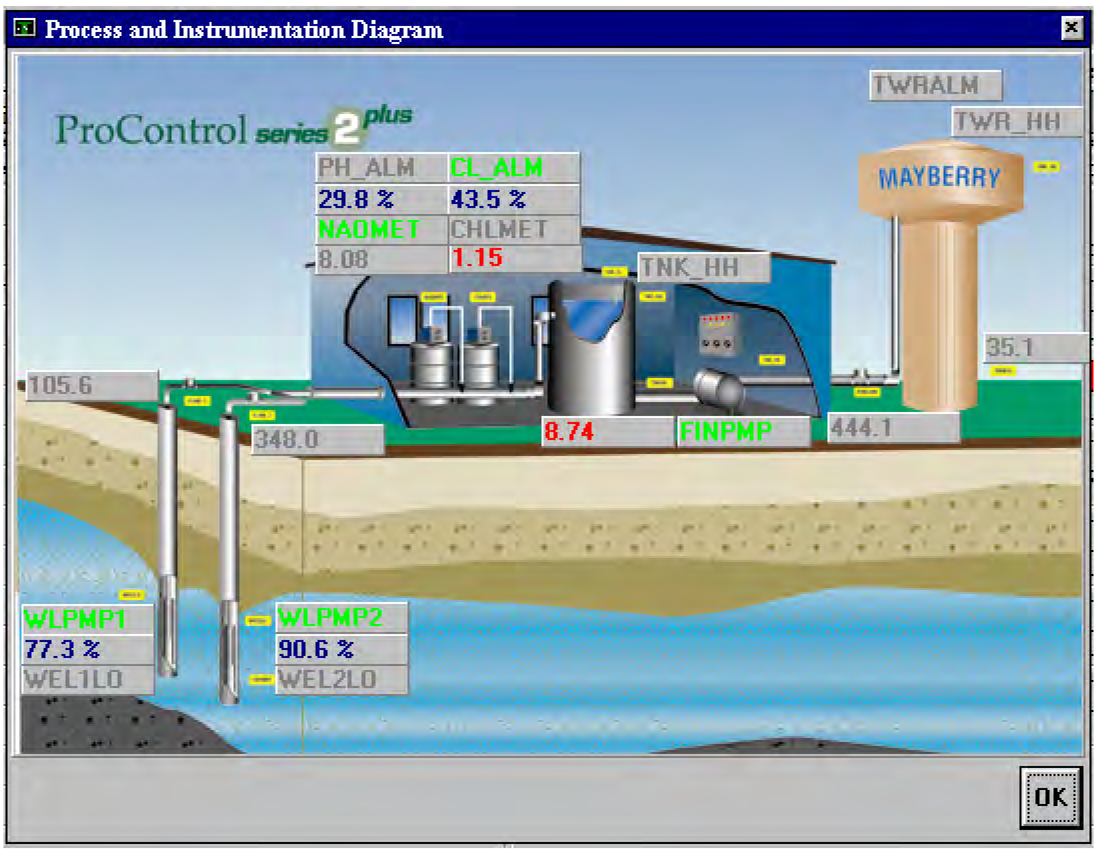
If the analog output is configured for proportional output, the dialog box on the right will be displayed. You can make changes as outlined above.



Process and Instrumentation Diagram

The **P&ID** option allows you to pull up an alternate "process and instrumentation diagram" representation of your system, which can be used to display operating data that is superimposed on a process diagram (or map, or picture of your dog, etc.). The P&ID option is designed to provide an alternate human-machine interface (HMI) for ProView with customizable graphics. Note that the P&ID screen is not interactive like the main ProView screen is; that is, data can be displayed on this screen, but commands cannot be issued from it.

Typically, your system integrator would configure this screen for you. The P&ID capability must be enabled by the integrator in order for you to use this feature. If this option has been included in your system configuration, you can view this diagram by clicking on the P & ID icon .



The **Process and Instrumentation Diagram** contains a graphical representation of your system. Digital inputs and outputs are displayed as tagname boxes that change color when the I/O point is active (red or green). Analog I/O are displayed as numerical values, with analog outputs also containing the **%** symbol to distinguish them from analog inputs. Click the **OK** button to go back to the main ProView screen.

As discussed above, the P&ID screen is typically supplied by your system integrator. However, if you would like to make changes to the P&ID screen, follow the procedures outlined below. If you want to change the background image, you can create a new **.pid** file. The P&ID must be a bitmap format file (.bmp) that can be created with Paintbrush™ or other drawing programs. The bitmap image can be any size you choose, the file name must be the same as your ProView site file (**.pvs**) with the filename extension changed to **.pid**, and it must be placed in the same folder as your .pvs file.

When you open the P&ID screen in ProView, you can move or remove the I/O boxes as you choose. Remember to **Save** the site file before you exit ProView to store these changes.

To change the appearance of the P & ID:

1. To move a descriptive box containing either a tagname or value, hold the shift key and click the left mouse button when positioned on the appropriate box. This will enable you to drag and re-position the box wherever you choose.
2. To remove a descriptive box, double-click on the box. Once you have removed a box, it will no longer be available to you unless you restore all boxes.
3. To restore all descriptive boxes, position the mouse at the bottom of the P & ID window in the gray area. Then hold down the control and shift keys while simultaneously clicking the left mouse button.

CHAPTER 6: WORKING WITH LOGGED DATA

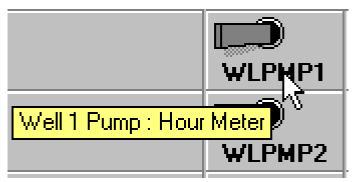
This chapter explains how to gather and analyze logged data that is being stored in the ProControl unit's battery-backed memory.

Hour Meters

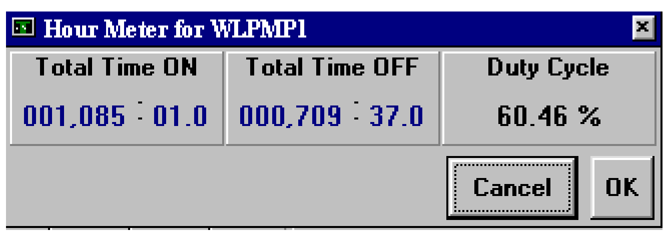
The ProControl maintains **Hour Meters** for inputs and outputs to indicate how long the I/O point has been ON and OFF. The hour meters are particularly useful in keeping track of equipment "run" times (discrete outputs), but are also maintained for discrete and analog inputs. For analog inputs, the hour meters indicate the time the input has been in and out of its *Active State* (see the definition of Active State in the Series 2*plus* User Manual). The hour meters are updated every second on the ProControl unit. The ON and OFF times are displayed at a resolution of 1/10 (0.1) of a minute.

To read the Hour Meters, follow these steps:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, then *right*-click until you see **Hour Meter**.



2. Click the left mouse button to view the hour meter. The **Hour Meter** dialog box appears.



3. The **Hour Meter** box displays information in the form of **Hours : Minutes.10th Minutes** for both ON time and OFF time. The **Duty Cycle** or ratio of ON time to total time is also displayed. It may take a few seconds for the display to be updated once the dialog box appears.

4. To edit the **Total Time ON** or **Total Time OFF**, click and highlight the total time text and make the required changes. Press the enter key to confirm the changes and send the new value to the ProControl unit. Resetting the time values to zero, for instance, can be used when a motor is changed out, to keep track of lubrication intervals, etc.

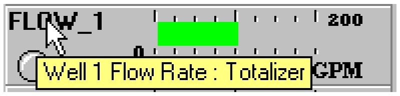
5. Click on the **OK** button to close the **Hour Meter** dialog box.

Totalizers

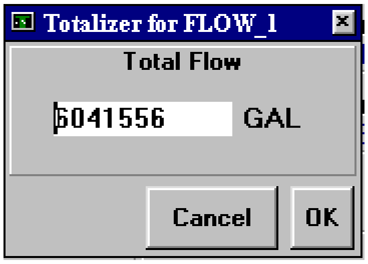
If your site configuration includes an analog input to which a flow meter or pulse counter is connected, it may also include a **Totalizer**. Totalizers provide the ability to view the cumulative total of a flow-based input or accumulated pulses from a counting device.

To view the **Totalizer** do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, then *right*-click until you see **Totalizer**.



2. Click the left mouse button to view the totalizer. The **Totalizer** dialog box appears.



3. The **Total Flow** for this input since the totalizer was last reset is displayed. It is updated every second while the dialog box is visible and while ProView is connected to the ProControl unit.

4. If you would like to set the totalizer to a different value, click on the value displayed in the dialog box. Enter the new value for the totalizer and press the enter key.

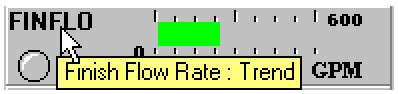
5. Click on the **OK** button to close the **Totalizer** dialog box.

Trend Graphing

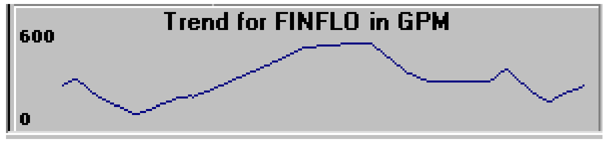
ProView can display a real-time trend graph while you are connected either locally or remotely to the ProControl. A 5-minute trend can be displayed in the lower left hand side of the ProView window.

To start trend graphing:

1. Position the mouse pointer over an analog input's tagname until a balloon appears, then *right*-click until you see **Trend**.



2. Click the left mouse button to produce the **Trend** window for that input.

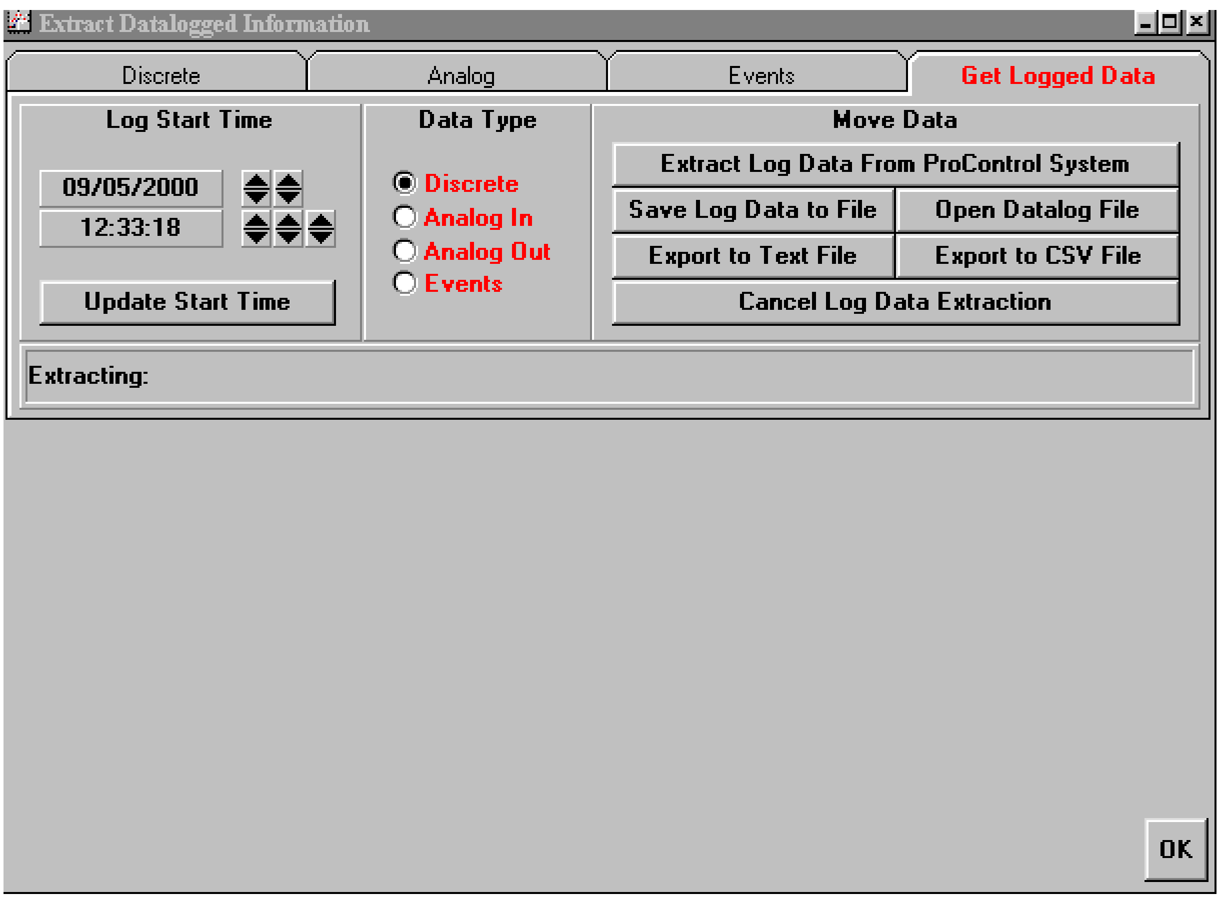


3. The trend window provides a 5-minute history of the real-time data for that analog input. You will see the trend "drift" from right to left across the window, and it will be updated as long as you are connected to the ProControl. If you wish to observe another trend, click on the tagname of another analog input and the trend window will be refreshed with the new data.

4. To stop trending and empty the trend window, click on the **Trend for…** text block in the trend panel.

Downloading Logged Data

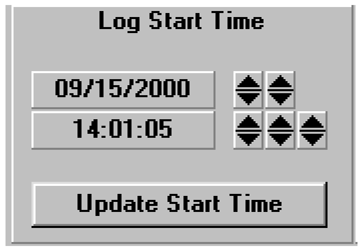
Operations data is stored electronically in the ProControl's memory in accordance with the datalogging setup (Chapter 5). To view the logged data, click on **Get Logged Data** in the **Datalogging** menu. This opens the **Extract Datalogged Information** dialog box.



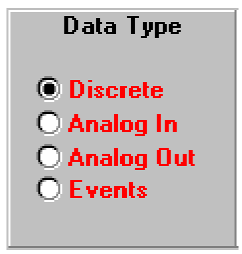
Getting Logged Data

To extract datalogged information from the ProControl unit, do the following:

1. Select the start time in the **Log Start Time** panel. ProView will extract all data that has been logged since this time. Change the start time by clicking on the spin buttons to increase or decrease the Month, Day, Hour, Minute or Second. Click on the **Update Start Time** button to reset the start time to the current time.



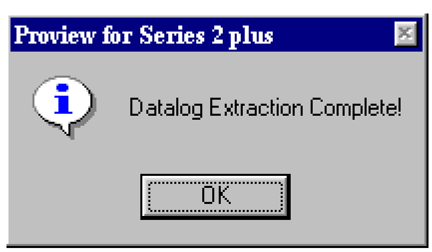
2. Select the type of data you wish to extract. Click on the **Discrete**, **Analog In**, **Analog Out** or **Events** radio button.



3. Click on the **Extract Log Data From ProControl System** button.

4. ProView performs a scan of available data. You can then monitor the progress of the data extraction.

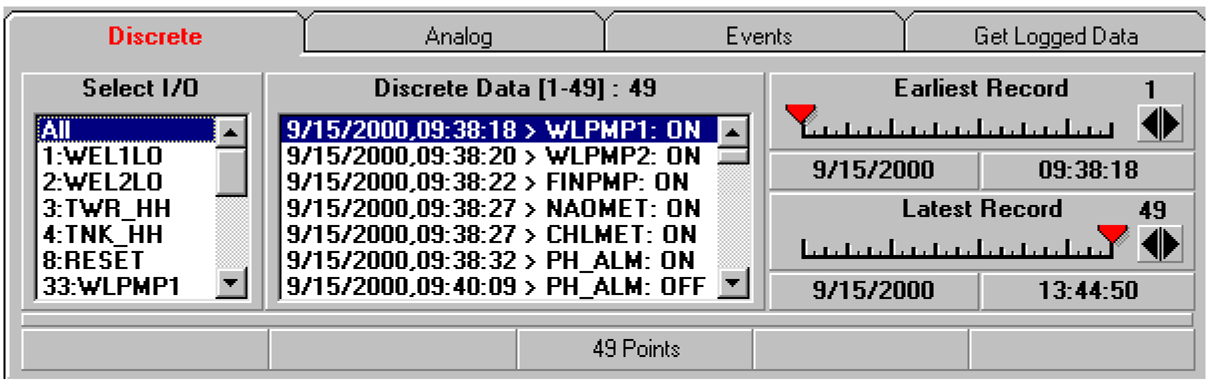
5. A message box will appear when the data extraction process is complete.



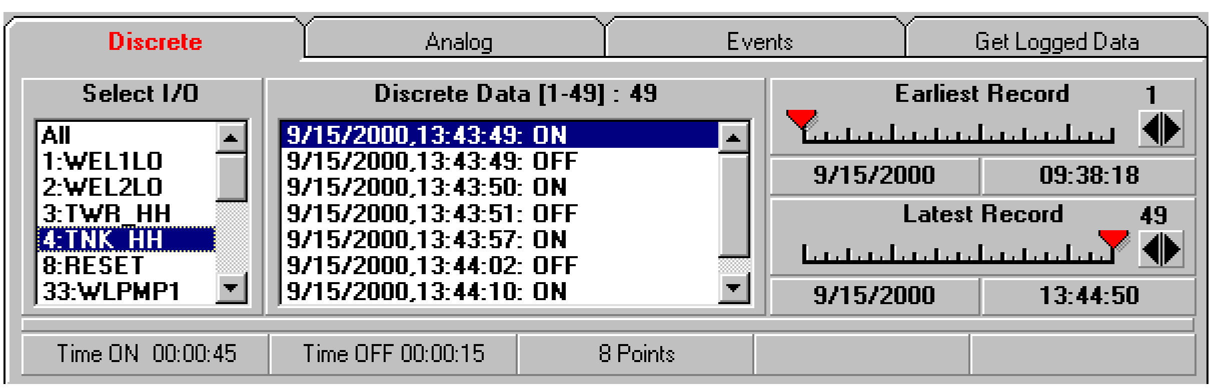
Looking at Discrete Data

To examine the discrete datalog record that you have extracted click on the **Discrete** tab.

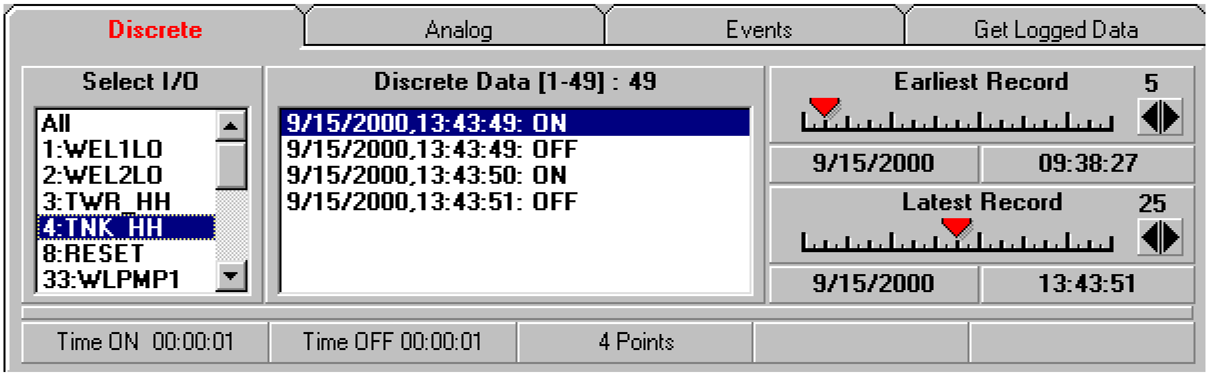
The **Discrete** data window appears. On the left, the **Select I/O** list box contains a list of all enabled discrete inputs and outputs. In the middle is the **Discrete Data** record. On the right, the **Earliest Record** extracted is shown as 9:38:18 on 9/15/2000. The **Latest Record** is 13:44:50 on 9/15/2000. A total of 49 records were extracted. Clicking on **All** in the **Select I/O** list box will show the entire discrete record in the **Discrete Data** window. You can scroll through the discrete records in the window.



The **Select I/O** list box can be used to filter the data record to include just one discrete input or output. In the example below, the **TNK_HH** input has been selected. Whenever a single input or output is selected, statistics are generated regarding the selected input or output, spanning the period of time from the first state change to the last one in the record. There are 8 data points for **TNK_HH** below, and the input was ON for 45 seconds and OFF for 15 seconds for the period of time between the first and last record.



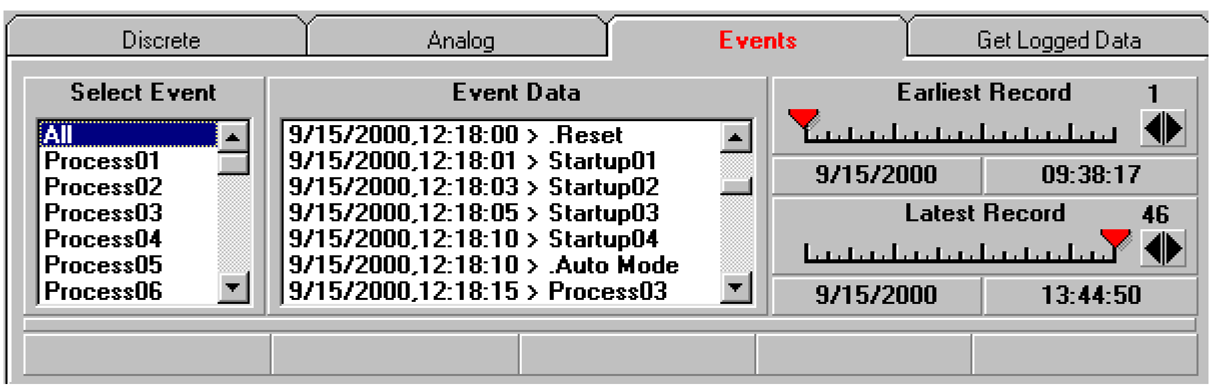
Moving the **Earliest Record** and **Latest Record** sliders or spin buttons will filter the total record with respect to time. Click and hold a slider and move the mouse to the left or right. You can also click on the spin buttons to change the time window. When you are finished filtering the time, click again on the input you wish to examine in the **Select I/O** list box to see the results of your changes. In the example below, the total record has been limited to records 5 through 25. Within this time interval, 4 state changes of **TNK_HH** occurred.



Looking at Events Data

First, go back to the **Get Logged Data** tab and extract the **Events** data. After the data has been extracted, click on the **Events** tab to examine the event datalogging record.

The **Events** data window appears. The **Select Event** list box contains a list of all enabled processes and other ProControl events. In the middle is the **Event Data** record. The **Earliest Record** and **Latest Record** extracted are shown to the right.

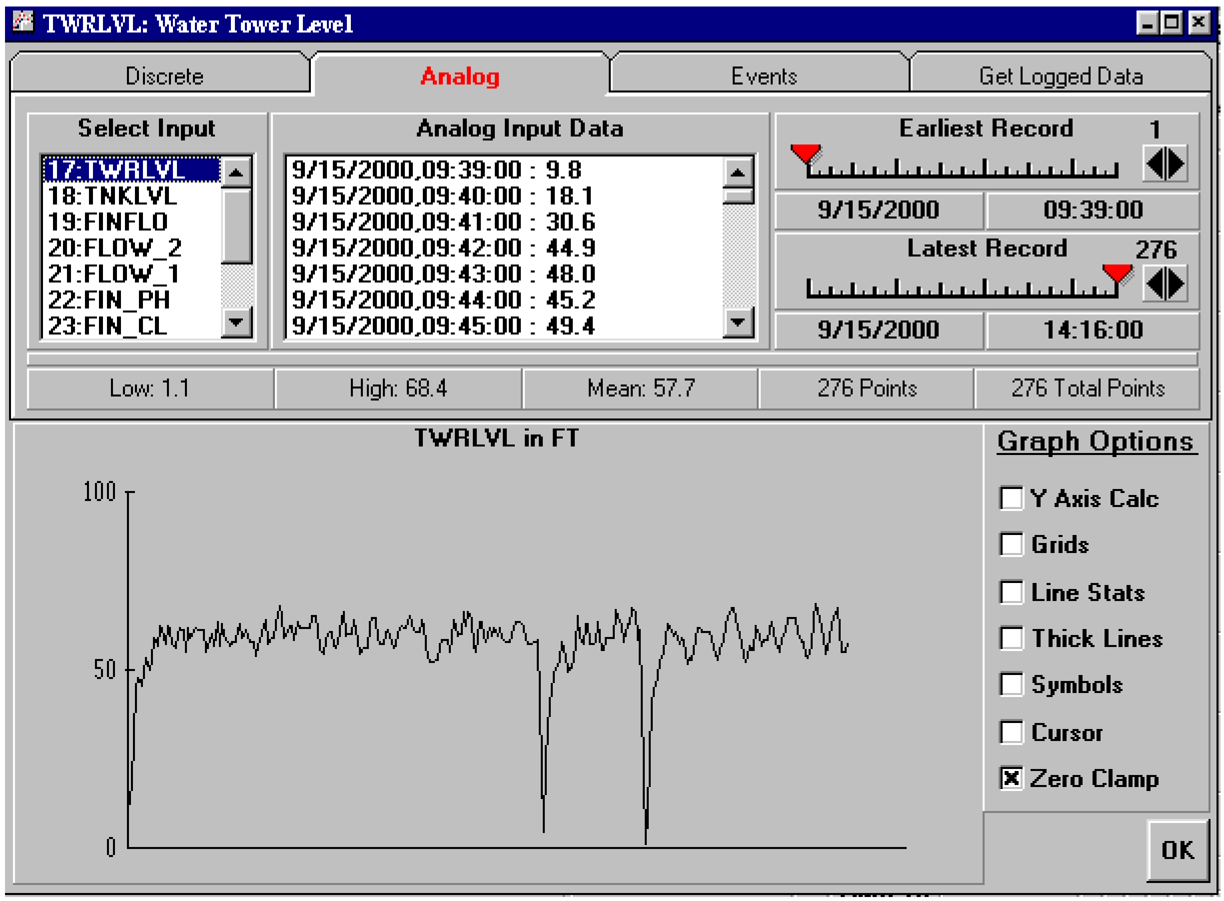


To view the data, follow the same procedure described for **Discrete Data**. Clicking on **All** in the **Select Event** list box will display all the events that were extracted. By clicking on an event in the **Event Data** window, a description is provided in the **Process Description** window below.

Looking at Analog Data

First, go back to the **Get Logged Data** tab and extract the **Analog In** or **Analog Out** data. After the data has been extracted, click on the **Analog** tab to examine the event datalogging record.

The **Analog** data window appears. The **Select Input** list box contains a list of all enabled analog inputs and outputs. In the middle is the **Analog Input Data** record. The **Earliest Record** and **Latest Record** extracted are shown to the right. By clicking on an input or output in the **Select Input** list box, a graph will be displayed in the window below.



In the example above, a water tower level is shown as it varies over time. Immediately above the graph, statistics are shown regarding the selected analog point (in this case there are 276 data points with a **Low** of 1.1, a **High** of 68.4 and a **Mean** of 57.7). As with the digital and events data, the **Earliest Record** and **Latest Record** sliders and spin buttons can be used to filter the total record with respect to time, which is helpful in focusing on a smaller portion of the graph. If you filter the data in this way, be sure to click on the input tagname again in the **Select Input** list box to see the results of your changes.

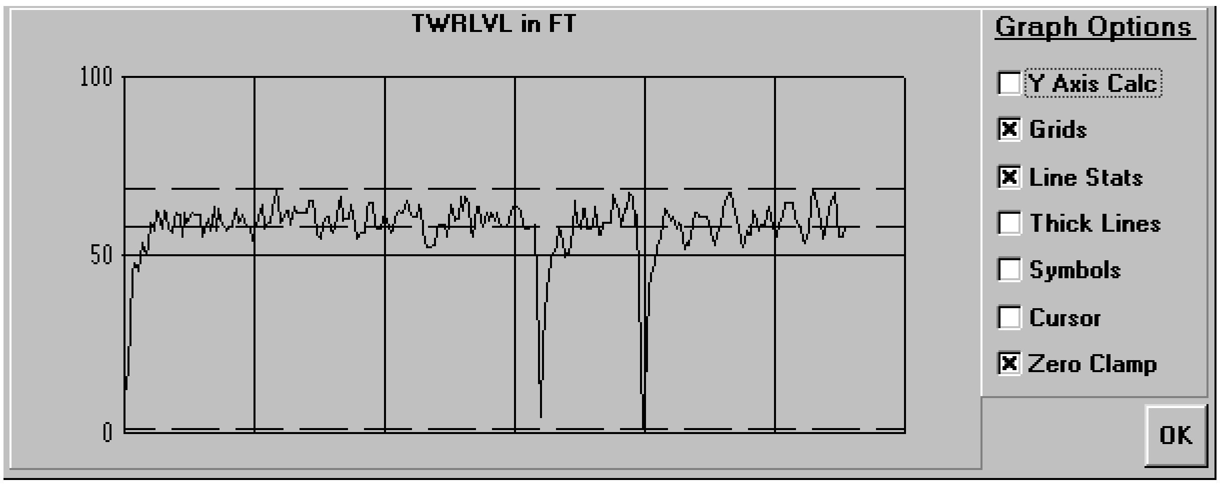
<u>Graphing Options</u>

Graph Options are available to change the look of the analog graph. Click on the check box adjacent to the option you want to use to enable it. The graphing options are described below.

Y Axis Calc: The default Y axis range displayed by ProView is that which is configured for that input in the ProControl unit. By clicking on **Y Axis Calc**, ProView redraws the graph with a calculated Y axis range based on the data in the sample. This will typically "tighten" the vertical axis on the graph to aid in showing smaller changes in the sampled data. Holding down the Shift, Control, or Alt key, respectively, while clicking **Y Axis Calc** will produce progressively tighter calculations of the vertical scale.

Grids: The grid option places some vertical and horizontal lines on the graph for reference.

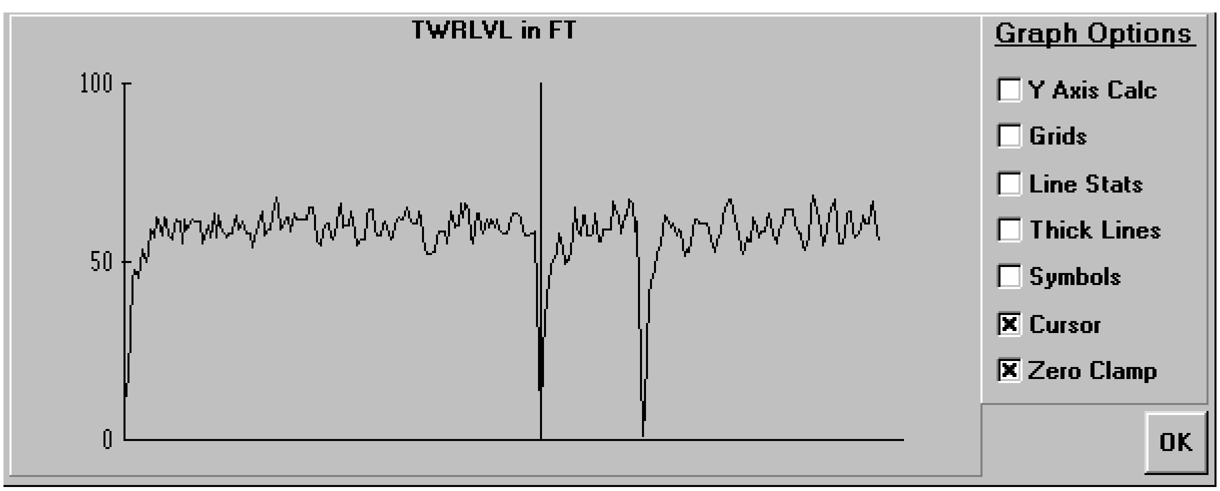
Line Stats: This option will draw dashed lines across the graph at the **Low**, **High** and **Mean** input levels. In the example below, the **Grids** and **Line Stats** options have been checked.



Thick Lines: This option increases the line weight of the graph.

Symbols: This option places a small "+" at each data point.

Cursor: This option places a vertical line on the graph at a data point selected in the **Analog Input Data** window. This option makes it easier to correlate the list data with the graph.



Zero Clamp: This option is selected by default, and forces the graph to display zero at all points where data was logged with a value less than zero. Negative values can be logged when an analog transmitter outputs less than 4 mA.

FYI

Be sure to disable the Zero Clamp option if you are viewing data for an analog input whose value can drop below zero under typical operating conditions.

After you are finished examining the datalogged information, you may want to save it for future reference within ProView or export it to a spreadsheet, database program or word processor.

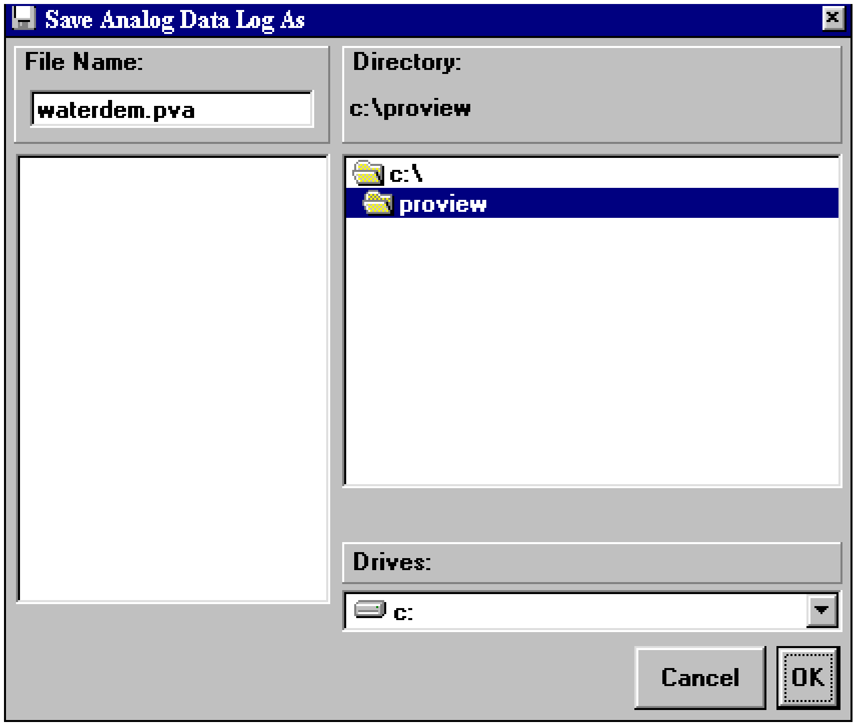
Saving Logged Data to File

To save a datalogging record to a ProView-readable file, do the following:

1. Click on the **Get Logged Data** tab. Select the type of file you wish to save by clicking on the appropriate button in the **Data Type** panel. *Remember that you must have already completed the separate step of extracting the data type you wish to save.*

2. Click on the **Save Log Data to File** button.

3. This opens the **Save *xxxxxx* Data Log As** dialog box, where ***xxxxxx*** is the type of data you wish to save. ProView selects a default file name for you, which is the name of the site configuration file with the .pvd, .pva or .pve file extension depending on the type of data file you intend to save (discrete, analog, or events, respectively). However, you may wish to change the file name to indicate a date representative of the log you are saving, for instance.



5. Click the **OK** button to save the file.

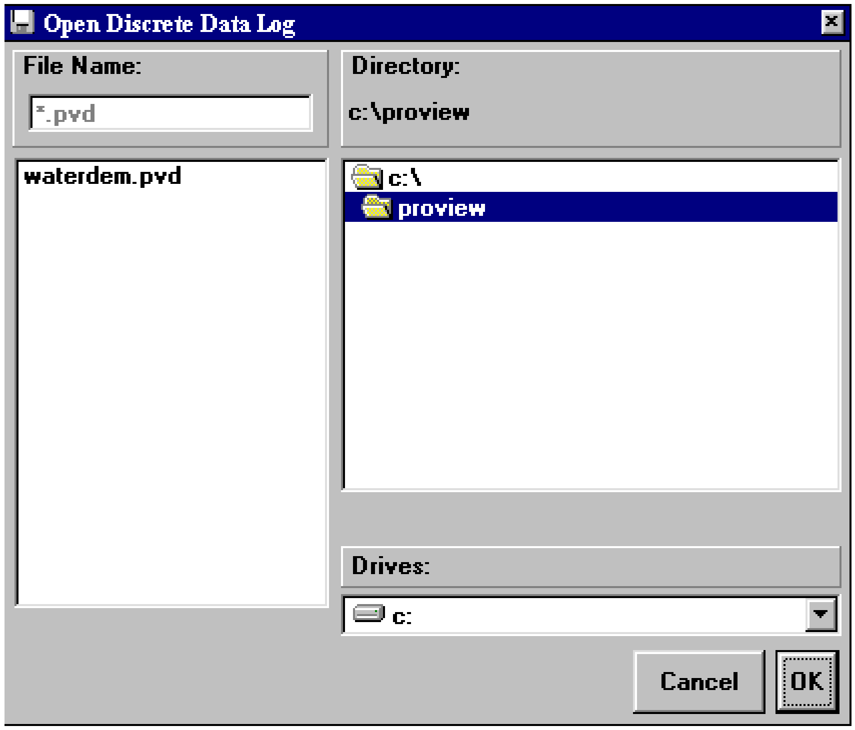
Opening a Datalog File

To view data that was previously saved in ProView-readable format, do the following:

1. In the **Get Logged Data** tab of the **Extract Datalogged Information** dialog box, select the type of data file you wish to open by clicking on the appropriate button in the **Data Type** panel.

2. Click on the **Open Datalog File** button.

3. This opens the **Open *xxxxxx* Data Log As** dialog box, where ***xxxxxx*** is the type of data you wish to view. ProView lists any files in the folder you have selected that contain the .pvd, .pva or .pve file extension (depending on the type of data file you intend to open). Click on the name of the file you wish to open, and it will appear in the **File Name:** text box. If the file you wish to open is stored elsewhere, select the location in the **Drives:** and **Directory:** list boxes.



4. Click on the **OK** button to open the file. View the data as you would any logged data that you have just extracted.

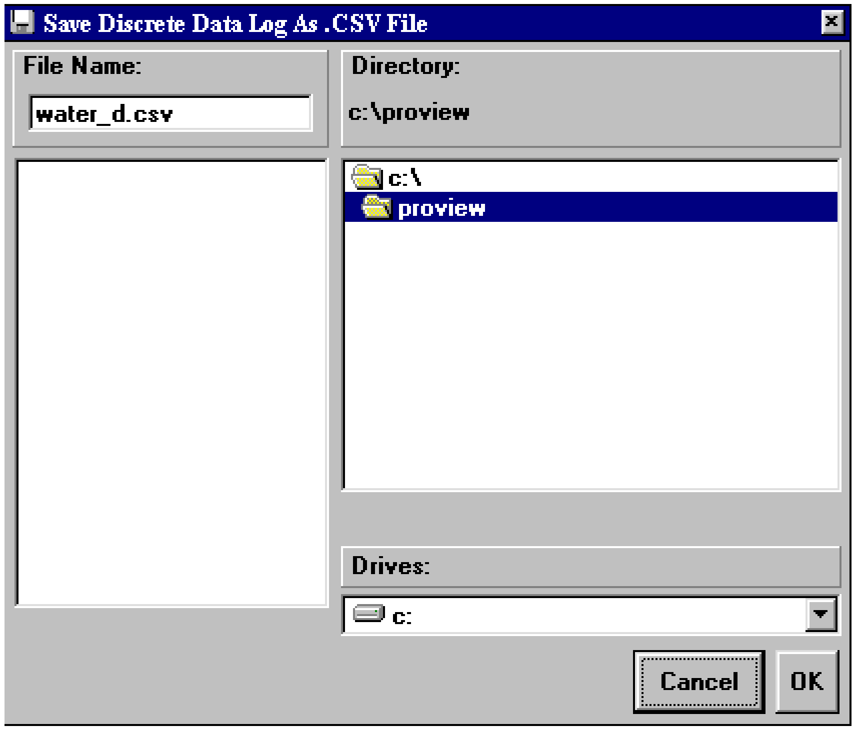
Exporting Logged Data for use in Other Applications

ProView provides users the ability to export data for use in other applications, so that you can take advantage of the data manipulation and graphing capabilities provided by widely-used software. ProView allows you to export analog, discrete or event data to a CSV (Comma-Separated Variable) file, which can then be opened by any spreadsheet or database program (e.g., Microsoft Excel™, Access™). You can also export discrete and event data to a text file for use in a word processor.

1. In the **Extract Datalogged Information** dialog box, click on the **Get Logged Data** tab. Select the type of file you wish to export by clicking on the appropriate button in the **Data Type** panel. Note that analog output data cannot be exported.

2. Click on the **Export to Text File** or **Export to CSV File** button.

3. This opens the **Save Analog Data Log As .CSV File,** the **Save Discrete Data Log As .TXT File** or other dialog box, depending on the type of file you wish to export. The default file name is the truncated name of the site configuration file with the .csv or .txt extension. However, you may wish to change the file name to indicate a date representative of the log you are saving, for instance.



5. Click the **OK** button to export the file.

6. You will be asked whether you would like to include header information in the file that is saved. The header provides two lines of basic site information and titles for the columns of data.

!

*The CSV file format is considered a **Text** format by most spreadsheet and database software. When you open the .csv file created by ProView, be sure to specify that you are opening a Text file. For instance, in Excel, in the **File….Open** dialog box, choose **Text Files** from the list in the **File of type** list box.*

FYI

*A word about the date format in the exported files: Discrete and event data are exported using a time stamp in which the date and the time are in separate columns or separated by a comma (for example, 9/15/2000,09:39:08). Analog data are exported using a <u>combined</u> date/time in standard Windows format (which is the decimal equivalent of the number of days and fractions of a day since January 1, 1900). When an analog data file is opened in a spreadsheet or database software package, you will probably want to reformat the date/time information in the leftmost column. For instance, in Excel, select the column, choose **Format….Cells**, and select a **Number** format that includes <u>both</u> the date and the time.*

CHAPTER 7: OTHER OPERATIONS

This chapter explains how to save the site setup, print current operating data to a file, view the process configuration, use the annunciator feature and exit the program.

Saving the Site Configuration to File

While you work in ProView, you may change certain system settings that are stored in your site configuration (or .pvs) file. Examples of some of the parameters stored with your site file include remote communication settings, passwords, and notes for your tagnames. You should save your .pvs file before closing ProView if you make any changes to these parameters.

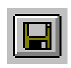
FYI

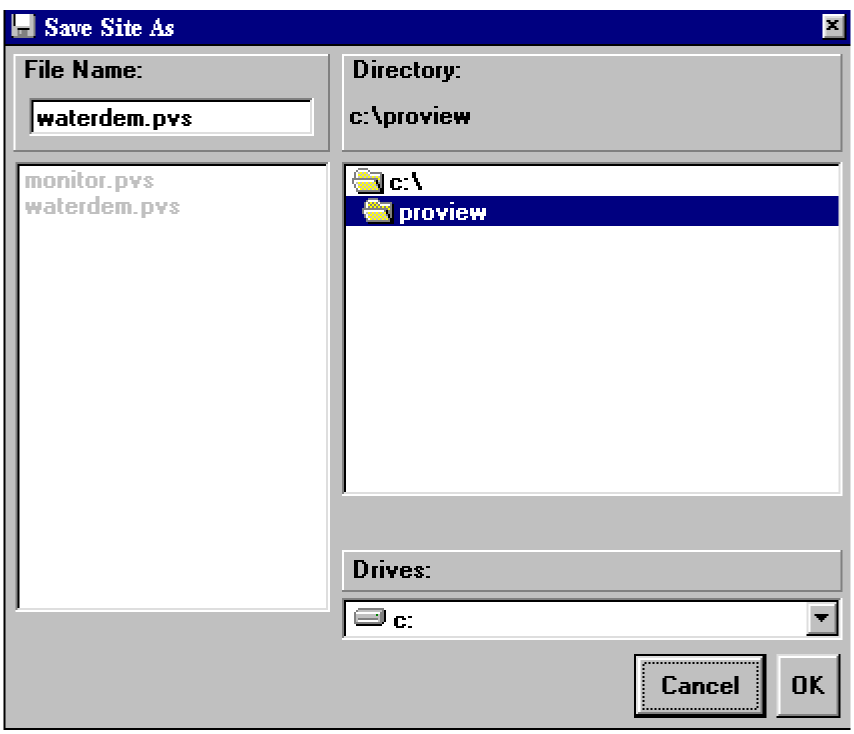
Remember that most operational settings, such as alarm levels, fax report numbers, datalogging setup, PID gains, etc. are stored in the ProControl unit, not in your site file. ProView "pulls up" this information stored in the ProControl unit when you connect to it. There is no need to save your site file if you only make changes to these operational settings.

To save your site configuration do the following:

1. Click on **Save Site** or **Save Site As…** in the **File** menu.

   Or

   Click on the **Save File** button on the toolbar.  The **Save Site As** dialog box appears. If you chose **File…Save Site**, ProView bypasses the dialog box.



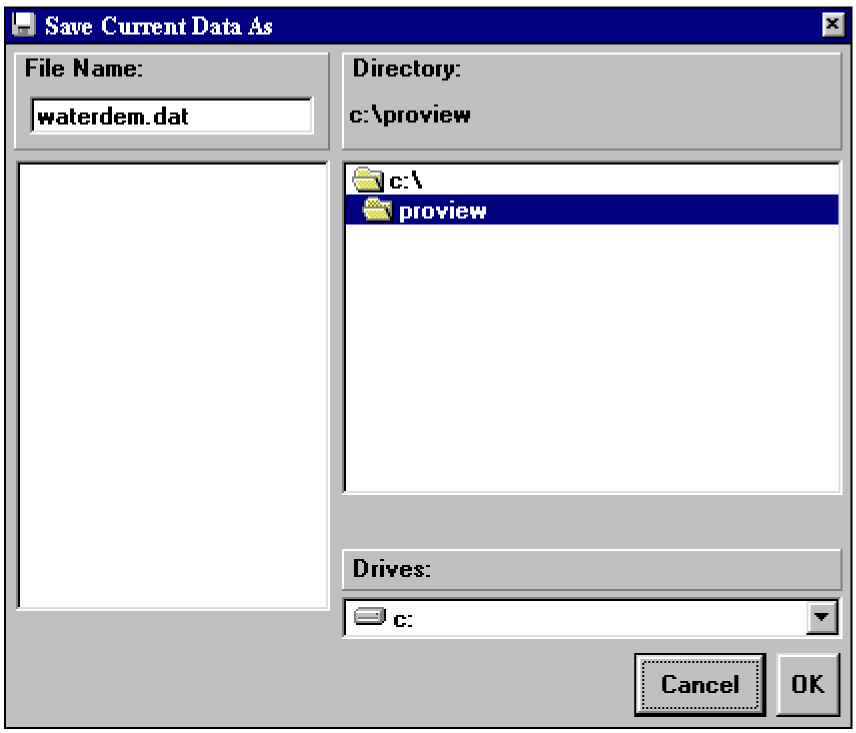
2. Select the **Drive**, **Directory** and **File Name** you would like and click on the **OK** button to save the file. You will be asked whether you wish to overwrite the existing file. Choose **Yes** to complete the file save.

Printing the Current Data to File

While you are connected to your ProControl via ProView, you can print the current operating data to a text file for future reference. This can prove useful for documentation and reporting purposes.

To save your current process data to a text file, do the following:

1. Click on **Print Current Data** in the **File** menu. You will see the **Save Current Data As** dialog box.



2. Select the **Drive**, **Directory** and **File Name** you would like. ProView selects a default file name for you, which is the name of the site configuration file with a .dat file extension. However, you may wish to change the file name to indicate a date representative of the information you are saving, for instance. Click the **OK** button to save the current data to the file.

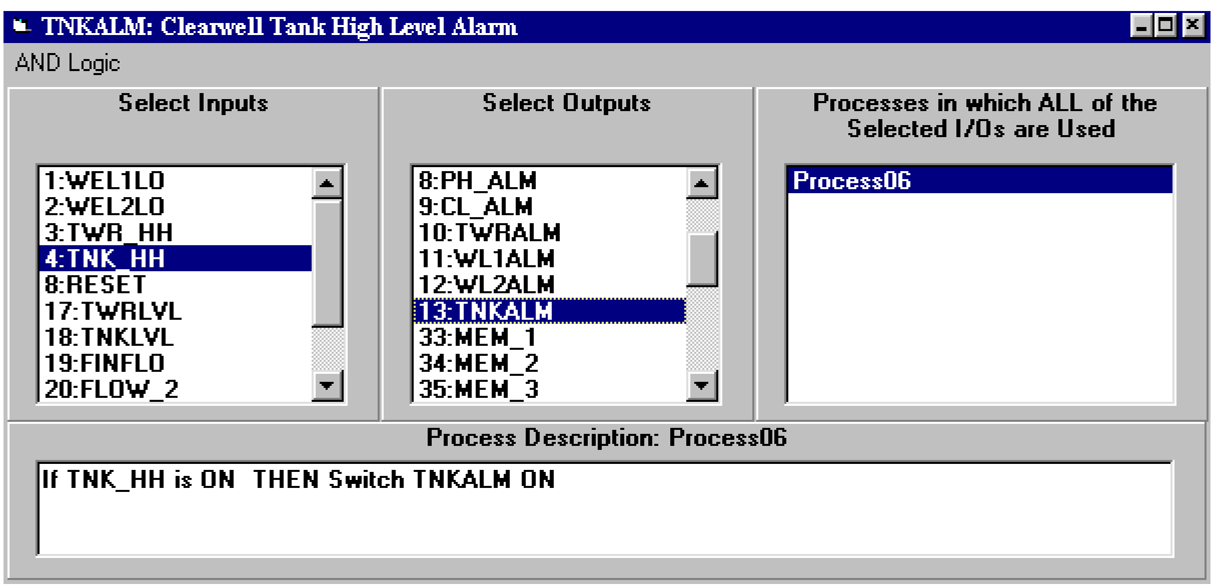
You can examine the current data file with any text editor or word processor. An example of a file generated for our sample operation is shown on the following pages.

```
                            EOS RESEARCH LTD.
                           ProControl Series II+

                   ProView Current Operational Information

          **********************************************************************
          ***** FAX Recipient:     BULLWINKLE MOOSE                        *****
          ***** Customer:          MAYBERRY WATER DEPT                     *****
          ***** Site Location:     MAYBERRY RFD                            *****
          **********************************************************************
          ***** Setup:             1                                       *****
          ***** Option:            B                                       *****
          ***** Type:              102                                     *****
          ***** Serial Number:     7429                                    *****
          ***** Date:              04/23/2000                              *****
          ***** Time:              14:52:35                                *****
          ***** ProView:           Version 2.153                           *****
          **********************************************************************

     ******************************************************************
     ***** Communications State:   REMOTE CONNECT                 *****
     ***** System Mode:            Auto 14                        *****
     ***** Last Shutdown:          Last Shutdown 12:28:27 , 2/20/2000 , Remote
                                                                  *****
     ***** Alarms:                 Alarms SET                     *****
     ***** FAX:                    Report ON                      *****
     ******************************************************************


THE CURRENT INPUT STATUS:

#  TAGNAME CURRENT VALUE LO ALARM  HI ALARM     TOTALIZER        HOURS ON      HOURS OFF
-- ------- ------------- --------- --------- ---------------   -------------  -------------
1  WEL1LO  is OFF                                               000,000  23.6  002,704  52.8
2  WEL2LO  is OFF                                               000,000  02.7  002,705  13.8
3  TWR_HH  is OFF                                               000,000  01.0  002,705  15.5
4  TNK_HH  is OFF                                               000,000  01.5  002,705  14.9
8  RESET   is OFF                                               000,000  00.8  002,705  15.7
17 TWRLVL  41.0 FT      30.0      55.0                          000,044  36.7  002,660  39.6
18 TNKLVL  10.07 FT     9.00      11.00                         000,018  38.8  002,686  37.7
19 FINFLO  220.0 GPM    0.0       600.0     2,707,032   GAL     000,749  30.0  001,955  46.4
20 FLOW_2  178.1 GPM    0.0       400.0     11,535,456  GAL     000,758  50.8  001,946  25.6
21 FLOW_1  95.8 GPM     35.8      170.0     10,479,505  GAL     000,003  03.4  002,702  13.1
22 FIN_PH  8.39 PH      7.50      8.50                          001,004  05.6  001,701  10.8
23 FIN_CL  0.99 PPM     0.80      1.15                          000,499  10.1  002,206  06.3

THE CURRENT OUTPUT STATUS:

#  TAGNAME CURRENT VALUE                                         HOURS ON      HOURS OFF
-- ------- -------------                                       -------------  -------------
1  WLPMP1  is  ON                                               001,871  40.2  000,833  36.1
2  WLPMP2  is  ON                                               001,871  26.7  000,833  48.8
3  FINPMP  is  ON                                               001,871  27.5  000,833  48.5
4  CHLMET  is  ON                                               001,655  51.6  001,049  24.9
5  NAOMET  is  ON                                               001,099  11.9  001,606  04.6
8  PH_ALM  is OFF                                               000,991  03.1  001,714  13.3
9  CL_ALM  is OFF                                               000,485  39.2  002,219  37.3
10 TWRALM  is OFF                                               000,028  11.2  002,677  05.1
11 WL1ALM  is OFF                                               000,000  12.0  002,705  04.6
12 WL2ALM  is OFF                                               000,000  00.1  002,705  16.5
13 TNKALM  is OFF                                               000,003  42.3  002,701  34.3

THE CURRENT ANALOG OUTPUT STATUS:

#  TAGNAME  VALUE  PID Mode SETPOINT  P Gain I Gain  D Gain  MAX CHG
-- ------- ------- -------- --------- ------ ------- ------- -------
1  VSPMP1  39.1  %   ALG    40.0      10.0   .010    0.1     5.0   %
2  VSPMP2  46.9  %   ALG    10.00     7.33   .010    0.5     5.0   %
3  NAOHFD  32.0  %   ALG    8.25      9.16   .010    0.1     5.0   %
4  CHLRFD  22.3  %   ALG              50                     5.0   %
```

```
ANALOG OUTPUT NOTES
-------------------
VALUE   - The current output level expressed as a percentage 0%=4ma 100%=20ma.
MAN     - (Manual) The PID or PRO control loop algorithm has been turned off.
PID     - The (Proportional, Integral, Derivative) control loop is running.
PRO     - The open loop (Proportional) algorithm is running.
MAX CHG - The maximum amount the output can change in one control cycle.


THE CURRENT REPORTING SETUP:

     ****************************************************************************
     ***** Report Enable:          ON                                      *****
     ***** FAX Number 1:           1 (999) 555-1234                        *****
     ***** FAX Number 2:           555-4321                                *****
     ***** Scheduled FAX:          Every Day at:       07:00               *****
     ***** Next Scheduled FAX:     07:00                                   *****
     ***** Pager #1:               Enabled, Numeric                        *****
     ***** Pager #2:               Enabled, AlphaNumeric                   *****
     ***** Paging:                 Will occur at 2400 baud                 *****
     ***** Page Number 1:          1 (700) 555-6789                        *****
     ***** Pager ID    1:          9876543                                 *****
     ***** Page Number 2:          1 (700) 555-6789                        *****
     ***** Pager ID    2:          3456789                                 *****
     ****************************************************************************

THE CURRENT DATALOGGING SETUP:

     ****************************************************************************
     ***** Enabled Datalogging:    Digital ,Analog ,Event                  *****
     ***** Datalogging Interval:   00:01                                   *****
     ***** Next Datalog Time:      13:47                                   *****
     ****************************************************************************
```

Reviewing the Process Configuration

ProView includes a utility that can help you understand the control logic that is programmed into your ProControl unit (if your site file is not the most up-to-date version, note that the control logic shown may not match what is in your ProControl unit). Click on **Process Configuration** under the **File** menu, and the following screen will appear, showing the inputs and outputs that are configured for your system:



By selecting inputs and outputs from the left and center columns, respectively, you will see a listing of process tasks that include your selected I/O. For instance, if you choose an output from the center column, you will see a list of processes that turn that output ON or OFF in the window on the right. Clicking on a process will provide a description in the **Process Description** window. You can select both inputs and outputs to filter the list of processes. To de-select an I/O point, **<Ctrl> - left click** on it.

Annunciators

The Annunciator feature is useful for those ProControl users that remain connected to their systems for extended periods of time via ProView. The Annunciator is a visual alarm indicator for the ProView screen that is designed to draw attention to an alarm condition that *presently exists*, or *has occurred but has now cleared*. Clicking on **Annunciation** in the **File** menu toggles the Annunciation feature on and off. If any discrete or analog input that is configured as an alarm input becomes *active*, the input's tagname will turn red, and the System Status panel (the panel that indicates **Auto** or **Manual** mode) will begin to flash red. The annunciator continues to flash even if the input is no longer active, so that the operator does not miss an alarm condition. To acknowledge the alarm, click on **Clear Annunciators** in the **System** menu. If an alarm condition still exists, the annunciator will begin flashing again. *Note that only those alarm conditions that occur in the current ProView session will be annunciated.*

Exiting ProView

You can exit ProView by clicking on the  at the top of the main screen or by clicking **Exit** in the **File** menu. You will be asked whether you want to save your site file and any logged date that you have extracted.

Model 400 Basic Monitoring

Features & Specifications

Features

INPUT ZONES:

- Flexible inputs that support
  Normally Open or Normally Closed contacts
  Temperature sensors: -20°F to 150°F
  Four channels
- Automatic input type confi guration.
- Programmable recognition times.
- Internal calibration.

ALARM NOTIFICATION:

- Four user defined telephone numbers
- Makes voice phone calls with customized messages for easy identifi cation.
- Built-in alarm test function to simulate and test the notifi cation process.
- Includes telephone Line Seizure.

VOICE MESSAGES

- Built in vocabulary for keypad programming and sensor readings
- Record custom voice phrases in your own voice to describe each input zone
- Record site identification message

MICROPHONE

- Internal microphone for custom voice message recording
- Monitor high sound alarms
- Microphone can also be used for remote listen-in feature

OUTPUT RELAY

- Low voltage NO/NC output relay included
- Manual or automatic alarm response switching

REMOTE ACCESS

- Call in with any Touch-Tone phone to check the status of all monitored conditions
- Make programming changes remotely from any Touch-Tone phone
- Remotely control the output relay

LOCAL ACCESS

- Keypad and speaker for local programming
- Easy voice-prompted programming
- Password-protected to restrict programming access

COMPATIBILITY

- The Sensaphone 400 is a direct replacement for the model 1104 and Cottagesitter

POWER SUPPLY

- Comes with plug-in power supply
- 24 Hour battery backup using 6 size C alkaline batteries (not included)
- Automatically monitors for power failure alarms
- International power options available

BUILT IN COTTAGESITTER CONTROL

- The built in relay can be used to remotely change the temperature of a dual setback thermostat. Provide your own, or order the FGD-0064 Thermostat from Sensaphone

Specifications

Size	71⁄2" W, 2" H, 81⁄2" D
Shipping Weight	4 lbs

Learn More

» Main
» Features
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Ordering Information

Sensaphone 400
FGD-0400
MSRP: $395.00

Sensaphone 400 w/ International Power Supply
FGD-0400-INT
MSRP: $415.00

Accessories

Accessory Wire
FGD-0010
MSRP: $6.00

ISOTEL Surge Protector
FGD-0023
MSRP: $100.00

Dual Setback Thermostat for 400/800
FGD-0064
MSRP: $69.00

12V Power Supply for Thermostat
XFR-0024
MSRP: $6.00

Monitoring Sensors

Magnetic Reed Switch
FGD-0006
MSRP: $10.00

Infra-Red Motion Detector
FGD-0007
MSRP: $79.00

Spot Water Detector
FGD-0013
MSRP: $90.00

Temp Alert
FGD-0022
MSRP: $65.00

Humidistat
FGD-0027
MSRP: $40.00

Smoke Detector 110VAC
FGD-0049
MSRP: $55.00

Smoke Detector 110VAC with Battery backup
FGD-0049-B
MSRP: $65.00

PowerOut Alert MODEL PS-110
FGD-0054
MSRP: $59.00

Zone Water Detector
FGD-0056
MSRP: $135.00

Extra 10' Water Detection Rope
FGD-0063
MSRP: $70.00

Remote Temperature Sensor 2.8K
FGD-0100
MSRP: $20.00

Batteries	(6) 1.5 Volt "C" cell alkaline (not included)
Telephone Connection	FCC approved RJ-11 plug-in modular connector with 6' cord
Operating Temp. Range	Unit should be kept between 32° F and 120° F
Temperature Sensing Range	-20º F to 150º F with remote temperature sensor
	NRTL listed for compliance with U.L. Standard 60950-1

2.8K Weatherproof Temperature
FGD-0101
MSRP: $30.00

Float Switch
FGD-0222
MSRP: $39.00

Product Quick Links

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SENSAPHONE®
DESKTOP MONITORING SYSTEM

Model 400
User's Manual

Stay informed and in control of vital environmental conditions and processes with the fully-programmable ***Sensaphone® Model 400.***

PHONETICS, INC.

LIT-0129

SENSAPHONE®

Model 1104

User's Manual

including CottageSitter, BusinessSitter,
RemoteControl & 1114 Line Seizure editions

Version 1.43

PHONETICS, INC.

Revised Edition, version 1.43, November, 2004

Written and produced by Phonetics. Inc.

Please address all comments on this publication to:

PHONETICS, INC.
901 Tryens Road
Aston, PA 19014
www.sensaphone.com

IMPORTANT SAFETY INSTRUCTIONS

Your Model 1104 has been carefully designed to give you years of safe, reliable performance. As with all electrical equipment, however, there are a few basic precautions you should take to avoid hurting yourself or damaging the unit:

- Read the installation and operating instructions in this manual carefully. Be sure to save it for future reference.
- Read and follow all warning and instruction labels on the product itself.
- To protect the Model 1104 from overheating, make sure all openings on the unit are not blocked. Do not place on or near a heat source, such as a radiator or heat register.
- Do not use your Model 1104 near water, or spill liquid of any kind into it.
- Be certain that your power source matches the rating listed on the AC power transformer. If you're not sure of the type of power supply to your facility, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Do not overload wall outlets and extension cords, as this can result in the risk of fire or electric shock.
- Never push objects of any kind into this product through ventilation holes as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.
- To reduce the risk of electric shock, do not disassemble this product, but return it to Sensaphone Customer Service, or other approved repair facility, when any service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the unit is subsequently used.
- If anything happens that indicates that your Model 1104 is not working properly or has been damaged, unplug it immediately and follow the procedures in Appendix D for having it serviced. Return the unit for servicing under the following conditions:

1. The power cord or plug is frayed or damaged.
2. Liquid has been spilled into the product or it has been exposed to water.
3. The unit has been dropped, or the cabinet is damaged.
4. The unit doesn't function normally when you're following the operating instructions.

- Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.

CAUTION

To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the following type and size batteries: Alkaline, size D.
2. Do not dispose of the batteries in a fire. The cell may explode. Check with local codes for possible special disposal instructions.
3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.
4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.
5. Do not mix old and new batteries in this product.

NRTL LISTED
C MET®
LISTING No: E112098

complies with
UL 60950
CSA C22.2 No. 60950

FCC Requirements

Part 68: The Sensaphone® Model 1104 complies with Part 68 of the FCC rules. On the back of the unit there is a label that contains, among other information, the FCC Registration Number and the Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your local telephone company.

The REN is useful to determine the quantity of devices that you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the REN's of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices that you may connect to your line, you may want to contact your local telephone company to determine the maximum REN for your calling area.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

Should the Model 1104 cause harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, the telephone company may temporarily discontinue service without notice and you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC. The telephone company may make changes in its facilities, equipment, operations, or procedures where such action is reasonably required in the operation of its business and is not inconsistent with the rules and regulations of the FCC that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with this equipment, or you need information on obtaining service or repairs, please contact:

PHONETICS, INC.

901 Tryens Road, Aston, PA 19014

610-558-2700 Fax: 610-558-0222

The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

Part 15: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits a designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications Statement

Notice: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, where the company's inside wiring is associated with a single line, individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device to prevent overloading. The termination on loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100. For the Sensaphone® Model 1104, the Load Number is 8.

1 YEAR LIMITED WARRANTY

PLEASE READ THIS WARRANTY CAREFULLY BEFORE USING THE PRODUCT.

THIS LIMITED WARRANTY CONTAINS SENSAPHONE'S STANDARD TERMS AND CONDITIONS. WHERE PERMITTED BY THE APPLICABLE LAW, BY KEEPING YOUR SENSAPHONE PRODUCT BEYOND THIRTY (30) DAYS AFTER THE DATE OF DELIVERY, YOU FULLY ACCEPT THE TERMS AND CONDITIONS SET FORTH IN THIS LIMITED WARRANTY.

IN ADDITION, WHERE PERMITTED BY THE APPLICABLE LAW, YOUR INSTALLATION AND/OR USE OF THE PRODUCT CONSTITUTES FULL ACCEPTANCE OF THE TERMS AND CONDITIONS OF THIS LIMITED WARRANTY (HEREINAFTER REFERRED TO AS "LIMITED WARRANTY OR WARRANTY"). IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS THIS WARRANTY, INCLUDING ANY LIMITATIONS OF WARRANTY, INDEMNIFICATION TERMS OR LIMITATION OF LIABILITY, THEN YOU SHOULD NOT USE THE PRODUCT AND SHOULD RETURN IT TO THE SELLER FOR A REFUND OF THE PURCHASE PRICE. THE LAW MAY VARY BY JURISDICTION AS TO THE APPLICABILITY OF YOUR INSTALLATION OR USE ACTUALLY CONSTITUTING ACCEPTANCE OF THE TERMS AND CONDITIONS HEREIN AND AS TO THE APPLICABILITY OF ANY LIMITATION OF WARRANTY, INDEMNIFICATION TERMS OR LIMITATIONS OF LIABILITY.

1. **WARRANTOR**: In this Warranty, Warrantor shall mean "Dealer, Distributor, and/or Manufacturer."

2. **ELEMENTS OF WARRANTY**: This Product is warranted to be free from defects in materials and craftsmanship with only the limitations and exclusions set out below.

3. **WARRANTY AND REMEDY**: One-Year Warranty — In the event that the Product does not conform to this warranty at any time during the time of one year from original purchase, warrantor will repair the defect and return it to you at no charge.

This warranty shall terminate and be of no further effect at the time the product is: (1) damaged by extraneous cause such as fire, water, lightning, etc. or not maintained as reasonable and necessary; or (2) modified; or (3) improperly installed; or (4) misused; or (5) repaired or serviced by someone other than Warrantors' authorized personnel or someone expressly authorized by Warrantor's to make such service or repairs; (6) used in a manner or purpose for which the product was not intended; or (7) sold by original purchaser.

LIMITED WARRANTY, LIMITATION OF DAMAGES AND DISCLAIMER OF LIABILITY FOR DAMAGES: THE WARRANTOR'S OBLIGATION UNDER

THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AT THE WARRANTOR'S OPTION AS TO REPAIR OR REPLACEMENT. IN NO EVENT SHALL WARRANTORS BE LIABLE OR RESPONSIBLE FOR PAYMENT OF ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL AND/OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO ANY LABOR COSTS, PRODUCT COSTS, LOST REVENUE, BUSINESS INTERRUTPION LOSSES, LOST PROFITS, LOSS OF BUSINESS, LOSS OF DATA OR INFORMATION, OR FINANCIAL LOSS, FOR CLAIMS OF ANY NATURE, INCLUDING BUT NOT LIMITED TO CLAIMS IN CONTRACT, BREACH OF WARRANTY OR TORT, AND WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE. IN THE EVENT THAT IT IS DETERMINED IN ANY ADJUDICATION THAT THE LIMITED WARRANTIES OF REPAIR OR REPLACEMENT ARE INAPPLICABLE, THEN THE PURCHASER'S SOLE REMEDY SHALL BE PAYMENT TO THE PURCHASER OF THE ORIGINAL COST OF THE PRODUCT, AND IN NO EVENT SHALL WARRANTORS BE LIABLE OR RESPONSIBLE FOR PAYMENT OF ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL AND/OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO ANY LOST REVENUE, BUSINESS INTERRUTPION LOSSES, LOST PROFITS, LOSS OF BUSINESS, LOSS OF DATA OR INFORMATION, OR FINANCIAL LOSS, FOR CLAIMS OF ANY NATURE, INCLUDING BUT NOT LIMITED TO CLAIMS IN CONTRACT, BREACH OF WARRANTY OR TORT, AND WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE.

WITHOUT WAIVING ANY PROVISION IN THIS LIMITED WARRANTY, IF A CIRCUMSTANCE ARISES WHERE WARRANTORS ARE FOUND TO BE LIABLE FOR ANY LOSS OR DAMAGE ARISING OUT OF MISTAKES, NEGLIGENCE, OMISSIONS, INTERRUPTIONS, DELAYS, ERRORS OR DEFECTS IN WARRANTORS' PRODUCTS OR SERVICES, SUCH LIABILITY SHALL NOT EXCEED THE TOTAL AMOUNT PAID BY THE CUSTOMER FOR WARRANTORS' PRODUCT AND SERVICES OR $250.00, WHICHEVER IS GREATER. YOU HEREBY RELEASE WARRANTORS FROM ANY AND ALL OBLIGATIONS, LIABILITIES AND CLAIMS IN EXCESS OF THIS LIMITATION.

INDEMNIFICATION AND COVENANT NOT TO SUE: YOU WILL INDEMNIFY, DEFEND AND HOLD HARMLESS WARRANTORS, THEIR OWNERS, DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, SUPPLIERS OR AFFILIATED COMPANIES, AGAINST ANY AND ALL CLAIMS, DEMANDS OR ACTIONS BASED UPON ANY LOSSES, LIABILITIES, DAMAGES OR COSTS, INCLUDING BUT NOT LIMITED TO DAMAGES THAT ARE DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL, AND INCLUDING ATTORNEYS FEES AND LEGAL COSTS, THAT MAY RESULT FROM THE INSTALLATION, OPERATION, USE OF, OR INABILITY TO USE WARRANTORS' PRODUCTS AND SERVICES, OR FROM THE FAILURE OF THE WARRANTORS' SYSTEM TO REPORT A GIVEN EVENT OR CONDITION, WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE.

YOU AGREE TO RELEASE, WAIVE, DISCHARGE AND COVENANT NOT TO SUE WARRANTORS, THEIR OWNERS, DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, SUPPLIERS OR AFFILIATED COMPANIES, FOR ANY AND ALL LIABILITIES POTENTIALLY ARISING FROM ANY CLAIM, DEMAND OR ACTION BASED UPON ANY LOSSES, LIABILITIES, DAMAGES OR COSTS, INCLUDING BUT NOT LIMITED TO DAMAGES THAT ARE DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL, AND INCLUDING ATTORNEYS FEES AND LEGAL COSTS, THAT MAY RESULT FROM THE INSTALLATION, OPERATION, USE OF, OR INABILITY TO USE WARRANTORS' PRODUCTS AND SERVICES, OR FROM THE FAILURE OF THE WARRANTORS' SYSTEM TO REPORT A GIVEN EVENT OR CONDITION, WHETHER OR NOT CAUSED BY WARRANTORS' NEGLIGENCE, EXCEPT AS NECESSARY TO ENFORCE THE EXPRESS TERMS OF THIS LIMITED WARRANTY.

EXCLUSIVE WARRANTY: THE LIMITED WARRANTY OR WARRANTIES DESCRIBED HEREIN CONSTITUTE THE SOLE WARRANTY OR WARRANTIES TO THE PURCHASER. ALL IMPLIED WARRANTIES ARE EXPRESSLY DISCLAIMED, INCLUDING: THE WARRANTY OF MERCHANTIBILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR USE AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND THE WARRANTY OF NON-INFRINGEMENT AND/OR ANY WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

It must be clear that the Warrantors are not insuring your premises or business or guaranteeing that there will not be damage to your person or property or business if you use this Product. You should maintain insurance coverage sufficient to provide compensation for any loss, damage, or expense that may arise in connection with the use of products or services, even if caused by Warrantors' negligence. The warrantors assume no liability for installation of the Product and/or interruptions of the service due to strikes, riots, floods, fire, and/or any cause beyond Seller's control, further subject to the limitations expressed in any License Agreement or other Agreement provided by Warrantors to purchaser.

The agreement between the Warrantors and the Purchaser, including but not limited to the terms and conditions herein shall not be governed by the Convention for the International Sale of Goods. Where applicable, the Uniform Commercial Code as adopted by the State of Delaware shall apply.

4. **PROCEDURE FOR OBTAINING PERFORMANCE OF WARRANTY**: In the event that the Product does not conform to this warranty, the Product should be shipped or delivered freight prepaid to a Warrantor with evidence of original purchase.

5. **LEGAL REMEDIES AND DISCLAIMER**: Some jurisdictions may not allow, or may place limits upon, the exclusion and/or limitation of implied warranties, incidental damages and/or consequential damages for some types of goods or products sold to consumers and/or the use of indemnifi-

cation terms. Thus, the exclusions, indemnification terms and limitations set out above may not apply, or may be limited in their application, to you. If the implied warranties can not be excluded, and the applicable law permits limiting the duration of implied warranties, then the implied warranties herein are to be limited to the same duration as the applicable written warranty or warranties herein. The warranty or warranties herein may give you specific legal rights that will depend upon the applicable law. You may also have other legal rights depending upon the law in your jurisdiction.

6. **CHOICE OF FORUM AND CHOICE OF LAW**: In the event that a dispute arises out of or in connection with this Limited Warranty, then any claims or suits of any kind concerning such disputes shall only and exclusively be brought in either the Court of Common Pleas of Delaware County, Pennsylvania or the United States District Court for the Eastern District of Pennsylvania.

Regardless of the place of contracting or performance, this Limited Warranty and all questions relating to its validity, interpretation, performance and enforcement shall be governed by and construed in accordance with the laws of the State of Delaware, without regard to the principles of conflicts of law.

Effective date 05/01/2004

PHONETICS, INC. d.b.a. SENSAPHONE
901 Tryens Road
Aston, PA 19014
Phone: 610.558.2700 Fax: 610.558.0222
www.sensaphone.com

TABLE OF CONTENTS

Chapter 1: Introduction

The Sensaphone® Model 1104 is a fully-programmable, environmental monitoring system that offers extensive on-site and remote monitoring capability to small businesses, private homes, farms, greenhouses, computer rooms, and remote facilities. Designed for desktop or wall mounting, the Model 1104 is simple to install, program and operate; no changes to standard electrical or telephone service are required. Connected to a telephone line, it will respond to an alarm by dialing up to four separate telephone numbers. When the call is answered, an “Alert Condition” message is delivered in digitized speech.

The Model 1104 features built-in sensors to monitor a variety of conditions:

- High sound level
- AC electric power failure
- Battery backup
- Temperature*

*Note: While technically not a “built-in” sensor, temperature is factory installed on input 1, and if left installed will limit your additional inputs as listed below to 3.

1104 is equipped with 4 alert inputs. Additional sensors* can be added to extend monitoring capabilities to include:

- Intrusion or unauthorized entry
- Water leaks and seepage
- Temperature
- Humidity
- Equipment operation
- Many other conditions that may require unique monitoring solutions

* Refer to Appendix D for information on additional sensors (available separately from Sensaphone) best suited to your application.

The status of each monitored condition is readily obtained at the unit's installation site, or remotely by telephone. At the close of every Status Report, time is provided for listening to on-site sounds.

To ensure reliable operation, the Model 1104 features power backup capability; in the event of AC power failure, six D-cell batteries (not included) will continue to power the unit for approximately 24 hours.

This manual comprises the instructions and commands for installing and operating the Model 1104. The Quick Start chapter is included to speed understanding of programming and operation. Communication and Alarm Programming chapters demonstrate step-by-step methods for utilizing the full range of available features. The Troubleshooting chapter provides assistance in the event that problems are encountered.

Chapter 8 covers the features, operation and programming of special Model 1104 versions: CottageSitter, BusinessSitter, RemoteControl, and 1114 “Line Seizure” edition.

Technical Support

If any questions arise upon installation or operation of the Model 1104, please contact Sensaphone Technical Service Department, at the number shown below, and have the following information:

- Date of Purchase ________________
- Serial number of your Model 1104 __________________

Technical Support is available from 8:00AM to 5:00PM EST.

Phonetics, Inc.

901 Tryens Road

Aston, PA 19014

610-558-2700

Fax: 610-558-0222

www.sensaphone.com

Chapter 2: Installation

Correctly installing the Model 1104 will ensure proper functioning of the unit. Please read the entire chapter before starting the installation process.

Within the packaging will be a Warranty Registration Card. Please take the time to fill this out and mail. The One Year Limited Warranty is explained in the back of this manual.

2.1 Operating Environment

The Model 1104 should be installed and operated in a clean, dry area that provides space for wiring sensors to the screw terminals, near an AC power source and telephone line. Operating temperature ranges from 32° Fahrenheit (0° Celsius) to +120° Fahrenheit (+49° Celsius).

NOTE

The Model 1104 is a sensitive electronic device. Do not install the Model 1104 near strong electrostatic, electromagnetic or radioactive fields. Do not expose to humid environments, fumes, or corrosive vapors.

2.2 Mounting

Flat Mount: Place the Model 1104 on top of a desk or other horizontal surface. Wall Mount: Mount on a wall with two screws using the keyholes on the back panel of the unit. Place the screws or bolts 3 13/16" apart at the desired height from the floor. Hook the unit over the screws and toward the floor. Refer to Figure 2-1.

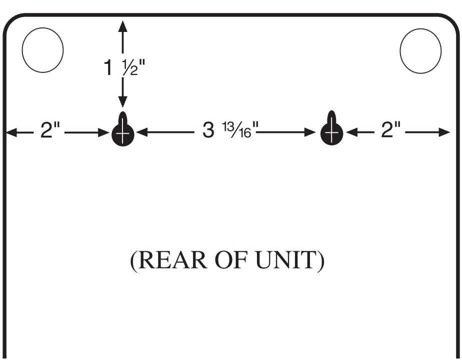


Figure 2-1. Wall Mount

2.3 Power Surge Protection

The Model 1104 can be damaged by power surges and lightning through the telephone line and the 120 VAC power supply. Although the Model 1104 has built-in surge protection, we recommend that additional protection be obtained for the unit and for any electronic equipment that is attached to your power supply and telephone lines. Power surge protection is especially important if you live in a lightning-prone area. The ISOTEL Surge Protector Model IB-4 is available through Phonetics, Inc. See Appendix D.

2.4 Power Supply and Battery Backup

The Model 1104 is provided with an AC power transformer that will plug into any standard 120 VAC outlet and a battery backup (batteries not included) that enables the unit to continue functioning if AC power is removed (due to electric power disruption or failure). The Model 1104 uses six, D-cell alkaline batteries. Do not use rechargeable nicad batteries.

NOTE

Be sure that the AC transformer is plugged into an outlet before installing batteries.

To install the batteries, open the battery compartment hatch located underneath the unit, align batteries according to the diagram shown in Figure 2-2, and replace the hatch.

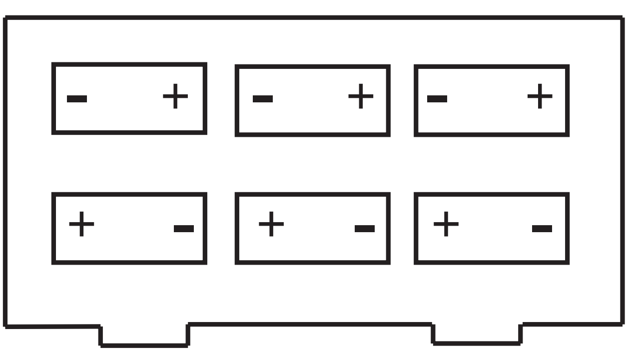


Figure 2-2. Battery Installation

2.5 Starting the Model 1104

When the AC power transformer is first plugged into the electrical outlet, the Model 1104 automatically starts in RUN mode. The red LED light will begin to glow. The unit will respond with,“Hello, this is Sensaphone 1104.”

2.6 Run Mode and Standby Mode

Pressing the RUN/STANDBY key on the Model 1104 keypad will alternately activate or deactivate the unit. If the unit is activated and in RUN mode, the red LED (small red light on the upper right of the unit’s front panel) glows steadily. In STANDBY mode, the red LED goes out, but will blink every few seconds to indicate that power is still supplied to the unit.

In RUN mode, the Model 1104 is able to receive incoming calls and to dial out automatically in the event of an alarm on one of the monitored conditions. To enter STANDBY mode, press RUN/STANDBY.

As soon as the Model 1104 enters STANDBY mode, it responds with “Have a good day.” The red light immediately goes out and then resumes with a blink every few seconds. While in STANDBY mode, all functions are disabled, but programmed memory is preserved. Upon exiting STANDBY mode, any currently existing alert conditions will be announced.

NOTE

STANDBY mode is not equivalent to “power off”—an electrical source, such as the 120 VAC, or the battery backup, continues to provide full power to the unit. If the unit is placed in STANDBY mode, unplugged from the 120 VAC outlet, and placed in storage, the batteries will continue to power the Model 1104, discharging until they fail. Consequently, batteries should always be removed from the unit following disconnection from any 120 VAC outlet, prior to storage.

Press the RUN/STANDBY key again to return to RUN mode.

Figure 2-3. The RUN/STANDBY Key

2.7 Telephone Line

The Model 1104 will operate with all standard telephone systems that accept pulse or tone dialing. The Model 1104 cannot be used on an extension line to dial its own telephone number. Also, it may not be installed on a party line or pay telephone line.

Certain private telephone systems and public switching equipment may not accept the Model 1104 dialing or may generate an unacceptable ring signal. In those cases, a dedicated line may be required. Consult the supplier of your telephone system if you encounter problems.

If you do not have a modular telephone extension at the Model 1104's location, you must contact your local telephone company to have one installed (there is a charge for this service). If you have four-pin jacks, adapters are available to convert them to the modular plugs. Contact your local telephone company or electronics parts store.

CAUTION

Never install telephone wiring during a lightning storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Use caution when installing or modifying telephone lines.

To install the telephone line, plug the modular telephone jack provided into any standard RJ11 phone outlet.
Refer to Figure 2-4.

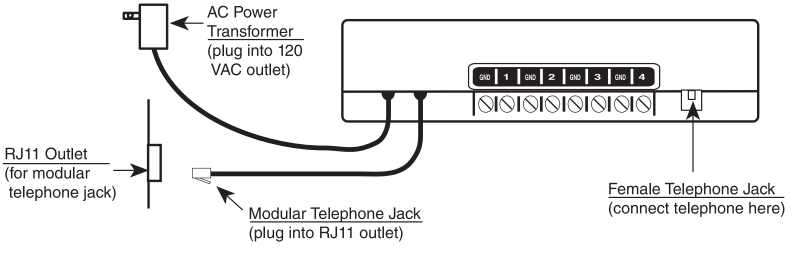


Figure 2-4. Installing the Telephone Line

On the back of the Model 1104 is a female telephone jack. This is provided so that a telephone or other answering device may be used on the same line as the unit. It is not necessary to hook up a telephone for the Model 1104 to operate.

2.8 The Microphone

The Model 1104 is provided with a built-in microphone which is used to monitor high sound levels produced near the installation site. The sensitivity of the microphone is configurable and will detect a continuous as well as a pulsating alarm. Note that beeping alamrs that have a half second or more of silence between beeps will not be detected.

Other programming options that apply to the microphone include setting the length of time before a high sound causes an alarm.

If this sound level exists for 8 consecutive seconds (default) or for the programmed length of time, the Model 1104 will dial out with an alarm message.

NOTE

The proximity of the audible alarm to the microphone is extremely important.

Normally, the Model 1104 and the audible alarm must be in the same room. The maximum distance can vary considerably depending on the alarm, the acoustics, and the size of the room.

During an alarm dial-out, the microphone allows four-second intervals to listen-in to sounds at the Model 1104's location.

When calling for a Status Report, the microphone permits listening to on-site sounds for a programmed time interval.

2.9 Alert Inputs

The Model 1104 can monitor up to 4 inputs (represented by the numbered terminal screws shown in Figure 2-5, below).

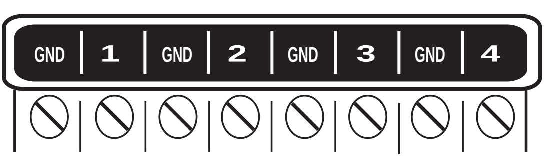


Figure 2-5. Alert Inputs

Inputs are configured as either dry contact or temperature. An input configured as dry contact can be used with any normally open (N.O.) or normally closed (N.C.) device. "Open" refers to an opened circuit path; if conditions cause the circuit to close, an alert condition occurs. "Closed" refers to a continuous circuit path; if a closed circuit is opened, an alert condition occurs. The Model 1104 determines the way inputs are configured by the type of sensor connected to each alert input (refer to Chapter 5, Section 5.1).

An input configured as "temperature" is designed to evaluate a range of settings. The Model 1104 will read the temperature at the sensor's location and compare that value to programmed high and low temperature limits. Temperature inputs must be used with Sensaphone's Remote Temperature Sensor.

NOTE

Before wiring, it is advisable to disable the inputs to prevent accidentally tripping an alarm. See Chapter 5, Section 5.2.

Important Note regarding Ultra-Low temperature freezers:

If you are connecting the Sensaphone to an ultra-low temperature freezer (i.e. Revco, Thermo Forma, Fisher Scientific, etc...) be aware that the Sensaphone can only monitor temperatures between -20 and 150 degrees Fahrenheit. As a result, you can *only* monitor these freezers if they are supplied with the appropriate alarm terminals/contacts. Please refer to your Freezer owner's manual for proper connection.

2.10 Installing the Sensor

After you have selected the sensor, loosen the screw of the alert input and its corresponding ground. Two wire leads are used to connect any monitoring sensor. Fasten one lead to the numbered screw and the other lead to GND. Tighten both screws. If the input was not disabled, the Model 1104 may recite its "Alert Condition Exists" message as you connect the sensor. If it does, just press any key to stop it. Re-enable the input after wiring. Refer to Figures 2-6 and 2-7 for connecting a sensor to an alert input.

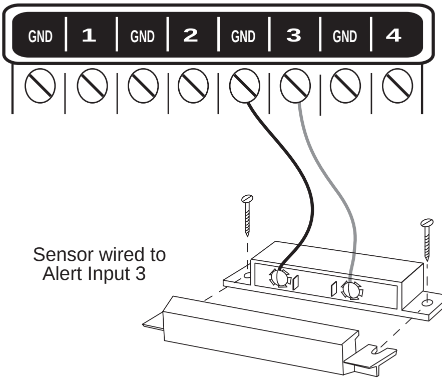


Figure 2-6. Sensor Connected to an Alert Input

Any sensor can be attached to the Model 1104 using 22-gauge wire. The sensor can be several hundred feet from the unit, as long as the total resistance of the circuit is not greater than 50 ohms. Use wire appropriate for the application.

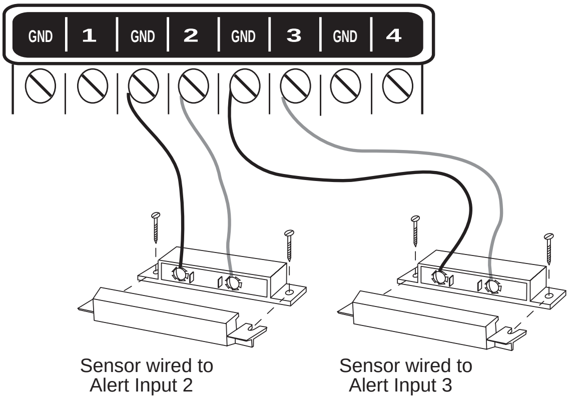


Figure 2-7. Two Sensors Wired to Adjacent Inputs

NOTE

Do not use sensors, switches, or relays that supply any voltage or current to the Model 1104. Be aware of proximity to other electrical wires or components when placing wires that lead from the sensors to the unit. Avoid running the wires near electrical devices that use high voltage or current, such as motors, heavy machinery, etc. This voltage may be inductively coupled into the sensor wiring and could result in damage to the the Model 1104's circuitry. Try to place wires at least 6 inches from other electrical wiring or devices.

2.11 Multiple Sensors

The Model 1104 may have more than one sensor connected to the same alert input, as long as the normal condition for each sensor on the same alert input is identical (either all N.O. or all N.C.). However, only one remote temperature sensor can be used on each input.

When wiring several normally closed sensors on one input, they must be connected in series. Connect one lead from the first sensor to the numbered screw of the alert input. Next, take the other lead from the first sensor and connect it to one lead from the next sensor. Continue connecting sensors end-to-end until you have connected all of your sensors. Take the second lead from the last sensor and connect it to the ground screw on the Model 1104. See Figure 2-8. Multiple N.C. sensors are typically magnetic reed switches to monitor the security of windows and doors.

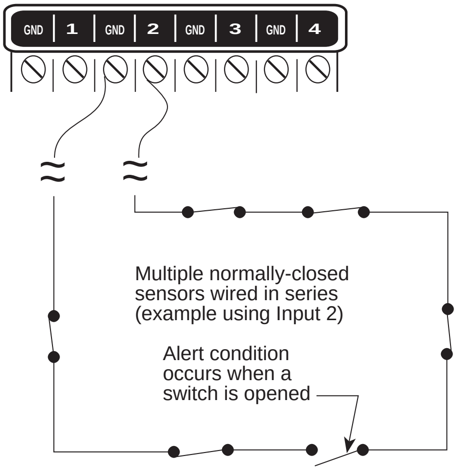


Figure 2-8. Multiple Normally Closed Sensors

To wire several normally open sensors to one alert input, connect them in parallel. To do this, take one lead from each sensor and attach it to the numbered terminal. Then, take the second lead from each sensor and attach each to the corresponding ground screw. Refer to Figure 2-9.

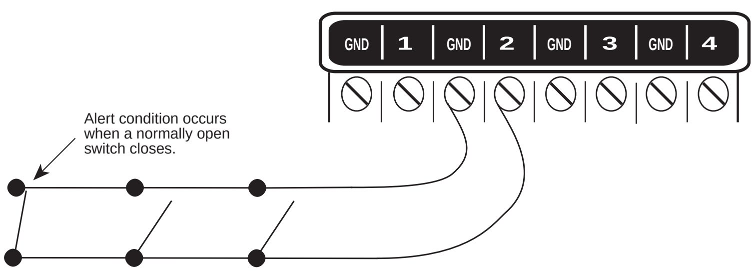


Figure 2-9. Multiple Normally Open Sensors

2.12 Outdoor Wiring

When wiring sensors outdoors, DO NOT allow exposed wires to run freely in open air; under such conditions, the Model 1104 is susceptible to serious damage during a lightning storm.

Depending upon the distance outdoor wiring must travel, consideration should be given to the use of shielded wire inside a metal conduit. Both shield and conduit should be connected to an earth ground. This prevents stray voltage from entering the unit.

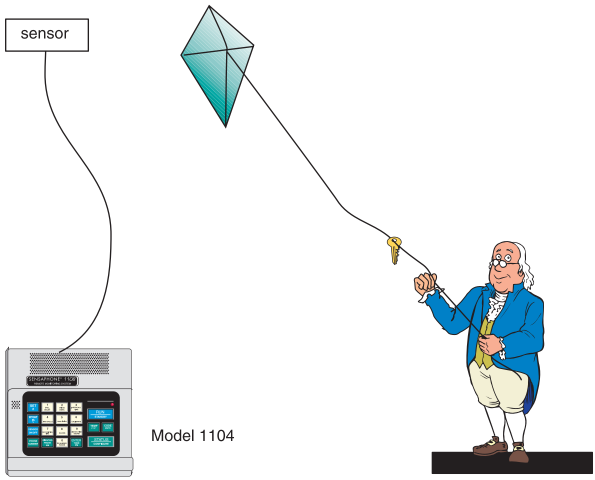


Figure 2-10. Potential Sensor Damage from Stray Electrical Noise

2.13 Disconnecting the Model 1104 for Storage or Seasonal Use.

If you plan to employ the Model 1104 as a seasonal "watchdog" for a few months during the year, **you must disconnect all wires from the unit completely to avoid damage to the circuitry when the unit is not in use**. If the unit is unplugged but left in place with all the sensors still connected, the wires act as antennae that draw in any stray "electrical noise" from such devices as fans, blowers, microwaves, etc.

Additionally, it is important to remove the batteries, or they will discharge until they fail.

Preserve your Model 1104 during the off-season, or when not in use:

- Remove the sensor wires at the screw terminals
- Remove the batteries
- Unplug the unit and store in a safe place

Chapter 3: Quick Start

This section presents a useful guide for first-time programming of the Model 1104. Follow instructions for installation before attempting to program the Model 1104. Refer to Chapter 2: Installation.

3.1 The Local Keypad

Programming is accomplished using the local keypad (shown below, Figure 3-1). Notice that a single key has several functions assigned to it; programming results are determined by the order in which keys are pressed.

Individual keystrokes are illustrated to show programming steps in the correct order. If you make a mistake by entering the wrong key, do not press another key until you hear the message *"Error 1."* Then, start over with the first key in the programming sequence.

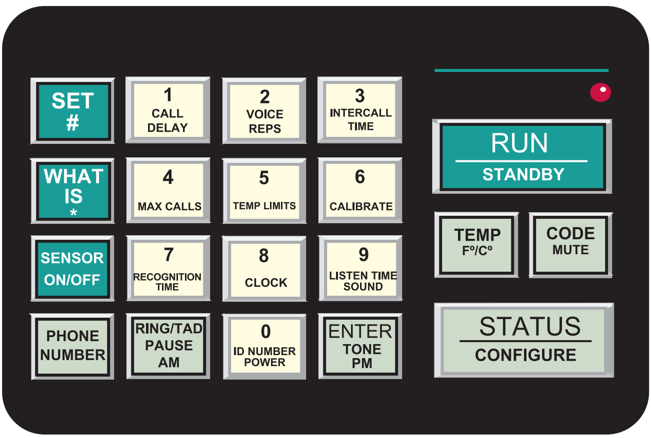


Figure 3-1. The Model 1104 Keypad

3.2 Preparation for Programming

Read complete instructions in Chapter 2: Installation, and make sure to follow these three steps first:

1. Plug the AC adaptor into the 120 VAC outlet.
2. Install the batteries.

3. Connect the Model 1104 to a telephone line.

When these steps are completed, the Model 1104 is fully operational and able to monitor temperature, high sound, AC power failure and battery backup condition; it can also be called on the telephone for a Status Report or used for listening to on-site sounds from any remote location. Now, the unit is ready for programming.

3.3 Quick-Start Programming Steps

Step 1: Set Configuration of Inputs

The Model 1104 will scan the 4 external inputs and determine if they are N.O. (normally open), N.C. (normally closed), or Temperature. If external sensors are added, make sure they are in their normal positions before proceeding—refer to Chapter 5, Section 5.1.

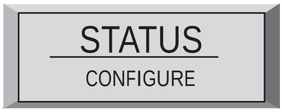
1. Press STANDBY to place the Model 1104 in Standby mode.

2. If you have external sensors available, wire the sensors to the inputs on the back of the Model 1104 (see Chapter 2, Section 2.10). Otherwise, skip this step and move to step 3.

3. Press RUN. The red light glows when the Model 1104 returns to Run mode.

4. Press SET.

5. Press CONFIGURE.



6. The Model 1104 will audibly recite the new configuration for each of the four inputs, responding with "*OK*," if it detects N.O. (normally open), "*beep-OK*," if it detects N.C (normally closed) or "*Temperature*," if it detects temperature (regardless of whether all the inputs have attached sensors or not). If an input is unused, it is treated as normally open.

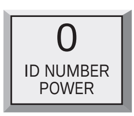
Step 2: Set the ID Number

It is recommended that you set the ID number to reflect the telephone number on which the Model 1104 is installed.

1. Press SET

.

2. Press ID NUMBER.



3. Using the number keys, enter the digits (up to 16 are permitted) for the ID number. The Model 1104 will recite the digits as they are pressed.

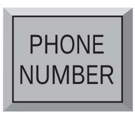
4. Press ENTER. The 1104 will respond: *"Enter."*

Step 3: Set Dial-Out Telephone Numbers

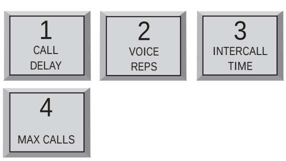
To program dial-out telephone numbers:

1. Press SET.

2. Press PHONE NUMBER.



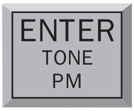
3. Select which telephone number to program. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. Model 1104 will respond: "Enter number."



4. Enter the complete telephone number using the number keys.

The Model 1104 will recite the digits as they are pressed.

5. Press ENTER. The unit will respond: *"Enter."*



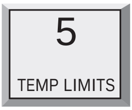
6. Repeat above procedure to program up to four separate telephone numbers.

Step 4: Set Temperature Limits

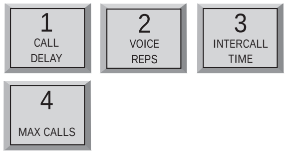
High and low temperature limits can be separately programmed for each input that is configured as temperature. Limits can range from –20° to +150° Fahrenheit, or from –30° to 65° Celsius. Default settings are: 10° F for low temperature and 100° F for high temperature. Do not set temperature limits too close to normal room temperature, since minor fluctuations could result in frequent and unnecessary alarm dialouts.

1. Press SET.

2. Press TEMP LIMITS.



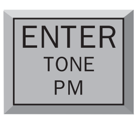
3. From the number keys, press a number (from 1 to 4) that corresponds to the temperature input being programmed.



The Model 1104 responds: *"Enter low temperature limit."*

4. Using the number keys, enter a value for low temperature limit. The Model 1104 will recite the digits as they are pressed. If a negative number is required, first press PAUSE, then enter the number.

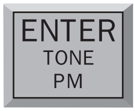
5. Press ENTER.



The Model 1104 responds: *"Enter high temperature limit."*

6. Using the number keys, enter the value for high temperature limit. The Model 1104 will recite the digits as they are pressed.

7. Press ENTER. The Model 1104 responds: *“Enter.”*



This concludes minimum programming to achieve normal operation of the Model 1104. In additon to the programming just accomplished, default settings for many more features take effect when the unit is first powered. You will be able to reprogram most of these factory-set defaults to suit your application.

For a complete explanation of each feature (with illustrations of keystrokes), refer to Chapter 4: Communications Programming and Chapter 5: Alarm Programming.

To gain a basic understanding of how the alarm dial-out feature works, refer to this chapter, Section 3-4. For extended information regarding dial-out and related programmable parameters, refer to Chapter 7: Operation.

3.4 Summary of the Alarm Dial-Out Process

Action—Response	Programmable Feature
1. THE MODEL 1104 DETECTS AN ALERT CONDITION An alert condition is not the same as a valid alarm—the condition must continue for the programmed time period, or ***Recognition Time***, before it is recognized as a valid alarm.	• **Recognition Time** This is the programmed waiting period to determine if an alert condition has persisted long enough to be considered a valid alarm. If the sensor returns to normal within recognition time, then no alarm will occur.
2. A VALID ALARM IS CONFIRMED An audible, on-site alarm message begins and continues until the alarm is acknowledged. (If the Mute feature is turned on, there is no on-site message.) ***Call Delay*** is activated.	• **Call Delay** This is the programmed waiting period, before the first telephone number is called, to report an alarm.
3. DIAL-OUT BEGINS Dial-out begins by calling telephone number 1 to report an alarm. If there is no acknowledgment, the Model 1104 waits the programmed ***Intercall Time*** before dialing subsequent telephone numbers. Dial-out continues in this manner, cycling through the remaining telephone numbers, for the programmed ***Max Calls***.	• **Intercall Time** This is the programmed waiting period, in between sequential dialing of telephone numbers, to report an alarm.
4. THE ALARM IS ACKNOWLEDGED When the alarm is acknowledged, the dial-out process is cancelled and the audible, on-site alarm message stops.	• **Max Calls** This is the total number of telephone calls that will be dialed in response to any valid alarm. Telephone numbers are dialed sequentially, and continue to cycle until the maximum number of calls is reached. If no acknowledgment occurs, then at the completion of Max Calls, all alarms are automatically acknowledged.

Chapter 4: Communications Programming

This chapter explains the keypad commands for communications programming of the Model 1104, including interrogation and resetting of the following:

- The Unit ID Number
- Dial-out Telephone Numbers
- Tone or Pulse Dialing
- Special Dialing with Pagers, Beepers and Access Numbers.
- Rings Until Answer and Telephone Answering Device Compatibility
- Listen-in Time
- Call Delay
- Local Voice Mute
- Voice Repetitions
- Intercall Time
- Maximum Number of Calls
- The Clock
- Security Code

4.1 The Unit ID Number

The Unit ID Number is the identification number of the Model 1104. This number may be the same as the telephone number where the unit is installed, or it may be designated using any number that best suits your application.

The purpose of the Unit ID Number is to immediately provide the source of any alarm, especially when using multiple Model 1104 units in a complex monitoring system. When the Model 1104 is called from a remote location, it always begins its message with the identification number:

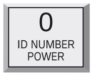
"Hello, this is telephone number (Unit ID Number)."

4.1.1 Programming the ID Number

To program the ID Number:

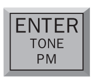
1. Press SET.

2. Press ID NUMBER.



3. Using the number keys, enter up to 16 digits for the ID number. The Model 1104 will recite the digits as they are pressed.

4. Press ENTER. The Model 1104 will respond: *"Enter."*

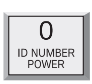


4.1.2 Interrogating the ID Number

To interrogate the ID numbers:

1. Press WHAT IS.

2. Press ID NUMBER. The Model 1104 will recite the Unit ID Number programmed.



4.2 Dial-out Telephone Numbers

The Model 1104 can store up to four 32-digit phone numbers. These are the numbers that will be called during dial-out. In the event of an alarm, the numbers are dialed sequentially, 1 through 4. Begin programming the first telephone number by assigning it to the key labeled with the number 1 on the keypad, and continue to assign any other telephone numbers in numerical order. ***A pause, pound*** or ***asterisk*** can be added to an individual phone number to access different phone and beeper systems. See *Special Dialing, Section 4.4.*

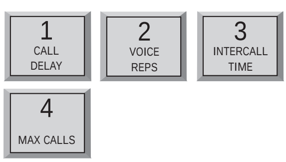
4.2.1 Programming Dial-out Telephone Numbers

To program dial-out telephone numbers:

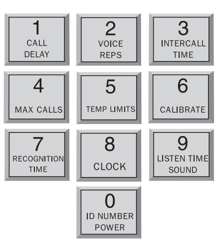
1. Press SET.

2. Press PHONE NUMBER.

3. Select which telephone number to program. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. The Model 1104 will respond: "*Enter number.*"



4. Enter the complete telephone number using the number keys.



5. Press ENTER. The unit will respond with "*Enter.*"

6. Repeat above procedure to program up to four separate telephone numbers.

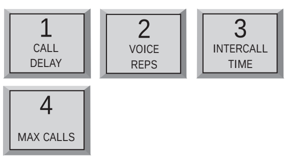
4.2.2 Interrogating a Dial-out Telephone Number

To interrogate dial-out telephone numbers:

1. Press WHAT IS.

2. Press PHONE NUMBER.

3. Press a number key (from 1 to 4).



Model 1104 will recite the corresponding telephone number. If there is no number programmed for a particular key, the unit will respond: "*No number.*"

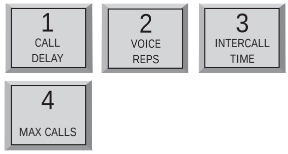
4.2.3 Erasing a Telephone Number

To erase a telephone number:

1. Press SET.

2. Press PHONE NUMBER.

3. Press the number key (from 1 to 4) representing the telephone number you want to erase.



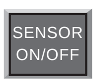
4. Press ENTER. The Model 1104 will say *“Enter.”*

4.3 Tone or Pulse Dialing

The Model 1104 can dial out in pulse or Touch Tone™. Select the type of dialing, in either pulse or tone, depending upon the type of service provided by your telephone company. The default is tone.

To program for either pulse or tone:

1. Press the SENSOR ON/OFF key.



2. Press TONE.

The Model 1104 will respond: *“Off”* to indicate that tone dialing is off and pulse is enabled, or *“On”* to indicate that tone dialing is on and pulse is disabled.

3. Repeat key sequence to switch between settings.

4.4 Special Dialing

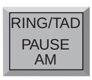
The Model 1104 has provisions for special dialing sequences. Special dialing sequences allow:

- Dialing that requires an access number to connect with an outside line.
- Dialing that requires the pound (#) or asterisk (*).
- Dialing to a beeper or pager.

4.4.1 Special Dialing Keys

The following designated keys represent special functions when used with PHONE NUMBER entries:

1. *Pause*



PAUSE represents a four-second pause in dialing. It can be used when an access number is required before dialing to an outside line. (For example, in some cases a "9" or other number, must be dialed first, in order to get a dial tone for an outside line.) When interrogating telephone numbers, PAUSE is audibly represented by a "*beep*."

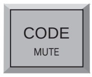
2. *Pound (#)*

A pound may be required when calling some phone or beeper systems. When interrogating telephone numbers, pound (#) is audibly represented by the word "*twelve*."

3. *Asterisk (*)*

An asterisk may be required when calling some phone or beeper systems. When interrogating telephone numbers, asterisk (*) is audibly represented by the word "*eleven*."

4. *Code*



CODE instructs the Model 1104 to wait until the call is answered before continuing. When interrogating telephone numbers, CODE is audibly represented by the word *"fourteen."*

NOTE

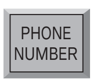
Each time a pause, pound (#) or asterisk (*) is incorporated in a programming sequence, it is counted as one digit toward the total of 32 digits allowed.

4.4.2 Incorporating a Pause

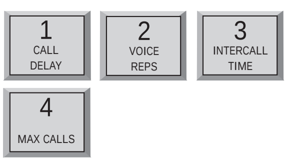
Incorporate PAUSE to access an outside telephone line:

1. Press SET.

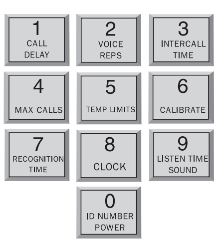
2. Press PHONE NUMBER.



3. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. Model 1104 will respond: *"Enter number."*



4. From the number keys, enter the access digit (i.e., 9). The Model 1104 will recite the digit.



5. Press PAUSE. The Model 1104 will *"beep."*

6. Enter the complete telephone number (1 + area code) using the number keys. The Model 1104 will recite the digits as they are pressed.

7. Press ENTER. The Model 1104 will say *"Enter."*

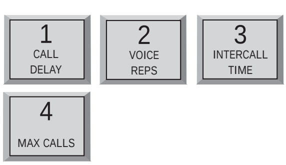
4.4.3 Incorporating a Pound (#) or Asterisk (*)

Incorporate a pound or asterisk if it is normally included in telephone number:

1. Press SET.

2. Press PHONE NUMBER.

3. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry. Model 1104 will respond: *"Enter number."*



4. Enter the telephone number using the number keys. The Model 1104 will recite the digits as they are pressed.

5. Position the pound (#) or asterisk (*) within the telephone number where required by pressing SET (where the pound is located) or WHAT IS (where the asterisk is located). The Model 1104 will "*beep*" each time pound or asterisk is pressed.

–OR–

6. Enter any remaining digits of the telephone number.

7. Press ENTER. The Model 1104 will say "*Enter.*"

4.4.4 Special Dialing to a Beeper or Pager

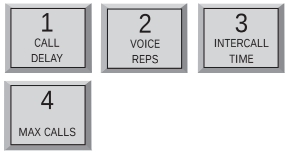
The following example demonstrates just one solution to programming the Model 1104 for dialing to a beeper or pager. Many other key sequences will also work. Start with steps 1–3 below; next, enter special dialing keys where required for your beeper or pager service.

To incorporate a pound or asterisk:

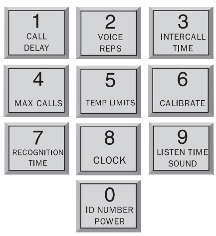
1. Press SET.

2. Press PHONE NUMBER.

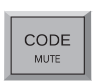
3. Press any unassigned number key (from 1 to 4) to represent the new telephone number entry.



4. Enter the complete telephone number using the number keys. The Model 1104 will recite the digits as they are pressed.



5. Press CODE. This instructs the Model 1104 to wait for the telephone call to be answered by the beeper or pager service. (A voice message will not occur—only digital tones are used.) Note that CODE may not work with beepers where there is no ring before the beeper connects. If that proves to be the case for your particular beeper, skip the CODE step and proceed from Step 4 to Step 6.



6. Now press PAUSE once to activate a four second delay. This assumes the call is answered by a beeper/pager service that immediately delivers a prerecorded voice message. PAUSE may be pressed more than once to program more time for the beeper/pager service to finish its message. Each press of PAUSE allocates four additional seconds. The Model 1104 will *"beep"* with each press.

7. Enter a telephone number or custom code number that will identify the Model 1104 as the caller to your beeper or pager. A code may consist of any number(s) you designate. Many users find it convenient to use the telephone number to which the Model 1104 is connected.

8. A pound or asterisk may be required in some dialing situations. If required, position the pound (#) or asterisk (*) within the telephone number where required by pressing SET (where the pound is located) or WHAT IS (where the asterisk is located). The Model 1104 will "*beep*" each time pound or asterisk is pressed. Enter any remaining digits of the telephone number.

–OR–

9. Press ENTER. The Model 1104 will say "*Enter.*"

Example 1 (using CODE key):

1-203-555-1123 - CODE - 621-9977-#
(beeper number) *(unit ID number)*

Example 2 (without using CODE key):

1-203-555-1123 - PAUSE - PAUSE - 621-9977-#
(beeper number) *(unit ID number)*

4.5 Rings Until Answer

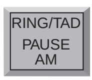
Rings Until Answer is the programmed number of times the telephone rings before the Model 1104 will answer an incoming call. This can be set from 1 to 15 rings. The default value is 4.

4.5.1 Programming Rings Until Answer

To program Rings Until Answer:

1. Press SET.

2. Press RING/TAD. The Model 1104 will respond: "*Enter number.*"



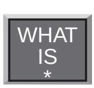
3. Using the number keys, enter a value.

4. Press ENTER. The Model 1104 will respond: "*Enter.*"

4.5.2 Interrogating Rings Until Answer

To interrogate Rings Until Answer:

1. Press WHAT IS.



2. Press RING/TAD.

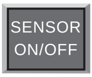
4.5.3 Double Ring Compatibility

In countries that utilize a double-ring pattern, you must enable Double Ring Compatibility in order to have the unit properly answer on the programmed number of rings.

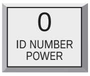
To enable/disable Double Ring Compatibility:

1. Press SET.

2. Press SENSOR ON/OFF.



3. Press 0 to Enable or press 1 to Disable.



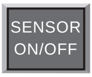
4. Press ENTER. The Model 1104 will respond : "*Enter.*"

4.5.4 Interrogating Double Ring Compatibility

To interrogate Double Ring Compatibility:

1. Press WHAT IS.

2. Press SENSOR ON/OFF. The model 1104 will say *"0"* if Double Ring Compatibility enabled and *"1"* if it is disabled.



4.6 TAD (Telephone Answering Device)

The TAD feature is especially useful because it integrates the operation of the Model 1104 with your telephone answering device in a way that retains the full flexibility of each system. This allows you to have on-demand telephone access to the Model 1104, for obtaining a Status Report, or for issuing call-in commands, while your telephone answering device is set to receive outside calls. Programming for use with a telephone answering device (TAD) is always used in conjunction with Rings Until Answer, detailed in section 4.5.

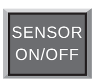
NOTE

The TAD feature only applies to answering devices connected to the same telephone line as the Model 1104.

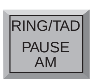
4.6.1 TAD Enable/Disable

To enable/disable the TAD feature:

1. Press SENSOR ON/OFF.



2. Press RING/TAD.



The Model 1104 will respond: *"On."* (If the Model 1104 says *"Off,"* repeat steps 1 and 2 to reactivate TAD.)

4.6.2 Using the TAD Feature

1. Make sure the TAD feature is enabled on the Model 1104. (The default setting is disabled, so you must enable it first.)
2. Determine the number of rings your telephone answering device uses to answer the telephone. (Most answering devices require 4 rings; others are selectable.)
3. On the Model 1104, program Rings Until Answer to a greater number than the number of rings set on your answering machine.

Example:

Telephone answering device, rings = 4

Model 1104, Rings Until Answer = 6

Using the procedure just outlined, all incoming calls will be answered by the telephone answering device, allowing it to operate normally. With the programming just accomplished, the Model 1104 can be accessed remotely, by telephone, to obtain the Status Report.

1. Dial the telephone number of the Model 1104.
2. Let the telephone ring once and then hang up.
3. Wait approximately ten seconds
4. Call the Model 1104 back.

It will answer the telephone on the first ring.

Explanation: The pattern of one ring, followed by a second call (within 30 seconds), signals the Model 1104 to answer your incoming call, excluding the telephone answering device.

NOTE

Special Case: If the Model 1104 shares the same line with a telephone answering device, and during certain time periods, frequent, incoming calls are expected on that line, then you may want to temporarily disable the TAD feature. If you leave the TAD enabled, it will not adversely affect normal operation, but if two outside telephone calls are received within the same 30-second time window, the Model 1104 will interpret this pattern as a signal to answer the telephone. If this occurs, press any key on the Model 1104 to hang up.

4.6.3 No TAD In Use

If a telephone answering device is not used on the same telephone line as the Model 1104, make sure that the TAD feature is disabled, or turned off. Only Rings Until Answer programming will determine how incoming calls are answered. For example, if you program Rings Until Answer to 3, incoming calls will be answered in 3 rings.

4.7 Listen-in Time

The Listen-in Time is the amount of time you can listen to sounds from the Model 1104's built-in microphone at its installation site. When you call in for a Status Report, the Model 1104 announces Listen-in Time at the end of its first round of status readings, saying, "*Listen to the sound level for (programmed time entered).*" The programmable range is from 0 to 255 seconds (or up to 4.17 minutes). The default value is 15 seconds.

NOTE

The microphone is also used to monitor high sound level. See Chapter 5, Section 5.10 through Section 5.11.1.

4.7.1 Programming the Listen-in Time

To program the Listen-in Time:

1. Press SET.

2. Press LISTEN TIME. The Model 1104 will respond: "*Enter seconds.*"

3. Using the number keys, enter the seconds. The Model 1104 will recite the digits as they are pressed.

4. Press ENTER. The Model 1104 will respond: "*Enter.*"

4.7.2 Interrogating the Listen-in Time

To interrogate the Listen-in Time:

1. Press WHAT IS.

2. Press LISTEN TIME. The Model 1104 will recite the listen time in seconds programmed.

4.8 Call Delay

Call Delay is the programmed length of time the Model 1104 waits, following detection of an alarm, before it begins the dial-out sequence. This applies only to the first call. (Delay time between calls is also programmable: refer to Intercall Time,

Section 4-11.)

The purpose for Call Delay is to allow time for personnel at the Model 1104's installation site to respond to and cancel an alarm before dial-out begins. During this time, the Model 1104 will audibly repeat its *"alert condition"* message (unless the Local Voice Mute feature has been activated—refer to Section 4.9). The default for Call Delay is 30 seconds. Call Delay can be programmed from 0 seconds to 60 minutes (1 hour).

4.8.1 Programming the Call Delay

To program the Call Delay:

1. Press SET.

2. Press CALL DELAY.

The Model 1104 will respond: "*Enter minutes.*"

3. Using the number keys, enter the minutes.

The Model 1104 recites the digits as they are pressed.

4. Press ENTER. The Model 1104 responds: "*Enter seconds*."

5. Using the number keys, enter the seconds. The Model 1104 recites the digits as you press them.

6. Press ENTER. The Model 1104 responds: "*Enter*."

4.8.2 Interrogating Call Delay

To interrogate Call Delay:

1. Press WHAT IS.

2. Press CALL DELAY.

The Model 1104 will recite the programmed Call Delay.

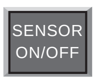
4.9 Local Voice Mute

When the Model 1104 dials out to report an alarm, it also audibly recites the alarm message at its installation site. The Local Voice Mute command allows you to turn off the voice at the Model 1104's site during alarm dialouts and status call-ins. This feature is used to prevent intruders or unauthorized persons from hearing the alarm dial-out message or from hearing the Status Report during an off-site call.

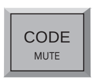
4.9.1 Enable/Disable Local Voice Mute

To enable/disable Local Voice Mute:

1. Press SENSOR ON/OFF.



2. Press MUTE.



The Model 1104 will say *"On"* to indicate that Local Voice Mute is enabled, or *"Off"* to indicate that it is disabled.

3. Repeat key sequence to switch between enabled or disabled Local Voice Mute.

4.10 Voice Repetitions

The Voice Repetitions feature allows programming of the number of times the alarm message is delivered *per phone call* during alarm dial-out.

The maximum repetitions may be set to 10; the default is

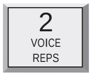
3 repetitions.

4.10.1 Programming Voice Repetitions

To program Voice Repetitions:

1. Press SET.

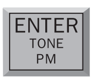
2. Press VOICE REPS.



The Model 1104 will respond: *"Enter number."*

3. Using the number keys, enter a value from 0 to 10.

4. Press ENTER. The Model 1104 will respond: *"Enter."*



4.10.2 Interrogating Voice Repetitions

To interrogate Voice Repetitions:

1. Press WHAT IS.

2. Press VOICE REPS.

The Model 1104 will recite the number programmed.

4.11 Intercall Time

The Intercall Time is the programmable period of time the Model 1104 waits in calling subsequent telephone numbers. Intercall Time is activated ***only after alarm dial-out to the first telephone number fails to be acknowledged***. This period can be programmed from 10 seconds to 60 minutes. The default intercall time is 1 minute.

If an incoming telephone call is made to the Model 1104 during Intercall Time (in between its dialing of subsequent telephone numbers to report an alarm), it will answer the incoming call and immediately report any existing alarms. The manner in which the incoming call is answered depends upon whether or not TAD is enabled or disabled:

- If TAD (Telephone Answering Device) is enabled, Rings Until Answer will be 1.
- If TAD is disabled, Rings Until Answer will be 10.

Refer to Section 4.5, Rings Until Answer; and Section 4.6, TAD (Telephone Answering Device).

4.11.1 Programming Intercall Time

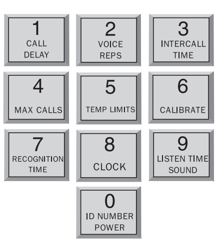
To program Intercall Time:

1. Press SET.

2. Press INTERCALL TIME.

The Model 1104 will respond: “*Enter minutes.*”

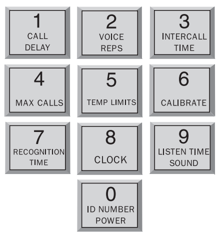
3. Using the number keys, enter the minutes.



The Model 1104 recites the digits as you press them.

4. Press ENTER. The Model 1104 will respond: "*Enter seconds.*"

5. Using the number keys, enter the seconds. The Model 1104 recites the digits as you press them.

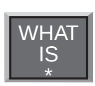


6. Press ENTER. The Model 1104 responds: "*Enter.*"

4.11.2 Interrogating Intercall Time

To interrogate Intercall Time:

1. Press WHAT IS.



2. Press INTERCALL TIME.

The Model 1104 will recite the programmed Intercall Time.

4.12 Maximum Number of Calls (Max Calls)

The Max Calls feature controls the total number of repeated calling attempts by the Model 1104 in the event of an alarm. When an alarm occurs, the dial-out process begins, and continues to cycle through your programmed telephone numbers until a maximum number of calls is reached. The Max Calls setting regulates the number of calls that will be made as a result of any alarms; if more than one alarm is detected at once, or if a second alarm occurs during dial-out on the first alarm, the Max Calls setting will start the calling process from zero, until the programmed number of calling attempts are completed.

The default setting for Max Calls is 100, but it may be programmed from 0 to 255 calls. Max Calls is cancelled when an alarm is acknowledged. If the maximum number of calls is completed and no alarm acknowledgement has occurred, the Model 1104 will automatically acknowledge any alarm and stop the dial-out.

NOTE

If only one telephone number is programmed, the Model 1104 will dial out a maximum of 15 times to report an alarm.

4.12.1 Programming Max Calls

To program Max Calls:

1. Press SET.

2. Press MAX CALLS.

The Model 1104 will respond: “*Enter number.*”

3. Using the number keys, enter a value. The Model 1104 will recite the digits as you press them.

4. Press ENTER. The Model 1104 responds: "*Enter.*"

4.12.2 Interrogating Max Calls

To interrogate Max Calls programmed:

1. Press WHAT IS.

2. Press MAX CALLS.

The Model 1104 will recite the value set for Max Calls.

4.13 The Clock

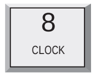
The Model 1104 has a built-in clock. The power-up time is 12 AM. The clock will keep time from 12 AM until you program the current time. It will then keep time from your programmed time. If the AC power fails, the clock will continue to keep time until the battery back-up fails. It will then reset to 12 AM when power is restored. ***An incorrect time is a good indication that the power has failed and the batteries have been expended.***

4.13.1 Setting the Clock

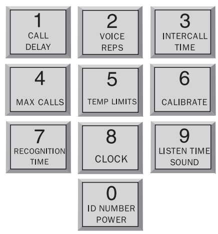
To set the clock:

1. Press SET.

2. Press CLOCK.



3. Using the number keys, enter the correct time. The Model 1104 will recite the digits as they are pressed.



4. If the time is AM, press the AM key. The Model 1104 will "*beep*." (If the time is PM , there is no key to press—the clock will be automatically set to PM if AM is not set.)

5. Press ENTER. The Model 1104 will say "*Enter*."

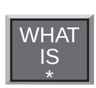
Example: You want to set the clock to 9:45 AM. Press the following keys in the order shown:

SET…CLOCK…0…9…4…5…AM…ENTER.

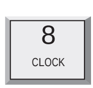
4.13.2 Interrogating for the Current Time

To interrogate the Model 1104 for the current time:

1. Press WHAT IS.



2. Press CLOCK. The Model 1104 will recite the programmed time.



4.14 The Security Code

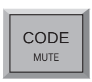
The Security Code is the last step after setting all other programming parameters for the Model 1104. The code consists of a 4-digit number you select and will effectively prevent unauthorized changes to the Model 1104's programming. When the Security Code is activated, all keyboard programming is inaccessible. The Model 1104 may be interrogated using the WHAT IS key, but the keyboard must be unlocked, via the Security Code, before any additional programming is possible.

4.14.1 Locking the Keypad

To program the Security Code:

1. Press SET.

2. Press CODE.



The Model 1104 will say "*Enter security code.*"

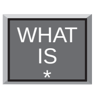
3. Using the number keys, enter 4 digits. The Model 1104 says, "*OK.*" The keyboard is now locked.

If unauthorized persons attempt to set a parameter, an error message, "*Error 2,*" is returned. Whenever any operation except WHAT IS takes place without entering the security code first, this error message occurs.

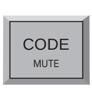
4.14.2 Unlocking the Keypad

To unlock the keyboard:

1. Press WHAT IS.



2. Press CODE.



The Model 1104 will say "*Enter Security Code.*"

3. Using the number keys, enter the digits for the code.

If the correct code is entered, the Model 1104 will say "*OK*." If the wrong code is entered, the Model 1104 will say "*Error 2*."

Chapter 5: Alarm Programming

This chapter explains the alarm programming and monitoring capabilities of the Model 1104, with specific instructions for the following features:

- Configure inputs as dry contact or temperature
- Enable/disable inputs
- Program alarm Recognition Time for each input
- Program high and low temperature limits
- Disable alarm response to high or low temperature
- Program temperature in Fahrenheit or Celsius scale
- Calibrate temperature
- Obtain current temperature
- Program AC power-failure Recognition Time
- Enable/disable AC power monitoring
- Program sound level sensitivity
- Program high sound Recognition Time
- Disable alarm response to high sound
- Use Exit Delay via Status Report

5.1 Input Configuration

In preparing the Model 1104 to sense an alert condition, the inputs must be configured as dry contact (either open or closed) or as temperature inputs. The default setting for input 1 is temperature; for inputs 2-4, the default is dry contact and open. To configure input normality, sensors are first wired to the terminal strip at the back of the unit. (Refer to Chapter 2, Section 2.9–2.12, for an explanation on wiring inputs.)

The configuration process directs the Model 1104 to initialize the 4 inputs and establish normal settings. Any change in the status of an input (for example, from a normally open contact to a suddenly closed contact) is recognized as an ***alert condition***. In the case of a temperature input, an alert condition is recognized when established temperature limits are exceeded.

NOTE

Before starting keyboard commands to configure input normality on the Model 1104, ***it is very important to check that the sensors you have wired to the unit are set in their normal, non-alarm positions.***

For example, if a magnetic reed switch (a normally-closed sensor used to detect unauthorized entry) has been wired to the Model 1104, make sure that the door or window to be monitored is shut before configuring the input. If a motion-detector is wired to the unit, it is advisable to block all sources of motion from the sensor before and during configuration.

5.1.1 Programming Input Configuration

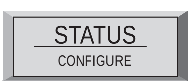
1. Press STANDBY to place the Model 1104 in Standby mode.

2. Wire sensors to the inputs to the back of the Model 1104 (see Chapter 2, Section 2.10).

3. Press RUN. The red light glows when the Model 1104 returns to Run mode.

4. Press SET.

5. Press CONFIGURE.



6. The Model 1104 audibly recites the configuration for each of the four inputs:

- If the input is ***normally open***, the Model 1104 recites the number of the input and says *"OK."*
- If the input is ***normally closed***, the Model 1104 recites the number of the input, followed by a *"beep"* and *"OK."*
- If the input is configured as ***temperature***, the Model 1104 recites the number of the input, followed by *"Temperature."*

5.1.2 Verifying Input Configuration

Input configuration can be verified when interrogating the Model 1104 for a complete Status Report. Refer to Chapter 6 for a more detailed description of the Status Report.

5.2 Enable/Disable Inputs

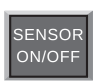
This function allows you to enable or disable an input's response to an alert condition. An enabled input will respond to an alert condition and allow dial-out. A disabled input will cause dial-out to be suppressed, but any existing alert conditions will be revealed during the Status Report. Enable/disable programming is useful during wiring of inputs (see Chapter 2) or when a condition needs to be monitored, but is not critical enough to be programmed for dial-out reporting. It is important to verify input status after performing any task that requires disabling. The default setting for all inputs is enabled (ON).

If an alert condition exists when inputs are re-enabled,

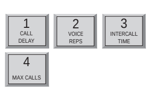
Recognition Time will restart—refer to Section 5.3.

5.2.1 Changing Enabled/Disabled Input Status

1. Press SENSOR ON/OFF.

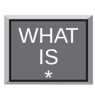


2. Press the number (1 to 4) of the selected input to enable/disable. The Model 1104 says *"Off"* to indicate disabled or *"On"* to indicate enabled.

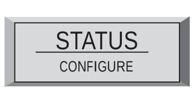


5.2.2 Verifying Enabled/Disabled Input Status

1. Press WHAT IS.



2. Press STATUS.



The Model 1104 audibly recites the current status of every input. In a Status Report, each input is first identified by its input number, followed by a report that specifies parameters currently affecting that input. ***If an input is disabled, the word "Off" immediately follows the number recited for that input.***

For example, input 3 is configured as a normally open, dry contact input. During the Status Report:

- ***If disabled***, the Model 1104 recites:
  "*Number 3—**Off**—OK,*" for input 3.
- ***If enabled***, the Model 1104 recites:
  "*Number 3—OK,*" for input 3.

In another example, input 2 is configured as a temperature input. The current temperature is 76 degrees. During a Status Report:

- ***If disabled***, the Model 1104 recites:
  "*Number 2—**Off**—76 degrees—OK.*"
- ***If enabled***, the Model 1104 recites:
  "*Number 2—76 degrees—OK.*"

5.3 Input Recognition Time

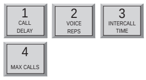
The Input Recognition Time is the length of time an alert condition must be present before a valid alarm exists and dial- out is activated. This time period is programmable, from 0 minutes, 0 seconds (for immediate response) up to a period of 272 minutes, 0 seconds. If an alert condition begins and then clears within the established Recognition Time, no dial-out will occur. When an alert condition continues beyond the programmed Recognition Time, the Model 1104 initiates dial-out. The default setting for Input Recognition Time is 0 minutes, 3 seconds.

5.3.1 Programming Input Recognition Time

1. Press SET.

2. Press RECOGNITION TIME.

3. Press the number (1 to 4) of the selected input to be programmed.

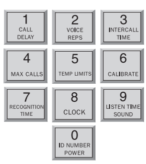


The Model 1104 responds: "*Enter minutes.*"

4. Using the number keys, enter the minutes. For example, to set a Recognition Time of five minutes, simply press "*5*" on the keypad. The Model 1104 recites the digits as they are pressed.

5. Press ENTER. The Model 1104 responds: "*Enter seconds.*"

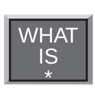
6. Using the number keys, enter the seconds. The Model 1104 recites the digits as they are pressed.



7. Press ENTER. The Model 1104 responds: "*Enter.*"

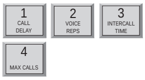
5.3.2 Interrogating Input Recognition Time

1. Press WHAT IS.



2. Press RECOGNITION TIME.

3. Press the corresponding input key (1 to 4).



The Model 1104 recites the programmed Recognition Time for that input.

5.4 Establishing High and Low Temperature Limits

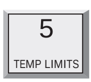
High and low temperature limits can be separately programmed for each input configured as temperature. Limits can range from –20° to +150° Fahrenheit, or from –30° to 65° Celsius.

When temperature limits exceed high or low settings, the Model 1104 will dial out with an alarm message. Default settings are: 10° F for low temperature and 100° F for high temperature.

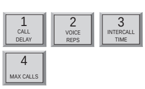
5.4.1 Programming Temperature Limits for a Selected Input

1. Press SET.

2. Press TEMP LIMITS.

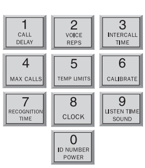


3. From the number keys, press a number (from 1 to 4) that corresponds to the temperature input being programmed.



The Model 1104 responds: *"Enter low temperature limit."*

4. Using the number keys, enter a value for low temperature limit. The Model 1104 will recite the digits as they are pressed. If a negative number is required, first press PAUSE, then enter the number.



5. Press ENTER.

The Model 1104 responds: *"Enter high temperature limit."*

6. Using the number keys, enter the value for high temperature limit. The Model 1104 recites the digits as they are pressed.

7. Press ENTER. The Model 1104 responds: *"Enter."*

NOTE

Do not set temperature limits too close to normal room temperature. Minor temperature fluctuations could result in frequent and unnecessary alarm dialouts.

5.4.2 Disabling Alarm Response to High or Low Temperature

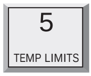
To disable alarm response to either high or low temperature settings exclusively, enter the maximum temperature limit when programming the selected input. (The Model 1104 will not respond to temperatures encountered at maximum settings or beyond.) Begin by following the key sequence shown in Section 5.4.1, and when prompted to enter the high or low temperature value:

- Set high temperature to either +150º F or +65º C (high temperature limit) to prevent the Model 1104 from responding to a high temperature alarm.
- Set low temperature to either -20° F or -30° C to prevent the Model 1104 from responding to a low temperature alarm.

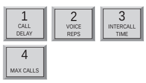
5.4.3 Interrogating High and Low Temperature Limits

1. Press WHAT IS.

2. Press TEMP LIMITS.



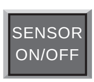
3. Press the number key corresponding to the selected temperature input.



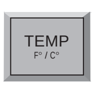
5.5 Temperature Scale

Temperature inputs may be set in either Fahrenheit or Celsius degrees. The default temperature scale is Fahrenheit. To change to Celsius:

1. Press SENSOR ON/OFF.



2. Press TEMP. The Model 1104 responds: "*Off,*" indicating Celsius scale has replaced Fahrenheit scale.



3. To return to Fahrenheit scale, repeat the key sequence. The Model 1104 responds: "*On,*" indicating Fahrenheit scale is in effect.

NOTE

When switching from Fahrenheit to Celsius, or vice versa, the change applies to all inputs configured to read temperature. When switching temperature scales it is important to reset high and low temperature limits on all temperature inputs. Refer to Section 5.4.1 to reset temperature limits.

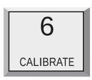
5.6 Temperature Calibration

To compensate for minor variances in sensor accuracy, an offset may be programmed for each temperature input. The amount of offset is measured in degrees Fahrenheit or degrees Celsius. Adjustments are possible within a range from -10 degrees to +10 degrees. For example, if input 3 is sensing temperature and is reading 1 degree too high, then the calibration for input 3 is set at -1 to obtain an accurate reading.

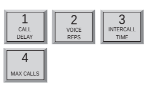
5.6.1 Programming Temperature Calibration

1. Press SET.

2. Press CALIBRATE.

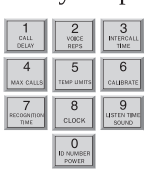


3. Press the number (1 to 4) of the selected temperature input to be calibrated.



4. Enter the number required to offset the current temperature reading so a correct reading is obtained.

   - To program a positive offset number (up to +10 degrees), enter the number on the keypad. The Model 1104 recites the digits as they are pressed.
   - To program a negative offset number (up to –10 degrees), first press PAUSE. The unit responds with a "*beep*." Next, enter the number on the keypad. The unit recites the digits as they are pressed.



5. Press ENTER. The Model 1104 responds: "*Enter.*"

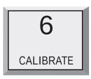
NOTE

If you find that your calibration offset exceeds more than + 5 or –5 degrees, other complicating factors could be affecting normal operation of the Model 1104. Call Sensaphone for technical assistance.

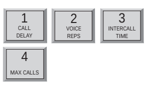
5.6.2 Interrogating Temperature Calibration

1. Press WHAT IS.

2. Press CALIBRATE.



3. Press the number key corresponding to the selected temperature input.

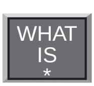


If a *"beep"* precedes the number as it is recited, then a negative offset is indicated.

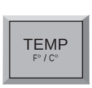
5.7 Obtaining Current Temperature

Current temperature readings for each temperature input may be accessed at any time. The Model 1104 recites the input number, and the actual temperature detected by the attached sensor, for all inputs configured as temperature. To obtain current temperature:

1. Press WHAT IS.



2. Press TEMP.



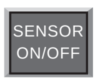
5.8 AC Power Monitoring Enable/Disable

The Model 1104 monitors AC power failure. This command enables or disables the power failure detection feature.When enabled, the Model 1104 will monitor power and dial out when AC power failure exceeds a programmable span of time (refer to AC Power Failure Recognition Time, Section 5.9).

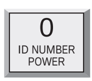
The default setting for AC power monitoring is enabled (on). When disabled, the Model 1104 will not dial-out to report power failure.

5.8.1 Enabling/Disabling the AC Power Alarm

1. Press SENSOR ON/OFF.



2. Press POWER.



   - The Model 1104 will say *"Off"* to indicate that the power alarm is disabled, or
   - The Model 1104 will say *"On"* to indicate that the power alarm is enabled.

3. Repeat key sequence to change settings.

5.9 AC Power Failure Recognition Time

The AC Power Failure Recognition Time is the length of time that AC electric power is off before a valid alarm is recognized and dial-out begins. The default setting is 5 minutes, 0 seconds, but is programmable from 0 seconds to a maximum of 272 minutes.

When AC power failure occurs, and throughout the programmed Recognition Time, the Model 1104 steadily repeats the message *"the electricity is off"* at the unit's installation site. There is no Call Delay programming available for AC power failure. Immediately following Recognition Time, the Model 1104 begins the dial-out process to report power failure.

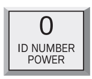
To cancel the power-failure message locally at the keypad (during or after Recognition Time) press any key on the Model 1104 keypad. This action also cancels the dial-out process. The AC power failure alarm may also be cancelled remotely, by telephone acknowledgment (see Chapter 6, Section 6.1).

5.9.1 Programming Power Failure Recognition Time

1. Press SET.

2. Press RECOGNITION TIME.

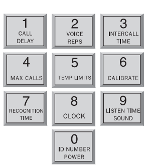
3. Press POWER. The Model 1104 responds: "*Enter minutes.*"



4. Using the number keys, enter the number of minutes. The Model 1104 will recite the digits as they are pressed.

5. Press ENTER. The Model 1104 responds: "*Enter seconds.*"

6. Using the number keys, enter the number of seconds. The Model 1104 will recite the digits as they are pressed.



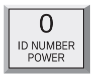
7. Press ENTER. The Model 1104 responds: "*OK.*"

5.9.2 Interrogating Power Failure Recognition Time

1. Press WHAT IS.

2. Press RECOGNITION TIME.

3. Press POWER.



The Model 1104 will recite the power Recognition Time.

5.10 Sound Alarm Monitoring

This feature allows you to program the level and duration of sound that will cause the Model 1104 to respond to an alarm and dial-out. It may be useful to desensitize the Model 1104 to sound if it is installed in an area with a relatively high noise level, or where a loud noise occurs frequently but is not associated with an alarm. In some applications, it may be desirable to increase sound sensitivity to low sound levels.

5.10.1 Programming Sound Alarm Sensitivity

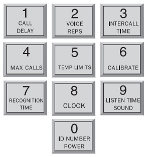
The sensitivity setting for sound alarm monitoring ranges from 1 to 255. A value of 1 makes the microphone the MOST sensitive to changes in sound. The value 255 makes the microphone the LEAST sensitive to sound. The default value is **32**.

1. Press SET.

2. Press CALIBRATE.

3. Press SOUND. The Model 1104 responds: *"Enter number."*

4. Using the number keys, enter a value for sound sensitivity.



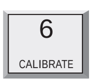
The Model 1104 recites the digits as you press them.

5. Press ENTER. The Model 1104 responds: "*Enter.*"

5.10.2 Interrogating Sound Sensitivity

1. Press WHAT IS.

2. Press CALIBRATE.



3. Press SOUND. The Model 1104 recites the programmed sound sensitivity level.

5.10.3 Programming High Sound Alarm Recognition Time

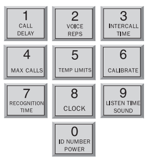
The Recognition Time for sound alarm monitoring ranges from 2 seconds to 59 seconds. The default value is **8** seconds.

1. Press SET.

2. Press RECOGNITION TIME.

3. Press SOUND. The Model 1104 responds: *“Enter seconds.”*

4. Using the number keys, enter the number of seconds. The Model 1104 will recite the digits as they are pressed.



5. Press ENTER.

5.11 High Sound Alarm Enable/Disable

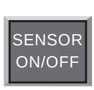
The Model 1104 monitors sound through the built-in microphone. When the sound level suddenly exceeds the programmed high sound limit, the Model 1104 will respond to an alert condition. The increased sound level must continue throughout the programmed recognition time. The default for high sound alarm is enabled (on).

NOTE

The microphone is also used for listening to on-site sounds. Refer to Chapter 4, Section 4.7. Disabling the sound alarm does not affect listen-in capability.

5.11.1 Changing Enabled/Disabled High Sound Alarm

1. Press SENSOR ON/OFF.



2. Press SOUND. The Model 1104 will say *"Off"* to indicate disabled or *"On"* to indicate enabled.

3. Repeat key sequence to change settings.

5.12 Exit Delay

When tripping an alarm is unavoidable, yet a true alert condition has not actually occurred, the alarm response, including dial-out, can be temporarily suppressed.

The Model 1104 is able to suppress and then reset its dial-out function automatically through use of the Status Report. This is especially convenient when an alert condition is created upon exiting a monitored door, and there is no way to cancel from the local keypad.

Example: You are planning to exit through a monitored door. Prior to exiting, you initiate a Status Report recitation at the Model 1104 keypad by pressing WHAT IS, followed by STATUS, (key sequence shown below). This allows you approximately 30 seconds to exit without activating the Model 1104's programmed response to an alarm. At the conclusion of the status report, normal alarm response is reactivated.

To use exit delay, initiate the Status Report.

1. Press WHAT IS.

2. Press STATUS. The Model 1104 recites the full Status Report; during this time, you are able to exit the monitored area without tripping an alarm.

Chapter 6: Acknowledgment, Status Report & Remote Access

In addition to communication and alarm monitoring capabilities, the Model 1104 will also respond to your instructions and provide you with access to information on monitored conditions at all times.

By issuing commands to the unit, either at the installation site or over standard telephone lines, the following features may be activated:

- Acknowledgment of existing alarms
- The Status Report on all monitored conditions.

6.1 Alarm Acknowledgment

When the Model 1104 dials out with an alarm message, it will request acknowledgment before hanging up. Acknowledgment indicates to the unit that the alarm message has been received. Upon acknowledgment, the Model 1104 will cancel the dial-out sequence.

There are three ways* that an alarm is acknowledged directly:

- Local Acknowledgment
- Touch-Tone™ Acknowledgment
- Callback Acknowledgment

* A fourth method of alarm acknowledgment is indirect. Refer to Max Calls, Chapter 4, Section 4.12 for an example of automatic alarm acknowledgment.

6.1.1 Local Acknowledgment

To acknowledge an alarm locally (directly at the installation site of the Model 1104), press any key.

6.1.2 Touch-Tone™ Acknowledgment

This method of remote alarm acknowledgment works with a Touch-Tone™ telephone.

Example: You receive a call from the Model 1104, reporting that an alarm exists. The message concludes: "*Indicate you have received warning message*." Now, or at any time during this call, you may acknowledge the alarm with the code **"555"** if you are using a Touch-Tone™ telephone.

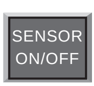
- To enter "555," press the number (5) key on the Touch-Tone™ phone keypad three times. The Model 1104 will respond: * ***"Warning message received by telephone number (last number dialed)."*** The Model 1104 will hang up and the dial-out sequence, including any further response to the alarm, will be cancelled.
- If you enter the wrong code or do not enter it within 10 seconds following the conclusion of the message, the Model 1104 will respond: ***"Dial telephone number (the programmed unit phone number) within (Intercall Time)."*** Then, the Model 1104 will hang up. The alarm is still not acknowledged until you call back. The alarm is still not acknowledged until you call back. You have a period equal to the programmed Intercall Time to call the unit back and enter the "555" acknowledgment code. If you are calling from a pulse or rotary telephone, refer to Callback Acknowledgment, Section 6.1.3, below.

6.1.3 Callback Acknowledgment

Callback Acknowledgement is a feature that allows you to acknowledge an alarm without entering Touch-Tones. This feature is disabled by default and must be enabled by entering the key sequence below. When Callback Acknowledgment is enabled, simply call the unit back and allow the line to ring 10 times. The unit will then answer the call, recite a Status Report, then say *"Warning message received by telephone number ..."* and recite the telephone number last dialed. This indicates that the alarm has been acknowledged.

To enable or disable Callback Acknowledgement:

1. Press SENSOR ON/OFF.



2. Press PHONE NUMBER.

The Model 1104 will say *"On"* to indicate that Callback Acknowledgment is Enabled, or *"Off"* to indicate that Callback Acknowledgement is Disabled. This method of remote alarm acknowledgment works with any telephone: pulse, rotary, or Touch-Tone.

Example: The Model 1104 calls you with an alarm message. You answer the call with a rotary or pulse telephone, and do the following:

- You listen to the message and hang up.
- Then you call the Model 1104 back on any telephone. You must wait for 10 rings—this signals the Model 1104 to answer your telephone call. (Make sure to call back within the programmed setting for Intercall Time—refer to Chapter 4, Section 4.11.)

When the Model 1104 answers your return call, it gives a Status Report (refer to Section 6.2). Then it says: "*Warning message received by ...*" and recites the telephone number last dialed. This indicates that the alarm has been acknowledged.

NOTE

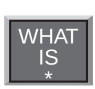
If you have the TAD feature (telephone answering device) enabled, the Model 1104 will answer the telephone on the first ring. If it is disabled, the telephone must be allowed to ring 10 times. This serves as a precaution against a random alarm acknowledgment. Refer to Chapter 4, Section 4.6, for complete information on using the TAD feature.

6.2 Status Report

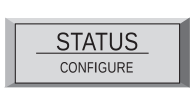
The Status Report allows access to complete information on all monitored conditions either locally, from the keypad, or by telephone, from any location. The Model 1104 will answer an incoming telephone call following the programmed Rings Until Answer (refer to Chapter 4, Section 4.5). Included with the Status Report are messages related to alarm conditions, AC power, battery backup and sound level. It also provides an opportunity for listening to on-site sounds (refer to Listen-in Time, Chapter 4, Section 4.7).

To initiate the Status Report:

1. Press WHAT IS.



2. Press STATUS.



Sections 6.2.1, 6.2.2, and 6.2.3 demonstrate two different Status Report recitations. The Status Report starts with:

"Hello. This is telephone number 555-1234 (or the programmed ID)."
"The time is 12:15PM (or the current time)."

The Model 1104 proceeds with a separate report for each input. Each input identifies itself by reciting the input number.

6.2.1 Example: Status Report, No Alarms

Inputs 2, 3, and 4 are configured as dry contact and input 1 is configured as temperature. No alarms exist. The Status Report begins by saying, "*Hello, this is telephone number 555-1234; the time is 12:15PM.*"

Following this introduction, the report continues:

"*Number 1, 74 degrees, OK.*"

"*Number 2, OK.*"

"*Number 3, OK.*"

"*Number 4, OK.*"

"*The electricity is ON.*" This refers to AC power.

"*Battery condition, OK.*" Other possible responses: "*Battery condition low*" or "*Replace batteries.*" (Refer to Section 6.2.4 for additional information regarding battery condition.)

"*Sound level, OK.*"

"*Listen to the sound level for 10 seconds.*" In this case, the programmed Listen-in Time is set at 10 seconds. (This feature is not available when obtaining the Status Report on-site, directly at the keypad.)

The Status Report repeats once more and the Model 1104 concludes the call, saying: "*Have a good day.*" (The Status Report will not repeat if obtained at the keypad; "*Have a good day,*" is also not recited.)

The phrase "*no number*" at the end of a Status Report indicates that no dial-out phone numbers have been programmed.

6.2.2 Example: Status Report, Existing Alarms

Inputs 2, 3,and 4 are configured as dry contact and input 1 is configured as temperature. An emergency situation is at hand: a fire in a greenhouse has tripped a smoke alarm and electrical power has been disrupted. In addition to high sound and AC power alarms, separate alarms exist on inputs 1, 2, 3, and 4. You happen to call in for the Status Report, which begins with, *"Hello, this is telephone number 555-1234; the time is 12:15PM."* Following this introduction, the report continues:

"Number 1, 110 degrees, HIGH."

"Number 2, EXISTS."

"Number 3, EXISTS."

"Number 4, EXISTS."

"The electricity is OFF."

"Battery condition, OK."

"Sound level, HIGH."

"Warning message received by ...(last telephone number dialed)."*

"Listen to the sound level for 10 seconds."

The Status Report repeats once more and the Model 1104 concludes the call by saying: *"Have a good day."*

> * The *"last telephone number dialed"* refers to any one of the programmed, dial-out telephone numbers through which the Model 1104 was able to receive alarm acknowledgment, prior to your call for a Status Report; this could also refer to the Model 1104's I.D. Number (identification number), if the alarms are acknowledged at the keypad by someone present at the site.

6.2.3 Example: Status Report, Disabled Inputs

If an input is disabled, the dial-out feature for that input is deactivated, but all other programmed parameters remain in effect. In the example below, all 4 inputs are disabled, although inputs 1 and 3 are detecting alarms. AC power and Sound Level is also disabled for dial-out. (Note that to indicate disabled status, only AC power will return two audible *"beeps,"* rather than the word *"OFF."*) When you call the Model 1104 for a Status Report, you hear the following:

"Hello, this is telephone number 555-1234.

"The time is 12:15PM."

"Number 1, OFF, 96 degrees, HIGH."

"Number 2, OFF, 74 degrees, OK."

"Number 3, OFF, EXISTS."

"Number 4, OFF, OK."

"The electricity is (beep, beep) ON." If the electricity is off, or the AC adaptor is disconnected, you will hear: *"The electricity is (beep, beep) OFF."*

"Battery condition, OK."

"Sound level OFF, OK." If the sound level is high you will hear: *Sound level OFF, HIGH."*

"Listen to the sound level for 10 seconds."

The Status Report repeats once more and the Model 1104 concludes the call, saying: *"Have a good day."*

6.2.4 Battery Condition

During a Status Report, you may hear one of three possible messages regarding battery power. The Model 1104 determines the appropriate message by measuring battery voltage. Depending upon the remaining voltage, it may respond:

- *"Battery Condition OK,"* if over 8.2 Volts.
- *"Battery Condition low,"* if between 7.2 and 8.2 Volts.
- *"Replace batteries,"* if below 7.2 Volts.

6.2.5 Remote Access by Touch-Tone™ Telephone

Calling the Model 1104 for a Status Report provides the opportunity to access other functions, using Touch-Tone™ push-button commands. Remote telephone commands include:

- Disabling/enabling any input.
- Disabling/enabling High Sound Alarm monitoring.
- Disabling/enabling AC Power monitoring.
- Activation of Listen-In Time.
- Activation of the Status Report.

To issue commands by telephone, first dial the number of the Model 1104 to access the Status Report. The Status Report will be followed by the programmed Listen-In Time. If you remain on the telephone, the Status Report will be repeated, followed by a 10 second waiting period and hang-up. During this 10 second waiting period, or ***at any time during the call, other commands may by accessed by pressing any push button on the telephone.***

If a Security Code is in effect, the Model 1104 will prompt you with: *"Enter Security Code."* If no Security Code is set, then it will say *"O.K."*

- Enter your Security Code (4 digits) with the telephone push buttons. If the code you enter is correct, the Model 1104 will respond: *"OK."*
- If you enter the wrong Security Code, the Model 1104 says, *"Error. Have a good day,"* and hangs up.

Disabling/enabling inputs – If an input is set to detect an alert condition, it can be disabled to prevent the Model 1104 from dialing out, or re-enabled at any time.

This feature allows the convenience of disabling an input, even if you are away from the site of the Model 1104. One such application may involve an input programmed to detect unauthorized entry. You are in another locale, but must allow someone else temporary access to the area monitored by the Model 1104. Using a Touch-Tone™ telephone, you can disable the appropriate input (thereby disabling any alarm dial-out response). The input remains disabled until you issue the same command, which effectively returns it to its former, enabled state.

Press the following push-buttons on the Touch-Tone™ telephone to execute the desired command:

*** (asterisk), 1**

...equal to Sensor On/Off, for input 1. To re-enable the input, repeat the same Touch-Tone™ button sequence used for disabling.

*** (asterisk), 2**

...equal to Sensor On/Off for input 2, and so on, for inputs up to 4. To re-enable the input, repeat the same Touch-Tone™ button sequence used for disabling.

Disabling/enabling High Sound Monitoring –

*** (asterisk), 9**

...equal to SENSOR ON/OFF for High Sound Alarm monitoring. To re-enable High Sound Alarm, repeat the command.

Disabling/enabling AC Power –

*** (asterisk), 0**

...equal to Sensor On/Off for AC Power monitoring. To re-enable AC Power monitoring , repeat the command.

Activating Listen-In Time –

 # (pound), 1

...initiates Listen-In Time for listening to on-site sounds for the programmed time available.

Activating Status Report –

 # (pound), 2

...initiates a full recitation of the Status Report.

Exiting –

 # (pound), # (pound)

...forces exit. The 1104 says, "*Have a good day,*" and hangs up.

Chapter 7: Operation

After installation and programming is completed, the Model 1104 is fully operational. This chapter explains the sequence of events that occur during an alarm dialout to illustrate how the Model 1104 operates.

7.1 Alarm Detection, Dial-out and Acknowledgment

Generally, an alarm event is structured in the following manner:

I. The Model 1104 detects an alert condition due to a change at the sensor.

II. A valid alarm is recognized.

III. Dial-out begins.

IV. The alarm is acknowledged.

Often, an alarm does not proceed through all stages: either an alert condition does not persist long enough to be considered valid, or a valid alarm is cancelled.

The table on the following pages explains the alarm detection, dial-out and acknowledgment features and lists important variable factors affecting their operation.

I.Model 1104 Detects a Change at the Sensor	Variable Factors
• Model 1104 detects a change in the monitored condition (from the sensor wired to one of the inputs). This is considered an alert condition, and does not qualify as a valid alarm at this point. • The condition continues throughout the programmed Recognition Time. If the condition (or sensor) reverts to its normal state before the Recognition Time is reached, no alarm will occur.	*Input Type: (1) An open circuit closes, (2) a closed circuit opens, or (3) temperature limits are exceeded.* *Recognition Time: Activated*
II. A Valid Alarm Is Recognized	**Variable Factors**
• The condition must persist long enough to meet or exceed the programmed Recognition Time. When Recognition Time has expired, but the alert condition continues, the Model 1104 will determine that a valid alarm exists.	*Recognition Time: Expired*
• When a valid alarm is determined, Call Delay is activated, forcing the Model 1104 to wait for a programmed period of time before starting the dial-out process. Call Delay applies to the period just prior to dial-out, before the first telephone call is made.	*Valid Alarm: Exists* *Call Delay: Activated*
• Call Delay provides the opportunity to cancel a valid alarm at the Model 1104's installation site, before dial-out occurs. An audible voice message indicates which of the inputs is in alarm. If on-site personnel acknowledge the alarm within the Call Delay time, the Model 1104 will not dial out. (Local Voice Mute is disabled, so that alarm messages can be heard at the site.)	*Alarm Message: Audible, On-site Activated* *Local Voice Mute: Disabled*

III. Dial-out Begins	Variable Factors
• The dial-out process is activated as soon as the Call Delay time expires (if the alarm has not been cancelled at the Model 1104's installation site.) The dial-out begins with telephone number 1 and proceeds sequentially, through the remaining telephone numbers.	*Call Delay: Expired*
• If the alarm is not acknowledged with the first dial-out telephone call, the Model 1104 waits the duration of Intercall Time before dialing the next telephone number. Intercall Time is the programmed waiting period in between each dial-out telephone call.	*Intercall Time: Activated*
• When the telephone is answered, the programmed Voice Repetitions determine the number of times per call the Model 1104 recites the alarm message.	*Voice Repetitions: Activated*
• Call Progress, an automatic feature, enables the Model 1104 to detect whether or not the telephone call is answered. After 8 rings, or if a busy signal is encountered, the Model 1104 will hang up, wait the programmed Intercall Time, and proceed to dial the next telephone number.	*Call Progress: Activated*
• If no telephone calls are answered, the Model 1104 dials out sequentially, through the remaining telephone numbers and continues to cycle until the programmed Maximum Number of Calls is reached.	*Max Calls: Activated*
• When the telephone is answered, the Model 1104 will immediately begin reciting a message that indicates which of the inputs is in alarm. At the same time, the alarm message is repeating at the Model 1104's installation site. The Model 1104 will request acknowledgment, if it has not yet occurred.	*Alarm Messages: By Telephone and On site*

IV. The Alarm Is Acknowledged	Variable Factors
• At any time after a valid alarm is determined, the alarm may be acknowledged at the Model 1104's installation site, by pressing any key.	*Local, On-site Acknowledgment*
• When the Model 1104 dials out and the call is answered via Touch-Tone telephone, any alarm may be instantly acknowledged by pressing "555."	*Touch-Tone Acknowledgment: Fast Code 555*
• If the alarm message repeats for the number of programmed Voice Repetitions, and "555" has not been entered, the Model 1104 will say: *"Indicate that you have received warning message."* The Model 1104 waits 10 seconds for the Touch-Tone code "555" to be entered. If the code is entered within 10 seconds, it responds: *Warning message received by telephone number...(the dialed phone number)."* The alarm is considered acknowledged and the dialout concludes.	*Touch-Tone Acknowledgment: Normal Code 555*
• If the Model 1104 does not receive the Touch-Tone code within 10 seconds, it recites the following and then hangs up: *"Dial telephone number (gives the Unit ID Number) within...(the programmed Intercall Time.)"* The recipient of this message must call the Model 1104 back within the period programmed for Intercall Time, in order to acknowledge the alarm. If Local Voice Mute is off, the unit will beep at the installation site while waiting for this call. • Callback: The Model 1104 waits 10 rings before answering to guard against random acknowledgment. If an	*Tone or Pulse Callback Acknowledgment: Within Intercall Time*

IV. The Alarm Is Acknowledged	Variable Factors
answering device is connected to the same line as the Model 1104 (and TAD is enabled), the Model 1104 will answer on the first ring. First, it recites the Status Report, followed by: *"Warning message received by telephone number...(the last number dialed)."* *"Have a good day."*	*Tone or Pulse* *Callback* *Acknowledgment:* *TAD Enabled*
When the Model 1104 hangs up, the alarm is acknowledged and dial-out stops.	
• If calls remain unanswered, or if they are received by an answering machine or FAX, the Model 1104 continues the dialout sequence; it waits the Intercall Time and proceeds to dial the next telephone number. Telephone numbers are dialed sequentially, and this cycle continues for the number of Max Calls programmed. If no acknowledgment occurs, then at the completion of Max Calls, the alarm is automatically acknowledged and the dial-out process is terminated.	*Max Calls* *Acknowledgment*

NOTE

Acknowledging the alarm does not correct the situation! The alarm condition will still exist until the sensor is restored to its normal state.

7.2 Example: A Dial-out Telephone Call

The following parameters are selected for demonstration purposes:

- Model 1104 Unit ID Number is set to 555-5674. It is currently installed at your place of business.
- Dial-out Telephone Number 1 is programmed to 555-1234, your home telephone number.
- Voice Repetitions are set to 4.

The Model 1104 is detecting an alarm on input 2.

The telephone rings at 555-1234, your home number.

You answer the telephone and hear the following message:

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Hello, this is telephone number 555-5674. The time is 8.30PM Alert condition two exists.*"
(4-seconds to hear on-site sound from unit's microphone.)

"*Indicate you have received warning message.*"

NOTE

It is important that your dial-out telephone numbers be answered by you or other authorized personnel in order to ensure adequate response to an alarm.

Chapter 8: Model 1104 Special Editions

The Sensaphone Model 1104 also comes in three editions with additional special features: the CottageSitter, BusinessSitter, RemoteControl, and Model 1114 Line Seizure models. If you have purchased one of these versions of the 1104, please refer to this chapter for additional information specific to the operation of your unit.

8.1 Sensaphone 1104 CottageSitter Edition

The Sensaphone 1104 CottageSitter allows you to monitor and check on the status of your cottage or cabin from any cellular or ordinary telephone. The Sensaphone 1104 CottageSitter also allows you to turn a device on or off using the 1104 keypad or using your touch-tone telephone. You can also inquire about the status of the device during a voice status report.

This Sensaphone contains a relay contact on the rear of the unit *(see Figure 1)*. The relay contact supports both a normally open and a normally closed contact, commonly referred to as a “double throw” relay.

When the Sensaphone relay is turned ON, a connection is made between the ON and C (common) terminals and the connection to the OFF terminal is disconnected. When the Sensaphone relay is turned OFF, a connection is made between the OFF and the C (common) terminals and the connection between the ON and C (common) is disconnected *(See Figure 1)*. When the Sensaphone unit is put in standby mode, the relay remains in its last known state. If the Sensaphone is completely shut down by removing the batteries and unplugging it from power, the relay returns to an OFF state, connecting the OFF terminal to the C (common).

The Sensaphone relay is a low voltage relay. Only voltages less than 30 volts AC 2AMPS, or 30 volts DC 2 AMPS may be switched. For higher voltages, an additional high-voltage relay would be required.

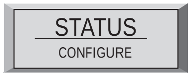
Always enlist the services of a licensed electrician when working with high voltages. Improper wiring can cause harm to you or your property.

> **NOTE:** For safety reasons it is highly recommended that the unit only be used to switch low voltage signals (30 volts or less). If you intend to control higher voltages you must install the unit in an NEC approved electrical panel or enclosure and have wiring performed by a qualified electrician.

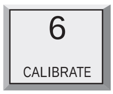
8.1.1 Switching the Output using the Keypad

To switch the output **ON** from the keypad:

1. Press STATUS.

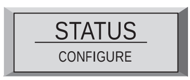


2. Press 6.



To switch the output **OFF** from the keypad:

1. Press STATUS.

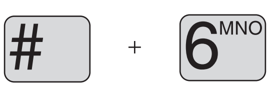


2. Press 3.

8.1.2 Switching the Output over the Telephone

1. Call the Sensaphone. When the unit answers, it will begin reciting a status report. At any time during the call, press a touch-tone. The unit will respond with *"OK."* The Sensaphone is now ready to accept touch-tone commands.

2. On your phone, press # 6 to turn **ON** the output. The Sensaphone will respond *"ON."*



3. Press pound # 3 to turn **OFF** the output. The Sensaphone will respond *"OFF."*

4. To check the present state of the relay press # 2.

This initiates a full recitation of the Status Report. At the end of the status report, the Sensaphone will say "*Number five On/Off.*"

8.1.3 Heating up your Cottage or Cabin Remotely

If you keep your cottage or cabin open all year around, or if you do not drain your pipes and antifreeze your plumbing, you likely keep your furnace active when you are away but at a very low temperature. The Sensaphone will provide an invaluable service to you by keeping you updated to any change in the status of your furnace operation. Prior to your arrival at your cottage or cabin, you can remotely use your phone to instruct the furnace to increase the heat.

Most furnaces use a typical 4-wire (heat/cooling) or 3-wire (heat only) thermostat. The Sensaphone can easily control these types of thermostats. ***If your heating source consists of high voltage electric baseboard heaters, you should consult a qualified electrician or heating professional for proper installation of the Sensaphone remote control facility.*** Electric baseboard heaters may utilize either a low voltage (2-wire) thermostat or a direct control high voltage thermostat. Only the low voltage thermostat may be directly connected to the Sensaphone.

8.1.4 The Dual Thermostat Concept

When a three or four wire low voltage thermostat is used, it is easy to connect the Sensaphone to your furnace with the addition of a secondary thermostat. One thermostat is set to your preferred "away" temperature and the other thermostat is set to your preferred "home" temperature. With your Sensaphone CottageSitter, you will be able to switch between these two thermostats.

Ideally, the "away" thermostat would be in your pump or furnace room. Remember that your "away" thermostat will be the only thermostat that keeps your cottage or cabin at minimal heat while you are away. It should not be located near a window or where direct sunlight might warm it, near a furnace radiator or vent, or any heat source such as a pilot light.

The second thermostat, the one pre-set for your preferred temperature when you arrive at your cottage or cabin, should be located in your normal living space. This would likely be your existing thermostat, already located in a suitable location by your heating professional at the time your furnace was installed.

By connecting these two thermostats together in a parallel fashion, and by passing the low voltage supply through the Sensaphone *(See Figure 1)*, you can remotely or locally decide which thermostat is in control of your furnace.

It is recommended that the "away" thermostat be connected to the OFF terminal while the "home" thermostat be connected to the ON terminal of the Sensaphone. This way, it's easy to understand which state your furnace is in: *ON = Home* and *OFF = Away*. The supply voltage from your furnace (typically the wire labeled R or 24VAC), should always be connected to the C (Common) terminal on the CottageSitter.

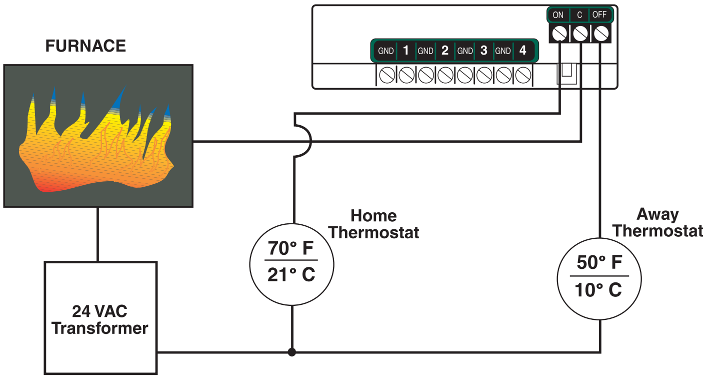


Figure 1: Dual Thermostat Setup

Note: This is a typical configuration when using standard single-zone heat/cool thermostats. For ease-of-use it is recommended that both thermostats be the same model. Note also that all thermostats may not be compatible with the dual-thermostat wiring diagram. Consult your heating/cooling professional for installation assistance.

8.1.5 Controlling Lights or other devices

Using X10 technology, you can remotely activate any electrical device or appliance in your home through your Sensaphone. X10 technology is a suite of control modules that plug into your existing electrical outlets and transmit coded signals to lamps, lights, and appliances to turn them on or off (See Figure 2).

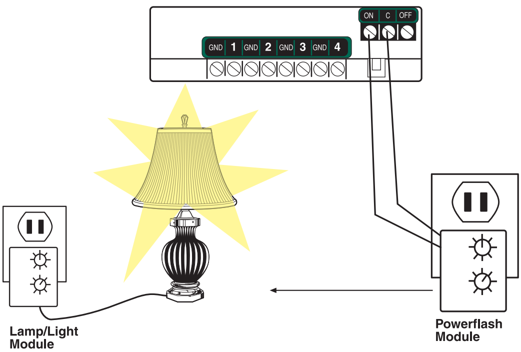


Figure 2: X10 Lighting Control Setup

Sensaphone supports these devices through use of the popular X10 Powerflash relay interface. To learn more about this technology, consult X10 products on the web at www.x10.com or visit your local electronics shop such as Radio Shack.

Such applications may include turning on a lamp or exterior lights remotely from your cellular telephone when arriving at your cottage or cabin late at night. Or you can use the X10 Powerflash Module (set to momentary contact) in conjunction with the X10 Universal Module to remotely control your electric garage door opener over the telephone—an ideal way of letting in your cottage or cabin service personnel without being on-site. You may also use the X10 technology to send the ON/OFF signal to a furnace or heater if your thermostat is not easy to wire directly.

Finally, in addition to remotely controlling devices, X10 technology lets you extend the reach of certain Sensaphone sensors such as door contacts, motion sensors, or water sensors. This of great benefit where it is impossible to wire directly from your sensors to your Sensaphone. Consult a qualified electrician or your heating professional for assistance with locating your remote sensors or contact your Sensaphone dealer.

8.1.6 Relay Output Specifications

Rated Load:	2 A at 30 VAC 2 A at 30 VDC
Max. Operating Voltage:	30 VAC 30 VDC
Max. Operating Current:	2 A
Max. Switching Capacity:	60 VA 60 W

8.2 Sensaphone 1104 BusinessSitter Edition

The Sensaphone 1104 BusinessSitter allows you to monitor and check on the status of your facility from any cellular or ordinary telephone. The Sensaphone 1104 BusinessSitter turns a device on when an alarm occurs. You can also inquire about the status of the device during a voice status report.

This Sensaphone edition contains a relay contact on the rear of the unit *(see Figure 3)*. The relay contact supports a normally open relay.

When the Sensaphone detects an alarm condition, it closes this relay, which then activates the device attached to the relay. The relay remains closed throughout the alarm process, even while the Sensaphone is making its alarm-response telephone calls out to you. Reset of the alarm relay may occur either locally or remotely via the telephone. This is discussed further in following sections.

The Sensaphone relay is a low voltage relay. Only voltages less than 30 volts AC 2AMPS, or 30 volts DC 2 AMPS may be switched. For higher voltages, an additional high-voltage relay would be required.

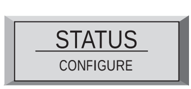
> ***Always enlist the services of a licensed electrician when working with high voltages. Improper wiring can cause harm to you or your property.***

NOTE: For safety reasons it is highly recommended that the unit only be used to switch low voltage signals (30 volts or less). If you intend to control higher voltages you must install the unit in an NEC approved electrical panel or enclosure and have wiring performed by a qualified electrician.

8.2.1 Switching the Output using the Keypad

To switch the output **ON** from the keypad:

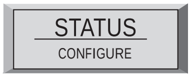
1. Press STATUS.



2. Press 6.

To switch the output **OFF** from the keypad:

1. Press STATUS.



2. Press 3.

8.2.2 Switching the Output over the Telephone

1. Call the Sensaphone. When the unit answers it will begin reciting a status report. At any time during the call, press a touch-tone. The unit will respond with *"OK."* The Sensaphone is now ready to accept touch-tone commands.

2. On your phone, press # 6 to turn **ON** the output. The Sensaphone will respond *"ON."*

3. Press # 3 to turn **OFF** the output. The Sensaphone will respond *"OFF."*

4. To check the present state of the relay press # 2.

This initiates a full recitation of the Status Report. At the end of the status report, the Sensaphone will say, *"Number five On/Off."*

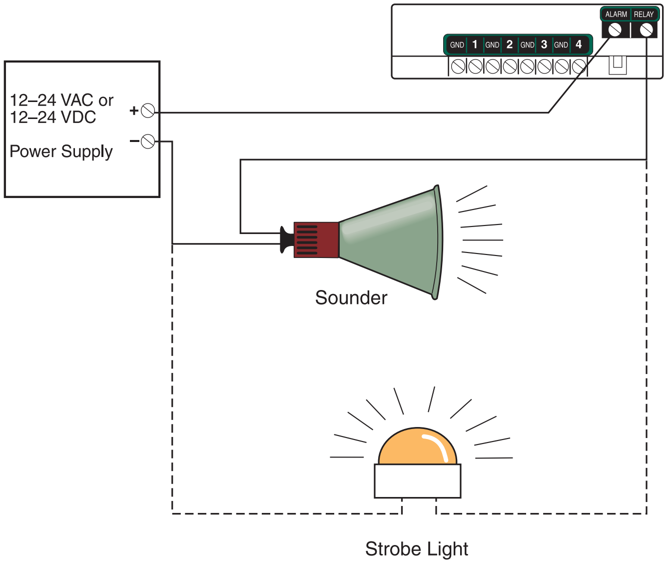


Figure 3: Activating a Sounder or Strobe on Alarm

8.2.3 Relay Output Specifications

Rated Load:	2 A at 30 VAC 2 A at 30 VDC
Max. Operating Voltage:	30 VAC 30 VDC
Max. Operating Current:	2 A
Max. Switching Capacity:	60 VA 60 W

8.3 Sensaphone 1104 RemoteControl Edition

The Sensaphone 1104 RemoteControl allows you to monitor and check on the status of your facility from any cellular or ordinary telephone. The Sensaphone 1104 RemoteControl also allows you to turn a device on or off using the 1104 keypad or using your touch-tone telephone. You can also inquire about the status of the device during a voice status report.

This Sensaphone contains a relay contact on the rear of the unit *(See Figure 4)*. The relay contact supports both a normally open and a normally closed contact, commonly referred to as a "double throw" relay.

When the Sensaphone relay is turned ON, a connection is made between the ON and C (common) terminals and the connection to the OFF terminal is disconnected. When the Sensaphone relay is turned OFF, a connection is made between the OFF and the C (common) terminals and the connection beetween the ON and C (common) is disconnected *(See Figure 4).* When the Sensaphone unit is put in standby mode, the relay remains in its last known state. If the Sensaphone is completely shut down by removing the batteries and unplugging it from power, the relay returns to an OFF state, connecting the OFF terminal to the C (common).

The Sensaphone relay is a low voltage relay. Only voltages less than 30 volts AC 2AMPS, or 30 volts DC 2 AMPS may be switched. For higher voltages, an additional high-voltage relay would be required.

Always enlist the services of a licensed electrician when working with high voltages. Improper wiring can cause harm to you or your property.

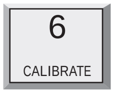
> **NOTE:** For safety reasons it is highly recommended that the unit only be used to switch low voltage signals (30 volts or less). If you intend to control higher voltages you must install the unit in an NEC approved electrical panel or enclosure and have wiring performed by a qualified electrician.

8.3.1 Switching the Output using the Keypad

To switch the output **ON** from the keypad:

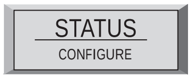
1. Press STATUS.

2. Press 6.

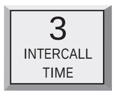


To switch the output **OFF** from the keypad:

1. Press STATUS.



2. Press 3.



8.3.2 Switching the Output over the Telephone

1. Call the Sensaphone. When the unit answers it will begin reciting a status report. At any time during the call, press a touch-tone. The unit will respond with *"OK."* The Sensaphone is now ready to accept touch-tone commands.

2. On your phone, press # 6 to turn **ON** the output. The Sensaphone will respond *"ON."*

3. Press # 3 to turn **OFF** the output. The Sensaphone will respond *"OFF."*

4. To check the present state of the relay press # 2.

This initiates a full recitation of the Status Report. At the end of the status report, the Sensaphone will say *"Number five On/Off."*

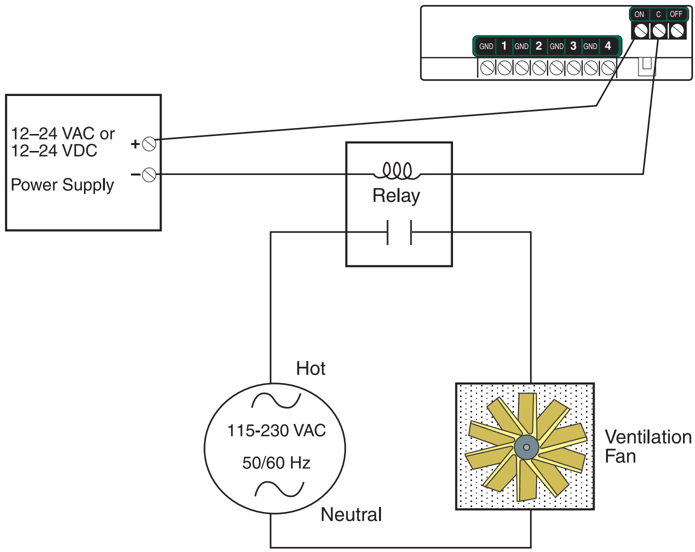


Figure 4: Controlling a Ventilation Fan

8.3.3 Controlling Lights or other devices

Using X10 technology, you can remotely activate any electrical device or appliance in your home through your 1104. X10 technology is a suite of control modules that plug into your existing electrical outlets and transmit coded signals to lamps, lights, and appliances to turn them on or off *(See Figure 5)*.

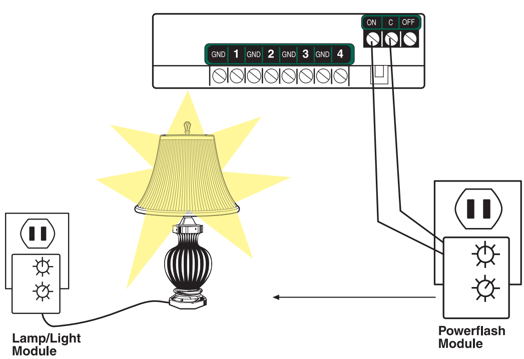


Figure 5: X10 Lighting Control Setup

The Model 1104 supports these devices through use of the popular X10 Powerflash relay interface. To learn more about this technology, consult X10 products on the web at www.x10.com or visit your local electronics shop such as Radio Shack.

Such applications may include turning on a lamp or exterior lights remotely from your cellular telephone when arriving at your cottage or cabin late at night. Or you can use the X10 Powerflash Module (set to momentary contact) in conjunction with the X10 Universal Module to remotely control your electric garage door opener over the telephone—an ideal way of letting in your cottage or cabin service personnel without being on-site. You may also use the X10 technology to send the ON/OFF signal to a furnace or heater if your thermostat is not easy to wire directly.

Finally, in addition to remotely controlling devices, X10 technology lets you extend the reach of certain Sensaphone sensors such as door contacts, motion sensors, or water sensors. This is of great benefit where it is impossible to wire directly from your sensors to your Sensaphone. Consult a qualified electrician or your heating professional for assistance with locating your remote sensors or contact your Sensaphone dealer.

8.3.4 Relay Output Specifications

Rated Load:	2 A at 30 VAC 2 A at 30 VDC
Max. Operating Voltage:	30 VAC 30 VDC
Max. Operating Current:	2 A
Max. Switching Capacity:	60 VA 60 W

8.4 Model 1114 Line Seizure Edition

The Sensaphone Model 1114 operates identically to the Model 1104 except for the "line seizure" feature. The following is an explanation of the setup procedures unique to the Model 1114.

8.4.1 How Line Seizure Works

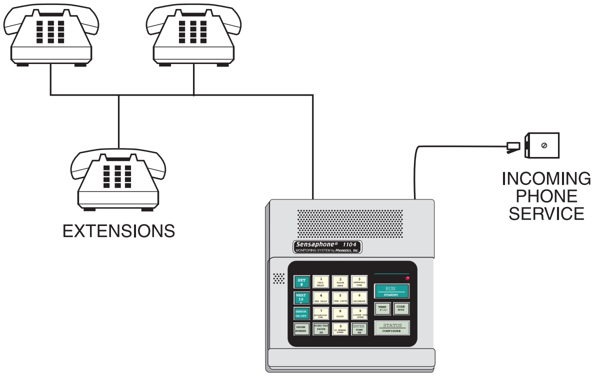
Line seizure gives the Sensaphone the ability to "seize" the telephone line when it needs to dial out. For example, if an emergency occurs that puts the Sensaphone into alert mode, the Sensaphone will be able to dial out even if a telephone has been left off the hook.

8.4.2 Hookup to the Phone Line

Programming and installation of the Sensaphone Model 1114 is identical the Model 1104 except for the telephone line hookup.

On the unit there are two RJ11C phone jacks:

- The six-foot telephone cord with the male RJ11C jack on the end is to be connected to the incoming line of your phone service, ahead of all other phones or telephone extensions.
- The female RJ11C telephone jack on the back of the unit is to be connected to all extensions.



Appendix A: Weekly Testing Procedure

We recommend that you test your Sensaphone weekly to be sure it is functioning properly. This will ensure that when a problem arises the Sensaphone will be ready to alert the appropriate personnel.

There are several tests that can be performed:

1) Call the unit and listen to the Status Report. This will test the unit's ability to answer the phone and speak a message. It will also verify that all of the inputs are reading properly, the alarm conditions are OK, the electricity is on, the microphone is functioning, and the batteries are OK.

2) Create an alarm on each input by tripping all connected sensors.

   Temperature sensors: Heat or cool the sensor.

   Motion sensors: Have someone walk in front of the sensor.

   Door/window sensors: open the door/window.

   Water sensors: Apply a small amount of water beneath the sensor or use a wet towel and touch it to the sensor probes.

   Humidity sensors: Raise the humidity around the sensor by holding a cup of very hot water beneath the sensor.

   Allow the unit to contact all programmed telephone numbers. This will make sure that the Sensaphone is programmed properly. It will also prepare personnel to respond appropriately when they receive a call from the Sensaphone.

3) Test the batteries by unplugging the AC adapter and making sure that the Sensaphone continues to function. Press WHAT IS, then STATUS on the keypad, and listen to the status report. Make sure the report states that *"the electricity is off"* and *"battery condition OK."* Keep the AC adapter unplugged so that a Power Failure alarm occurs. Allow the unit to dial all programmed telephone numbers while running on battery backup. Plug in the AC adapter after the unit has finished dialing all of the telephone numbers.

4) If you are using your Sensaphone to listen for a smoke alarm, then be sure to test the smoke alarm to make sure that the Sensaphone picks up the audible signal and triggers a high-sound-level alarm. Allow the unit to dial all programmed telephone numbers.

5) Keep a log of your tests, noting the date and whether the 1104 passed in each category tested. An example of such a log is shown below. *(See "Test Log" at the end of this manual.)*

1104 Test Log

Date	Inputs		Dialout		Call-in		Tested by
	Pass	*Fail*	*Pass*	*Fail*	*Pass*	*Fail*	
7/1/04	X		X		X		Bob H
7/15/04	X		X		X		Alex G.
7/22/04	X		X		X		Bob H.

If you require assistance, call Sensaphone Technical Support at 610-558-2700.

Appendix B: Troubleshooting

In the event that a problem is encountered, this section will assist you in determining the cause, so you can return the unit to its usual monitoring routine with minimal interruption.

Most problems with the Model 1104 are easy to identify and quickly corrected, and are found under the following general headings:

- Error Messages
- Communications/dial-out functions
- Temperature monitoring
- Sound level monitoring
- Other monitoring functions

If you have tried the solutions outlined in this section and are not satisfied with the results, call Sensaphone Technical Support at 610-558-2700, or follow the guidelines for shipping the Model 1104 to PHONETICS, INC. for repair (see Appendix F).

Error Messages

Problem	Cause	Solution
1. The unit says “Error 1.”	An invalid value has been entered or too much time has passed without entering a value.	Only enter values within the allowed programming range, and make programming changes in a timely fashion.
2. The unit says “Error 2.”	Programming changes were attempted without unlocking the keypad.	Unlock the keypad, then make programming changes.

Communications / Dial-out:

Problem	Cause	Solution
1. The Model 1104 fails to dial out.	a) The telephone number may be incorrectly programmed.	Recheck programming steps. Refer to Chapter 4, Section 4.2.1.
	b) Tone or pulse (the current dialing method) is not compatible with the telephone line on which the Model 1104 is installed.	Switch from the current setting: from tone to pulse, or from pulse to tone. Refer to Chapter 4, Section 4.3.
	c) Recognition Time is too long. An alert condition does not remain in effect long enough to become a valid alarm.	Reprogram Recognition Time. Set the Recognition Time to the minimum duration required to create a valid alarm. If possible, test the new setting by deliberately creating an alert condition. Refer to Chapter 5, Section 5.3.
	d) Max Calls is set to zero.	Reprogram Max Calls. It is a good idea to set your Max Calls to at least equal the number of dial-out telephone numbers programmed. Refer to Chapter 4, Section 4.12.1.

Communications / Dial-out:

Problem	Cause	Solution
	e) The Model 1104 is connected to an incompatible telephone line.	The Model 1104 must be connected to a standard (2-wire analog) telephone line, ***not a digital extension*** to a phone system. If the unit will not dial out and the factors previously listed have been ruled out, try connecting the unit to a standard residential telephone line.
2. The Model 1104 will not answer the telephone when called for a Status Report or alarm acknowledgment.	a) Rings Until Answer is incorrectly programmed.	Recheck programming of Rings Until Answer. Refer to Chapter 4, Section 4.5.1.
	b) The Model 1104 is connected to an incompatible telephone line.	Some telephone systems will not allow the telephone to ring beyond 4 rings. If your Model 1104's Rings Until Answer is set at more than 4 rings, you may not be able to access the unit. Try setting the Rings Until Answer to less than 4 rings. If this does not correct the problem, it may indicate telephone line incompatibility. In this case, try connecting the Model 1104 to a standard, residential telephone line.

3. The Model 1104 will not answer the telephone for Callback Acknowledgement.	You did not allow the telephone to ring 10 times. Note: If the TAD (telephone answering device) is disabled, the telephone rings ten times before the Model 1104 answers. If the TAD is enabled, the telephone rings once before the Model 1104 answers the call.	When calling the Model 1104, and the TAD is disabled, allow the telephone to ring 10 times. Refer to Chapter 6, Section 6.1.3, and Chapter 4, Section 4.6.3.
4. The Model 1104 recites the alarm message or Status Report over the telephone, but is silent at the installation site.	The local voice mute feature is in effect.	Deactivate local voice mute. Refer to the programming steps in Chapter 4, Section 4.9.
5. The Model 1104 dials out correctly but fails to audibly recite its alarm message when you answer the call.	Voice Reps is set to zero.	Reprogram Voice Reps to 1 or greater. Refer to Chapter 4, Section 4.10.
6. The Model 1104 and telephone answering device (sharing the same line) answer incoming calls simultaneously.	The Model 1104's number of Rings Until Answer is set to equal the number of rings set for the telephone answering device.	Change the number of Rings Until Answer for the Model 1104. Refer to Chapter 4, Section 4.5.

Temperature Monitoring:

Problem	Cause	Solution
1. Can’t program temperature limits; or the unit won’t read the temperature sensor.	The input isn’t configured to read a temperature sensor.	Press SET and CONFIGURE to program the input. (See Section 5.1.1 for more information on configuring inputs.)
2. The temperature reading is -20° F or -30° C.	The temperature sensor has been disconnected or has broken wires.	Examine the wires to temperature sensor and connect or replace wiring.
3. Temperature reads 150° F or 65° C.	Temperature sensor wires are touching or have shorted.	Verify and correct wiring.
4. Temperature reading is inaccurate.	a) Temperature sensing may be affected by a source of ambient heat (ie., direct sunlight, or heat duct proximity).	Try moving the unit to a different location.
	b) Temperature may require calibration.	After moving or placing the unit away from ambient heat sources, the temperature may be calibrated to offset inaccurate normal reading by several degrees. Refer to Chapter 5, Section 5.6.
	c) The unit is using the wrong temperature scale (Fahrenheit vs. Celsius).	Verify temperature scale. Refer to Chapter 5, Section 5.5.

5. False high temperature alarms from freezer.	Most freezers have a defrost cycle during which the temperature will rise considerably, thus causing an alarm to occur.	Program an input recognition time longer than the defrost cycle.
6. The Sensaphone calls with a high/low temperature alarm but recites a temperature that's within the programmed limits.	The Sensaphone recites the "current" temperature when it calls you, not the temperature at the time the alarm occurred. It is likely that the temperature has changed since the time the alarm was detected and has since returned to normal operating conditions.	Shorten the Call Delay or lengthen the Input Recognition Time.

Sound Level Monitoring:

Problem	Cause	Solution
1. False high sound alarms occur frequently.	The programmed sound sensitivity results in over-sensitivity to non-alarm sound as well as alarm sound.	Reprogram the sound sensitivity. Refer to Chapter 5, Section 5.10.
	Sound Recognition Time is too short.	Lengthen the sound Recognition Time. Refer to Chapter 5, Section 5.10.
2. High sound does not cause an alarm.	The unit is not close enough to the high sound source, or the programmed sound setting results in a lack of sensitivity to high sound.	Move the unit closer or reprogram the sound sensitivity. Refer to Chapter 5, Section 5.10.

Other Monitoring:

Problem	Cause	Solution
1. Alarm status of an alert input is incorrect.	Incorrect input normality.	Reconfigure the input. Refer to Chapter 5, Section 5.1.
2. False power out alarms	Programmed Recognition Time is too short.	AC power is often subject to brief interruptions. To avoid frequent, false alarms, increase the power Recognition Time. Refer to Chapter 5, Section 5.9.
3. The Model 1104 does not recognize power failure.	a) Batteries are either incorrectly installed or drained.	To verify proper battery function, unplug the unit and verify continued operation using batteries only. If unit ceases to function, first try reinstalling the batteries. If this is not successful, replace the batteries. Refer to Chapter 2, Section 2.4 for complete instructions.
	b) Recognition time setting is too long.	Reprogram Recognition Time. Set the Recognition Time to the minimum required before a valid alarm occurs. If possible, test the condition by deliberately creating an alert condition. Refer to Chapter 5, Section 5.9.

4. The Model 1104 does not recognize any alarm.	a) Inputs for alarm are disabled.	Enable the inputs for alarm. Refer to Chapter 5, Section 5.2.
	b) Programmed Recognition Time is too long.	Reprogram Recognition Time. Set the Recognition Time to the minimum required for a monitored condition to become a valid alarm. If possible, test the condition by deliberately creating an alert condition. Refer to Chapter 5, Section 5.3.
5. The batteries drain prematurely.	The unit's AC transformer is unplugged or for some other reason, full AC power is not available to the unit.	The batteries will take over powering the unit when the AC transformer is unplugged from the 120 VAC outlet. When storing the unit, be sure to remove the batteries. Refer to Chapter 2, Section 2.4. *Be sure to use alkaline batteries—do not use rechargeable nicad batteries.*

If the solutions offered above do not appear to correct the problem, apply the following steps, in the order shown.

- Remove the batteries.
- Unplug the unit.
- Wait one minute for the Model 1104 to completely power down.
- Plug in the unit's AC adaptor into a standard 120 VAC outlet.
- Replace the batteries.

Refer to Chapter 2, Installation, for additional information on batteries and installation procedures.

Appendix C: 1104 QUICK REFERENCE

Parameter	Description	Key Sequence*	Range	Default
Call Delay	Time delay until first call is made	[SET] or [WHAT IS] + [CALL DELAY]	Min: 00:00 Max 60:00 (min:sec)	00:30 (min:sec)
Voice Reps	Number of times alarm message is repeated over the phone	[SET] or [WHAT IS] + [VOICE REPS]	Min: 0 reps Max: 10 reps	3 reps
Intercall Time	Time delay between phone calls	[SET] or [WHAT IS] + [INTERCALL TIME]	Min: 00:10 Max: 60:00 (min:sec)	01:00 (min:sec)
Max Calls	Number of calls until unit self-acknowledges	[SET] or [WHAT IS] + [MAX CALLS]	Min: 0 calls Max: 255 calls	100 calls
Temp Limits	High and low temperature alarm limits	[SET] or [WHAT IS] + [TEMP LIMITS] + [input #]	Min: -20°F/-30°C Max: 150°F/65°C	Low: 10°F High: 100°F
Calibrate	Temperature Correction factor	[SET] or [WHAT IS] + [CALIBRATE] + [input #]	Min: -10° Max: 10°	0°
Recognition Time: inputs 1–4	Length of time a fault condition must exist to trip an alarm	[SET] or [WHAT IS] + [RECOGNITION TiME] + [input#]	Min: 00:00 Max: 272:00 (min:sec)	00:03 (min:sec)
Recognition Time: Power Failure	Length of time the power must be off to trip an alarm	[SET] or [WHAT IS] +[RECOGNITION TIME]+[POWER]	Min: 00:00 Max: 272:00 (min:sec)	05:00 (min:sec)
Recognition Time: High Sound Level	Length of time the sound must be high to trip an alarm	[SET] or [WHAT IS] +[RECOGNITION TIME] + [SOUND]	Min: 00:00 Max: 272:00 (min:sec)	00:08 (min:sec)
Clock	Real time clock	[SET] or [WHAT IS] + [CLOCK] + [time] + [AM] or [PM]	Min: Max:	12:00 AM
High Sound Level Alarm Sensitivity	Microphone sensitivity for high sound level alarm	[SET] or [WHAT IS] + [CALIBRATE] + [SOUND]	Min: 1 unit Max: 255 units	32 units
Listen Time	Length of listen-in time during call-in status report	[SET] or [WHAT IS] + [LISTEN TIME]	Min: 0 sec Max: 255 sec	00:15 (min:sec)
Rings Until Answer	Number of rings until unit answers an incoming call	[SET] or [WHAT IS] + [RING]	Min: 1 ring Max: 15 rings	4 rings

* press [ENTER] after all Key Sequences starting with [SET]

Parameter	Description	Key Sequence	Response	Default
Speaker Mute	Turns off the speaker during alarm conditions	[SENSOR ON/OFF] + [MUTE]	On or Off	off
Input Enable/Disable	Turns input alarm detection on or off	[SENSOR ON/OFF] + [input#]	On or Off	Enabled
Power Alarm Enable/Disable	Turns power alarm detection on or off	[SENSOR ON/OFF] + [POWER]	On or Off	Enabled
Sound Alarm Enable/Disable	Turns high sound level alarm detection on or off	[SENSOR ON/OFF] + [SOUND]	On or Off	Enabled
Temperature Scale	Selects between Fahrenheit and Celsius	[SENSOR ON/OFF] + [F/C]	On or Off	Fahrenheit (on)
Security Code	Prohibits programming changes	[SET] or [WHAT IS] + [CODE] + [4 digit code]		none
Callback Acknowledgment	Turns Callback Acknowledgment on or off	[SENSOR ON/OFF] + [PHONE]	On or Off	off

SPECIAL KEY FUNCTIONS:

RING/TAD/PAUSE/AM
1) Used to enter a minus sign for negative temperature limits or temperature calibrations.
2) Used to program a 4 second pause into dialout phone numbers.

CODE/MUTE Key
Used to program a "wait for answer" into dialout phone numbers.

SET/# Key
Used to program a "#" into dialout phone numbers.

WHAT IS/* Key
Used to program an "*" into dialout phone numbers.

PROGRAMMING THE 1104 FOR USE WITH A PAGER
Press [SET/#] + [PHONE NUMBER] key + the phone number of the pager + [RING/TAD/**PAUSE/**AM]***** + the phone number of the 1104 (+ optional [SET/#] if required by your pager service) + [ENTER].

*__NOTE__: You may have to press the [PAUSE] key multiple times to coordinate with the delay in your pager service's answering function. We recommend you try pressing [PAUSE] twice.

REMOTE TOUCH-TONE COMMANDS

Enable/Disable Alert Inputs: [*] + [input #]
Enable/Disable High Sound Level: [*] + [9]
Enable/Disable AC Power: [*] + [0]

Activate Listen-in: [#] + [1]
Activate Status Report: [#] + [2]
Disconnect: [#] + [#]

Appendix D: Accessories

The sensors listed below are available from Phonetics, Inc., and represent the most commonly used input devices. Other dry contact sensors, designed for more specialized applications, may also be used. Commercial or industrial electrical supply houses can provide devices to monitor virtually any condition. For further information, contact Sensaphone Customer Service at 610-558-2700.

PART #	SENSOR / SWITCH
FGD-0006	Magnetic Reed Switch
FGD-0007	Passive Infra-Red Detector
FGD-0010	50' two-conductor #22AWG shielded Accessory Cable
FGD-0013	Spot Water Detector
FGD-0022	Temp° Alert
FGD-0023	ISOTEL Surge Protector
FGD-0027	Humidistat
FGD-0049	Smoke Detector with Built-in Relay
FGD-0054	Power-Out Alert™
FGD-0056	Zone Water Detector w/Water Rope
FGD-0063	10' Water Rope for FGD-0056
FGD-0100	Remote Temperature Sensor
FGD-0101	Weatherproof Temperature Probe
FGD-0200	Phonecell SX3e Cellular Phone

Appendix E: Specifications

Alert Inputs

Number of Inputs: 4 (thermistor installed on input #1 for local temperature monitoring)

Input Connector: terminal block

Input Types: N.O./N.C. contact, 2.8K thermistor (-20 to 150° F or -30 to 65° C)

Input Characteristics: 5.6K to 5V (Short circuit current: 1mA max.)

A/D Converter Resolution: 10 bits ±2 LSB

Input Protection: 5.5VDC Metal Oxide Varistor with fast acting diode clamps.

Microphone

Internal Electret Condenser: For listening in to on-site sounds and detecting high sound levels.

Phone Interface

6' Cord w/RJ11 Plug: For connection to a two-wire analog telephone line.

Extension RJ11 Jack: For connecting other devices on the same telephone line.

Line Seizure RJ11 Jack (Model 1114 Only): Devices connected to this jack are disconnected in the event that the 1114 must dial out for an alarm.

Phone Line Protection: Metal Oxide Varistor & self-resetting fuse

LED Indicator

System LED: On steady when the unit is in RUN mode. LED blinks once every few seconds while in STANDBY mode.

Relay Output (1104-CS/BS/RC only)

Rated for 2A 30VAC/2A 30VDC maximum.

Power Supply

Power Supply: 120VAC/8VAC 60Hz 12W wall plug-in transformer w/6' cord.

Power Consumption: 5 Watts

Power Protection: Metal Oxide Varistor

Battery Backup: Six size-D alkaline batteries (not included), providing up to 24 hours of back-up time.

Environmental

Operating Temperature: 32–122° F (0–50° C)

Operating Humidity: 0–90% RH non-condensing

Storage Temperature: 32–140 deg F

Physical

Dimensions: 2.1"h x 7.8"w x 8.8"d

Weight: 2 lbs.

Enclosure: Indoor-rated plastic housing suitable for wall or desktop installation.

Certifications

NRTL Listed—File #E112098. Complies with UL60950-1/ CSA60950-1.

FCC Part 68 certified.

FCC Part 15 class B certified.

Industry Canada CS03 certified.

Appendix F: Returning the Unit for Repair

In the event that the Model 1104 does not function properly, we suggest that you do the following:

1) Record your observations regarding the Model 1104's malfunction.

2) Call the Technical Service Department at 610-558-2700 prior to sending the unit to Sensaphone for repair.

If the unit must be sent to Sensaphone for Servicing, please do the following:

1) Unplug the AC power supply from the wall outlet, remove the batteries, and disconnect all sensors from the alert inputs.

2) Carefully pack the unit to avoid damage in transit. Use the original container (if available) or a sturdy shipping box.

3) **You must include the following information to avoid shipping delays:**

   a) Your name, address and telephone number.

   b) A note explaining the problem.

4) Ship your package to the address below:

SERVICE DEPARTMENT
Phonetics, Inc.
901 Tryens Road
Aston, PA 19014

5) Ship prepaid and insured via UPS or US Mail to ensure a traceable shipment with recourse for damage or replacement.

Test Log

Date	Inputs	Dialout	Call-In	Battery		Tested By
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	
	Pass ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	*Pass* ☐ *Fail* ☐	

Date	Inputs	Dialout	Call-In	Battery		Tested By
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	
	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	

larger image

T50 Quartz AC Hour Meter I.
T50 Quartz AC Hour Meter

Specifications

Series	T50
Display	6-Digit
Voltage	115 V AC
Reset	None
Size	1.68W x 1.68H x 1.26D Inch
Face Dia - Flange	2.31 Inch
Face Dia - Cutout	2 Inch
Weight	2 oz.
Mounting Style	Panel Mount
Power	Less than 0.4 W

Print Back

DIEHLControls

24 HOUR & 7 DAY TIMESWITCH

Series 884 • Digital Timeswitch 1 Channel

General Description

Compact digital timeswitch which provides precise timing with the flexibility of daily and/or weekly programming. Simple and fast setting by means of push buttons and display prompts.

Features

- 24 hour/7 day timing combined
  8 on/off operations daily
- Repeat programs provide up to 56 switching cycles per week
- Minimum time setting: 1 minute
- Lithium battery provides minimum 5 year reserve (unpowered)
- 24 hour display (military or AM/PM)
- Manual override
- Skip a day

Applications

Popular applications include: Heaters, filters, pumps, fans, signs, blowers, indoor and outdoor lighting, feeders, security/alarm systems, and process controls.

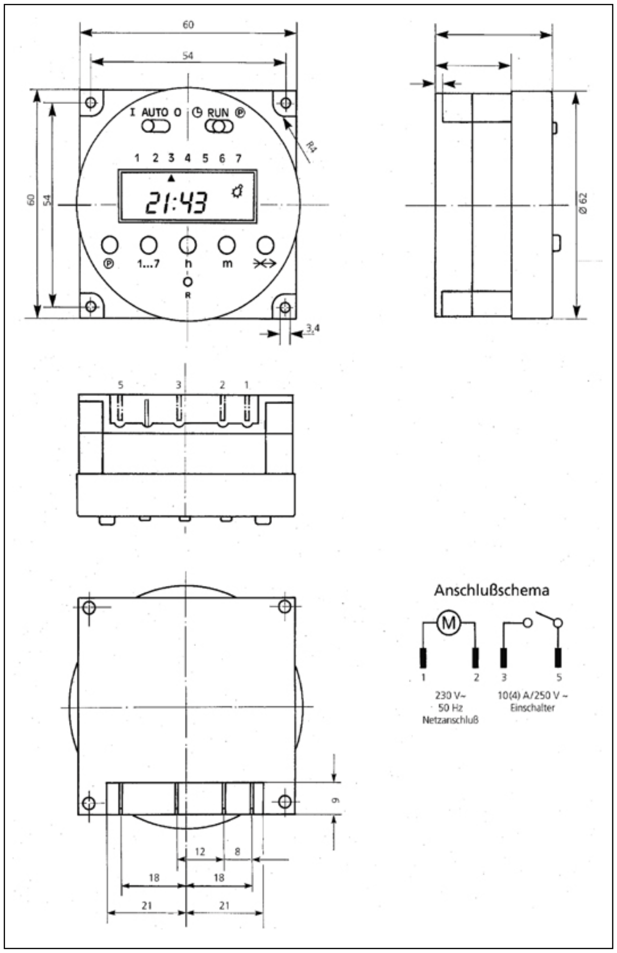
BORG GENERAL CONTROLS
1386 Jarvis Avenue
Elk Grove Village, IL 60007

800/338-1260
847/640-4635
F: 847/640-7934

e-mail: sales@borggeneral.com
www.borggeneral.com

24 HOUR & 7 DAY TIMESWITCH

Series 884 • Digital Timeswitch 1 Channel



Technical Data

Operating voltages:
- 120 VAC, 50/60 Hz
- 240 VAC, 50/60 Hz
- 24 VAC, 50/60 Hz
- 12 VDC
- 24 VDC

Rated Power:
- 3.5 VA

Switching:
- SPST
- SPDT

Connections:
- 6.3 x 0.8mm tab terminals (complies with DIN 46244)

Switch rating:
- 16 Amps @ 45°C
- 10 Amps @ 55°C

Operating Temperature Range
- 14°F (-10°C) to 131°F (55°C)

Setting Options

- Time of day
- Single day
- Repeat programs for daily recurring switching times
- 1-2-3-4-5 (Monday through Friday)
- 1-2-3-4-5-6 (Monday through Saturday)
- 1-2-3-4-5-6-7 (Monday through Sunday)
- 6-7 (Saturday and Sunday)
- Skip function (→) for skipping all the switching programs for the next calendar day
- Reset function for clearing the whole switching program

Mounting

- Terminal orientation: top, bottom
- Mounting accessories available

Approvals

UL
CSA Pending
VDE (@240 VAC)

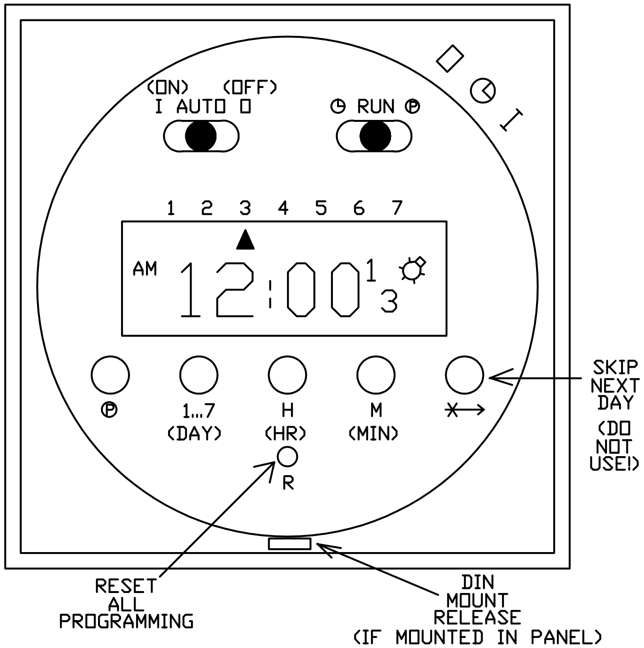
DIEHLControls

BORG GENERAL CONTROLS LLC.
1386 Jarvis Avenue
Elk Grove Village, IL 60007

800/338-1260 F: 847/640-7934

Printed in U.S.A.

SINGLE CHANNEL 884.1K2



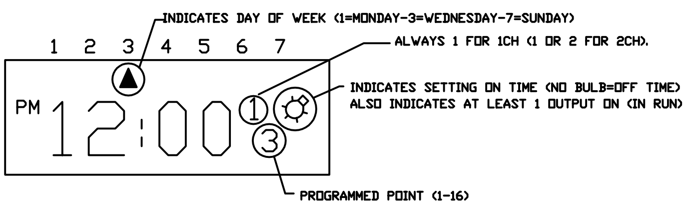
TYPICAL 1 CHANNEL TIMER DRAWING (FOR REFERENCE)

NUMBER OF TIMERS MAY VARY PER INDIVIDUAL PROJECT.

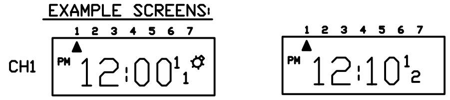
TIMER 1
(T1)

	PT	SETTING DOTW (SEE NOTE4)	SETTING TIME
MON. ON	1	1	12:00 PM
MON. OFF	2	1	12:10 PM
WED. ON	3	3	12:00 PM
WED. OFF	4	3	12:10 PM
FRI. ON	5	5	12:00 PM
FRI. OFF	6	5	12:10 PM
SAT. ON	7	6	12:00 PM
SAT. OFF	8	6	12:10 PM
	9		0:00
	10		0:00
	11		0:00
	12		0:00
	13		0:00
	14		0:00
	15		0:00
	16		0:00

PROGRAMMING MODE SCREEN



EXAMPLE SCREENS:



1. TIMER CH1 ON TIME SET FOR 12:00 PM MON.
2. TIMER CH1 OFF TIME SET FOR 12:10 PM MON.

<u>Example settings:</u>
To set solenoid open (or turn a motor on) for 10 minutes on Mon, Wed, Fri, Sat. Set the 8 memory points as shown in table to left.

<u>To Program:</u>
1. Slide run switch to "P"
2. Press "P" button
3. Enter first time in Memory Location 1
4. Select day of week (DOTW) using button with 1-7; where Mon=1, Tues = 2, etc
5. Enter desired hour by pressing "H" button
6. Minutes by pressing "M" button
7. Press "P" to save and advance to next memory location
8. When done programming slide Run switch back to RUN.

<u>To Review Programming:</u>
1. Slide Run switch to "P"
2. Press "P" button and cycle through points
3. slide switch back to RUN.

<u>To Set Time:</u>
1. Slide Run switch to clock symbol.
2. Press 1...7 button to set day.
2. Press H button to set hours
3. Press M button to set minutes.
4. Slide switch back to RUN.

<u>To Zero A Memory Point:</u>
1. While in programming mode go to desired point. Press skip button x--> then P button (simultaneously) for 3 full seconds. Value should go to zero.
2. Zero corresponding point (on and off times).

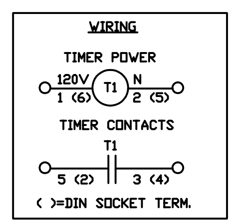
<u>To Manually switch timer on:</u>
1. Slide Auto switch to "I" position.

<u>To Manually switch timer off:</u>
1. Slide Auto switch to "0" position.

NOTE:
1. ODD NUMBERED TIMER SETTINGS WILL TURN INSTRUMENTS TO AN "ON" STATE.
2. EVEN NUMBERED TIMER SETTINGS WILL TURN INSTRUMENTS TO AN "OFF" STATE.
3. EACH TIMER SETTING MUST HAVE AN ON AND OFF VALUE SET OR ALL ZEROS.
4. SCHEDULE CAN BE RUN AS FOLLOWS:
   A. INDIVIDUAL DAYS (1 OR 2 OR 3 OR ...7) DAY
   B. WEEKDAYS (1-5)
   C. WEEKENDS (6-7)
   D. WEEKDAYS + ONE (1-6)
   E. FULL SEVEN DAY WEEK (1-7)

   1 =MONDAY
   2 =TUESDAY
   3 =WEDNESDAY
   4 =THURSDAY
   5 =FRIDAY
   6 =SATURDAY
   7 =SUNDAY

5A. BATTERY LIFE IS RATED FOR 3 YEARS BY MANUFACTURER.
5B. BATTERY IS A REPLACEABLE COIN CELL (CR2032) AND IS AVAILABLE AT MOST PHARMACIES.
6. SEE MANUFACTURER'S MANUAL IF NECESSARY
7. TEXT IN PARENTHESES ( ) DOES NOT APPEAR ON UNIT.
8. TO ACCESS BATTERY REMOVE TIMER: SQUEEZE EDGES OF GREY BODY INSERT CREDIT CARD AND UNHOOK (4) GREY CLIPS.



NES
NATIONAL ENVIRONMENTAL SYSTEMS

TIMER PROGRAMMING (1 CHANNEL DIGITAL) REFERENCE DRAWING			
NES PROJECT #: REF		SHEET: 1 OF 1	
DATE: 1/18/10	DRAWN: MS		REV:
SCALE: N. T. S.	DESIGN: RJD		

Operating instructions for built-in electronic timers with Day and Week programms

Series 884

Attention:

This operating manual is destined for our OEM customers and is intended as a basis for the instruction manual of their appliances.

Subject to technical modifications and availability.

Operating instructions for built-in electronic timers with Day and Week programmes

Series 884

Electronic timers with Day/Week programmes enable operation on individual days or series of days which are precise to the minute (e.g. Monday to Friday or Saturday to Sunday)

Available with 1 Channel and 2 Channel-set-up

Fig. 1: 1 Channel set-up

Fig. 2: 2 Channel set-up

Contents

1 General

1.1 How to Use the Manual

Please read this operating instruction carefully bevor installing, connecting or operating this electronic timer.

1.2 Safety Notes

- **This timer may only be fitted by a qualified electrician.**
- **Warning! Shock hazard! This timer uses the specified supply voltage. Fit the timer appropriately before connecting it to the mains supply. Never touch the live contacts at the back of the timer.**
- **In the case of 12 or 24 V models, the outputs do not correspond to the conditions for safety driven electrical disconnection. The supply voltage to the appliance should only be at SELV (low safety voltage) when a low safety voltage is applied equally to the output. If that is not the case operation with low safety voltage (SELV) is forbidden.**
- **Protection against touch contact must be ensured by a proper mounting. When fitting the timer, make sure that during normal operation of the appliance the timer was fitted in it is impossible to touch the live parts.**
- **When fitting the timer, make sure that during normal operation it is impossible for the end user of the appliance it was fitted in to remove the timer by pulling it to the front and exposing the live parts.**
- **Avoid any contact of the timer with water.**
- **In case of timers with radio time signal receiver (DCF 77) care should be taken to design the antenna and the connecting wires for a supply voltage of 230V. In other words, double or stronger isolation is required.**

1.3 Your Timer

The 884 timer is an electronic **built-in range timer** designed to be fitted into electrical appliances or installations. **The timer may only be operated after installation in a protective housing.**

Series 884

Diehl AKO Stiftung & Co. KG, Werk Nürnberg, Donaustraße 120, 90451 Nürnberg

1.4 Timer features

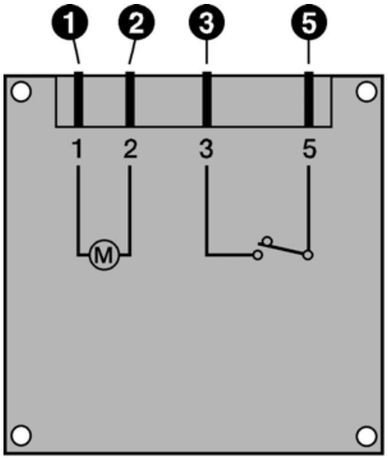
The 884 timer switches appliances such as kitchen stoves, baking ovens, sauna heating, drying appliances, annealing ovens, burning ovens and laboratory equipment at a particular time or for a preset running time. It thus adds to the operating convenience of such appliances and increases their functional scope.

Depending on the variant either a relay or a transistor is switching the connected appliance.

1.5 Functional Scope

- Day, hour and minute are selectable
- 56 switching programmes (1 Channel set-up)
  112 switching programmes (2 Channel set-up)
- Particularly rugged electronics design
- Fast and easy programming
- Optical signals indicate the running of the programmed time
- Easy reading Display with univocal functional symbols
- Time format in 12-hour mode or 24-hour mode
- Radio time reception (DCF) is optional
- Fast and easy selection and setting of the function via six buttons and two sliding switches
- Compact housing

2 Description of the Functional Parts



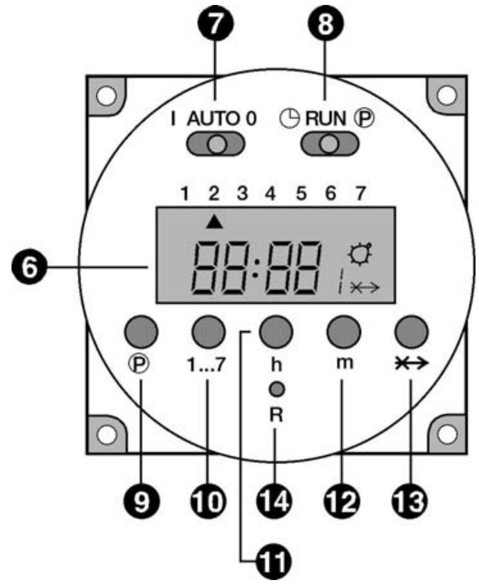
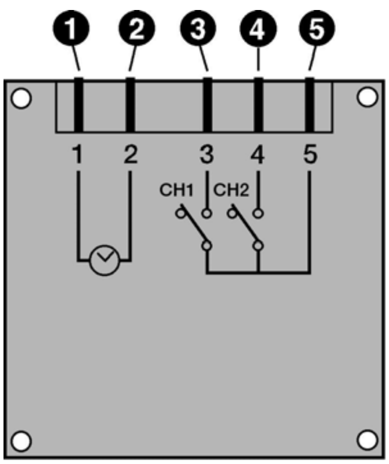


Fig. 3: The functional parts, 1 Channel set-up



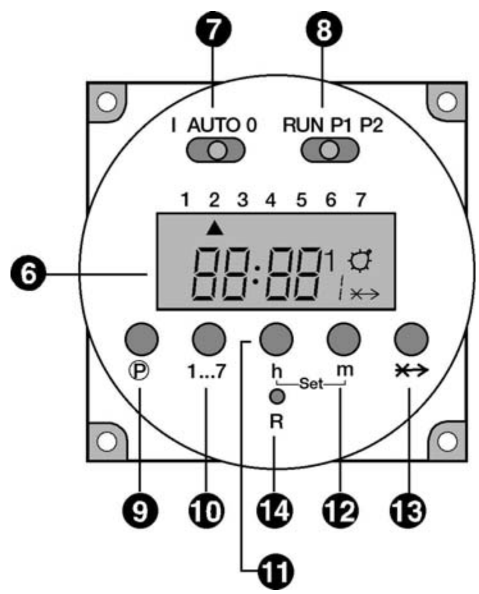


Fig. 4: The functional parts, 2 Channel set-up

Please note:

In relation to days of the week, the timer may be optionally printed with:

1	2	3	4	5	6	7	1...7

or

M	T	W	Th	F	S	Su	DAY

(1), (2) Contacts for connection to the mains supply

(3), (4), (5) Relay contacts

(6) LCD-Display

(7) Sliding switches to set operating mode:
I: Permanently ON
AUTO: Switches on and off in accordance with programmed switch times
O: Permanently OFF

(8) Sliding switches to set Time and Switch Times:

For 1 Channel set-up:
🕒: Set current time
RUN: Switch program and clock run
Ⓟ: Input switch times

For 2 Channel set-up:
RUN: Switch program and clock run
P1: Input switch times for Channel 1
P2: *Input switch times for Channel 2*

(9) Ⓟ Button for programming the 16 switch points;
When time switch points 1, 3, 5, 7, 9, 11, 13, 15, (activate time points) are selected, the symbol ✷ will appear in the right of the display.
If time switch points 2, 4, 6, 8, 10, 12, 14, 16 (switch off time points) are selected, there will be no symbol.

(10) 1...7: Button to input the day of the week (current day and switching day). When programming timing points and individual days the following block day programmes are also possible:

1..5 (Monday to Friday) 1..6 (Monday to Saturday)
6..7 (Saturday to Sunday) 1..7 (Monday to Sunday)

(11) h: Button to input hours
(for current time and switching time)

(12) m: Button to input minutes
(for current time and switching time)

(11+12)-Set in the 2 Channel set-up:
simultaneously pressing of buttons „h“ and „m“ for 2-3 seconds enables the time of day to be set.

General information for buttons „P“, „1...7“, „h“ und „m“:
Short pressing of these buttons gives: counting up by 1 digit
Pressing for longer than 3 seconds effects: more rapid and continuous counting up.

(13) -X-> Skip-Function:
Pressing the Skip-button '-X->' results in the fitted timer

reverting to the opposite function mode.

For example: If the timer is in „switched on“ mode, it will be immediately switched off and vice-versa.

(14) R: Reset button will delete all switching times and current time of day

3 Timer Fitting and Connection

Important! When fitting the timer, see the dimensioned drawing in the product data sheet.

1. Use the contacts (3) and (5) (1 Channel) or (3), (4), (5) (2 Channel) if you wish to connect an appliance or an appliance module to the timer
2. Use the contacts (1) and (2) to connect the timer to the mains supply.
3. Fit the timer by pushing it from the rear into the cutout provided on your appliance and fix it with four screws.

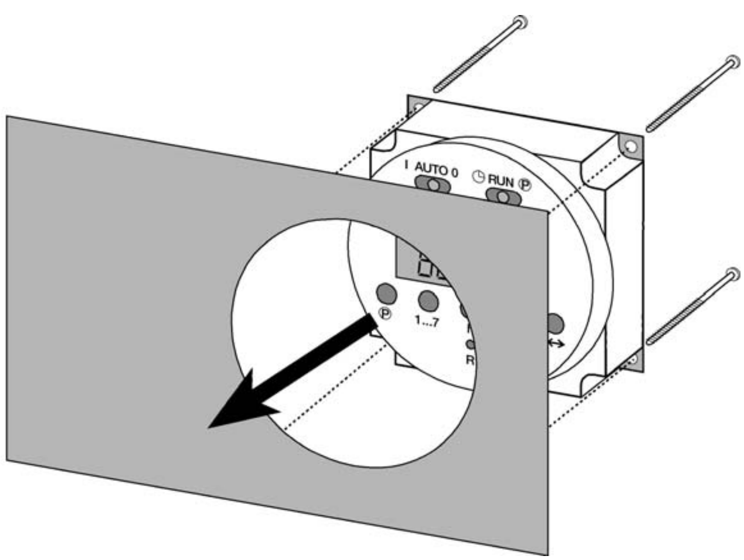


Fig. 5: Fitting the 884

4 Operating the 884

The timer is ready for service after a Reset.

4.1 Reset

Before the first commissioning/progamming a Reset must be carried out:

<table>
<tr><th></th><th>1 Channel</th><th>2 Channel</th></tr>
<tr><td>1.</td><td colspan="2">Ensure that the right sliding switch is in the RUN position.</td></tr>
<tr><td>2.</td><td colspan="2">Press button „R“ with the point of a biro or similar implement.
The Display will start to flash 0:00.</td></tr>
</table>

4.2 Setting the Time and Day

Proceed as follows:

<table>
<tr><th></th><th>1 Channel</th><th>2 Channel</th></tr>
<tr><td>1.</td><td>Set the right sliding switch to position</td><td>Set the right sliding switch to position RUN and next press buttons „h“ and „m“ simultaneously for 2 to 3 seconds (Set function).</td></tr>
<tr><td>2.</td><td colspan="2">Press button „1...7“ to input the day of the week
1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday
7 = Sunday
An arrow will be seen in the Display indicating the day of the week.</td></tr>
<tr><td>3.</td><td colspan="2">Use buttons „h“ and „m“ to set the time.</td></tr>
<tr><td>4.</td><td>Set the right sliding switch to the RUN position. The time of</td><td>After 15 seconds the times will automatically pick up the time of</td></tr>
</table>

day will be activated.	day. (The colon in the Display will start to flash.) Or set the right sliding switch briefly to P1 or P2 and then back to RUN. The time of day will be activated immediately.

4.3 Setting Operation Modes

Operation Mode	***1 Channel***	***2 Channel***
Permanently ON The appliance(s) connected is/are permanently switched on	• Set the left sliding switch to position I. • The symbol ✷ shows in Display.	• Set the left sliding switch to position 1. • Choice of Channel is effected using the Skip button „X->“. **Choice**: Channel 1: ON or Channel 2: ON or (the other Channel stays in the previous setting) or Channel 1 and 2: ON **Set Channel:** Channel 1: press once Channel 2: press twice Channel 1 and 2: First select Channel 1 or 2. Then press the Skip button again to select the second Channel. ▪ The symbol ✷ appears as soon as at least one Channel has been selected. • To delete a selected Channel set the left sliding switch for 2-3 seconds to AUTO and then back to I. The permanently ON Channel can be selected again.
Permanently OFF The appliance(s) connected is/are permanently switched off	• Set the left sliding switch to position 0 The symbol ✷ is extinguished	• Set the left sliding switch to postition O. • Choice of Channel is effected using the Skip button „-X->“. **Choice**: Channel 1: OFF or Channel 2: OFF (the other Channel stays in the previous setting) or Channel 1 and 2: OFF **Set channel:** Channel 1: press once Channel 2: press twice Channel 1 and 2: First select Channel 1 or 2. Then press the Skip button again to select the second Channel. The selected Channel number(s) show in the Display. • No ✷ symbol. • To delete a selected Channel set the left sliding switch for 2-3 seconds to AUTO and then back to 0. The permanently OFF Channel can be selected again
AUTO The appliance(s) connected switch according to a pre-set programme	• Set the left sliding switch to position AUTO. • ON mode: symbol ✷ appears. OFF mode: symbol ✷ is extinguished.	• Set the left sliding switch to position AUTO. • No Channel selection is possible in this setting – both Channels switch according to how they have been programmed. • ON mode: symbol ✷ and the relevant Channel number(s) show up in the Display. • OFF mode: symbol ✷ disappears.

4.4 Switching Times

4.4.1 Programming

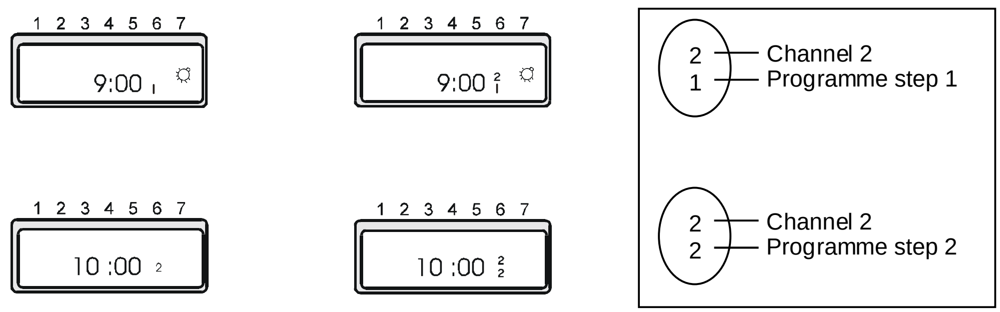
Each Channel has 16 programmeable Switching Points (8 x ON, 8 x OFF):
Nos. 1, 3, 5, 7, 9, 11, 13, 15 are Switch On points (symbol ✷).
Nos. 2, 4, 6, 8, 10, 12, 14, 16 are Switch Off points (no symbol).

The Switch Time selected will be indicated by a number in the lower right of the Display and the symbol ✷.
In addition for 2 Channel set-up the Channel No will be indicated above right.

1 Channel set-up **2 channel set-up**

ON

OFF



Please note when programming:
Each switch on point is closely linked to the following switch off point

Switch-point 1: switch on
Switch-point 2: switch off
Switch-point 3: switch on
Switch-point 4: switch off
usw.

They should always be programmed in pairs to avoid errors.
Attention: The shortest possible switching interval is 1 minute!

Proceed as follows:

	1 Channel	*2 Channel*
1.	Set the right sliding switch to position P .	Set the right sliding switch to position P1 (Channel 1) or P2 (Channel 2).
	The first switch point (switch on) is displayed.	

2. Setting the Switch On Point

Press button „1...7“ to input the day of the week or blocks of days.

Continuous pressing of this button allows you to select individual days and the following blocks of days:

Press once:	Day 1	(Monday)
Press twice:	Day 2	(Tuesday)
Press three times:	Day 3	(Wednesday)
Press four times::	Day 4	(Thursday)
Press five times:	Day 5	(Friday)
Press six times:	Day 6	(Saturday)
Press seven times:	Day 7	(Sunday)
Press eight times:	Block 1 to 5	(Monday to Friday)
Press nine times:	Block 6 to 7	(Samstag to Sunday)
Press ten times:	Block 1 to 6	(Monday to Saturday)
Press eleven times:	Block 1 to 7	(Monday to Sunday)

Arrows in the Display indicate days of the week.

- Press buttons „h“ and „m“ to set the time.

3. Setting the Switch Off Point

- Press button „P“.
  The next switch point (switch off) is displayed.
- Press button „1...7“ to input the day of the week or blocks of days. Continuous pressing of this button allows you to select individual days or blocks of days.
- Press buttons „h“ and „m“ to set the time.

4. Repeat steps 2 to 3 as often as required.

5. After setting the desired switching times: Set the left sliding switch to position AUTO and the rightsliding switch to position RUN.

   The timer will now operate according to the programmed switching times.

4.4.2 Programme Running

When reaching the Switch On Point the connected appliance will be switched on. During the activated time the symbol ✷ will be shown in the display. When reaching the Switch Off Point the connected appliance will be switched off and the symbol disappears.

4.4.3 Checking, changing and deleting switching times

Proceed as follows:

	1 Channel	*2 Channel*
1.	Set the right sliding switch to position P	Set the right sliding switch to position P1 (Channel 1) or P2 (Channel 2).
2.	**Checking** Press button „P“ as often as necessary to show the desired switching point in the Display. The Switching Points which are not activated will be indicated by flashing „0:00“.	Press buttons „P1“ or „P2“ as often as necessary to show the desired switching point in the Display.
3.	**Changing** Use button „P“ to flag up the desired „saved“ location. Press buttons „1...7“ to change the day of the week. Press buttons „h“ and „m“ to change the switching time, as described earlier.	
4.	**Deleting** Use button „P“ to flag up the desired „saved“ location. Then press button ”-X->” and button „P simultaneously for 3 – 4 seconds. The Display will show a flashing 0:00 and the switching point is deleted.	
5.	If the check, change or deletion is complete set the right sliding switch back to position RUN.	

4.4.4 Skip-Function (Soft-Override)

The Skip Function changes the switching mode of the appliance connected until the next step of programme is reached.
For instance: if the appliance is in ON mode, pressing the Skip-button '-X->'will immediately turn it off and vice-versa.

Proceed as follows:

	1 Channel	*2 Channel*
1.	Set the right sliding switch to position RUN.	
2.	Press the Skip button "-X->".	Pressing Skip button „-X->" once switches Channel 1. Pressing Skip button „-X->" twice switches Channel 2.
	The appliance will change over to the opposite switching mode. The Skip symbol (-X->) show up in the Display..	
3.	Further pressing of the Skip button „-X->" brings up the Skip Function again.	

Please note in connection with the Skip Function:

- Display of the number and the symbol occurs after a lapse of about 3 seconds.
- The Skip Function only operates until the next programmed switch time is reached. At this point the Skip Function is deleted and the programmed switch time cycles are activated again.

5 Programming Errors

Every switch on point is closely linked to the following switch off point. Therefore the following combinations of on/off switching can, for example, lead to errors:

Switch on time	Switch off time
Switch on time programmed	No setting
No setting	Switch off time programmed
Day block (e.g. 1, 2, 3, 4, 5)	Different day block (e.g. 1, 2, 3, 4, 5, 6)
Day block	Week day
Switch on time programmed (e.g. Wednesday, 09:00)	Switch off time is *before* the switch on time on the same day (e.g. Wednesday, 08:59)
On and Off switch times occur at the same time (e.g. Wednesday, 09:00)	

6 Technical Data

Functions	
Installation:	in appliances of Safety Class I and II
Time switch:	day and week programme
Shortest intervall:	1 min.
Output:	Relay or transistor output
Action:	type 1B (relay switching version), type 1Y (transistor version)
Operation:	via 6 buttons and 2 sliding switches
Display:	LCD
Power failure bridging:	> 5 Years with lithium battery (3 V)
Product features 1 channel	
Switching capability:	16 (8 x ON, 8 x OFF), with day blocks up to 56 switching possibilities
Breaking capacity:	10 A/250 V AC (ohm.) or 4 A/250 V AC (ind.)
Product features 2 channel	
Switching capability:	16 each channel (8 x ON, 8 x OFF), with day blocks up to 112 switching possibilities
Breaking capacity:	2x5 A/250 V AC (ohm.) or 2x2 A/250 V AC (ind.)
DCF	In the case of 2 channel set-up, DCF input/reception (radio reception in accordance with german time standard) is available for option. Attention, antenna and connecting cables have to be for 230V. Please follow the safety instructions on page 3.
Specifications	
Mains voltage (VDE-tested):	12 VAC/DC, 24 VAC/DC, 230-240 VAC ± 10%
Mains voltage (UL-tested):	110-120 VAC, 220-240 VAC ± 10 %
Mains frequency:	50/60 Hz
Power input	ca. 3,2 VA
Ambient temperature	0 °C - +55 °C
Control pollution:	Normal
Connection	
Electrical connections:	connection to the mains supply and power relay via flat plug 6.3 x 0.8 mm according to DIN 46244
Conformity mark:	VDE or UL
	Subject to technical modifications

QO327M100RB

LOAD CENTER QO MB 240V 100A 3PH 27SP

List Price	$1,185.00 USD
Availability	**Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Ampere Rating	100A
Approvals	UL Listed
Enclosure Type	Outdoor/Rainproof
Cover Type	Surface
Application	Designed to meet residential, commercial and industrial requirements to protect electrical systems, equipment and people.
Box Number	6R
Bus Material	Tin Plated Copper
Short Circuit Current Rating	25kA
Maximum Tandem Circuit Breakers	0
Phase	3-Phase
Main Type	Convertible Mains - Breaker
Spaces	27
Enclosure Rating	NEMA 3R
Maximum Single Pole Circuits	27
Grounding Bar	Order separately
Voltage Rating	208Y/120 Vac - 240/120 Vac Delta - 240 Vac Delta
Wire Size	#4 to 2/0 AWG(Al/Cu)
Wiring Configuration	4-Wire

Notes:

Side hinge door device allow 1.25 inches on the left side for door to open.

Shipping and Ordering

Category	00017 - Load Centers, 3 phase, Outdoor
Discount Schedule	DE3
GTIN	00785901295488
Package Quantity	1
Weight	32.41 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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40269-469-02
03/2006
Lexington, KY, USA

Instruction Bulletin

Replaces 40269-469-01 03/1983

QO® Circuit Breaker Load Centers

Retain for future use.

INSTALLATION

⚠ DANGER

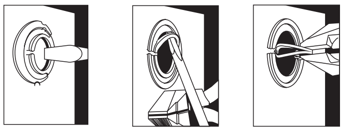
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Remove Knockouts

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Drive center knockout inward and alternately pry up or drive in outer rings, one at a time.



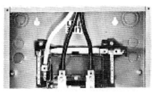
Mount Box

Position box so Line/Line marking is up for top feed and down for bottom feed.

Pull Conductors Into Box

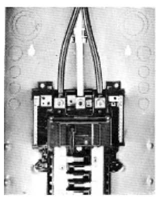
NOTE: Conductors must enter the box through approved wire clamps, conduit bushing or by other methods approved for the purpose, to prevent damage to conductor insulation.

Figure 1: Wire Mains and Neutral

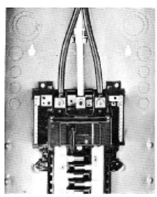


Main Lugs (125 A Max.)

Main Circuit Breaker (125 A Max.)



Main Lugs (225 A Max.)



Main Circuit Breaker (225 A Max.)

a brand of Schneider Electric

SQUARE D

INSTALLATION AND WIRING BRANCH CIRCUIT BREAKERS

⚠ WARNING

HAZARD OF EQUIPMENT DAMAGE

- This equipment is designed and tested by Square D® to performance levels which exceed Underwriter's Laboratories Standards.
- Use of other than Square D® circuit breakers may adversely affect user safety and impair reliability. Schneider Electric disclaims all liability for damage, injury or non-performance caused by the use or failure of non-Square D circuit breakers.

Failure to follow these instructions can result in death or serious injury.

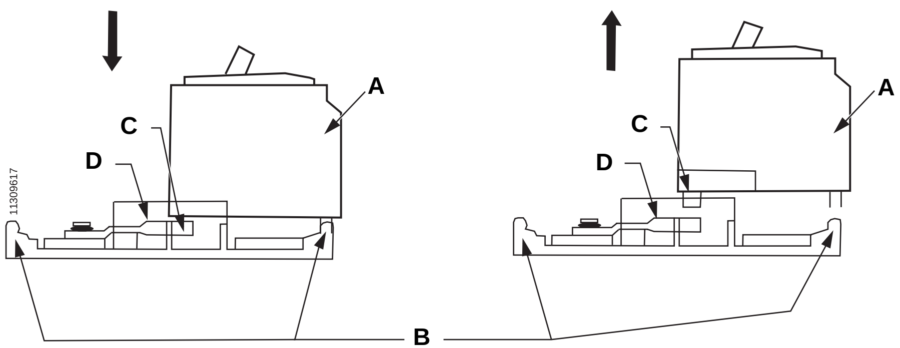
Installing Circuit Breaker

1. Turn OFF (O) circuit breaker.
2. Snap wire terminal end (A) of circuit breaker onto mounting rail (B).
3. Push circuit breaker inward until plug-on jaws (C) plug securely onto bus bar connector (D).
4. Install wire(s).

Removing Circuit Breaker

1. Turn OFF (O) circuit breaker.
2. Remove wire(s).
3. Disconnect plug-on jaws (C) from connector by pulling circuit breaker outward until it disengages from mounting rail (B).

Figure 2: Installing and Removing Circuit Breaker



INSTALLATION FOR QOT CIRCUIT BREAKERS

NOTE: Square D® Class CTL load centers are designed to restrict the installation of more overcurrent devices than that number for which each was designed, rated and approved. To accomplish this, the mounting means for QOT® circuit breakers is different from QO® and Q1® circuit breakers.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Before energizing load center, turn main and branch circuit breakers to OFF (O) position. After power is turned on to load center, turn main circuit breaker ON (I) and then turn on branch circuit breakers.
- See lug data chart on load center wire diagram for lug torque specifications.
- See circuit breaker marking for circuit breaker lug torque specifications.
- The QOT mounting cam is thick, hardened steel. Excessive force to improperly install a tandem circuit breaker where no mounting slot is provided will destroy the circuit breaker case.

Failure to follow these instructions may result in equipment damage.

Installation

NOTE: Type QOT tandem circuit breakers may be installed only in load centers where the mounting rail has a slot at the center line of the desired pole place.

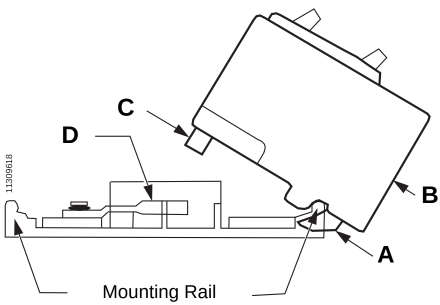
1. Turn OFF (O) circuit breaker.
2. Hold QOT circuit breaker at a 30° angle and insert mounting cam (A) in mounting rail (B) as far as possible.
3. Rotate circuit breaker until plug-on jaws (C) plug securely onto bus bar connector (D).

   NOTE: Bottom of circuit breaker case should remain against mounting rail.
4. Install wires.

Removal

1. Turn OFF (O) circuit breaker.
2. Remove wires.
3. Disconnect circuit breaker by rotating the plug-on jaws (C) away from bus bar connector (D) until the jaws disengage.
4. Remove circuit breaker from the mounting rail (B).

Figure 3: Tandem Circuit Breaker Mounting and Removal



REMOVE COVER TWISTOUTS

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Remove main circuit breaker twistout only when main circuit breaker is installed. Close unused circuit breaker openings with filler plates.

Failure to follow this instruction will result in equipment damage.

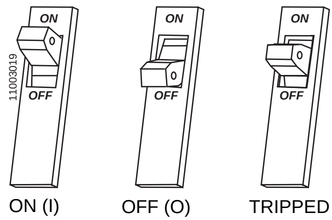
NOTE: Remove only those twistouts which match installed circuit breakers by twisting out with pliers at center of twistout.

Table 1: Filler Plates

Type	Usage
QOFP	Closes 1-pole branch circuit breaker opening.
QOM1FP	Closes 70–125 A main circuit breaker opening.
QOM2FP	Closes 150–225 A main circuit breaker opening.

IDENTIFY CIRCUITS

1. Identify branch circuits on directory label.
2. Handle at mid-position and red Visi-Trip® indicator show circuit breaker is tripped.
3. To reset, move handle to OFF (O) position, then to ON (I) position.



NOTE: If load center is used as service equipment, apply “Service Disconnect” label to cover near main circuit breaker handle. If load center is not used as service equipment, apply “Main” label to cover near main circuit breaker handle.

Schneider Electric USA
1601 Mercer Road
Lexington, KY 40511 USA
1-888-SquareD (1-888-778-2733)
www.us.SquareD.com

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.

Product Data Sheet

H323NRB

SW FUSIBLE 240V 100A 3P NEMA3R/NEUTRAL

List Price	$1,278.00 USD
Availability	**Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Disconnect Type	Fusible
Type of Duty	Heavy Duty
Enclosure Rating	NEMA 3R
Action	Single Throw
Short Circuit Current Rating	10kA (Class H or K) - 200kA (Class R,J or L)
Ampere Rating	100A
Enclosure Type	Rainproof and Sleet/Ice proof (Indoor/Outdoor)
Mounting Type	Surface
Enclosure Material	Galvannealed Steel
Number of Poles	3-Pole
Approvals	UL Listed
Terminal Type	Lugs
Factory Installed Neutral	Yes
Electrical Interlock	None
Maximum Voltage Rating	240VAC/250VDC
Wire Size	#12 to #1/0 AWG(Al) or #14 to #1/0 AWG(Cu)
Depth	6.38 Inches
Height	21.25 Inches
Width	8.50 Inches

Shipping and Ordering

Category	00009 - Safety Switch, Heavy Duty, 2 & 3 Pole, 30-200 Amp, Outdoor
Discount Schedule	DE1
GTIN	00785901480297
Package Quantity	1
Weight	18.28 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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

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 30 Hp)
  - 480/600V, 3Ø (up to 30 Hp)

Industrial Grade Packaging

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

Simplicity

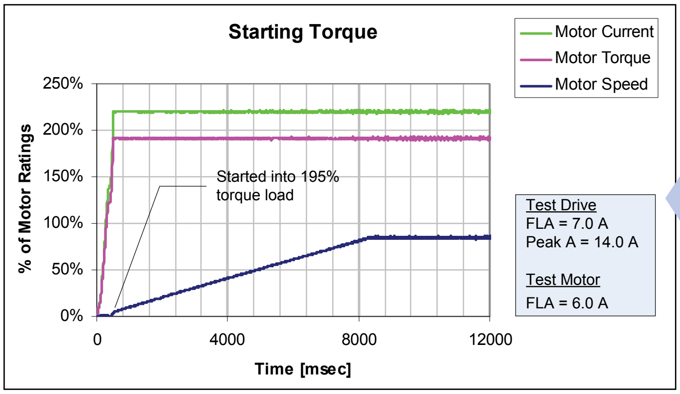
- Intuitive User Interface
- Electronic Memory Module (EPM)
- Optional Disconnect Switch (NEMA 4X only)
- Optional Potentiometer Switch (NEMA 4X only)

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 reseting the drive to factory or user default settings.

When drive reset is necessary, reset to factor 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 confighuration is not lost, simply plug in the pre-programmed EPM. You are good to go with Ever Present Memory.

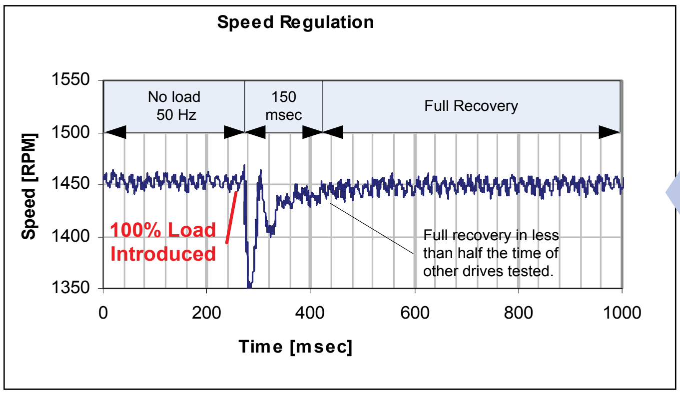
SMVector | Performance



Exceptional Starting Torque

Overpower demanding applications

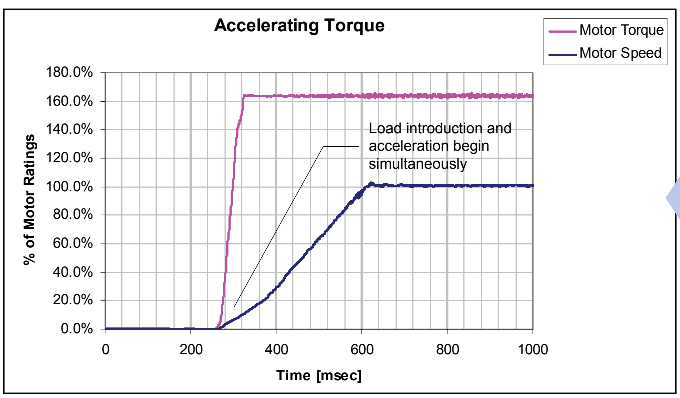
The SMVector is peerless in controlling the motor's ability to convert current into torque. In this example, the SMVector is started into a stiff 195% torque load. Not only does the motor start the load, but it also delivers a full 195% torque while accelerating to 50 Hz in 8 seconds.



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

SMV NEMA 4X (IP65)
With Disconnect and 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

SMVector | Specifications

World Class Control

Modes of Operation
- Open Loop Flux Vector, Speed or Torque Control with 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 or 12 kHz

Universal Logic Assertion (Selectable)
- Positive or Negative Logic Input
- Digital Reference Available

Braking Functions
- DC Injection Braking
- Optional Dynamic Braking

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

Process Control
- PID Modes: Direct and Reverse Acting
- PID Sleep Mode
- 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 @ 6 kHz
- 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

Three ReStarts
- Two 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

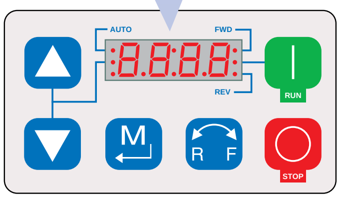
Simple Six Button Programming
Start
Stop
Forward/Reverse
Scroll Up
Scroll Down
Enter/Mode

Informative LED Display

Vivid Illumination
- Easily Read from a Distance

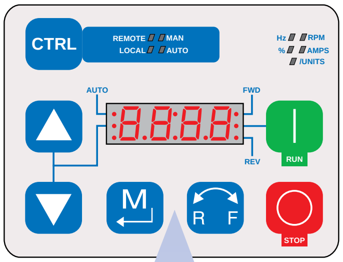
Five Status LEDs
- Run
- Automatic Speed mode
- Manual Speed Mode
- Forward Rotation
- Reverse Rotation

Status Display
- Motor Status
- Fault Management
- Operational Information



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

NEMA1 15-30HP 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

Selector switch for negative or positive logic.

EPM (Electronic Programming Module)

Communication Gateway

DC Bus

Removable terminal cover and steel conduit plate (not shown).
Easy access for control & power wiring.
An extra IP21 finger guard ships with every drive.

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, 15-30 HP only)

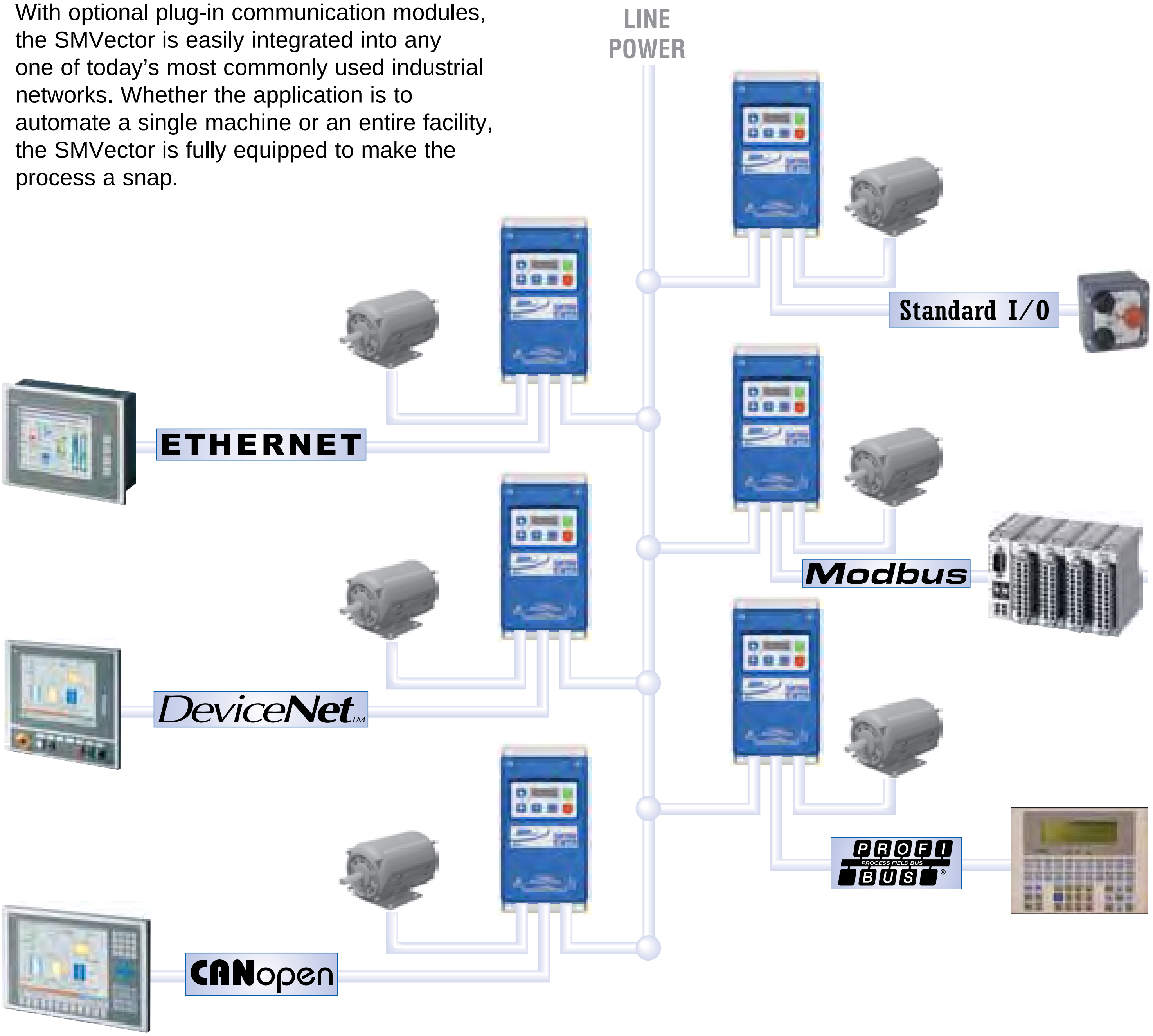
1 Programmable Digital Input
1 Common
RS-485 Modbus Communications
- TXA
- TXB

Lenze AC Tech

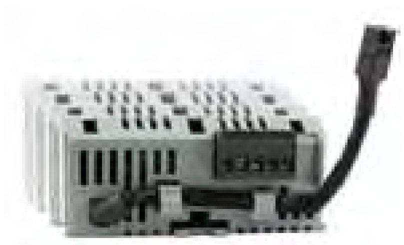
RoHS COMPLIANT

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.

Lenze AC Tech

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)

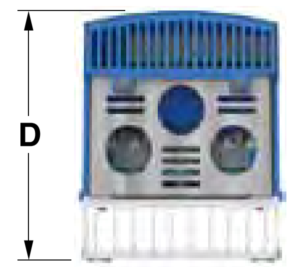
Power		NEMA1		NEMA4X - Indoor [C or D]/Outdoor[E or F]*		NEMA4X w/Disconnect - Indoor**	
Hp	kW	Model	Size	Model	Size	Model	Size
0.5	0.37	ESV371N04TXB	G1	ESV371N04TX[C] or [E]	R1	ESV371N04TMC	AA1
1	0.75	ESV751N04TXB	G1	ESV751N04TX[C] or [E]	R1	ESV751N04TMC	AA1
1.5	1.1	ESV112N04TXB	G2	ESV112N04TX[C] or [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

*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

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
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	10.30	261
AF1	18.50	470	9.40	240	11.20	285

SMVector - Frequency Inverter
Operating Instructions

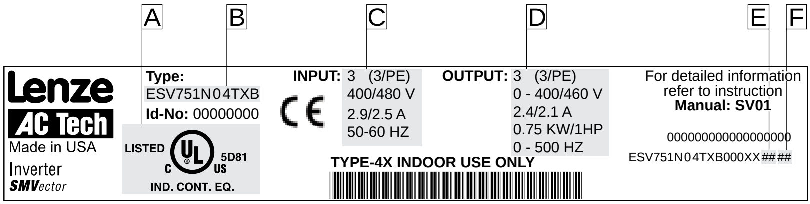
Contents

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 4.0 or higher
(refer to drive nameplate, an example is shown below).

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
• 1 SMV Inverter with EPM installed (see Section 4.4) • 1 Operating Instructions manual	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. Claim: • visible transport damage immediately to the forwarder. • visible deficiencies /incompleteness immediately to your Lenze AC Tech representative

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.

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	**STOP!**	Warns of potential damage to material and equipment.	Damage to the controller/drive or its environment.
i	**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 permissable 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! Hazard of Electrical Shock
Capacitors retain charge for approximately 180 seconds after power is removed. Allow at least 3 minutes for discharge of residual charge before touching the drive.

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.

NOTE
Control and communications terminals provide reinforced insulation when the drive is connected to a power system rated up to 300V rms between phase to ground (PE) and the applied voltage on Terminals 16 and 17 is less than 150VAC between phase and ground.

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 phase and ground (PE).

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.

Warnings!

- 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.
- Use minimum 75 °C copper wire only.
- 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).

Torque Requirements (in accordance with UL) are listed in section 3.2.1, Power Connections.

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	– 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 Permissable 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 plenun rated in accordance with UL 508C and are suitable for installation in a compartment handling conditioned air.	
Protection measures against	short circuit, earth fault, phase loss, over voltage, under voltage, motor stalling, over temperature, motor overload	
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	N0	2	T	X	B

Electrical Products in the SMVector Series (ESV)

Power Rating in kW: (152)

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): (N0)

C_ = CANopen (Available all models)	The "_" blank can be:
D_ = DeviceNet (Available all models)	0 = Standard Keypad
E_ = Ethernet/IP, ModBus TCP/IP (Avail all models)	
R_ = RS-485 / ModBus /Lecom (Avail all models)	
P_ = ProfiBus-DP (Available all models)	
N_ = No Communications installed	

Input Voltage: (2)
- 1 = 120 VAC (doubler output) or 240 VAC
- 2 = 240 VAC
- 4 = 400/480 VAC
- 6 = 600 VAC

Input Phase: (T)
- S = Single Phase Input only
- Y = Single or Three Phase Input
- T = Three Phase Input only

Input Line Filter (X)
- 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)
- 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 contaminates, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).

2.3 Ratings

120V / 240VAC Models

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 filter	N4X/IP65 W/ filter
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	

Mains = 120V Single Phase (1/N/PE) (90...132V), 240V Single Phase (2/PE) (170...264V); 48...62Hz

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) 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 filter	N4X/IP65 W/ filter
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 filter	N4X/IP65 W/ filter
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 filter	N4X/IP65 W/ filter
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 filter	N4X/IP65 W/ filter
					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 filter	N4X/IP65 W/ filter
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 (In) 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 (In) 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

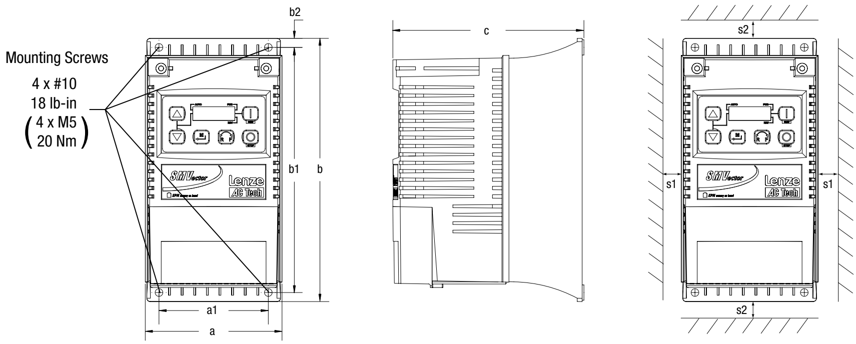
Output Current (In) derating for Carrier Frequency (P166) for NEMA 4X (IP65) Models:
- If P166=1 (6 kHz), derate I_n to 92% of drive rating
- If P166=2 (8 kHz), derate I_n to 84% of drive rating
- If P166=3 (10 kHz), derate I_n to 76% of drive rating

3 Installation

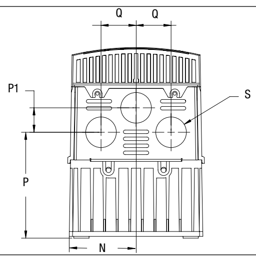
3.1 Dimensions and Mounting

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.

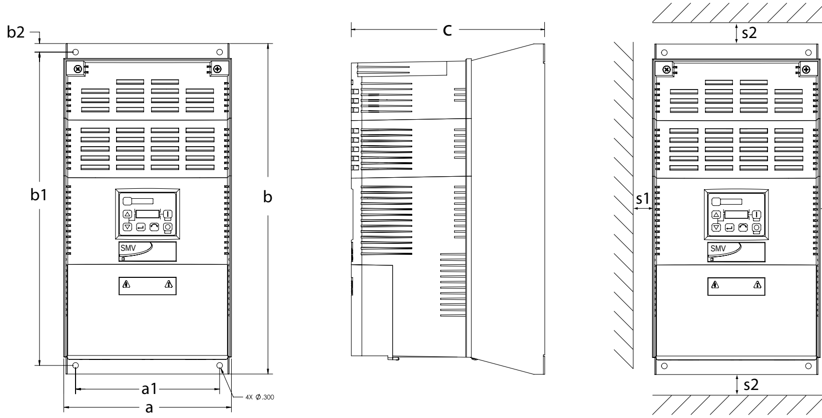
3.1.1 NEMA 1 (IP31) Models ≤ 30HP (22kW)



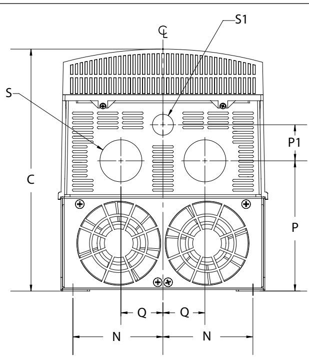
	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
G1	ESV251~~~~~B; ESV371~~~~~B ESV751~~~~~B	3.90 (99)	3.12 (79)	7.48 (190)	7.00 (178)	0.24 (6)	4.35 (111)	0.6 (15)	2.0 (50)	2.0 (0.9)
G2	ESV112~~~~~B; ESV152~~~~~B ESV222~~~~~B	3.90 (99)	3.12 (79)	7.52 (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)

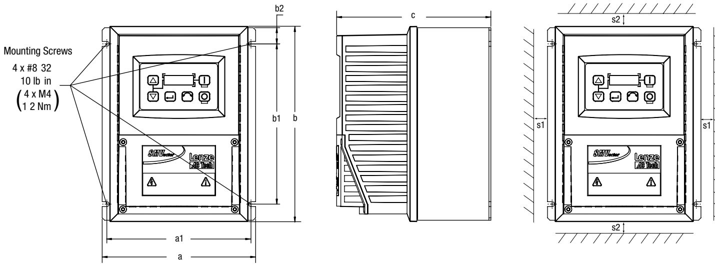
3.1.2 NEMA 1 (IP31) Models > 30HP (22kW)



	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)

3.1.3 NEMA 4X (IP65) Models

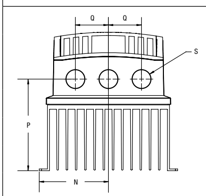


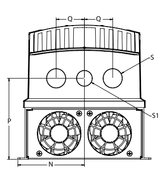
	Type	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
R1	ESV371N01SX_; ESV751N01SX_; ESV371N02YX_; ESV751N02YX_; ESV371N04TX_; ESV751N04TX_; ESV751N06TX_; ESV371N02SF_; ESV751N02SF_; ESV371N04TF_; ESV751N04TF_;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	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)

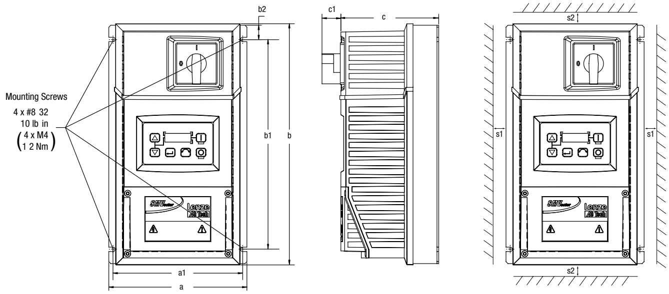
Conduit Hole Dimensions





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)

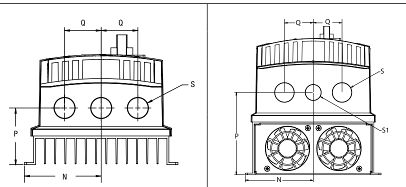
3.1.4 NEMA 4X (IP65) Models with Disconnect Switch



	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)
AA2	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)	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)	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)	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)	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)

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.

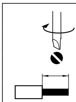
In order to reform the capacitors and prepare the drive for operation after a long period of inactivity, apply input power to the drive for 8 hours prior to actually operating the motor.

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).

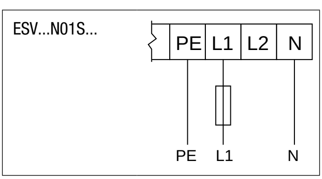
DANGER! Hazard of electrical shock!
Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.

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.

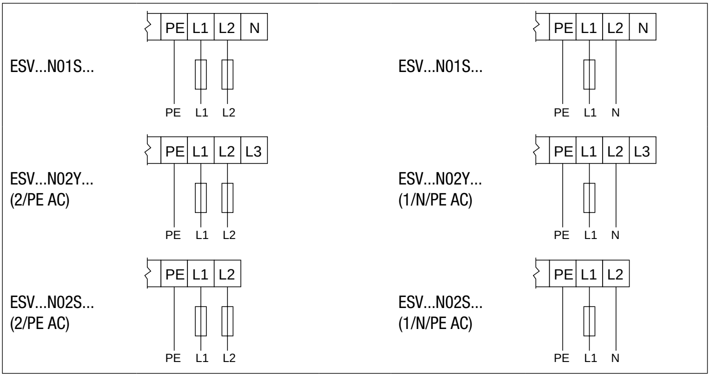


Mains and Motor Terminations		
Type	**Torque**	**Strip Length**
<5HP	12 lb-in (1.3 Nm)	0.25 in (6mm)
ESV552xx2T, ESV752xx2T, ESV113xx4/6, ESV153xx4/6, ESV183xx6, ESV223xx6	16 lb-in (1.8 Nm)	0.25 in (6mm)
ESV552xx4Txx, ESV752xx4Txx, ESV552xx6Txx, ESV752xx6Txx	12 lb-in (1.3Nm)	0.25 in (6mm)
ESV113xx2xxx, ESV153xx2xxx, ESV183xx4xxx, ESV223xx4xxx	24 lb-in (2.7 Nm)	0.25 in (6mm)
Torque: N4X/IP65 Door Screws		
N4X/IP65	6-7 lb-in (0.67-0.79 Nm)	0.25 in (6mm)

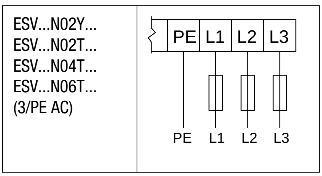
3.2.1.1 Mains Connection to 120VAC Single-Phase Supply



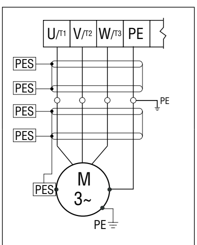
3.2.1.2 Mains Connection to 240VAC Single-Phase Supply



3.2.1.3 Mains Connection to Three-Phase Supply



3.2.1.4 Motor Connection



PES = Protective Earth Shielding

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.

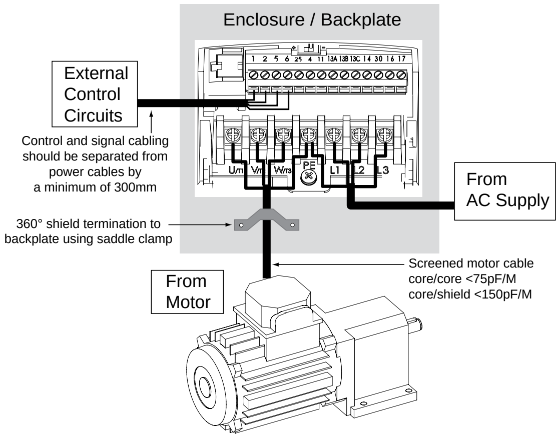
3.2.1.5 Installation Recommendations for EMC Compliance

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.

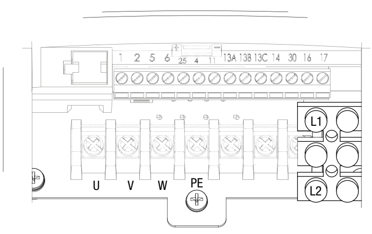
Motor cable should be low capacitance (core/core <75pF/m, core/shield <150pF/m). Filtered drives can meet the class A limits of EN 55011 and EN 61800-3 Category 2 with this type of motor cable up to 10 meters.

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.

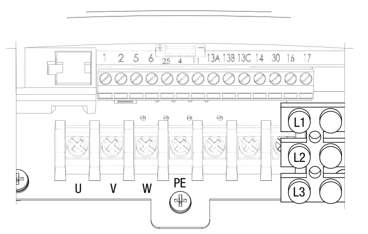


3.2.1.6 NEMA 4X (IP65) Input Terminal Block

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)
With Filter and/or integrated line disconnect

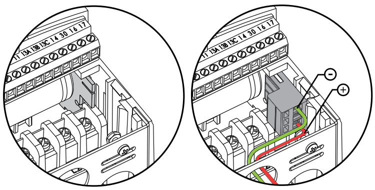
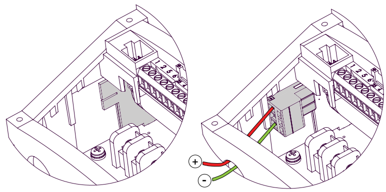


Three Phase (3/PE)
With Filter and/or integrated line disconnect

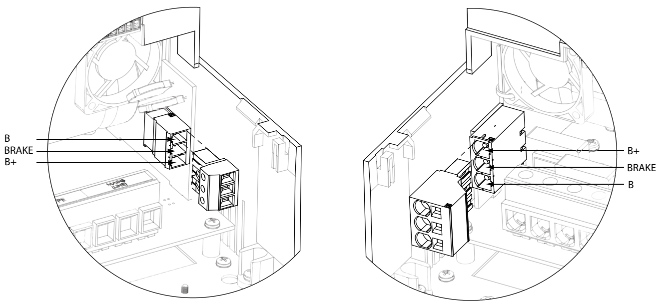
WARNING
Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

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.

NEMA 1 (IP31) up to 30HP (22kW)	NEMA 4X (IP65) up to 30HP (22kW)
	

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 (30.0...45.0 kW) 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-.



40HP 50/60HP

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 #**
ESV303**4T**	40	30	23.5	1020	841-013
ESV373**4T**	50	37	17	1400	841-015
ESV453**4T**	60	45	17	1400	841-015
600 VAC SMV Inverter			**Resistor Kit**		
Type	**Hp**	**kW**	**Resistance (Ω)**	**Power (W)**	**Catalog #**
ESV303**6T**	40	30	35	1070	841-014
ESV373**6T**	50	37	24	1560	841-016
ESV453**6T**	60	45	24	1560	841-016

3.2.2 Fuses/Cable Cross-Sections

NOTE: Observe local regulations. Local codes may supersede these recommendations

Type		Recommendations				
		Fuse	Miniature circuit breaker(1)	Fuse (2) or Breaker(3) (N. America)	Input Power Wiring (L1, L2, L3, PE)	
					[mm²]	[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
240V 3~ (3/PE)	ESV371N02YXB, ESV751N02YXB, ESV371N02Y_*, ESV751N02Y_*	M10 A	C10 A	10 A	1.5	14
	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	C50 A	45 A	10	8
	ESV113N02TXB, ESV113N02TX~, ESV113N02TM~	M80 A	C80 A	80 A	16	6
	ESV153N02TXB, ESV153N02TX~, ESV153N02TM~	M100 A	C100 A	90 A	16	4
400V or 480V 3~(3/PE)	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
	ESV552N04TXB, ESV552N04T_*	M20 A	C20 A	20 A	2.5	14
	ESV752N04TXB, ESV752N04T_~	M25 A	C25 A	25 A	4.0	10
400V or 480V 3~(3/PE)	ESV113N04TXB, ESV113N04T_~	M40 A	C40 A	40 A	4	8
	ESV153N04TXB, ESV153N04T_~	M50 A	C50 A	50 A	10	8
	ESV183N04TXB, ESV183N04T_~	M63 A	C63A	70 A	10	6
	ESV223N04TXB, ESV223N04T_~	M80 A	C80 A	80 A	16	6
	ESV303N04TXB	M100 A	C100 A	100 A	25	4
	ESV373N04TXB	M125 A	C125 A	125 A	35	2
	ESV453N04TXB	M160 A	C160 A	150 A	35	1
600V 3~(3/PE)	ESV751N06TXB ...ESV222N06TXB ESV751N06T_* ...ESV222N06T_*	M10 A	C10 A	10 A	1.5	14
	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	C40 A	40 A	4	8
	ESV183N06TXB, ESV183N06TX~, ESV183N06TM~	M50 A	C50 A	50 A	6	8
	ESV223N06TXB, ESV223N06TX~, ESV223N06TM~	M63 A	C63 A	60 A	10	8
	ESV303N06TXB	M80 A	C80 A	70 A	16	6
	ESV373N06TXB	M100 A	C100 A	90 A	16	4
	ESV453N06TXB	M125 A	C125 A	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, JJN or JJS or equivalent.
(3) Thermomagnetic type breakers preferred.

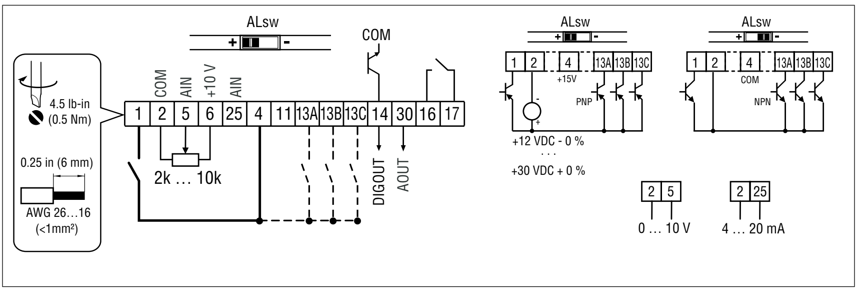
_ 11th digit of part number:	F = Integral EMC Filter
	L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
	M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
	X = No EMC Filter/ No Disconnect Switch
* = Last digit of part number:	C = N4X Indoor only (convection cooled)
	E = N4X Indoor/Outdoor (convection cooled)
~ = Last digit of part number:	D = N4X Indoor only (fan cooled)
	F = N4X Indoor/Outdoor (fan cooled)

Observe the following when using Ground Fault Circuit Interrupters (GFCIs):

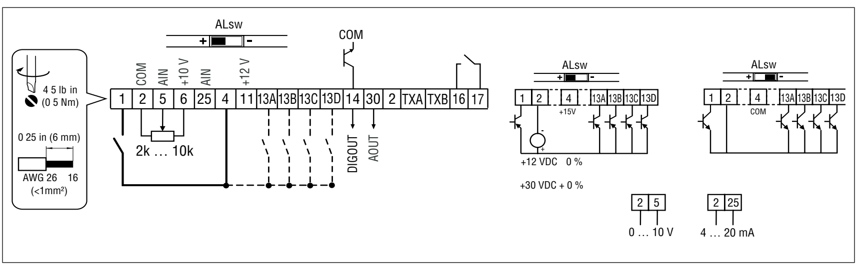
- Installation of GFCI only between supplying mains and controller.
- The GFCI can be activated by:
  - capacitive leakage currents between the cable screens during operation (especially with long, screened motor cables)
  - connecting several controllers to the mains at the same time
  - RFI filters

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).

Control Terminal Strip Descriptions

Terminal	Description	Important
1	Digital Input: Start/Stop	input resistance = 4.3kΩ
2	Analog Common	
5	Analog Input: 0...10 VDC	input resistance: >50 kΩ
6	Internal DC supply for speed pot	+10 VDC, max. 10 mA
25	Analog Input: 4...20 mA	input resistance: 250Ω
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 = 4.3kΩ
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 DC 24 V / 2 A … 240 V / 0.22 A, non-inductive
17		

***** = Terminal is part of the terminal strip for the 15HP (11kW) and higher models only.

Assertion level of digital inputs

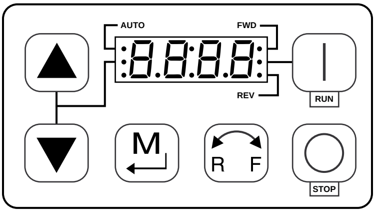
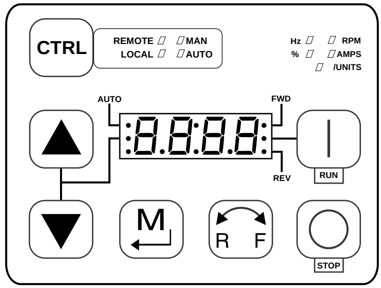
The digital inputs can be configured for active-high or active-low by setting the Assertion Level Switch (ALsw) and P120. If wiring to the drive inputs with dry contacts or with PNP solid state switches, set the switch and P120 to “High” (+). If using NPN devices for inputs, set both to “Low” (-). Active-high (+) is the default setting.

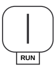
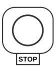
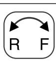
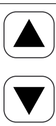
HIGH = +12 … +30 V
LOW = 0 … +3 V

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: - 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 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.
	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.

Display	INDICATING LEDs (on 4-character display)
FWD	FWD LED: Indicate the present rotation direction is forward. Refer to ROTATION description above.
REV	REV LED: Indicate the present rotation direction is reverse. Refer to ROTATION description above.
AUTO	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	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

CTRL

The CTRL pushbutton selects the start and speed reference control sources for the drive.

Press [M] mode button to accept the new control mode selection.

CTRL LEDs		START CONTROL	REFERENCE CONTROL
REMOTE MAN LOCAL AUTO	[LOCAL] [MAN]	Keypad	P101 Settings
REMOTE MAN LOCAL AUTO	[LOCAL] [AUTO]	Keypad	Terminal 13x Settings
REMOTE MAN LOCAL AUTO	[REMOTE] [MAN]	Terminal Strip	P101 Settings
REMOTE MAN LOCAL AUTO	[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			

<table>
<tr><th>Display</th><th colspan="2">START CONTROL</th></tr>
<tr><td></td><td colspan="2">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.</td></tr>
<tr><td rowspan="4"></td><td colspan="2">REFERENCE CONTROL</td></tr>
<tr><td colspan="2">The AUTO/MANUAL LEDs indicate the current reference control source.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td></td><td colspan="2">UNITS LEDs</td></tr>
<tr><td></td><td>HZ: current display value is in Hz</td><td rowspan="5">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.
In Torque mode, the HZ LED will be ON when the drive is in run (non-programming) mode.
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.</td></tr>
<tr><td></td><td>%: current display value is in %</td></tr>
<tr><td></td><td>RPM: current display value is in RPM</td></tr>
<tr><td></td><td>AMPS: current display value is in Amps</td></tr>
<tr><td></td><td>/UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)</td></tr>
</table>

4.2 Drive Display and Modes of Operation

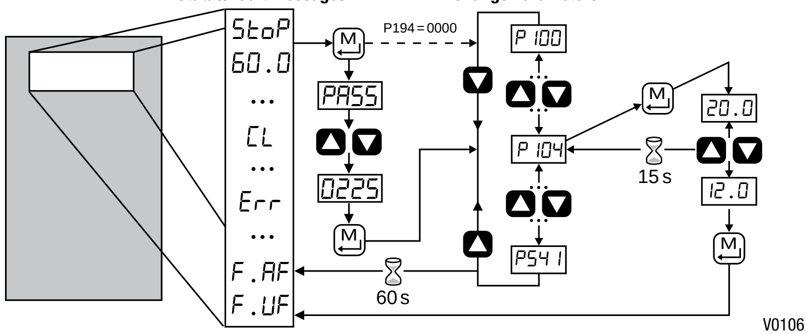
Speed Mode Display
In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive’s output frequency.

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.

4.3 Parameter Setting



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.

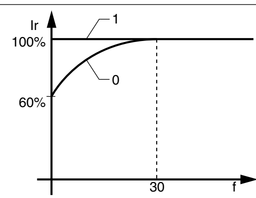
While the EPM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing EPM will trigger an F_F1 fault)

4.5 Parameter Menu

4.5.1 Basic Setup Parameters

Code		Possible Settings		IMPORTANT
No.	**Name**	**Default**	**Selection**	
P 100	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	• Start command must come from network (Modbus, CANopen, etc) • Requires 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 • 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_AL 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.	
P 101	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	
			4 Preset #2	
			5 Preset #3	
			6 Network	
			7 Preset Sequence Segment #1	Selections 7, 8 & 9 are not valid for PID setpoint or torque reference.
			8 Preset Sequence Segment #2	
			9 Preset Sequence Segment #3	

(1) Any changes to this parameter will not take effect until the drive is stopped

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 102	Minimum Frequency	0.0	0.0 {Hz} P103	• P102, P103 are active for all speed references • When using an analog speed reference, also see P160, P161
P 103	Maximum Frequency	60.0	7.5 {Hz} 500	
			NOTE • P103 cannot be set below Minimum Frequency (P102) • To set P103 above 120 Hz: - Scroll up to 120 Hz; display shows H iFr (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	• P104 = time of frequency change from 0 Hz to P167 (base frequency) • P105 = time of frequency change from P167 to 0 Hz • For 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	• P106 = 0.0: Linear accel/decel ramp • P106 > 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 50" (Parameter P199, selection 4) with 480V models. In this case, the default setting is 0.
P 108	Motor Overload	100	30 {%} 100	P108 = motor current rating x 100 / SMV output rating 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	V0108

Code		Possible Settings		IMPORTANT
No.	**Name**	**Default**	**Selection**	
P110	Start Method	0	0 Normal	
			1 Start on Power-up	Drive will automatically start when power is applied.
			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 #1	• Drive will automatically restart after faults, or when power is applied. • After 3 failed attempts, drive will Auto Restart with DC brake. • P110 = 5: Performs speed search, starting at Max Frequency (P103)
			6 Flying Start/Restart #2	• P110 = 6: Performs speed search, starting at the last output frequency prior to faulting or power loss • If P111 = 0, a flying START is performed when a start command is applied.
			NOTE • 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.	
	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	

Code		Possible Settings		IMPORTANT
No.	**Name**	**Default**	**Selection**	
P113	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.
		i	**NOTE** P113 is applicable to SMV 15HP (11kW) and higher models only.	
P115	MOP Speed Initialization at Power-Up	0	0 Set to last MOP speed at power up	
			1 Set to 0.0Hz at power up	
			2 Set to Preset #3 at power up	

4.5.2 I/O Setup Parameters

Code		Possible Settings		IMPORTANT
No.	**Name**	**Default**	**Selection**	
P120	Assertion Level	2	1 Low	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.
			2 High	
P121	TB-13A Input Function	0	0 None	Disables input
P122	TB-13B Input Function		1 AUTO Reference: 0-10 VDC	For frequency mode, see P160...P161, For PID mode, see P204…P205, For vector torque mode, see P330
P123	TB-13C Input Function		2 AUTO Reference: 4-20 mA	
P124	TB-13D* Input Function		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
	NOTE: P124 is applicable to SMV 15HP (11kW) and higher models only		4 AUTO Reference: MOP Up	• Normally open: Close input to increase or decrease speed, PID or torque setpoint. • MOP Up is not active while in STOP
			5 AUTO Reference: MOP Down	
			6 AUTO Reference: Keypad	
			7 AUTO Reference: Network	
			8 Control Select	Use when P100 = 4, 5 to switch between terminal strip control and local or remote keypad control.
			9 Network Enable	Required to start the drive through the network.
			10 Reverse Rotation	Open = Forward Closed = Reverse
			11 Start Forward	Refer to Note for typical circuit
			12 Start Reverse	
			13 Run Forward	Refer to Note for typical circuit
			14 Run Reverse	
			15 Jog Forward	Jog Forward speed = P134
			16 Jog Reverse	Jog Reverse speed = P135 Active even if P112 = 0
			17 Accel/Decel #2	Refer to P125, P126
			18 DC Brake	Refer to P174; close input to override P175
			19 Auxiliary Ramp to Stop	Normally closed: Opening input will ramp drive to STOP according to P127, even if P111 is set to Coast (0 or 1).
			20 Clear Fault	Close to reset fault
			21 External Fault F_EF	Normally closed circuit; open to trip
			22 Inverse External Fault F_EF	Normally open circuit; close to trip
			23 AUTO Ref: Sequence Segment #1	Works in Speed Mode only
			24 Start Sequence	
			25 Step Sequence	Transition from non-asserted to asserted state
			26 Suspend Sequence	

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.

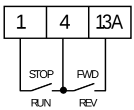
WARNING
If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			

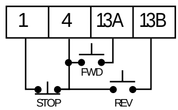
NOTE

- When input is activated, settings 1...7 override P101
- When 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 STOP
- If Jog input is activated while drive is running, the drive will enter Jog mode; when Jog input is deactivated, drive will STOP
- An F_AL 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:
  - TB-13A...TB-13D settings are duplicated (each setting, except 0 and 3, 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:
  - If any input is set to 10, 12 or 14, P112 must be set to 1 for Reverse action to function.

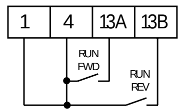
Run / Stop
with Direction
P121 = 10



Start Forward /
Start Reverse
P121 = 11, P122 = 12



Run Forward /
Run Reverse
P121 = 13, P122 = 14



No.	Name	Default	Selection			IMPORTANT
P125	Acceleration Time 2	20.0	0.0	{s}	3600	• Selected using TB-13A...TB-13D (P121...P124 = 17) • For S-ramp accel/decel, adjust P106
P126	Deceleration Time 2	20.0	0.0	{s}	3600	
P127	Deceleration Time for Auxiliary Ramp to Stop	20.0	0.0	{s}	3600	• Selected using TB-13A...TB-13D (P121...P124 = 19). • For S-ramp accel/decel, adjust P106 • Once executed, this ramp time has priority over P105 and P126.
P129	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)
P131	Preset Speed #1	0.0	0.0	{Hz}	500	
P132	Preset Speed #2	0.0	0.0	{Hz}	500	
P133	Preset Speed #3	0.0	0.0	{Hz}	500	
P134	Preset Speed #4	0.0	0.0	{Hz}	500	
P135	Preset Speed #5	0.0	0.0	{Hz}	500	
P136	Preset Speed #6	0.0	0.0	{Hz}	500	
P137	Preset Speed #7	0.0	0.0	{Hz}	500	
P138	Preset Speed #8	0.0	0.0	{Hz}	500	

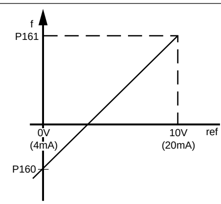
PRESET SPEED	13A	13B	13C	13D
1	X	--	--	--
2	--	X	--	--
3	--	--	X	--
4	X	X	--	--
4 (alternate)	--	--	--	X
5	X	--	X	--
6	--	X	X	--
7	X	X	X	--
8 (alternate)	--	X	--	X
8 (alternate	--	--	X	X

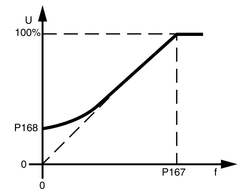
- Speed setting is used by P158
- 13D available on 15HP (11kW) & higher drives.

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 falls below 2 mA
			10 Loss of Load	Energizes when motor load drops below P145; Refer to P146 also
			11 Local Keypad Control Active	Energizes when the selected source is active for start control
			12 Terminal Strip Control Active	
			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	Requires optional communication module (refer to the network module documentation).
			26 Loss of 0-10V Input	
			27 Sequencer Controlled	State set in individual sequencer segments
			28 Sequencer Active	
			29 Sequencer Suspended	
			30 Sequence Done	End Sequence
			31 Actual Speed = 0.0Hz	
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)	

<table>
<tr><th colspan="2">Code</th><th colspan="2">Possible Settings</th><th rowspan="2">IMPORTANT</th></tr>
<tr><th>No.</th><th>Name</th><th>Default</th><th>Selection</th></tr>
<tr><td rowspan="3">P 144</td><td rowspan="3">Digital Output Inversion</td><td></td><td><table><tr><th>P144</th><th>Invert P142</th><th>Invert P140</th></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></td><td>Used to invert the selections for P140 (Relay Output) and P142 (TB-14 Output).
EXAMPLE: When P140 = 6 (AT SPEED), the relay is energized when output frequency = commanded frequency. IF P144=1 or 3, then P140 is inverted (INVERSE AT SPEED) and the relay is energized when the output frequency does not equal the command frequency.</td></tr>
<tr><td>i</td><td colspan="2">NOTE
Inverting P140 or P142 when the parameter is set to NONE (0) will result in the output being energized continuously.</td></tr>
<tr><td>i</td><td colspan="2">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).</td></tr>
<tr><td>P 145</td><td>Loss of Load Threshold</td><td>0</td><td>0 {%} 200</td><td rowspan="2">P140, P142 = 10: Output will energize if motor load falls below the P145 value longer than the P146 time</td></tr>
<tr><td>P 146</td><td>Loss of Load Delay</td><td>0.0</td><td>0.0 {s} 240.0</td></tr>
<tr><td>P 149</td><td>Analog Offset</td><td>0.0</td><td>0 {%} 100</td><td>Scaled value. Example: P149 = 10%, Scaled variable = freq, P150 = 1, P152 = 60Hz; then TB30 = 0VDC below 6Hz</td></tr>
<tr><td rowspan="11">P 150</td><td rowspan="11">TB-30 Output</td><td rowspan="11">0</td><td>0 None</td><td rowspan="9">2-10 VDC signal can be converted to 4-20 mA with a total circuit impedance of 500 Ω</td></tr>
<tr><td>1 0-10 VDC Output Frequency</td></tr>
<tr><td>2 2-10 VDC Output Frequency</td></tr>
<tr><td>3 0-10 VDC Load</td></tr>
<tr><td>4 2-10 VDC Load</td></tr>
<tr><td>5 0-10 VDC Torque</td></tr>
<tr><td>6 2-10 VDC Torque</td></tr>
<tr><td>7 0-10 VDC Power (kW)</td></tr>
<tr><td>8 2-10 VDC Power (kW)</td></tr>
<tr><td>9 Network Controlled</td><td>Requires optional communication module (refer to the network module documentation).</td></tr>
<tr><td>10 Sequencer Controlled</td><td>Value set in individual sequencer segments</td></tr>
<tr><td>P 152</td><td>TB-30 Scaling: Frequency</td><td>60.0</td><td>3.0 {Hz} 2000</td><td>If P150 = 1 or 2, sets the frequency at which output equals 10 VDC</td></tr>
<tr><td>P 153</td><td>TB-30 Scaling: Load</td><td>200</td><td>10 {%} 500</td><td>If P150 = 3 or 4, sets the Load (as a percent of drive current rating) at which output equals 10 VDC.</td></tr>
<tr><td>P 154</td><td>TB-30 Scaling: Torque</td><td>100</td><td>10 {%} 1000</td><td>If P150 = 5 or 6, sets the Torque (as a percent of motor rated torque) at which output equals 10 VDC</td></tr>
<tr><td>P 155</td><td>TB-30 Scaling: Power (kW)</td><td>1.0</td><td>0.1 {kW} 200.0</td><td>If P150 = 7 or 8, sets the power at which output equals 10 VDC</td></tr>
</table>

4.5.3 Advanced Setup Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P156	Analog Inputs Configuration		0 TB5: (0-10 VDC); TB25: (4-20mA)	
			1 TB5: (0 - 5 VDC); TB25: (4-20mA)	
			2 TB5: (2 - 10 VDC); TB25: (4-20mA)	
			3 TB5: (-10 - +10 VDC); TB25: (4-20mA)	Available on special option module only
			4 TB5: (0-10 VDC); TB25: (0-20mA)	
			5 TB5: (0 - 5 VDC); TB25: (0-20mA)	
			6 TB5: (2 - 10 VDC); TB25: (0-20mA)	
			7 TB5: (-10 - +10 VDC); TB25: (0-20mA)	Available on special option module only
P157	TB5 (0-10V) Analog Input Monitoring Action		0 No Action	Selects the reaction to a loss of the 0-10V signal at TB5 Minimum time above/below Monitoring Level (P158) before triggering action is 500ms.
			1 P157 < P158 - Trip Fault F_FAU	
			2 P157 < P158 - Run Preset #8	
			3 P157 < P158 - Run Preset Seq. #16	
			4 P157 > P158 - Trip Fault F_FAU	
			5 P157 > P158 - Run Preset #8	
			6 P157 > P158 - Run Preset Seq. #16	
P158	TB5 (0-10V) Analog Input Monitoring Level (ML)	0.0	-10.0 {VDC} 10.0	
P159	0-10V Analog Input Deadband	0.0	0 {VDC} 10.0	Not active if [-10 to +10 VDC] option is selected.
P160	Speed at Minimum Signal	0.0	-999.0 {Hz} 1000	 V0111
P161	Speed at Maximum Signal	60.0	-999.0 {Hz} 1000	
			NOTE • P160 sets the output frequency at 0% analog input • P161 sets the output frequency at 100% analog input • P160 or P161 < 0.0 Hz: For scaling purposes only; does not indicate opposite direction! • P160 > P161: Drive will react inversely to analog input signal	
P162	Analog Input Filter	0.01	0.00 {s} 10.00	Adjusts the filter on the analog inputs (TB-5 and TB-25) to reduce the effect of signal noise
P163	TB-25 (4-20mA) Analog Input Monitoring Action	0	0 No Action	• Selects the reaction to a loss of the 4-20 mA signal at TB-25. • Signal is considered lost if it falls below 2 mA • Digital outputs can also indicate a loss of 4-20 mA signal; see P140, P142
			1 P163 < P164 - Trip Fault F_FoL	
			2 P163 < P164 - Run Preset #7	
			3 P163 < P164 - Run Preset Seq. #15	
			4 P163 ≥ P164 - Trip Fault F_FoL	
			5 P163 ≥ P164 - Run Preset #7	
			6 P163 ≥ P164 - Run Preset Seq. #15	

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P164	TB-25 (4-20mA) Analog Input Monitoring Level	2.0	0.0	{mA}	20.0	
P165	Base Voltage		15	{V}	1000	Valid for V/Hz mode only. Set voltage for bus compensation in V/Hz mode
P166	Carrier Frequency	See Notes	0 4 kHz 1 6 kHz 2 8 kHz 3 10 kHz			• As carrier frequency is increased, motor noise is decreased • Observe derating in section 2.3 • Automatic shift to 4 kHz at 120% load • NEMA 4X (IP65) Models: Default = 0 (4kHz) • NEMA 1 (IP31) Models: Default = 1 (6kHz)
P167 (1)	Base Frequency	60.0	25.0	{Hz}	1500	 V0112
P168	Fixed Boost		0.0	{%}	40.0	
			NOTE • P167 = rated motor frequency for standard applications • P165, P168 = default setting depends on drive rating			
P169	Accel Boost	0.0	0.0	{%}	20.0	Accel Boost is only active during acceleration
P170	Slip Compensation	0.0	0.0	{%}	40.0	Increase P170 until the motor speed no longer changes between no load and full load conditions.
P171 (1)	Current Limit	Max I	30	{%}	Max I	• 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 (%)
P172	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.
P173	Decel Override Time	2.0	0.0	{s}	60.0	Maximum time before drive trips into HF fault.
P174	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

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: • 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 disabled.
P 177 (2)	Speed Units	0	0 Hz 1 RPM 2 % 3 /UNITS 4 NONE	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.
P 178	Display Frequency Multiplier	0.00	0.00 650.00	• 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	• 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	• 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 (2)	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 (3)	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.

Code		Possible Settings		IMPORTANT
No.	**Name**	**Default**	**Selection**	
P190	Motor Braking		0 Disabled	
			1 Braking with BUS threshold	
			2 Braking always on with deceleration	
			3 Braking with bus regulator	
			4 Special (Consult factory before using)	
P191	Motor Brake Level	0	0 (flux braking disabled) {%} 75	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)
P192	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)
P194	Password	0	0000 9999	• Must enter password to access parameters • P194 = 0000: Disables password
P197	Clear Fault History	0	0 No Action	
			1 Clear Fault History	
P199	Program Selection		0 Operate from User settings	
			1 Operate from OEM settings	Refer to Notes 1, 2 and 3
			2 Reset to OEM default settings	Refer to Note 1
			3 Reset to 60 Hz default settings 4 Reset to 50 Hz default settings	• Refer to Note 4 • Parameters are reset to the defaults listed in this manual. • For P199=4, the following exceptions apply: - P103, P152, P161, P167 = 50.0 Hz - P304 = 50 Hz; - P305 = 1450 RPM - P107 = 0 (480 V drives only)
			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 (GE will be displayed if attempted).

NOTE 3
Auto Calibration is not possible when operating from OEM Settings.

NOTE 4
Reset 60 and Reset 50 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.

NOTE 5 - on next page.

Code		Possible Settings		IMPORTANT
No.	**Name**	**Default**	**Selection**	
P199	Program Selection		**NOTE 5** If an EPM that contains data from a previous compatible software version is installed: • 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.	

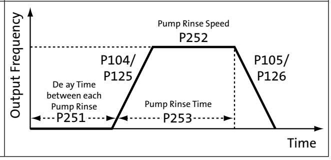
4.5.4 PID Parameters

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	• 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)
			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_IL fault will occur. **Example:** The desired PID setpoint reference is the keypad (▲ and ▼). Set TB-13x = 6 (Auto Reference: Keypad): • 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 (2)	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 **Example:** Feedback signal is 0 - 300 PSI; P204 = 0.0, P205 = 300.0
P205	Feedback at Maximum Signal	100.0	-99.9 3100.0	

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

Code		Possible Settings				IMPORTANT
No.	**Name**	**Default**	**Selection**			
P207	Proportional Gain	5.0	0.0	{%}	1000.0	Used to tune the PID loop: • 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	
			NOTE • 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			
P210	PID Setpoint Ramp	20.0	0.0	{s}	100.0	• 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(2)	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	• 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	0.0 Where: B_{max} = |(P205 - P204)|		B_{max}	
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			Activated in sleep mode only. Sleep Recovery cancels Auto Rinse
			1 Enabled			
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
			Auto Pump Rinse Setup: P250=1 (Enabled) P251=# minutes between each PumpRinse P252=Hz speed of Pump Rinse P253=# seconds Pump Rinse duration			

4.5.5 Vector Parameters

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P300 (1)	Drive Mode	0	0 Constant V/Hz			Constant torque V/Hz control for general applications
			1 Variable V/Hz			Variable torque V/Hz control for centrifugal pump and fan applications
			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: • 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
		i	**NOTE** To configure the drive for either Vector mode or Enhanced V/Hz mode: • P300 = 4, 5: - Set P302...P306 according to motor nameplate - Set P399 = 1 or 2 (if option 1 failed or in case of non-standard motor) - Make sure motor is cold (20° - 25° C) and apply a Start command - Display will indicate CAL for about 40 seconds - Once the calibration is complete, the display will indicate StoP; apply another Start command to actually start the motor - If an attempt is made to start the drive in Vector or Enhanced V/Hz mode before performing the Motor Calibration, the drive will display F_n Id and will not operate • P300 = 2, 3: Same as above but only need to set P302…P304			
P302 (1)	Motor Rated Voltage		0	{V}	600	• Default setting = drive rating • Set to motor nameplate data
P303 (1)	Motor Rated Current		0.1	{A}	500.0	

(1) Any changes to this parameter will not take effect until the drive is stopped

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	• P310, 311 default setting depends on drive rating • Will be automatically programmed by P399 • Changing 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	• Adjust dead time correction from internal default • Takes 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			• 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 motors • An alternating CAL / Err will occur if: - attempt motor calibration with P300 = 0 or 1 - motor calibration is attempted before programming motor data
			NOTE: To run the Auto Calibration: – Set P302...P306 according to motor nameplate – Set 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 command – Display will indicate CAL for about 40 seconds – Once the calibration is complete, the display will indicate StoP; apply another Start command to actually start the motor – Parameter 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	This parameter setting is based upon the network or I/O module that is installed.
			1 Remote Keypad	
			2 Modbus RTU	
			3 CANopen	
			4 DeviceNet	
			5 Ethernet	
			6 Profibus	
			7 Lecom-B	
			8 I/O Module	
P401	Module Type Installed	0	0 No Module Installed	Module type format: 0xAABC; Drive Display: AA.B.C
			1 Basic I/O (0x0100, 1.0.0)	AA = Module Type
			2 RS485/Rem. Keypad (0x0200, 2.0.0)	B = Major revision
			3 CANopen (0x0300, 3.0.0)	C = minor revision
			11 PROFIBUS (0x1100, 11.0.0)	
			12 Ethernet (0x1200, 12.0.0)	
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	Module type mismatch P401
			7 Initialization Error	Protocol selection mismatch P400
P403	Module Reset	0	0 No Action	Returns module parameters 401…499 to the default values shown in the manual
			1 Reset parameters to default values	
P404	Module Timeout Action	0	0 No Fault	Action to be taken in the event of a Module/ Drive Time-out.
			1 STOP (see P111)	Time is fixed at 200ms
			2 Quick Stop	STOP is by the method selected in P111.
			3 Fault (F_ntF)	
P405	Current Network Fault		0 No Fault	
			1 F.nF1	NetIdle Mode
			2 F.nF2	Loss of Ethernet I/O connection
			3 F.nF3	Network Fault
			4 F.nF4	Explicit Message Timeout
			5 F.nF5	Overall Network Timeout
			6 F.nF6	Overall Explicit Timeout
			7 F.nF7	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.

4.5.7 Diagnostic Parameters

Code No.	Name	Display Range (READ ONLY)			IMPORTANT
P500	Fault History				• 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
P521	4-20 mA Input	0.0	{mA}	20.0	Actual value of signal at TB-25
P522	TB-5 Feedback	P204		P205	TB-5 signal value scaled to PID feedback units
P523	TB-25 Feedback	P204		P205	TB-25 signal value scaled to PID feedback units
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	• 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.

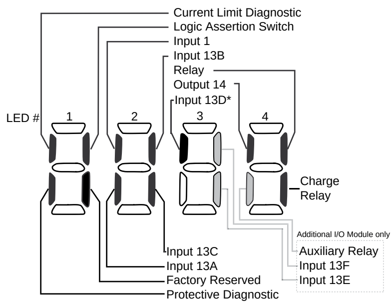
Code No.	Name	Display Range (READ ONLY)			IMPORTANT
P560	Sequencer: Currently Active Segment	0		17	
P561	Sequencer: Time since Start of Active Segment	0.0 0	{P708} {P708}	6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P562	Sequencer: Time Remaining in Active Segment	0.0 0	{P708} {P708}	6553.5 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).



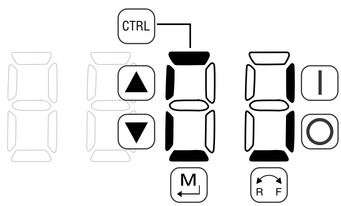
* Input 13D available on 15-30HP (11-22kW) models only

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.



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	This parameter enables the onboard network communications.
			1 Remote Keypad	
			2 Modbus	
			7 Lecom	
			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	Modbus
			1 4800 bps; 3 19200 bps	
		0	0 9600 bps	Lecom
			1 4800 bps	
			2 2400 bps	
			3 1200 bps	
			4 19200 bps	
P612	Network Data Format	0	0 8, N, 2	Modbus Only
			1 8, N, 1	
			2 8, E, 1	
			3 8, 0, 1	
P620	Network Control Level	0	0 Monitor Only	Lecom Only
			1 Parameter Programming	
			2 Programming and Setpoint Control	
			3 Full Control	
P624	Network Powerup Start Status	**0**	0 Quick Stop	Lecom Only
			1 Controller Inhibit	
P625	Network Timeout	10.0	0.0 - 300.0 seconds	Modbus
		50	0 - 65000 milliseconds	Lecom
P626	Network Timeout Action	**4**	0 No action	Modbus
			1 Stop (P111)	
			2 Quick Stop	
			3 Controller Inhibit	
			4 Trip Fault, F.nF1	
		0	0 No action	Lecom
			1 Controller Inhibit	
			2 Quick Stop	
			3 Trip Fault, F.nF1	
P627	Network Messages Received		Read-Only: 0 - 9999	Valid network messages received
			NOTE: When the number of messages exceeds 9999, the counter resets and resumes counting from 0.	

4.5.9 Sequencer Parameters

The P700 Sequencer parameters are listed herein. Refer to section 4.5.7 for P56x Sequencer Diagnostic Parameters.

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	Asserting TB13A with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
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 thanTB13B, 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
P708	Sequencer: Time units/scaling	0	0 0.1 {sec} 6553.5 1 1 {sec} 65535 2 1 {min} 65535	Setup units/scaling for all sequencer time related parameters
			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 {P708} 6553.5 0 {P708} 65535	Scaling/units depend on P708 Skip segment if time = 0
P713	Segment #1 Digital Output State	0	Bit0 Relay Bit1 TB14	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
	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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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
	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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P733	Segment #5 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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
	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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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

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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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
	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

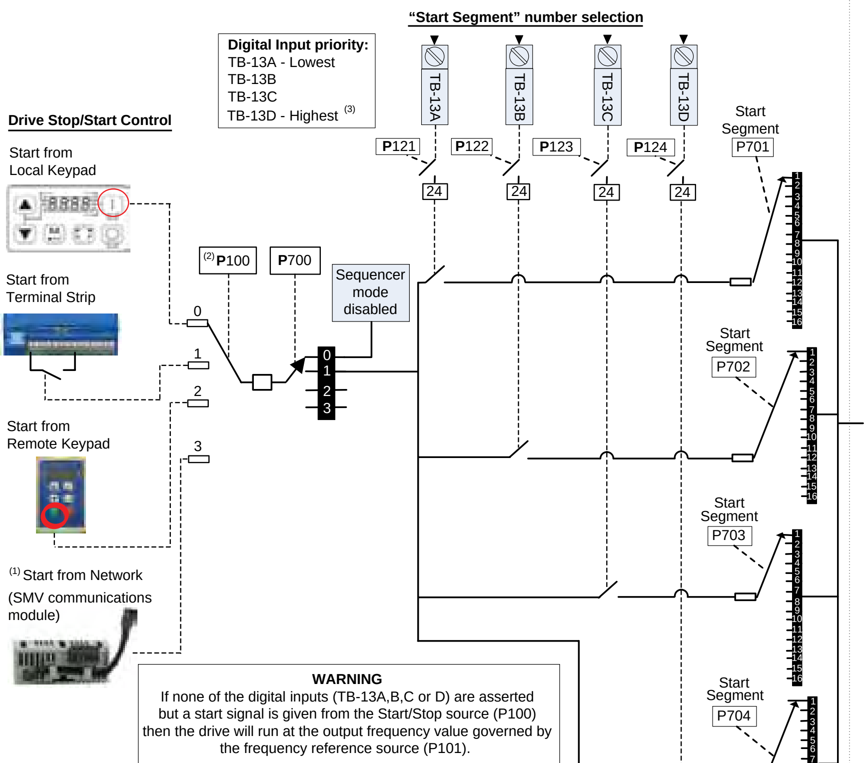
Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P768	Segment #12 Digital Output State	0	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
P769	Segment #12 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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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
	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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
	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	Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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		Bit0 Relay Bit1 TB14			bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept value the from the sequencer: P140, P142=27
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 1 Stop (based on P111) 2 Coast to Stop 3 Quick Stop 4 Coast with DC Brake 5 Ramp with DC Brake			Recovery: Toggling the START SEQUENCE will start the cycle from 'end segment Stop' or 'end segment 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

Sequencer Flow Diagram



WARNING
If none of the digital inputs (TB-13A,B,C or D) are asserted but a start signal is given from the Start/Stop source (P100) then the drive will run at the output frequency value governed by the frequency reference source (P101).

Notes

(1) Refer to relevant communications module user guide for starting from a communications network, RS485 etc..

(2) Refer to P100 description in the SMV Operating instructions for further combinations of start sources.

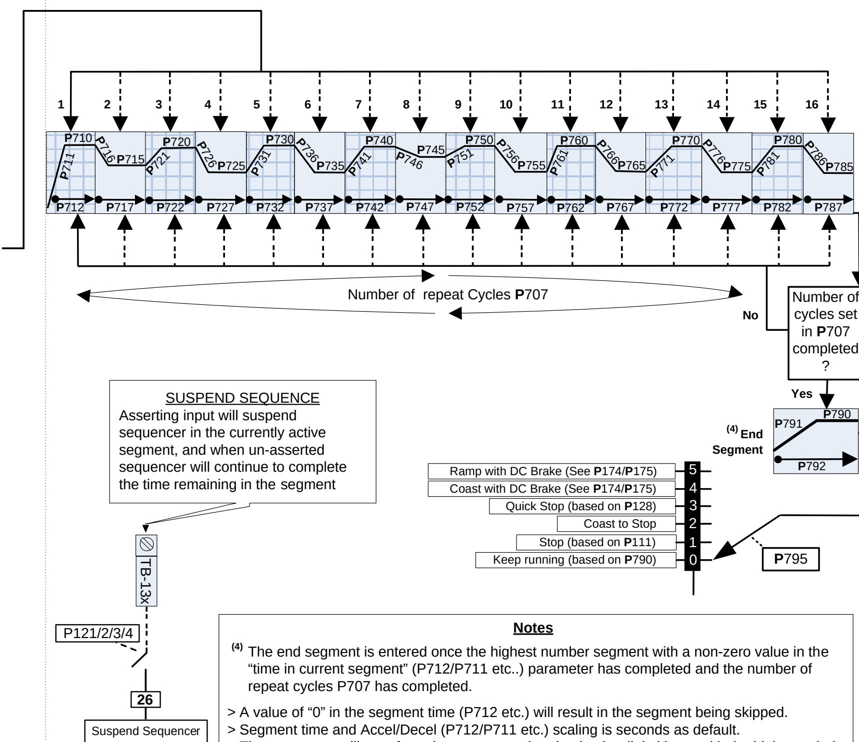
(3) TB-13D available on SMV models rated 15HP (11kW) or greater.

> Selections shown as default values

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).

4.5.9.2 Sequencer Flow Diagram Right

Action after Stop/Start (P100) transition/digital input (if setup for sequencer mode) transition or restart after trip.	
P706	**Action**
0	Restart at beginning of sequence (pointed by TB13x)
1	Restart at beginning of current segment
2	Start at beginning of prior segment
3	Start at beginning of next segment

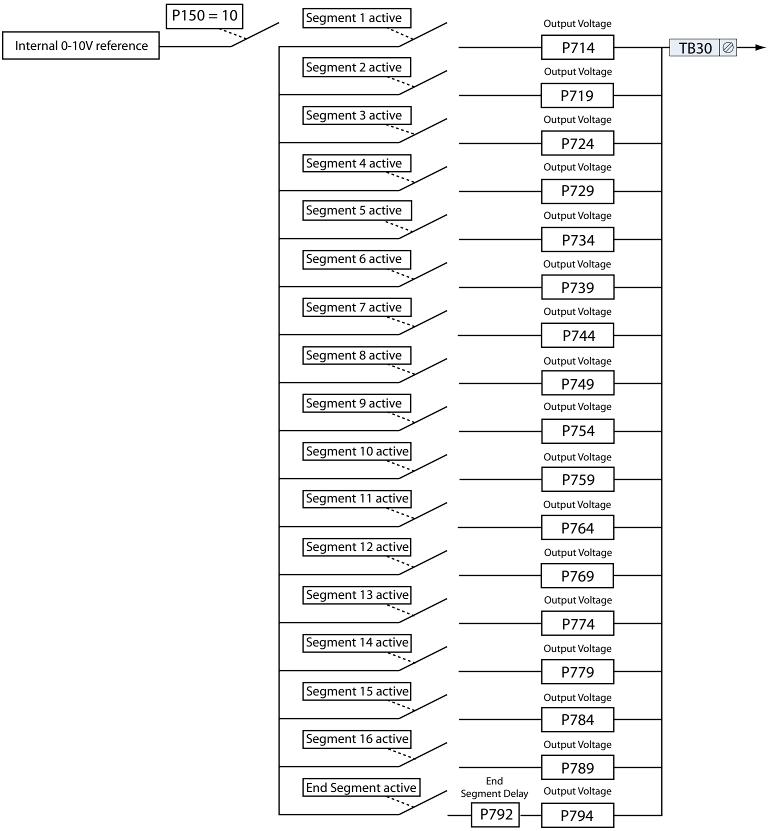


Notes

(4) The end segment is entered once the highest number segment with a non-zero value in the "time in current segment" (P712/P711 etc..) parameter has completed and the number of repeat cycles P707 has completed.

> A value of "0" in the segment time (P712 etc.) will result in the segment being skipped.
> Segment time and Accel/Decel (P712/P711 etc.) scaling is seconds as default.
> The sequencer will start from the segment pointed to by the digital input with the highest priority.
> Selections shown as default values.

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.

5 Troubleshooting and Diagnostics

5.1 Status/Warning Messages

Status / Warning		Cause	Remedy
br	DC-injection brake active	DC-injection brake activated • activation of digital input (P121...P124 = 18) • automatically (P110 = 2, 4...6) • automatically (P111 = 1, 3)	Deactivate DC-injection brake • 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.	• 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	• 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: • 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)	• 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.	
PId	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)

5.2 Drive Configuration Messages

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) E1 = 4-20 mA (TB-25) JG = Jog nt = Network OP = MOP P1..._P7 = Preset 1...7 01... 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_ 12 = 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_03 = 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	• Reduce drive load • Improve cooling
F_AL	Assertion Level fault	• 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.	• 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	• 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	

(1) The drive can only be restarted if the error message has been reset.

Fault		Cause	Remedy (1)
F_dbF	Dynamic Braking fault	Dynamic braking resistors are overheating	• Increase active decel time (P105, P126, P127). • Check mains voltage and P107
F_EF	External fault	• P121…P124 = 21 and that digital input has been opened. • P121…P124 = 22 and that digital input has been closed.	• Correct the external fault condition • Make sure digital input is set properly for NC or NO circuit
F_F1	EPM fault	EPM missing or defective	Power down and replace EPM
F_F2 ... F_F12	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	Loss of 4-20 mA signal fault	4-20 mA signal (at TB-25) is below 2 mA (P163 = 1)	Check signal/signal wire
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_nId	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	See P300…P399 for Drive Mode setup and calibration.
F_ntF	Module communication fault	Communication failure between drive and Network Module.	Check module connections
F_nF1 ... F_nF9	Network Faults	Refer to the module documentation. for Causes and Remedies.	

(1) The drive can only be restarted if the error message has been reset.

Fault		Cause	Remedy (1)
F_OF	Output fault: Transistor fault	Output short circuit	Check motor/motor cable
		Acceleration time too short	Increase P104, P125
		Severe motor overload, due to: • Mechanical problem • Drive/motor too small for application	• 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	• 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_OF1	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	• 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).	• Must wait at least 2 seconds after power-up to apply Start command • Consider alternate starting method (P110).

(1) The drive can only be restarted if the error message has been reset.

Appendix A

A.1 Permissable Cable Lengths

The table herein lists the permissable 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☝☝2SF☝	38	12	35	10	33	5	30	N/A
	ESV371☝☝2SF☝	38	12	35	10	33	5	30	N/A
	ESV751☝☝2SF☝	38	12	35	10	33	5	30	N/A
	ESV112☝☝2SF☝	38	12	35	10	33	5	30	N/A
	ESV152☝☝2SF☝	38	12	35	10	33	5	30	N/A
	ESV222☝☝2SF☝	38	12	35	10	33	5	30	N/A
400/480 V,3-phase (3/PE)	ESV371☝☝4TF☝	30	4	25	2	20	N/A	10	N/A
	ESV751☝☝4TF☝	30	4	25	2	20	N/A	10	N/A
	ESV112☝☝4TF☝	30	4	25	2	20	N/A	10	N/A
	ESV152☝☝4TF☝	30	4	25	2	20	N/A	10	N/A
	ESV222☝☝4TF☝	30	4	25	2	20	N/A	10	N/A
	ESV302☝☝4TF☝	30	4	25	2	20	N/A	10	N/A
	ESV402☝☝4TF☝	54	5	48	3	42	2	N/A	N/A
	ESV552☝☝4TF☝	54	5	48	3	42	2	N/A	N/A
	ESV752☝☝4TF☝	54	5	48	3	42	2	N/A	N/A

NOTE: The “☝☝” and “☝” 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.

APPENDIX D: EOS INPUT/OUTPUT LIST

NES JOB NAME: EAR / FARMINGDALE PLAZA CLEANERS (FARMINGDALE,NY)

NES JOB NUMBER: 11-177 DATE:7/25/11

PROCONTROL INPUT/OUTPUT LIST (TYPE B1)

	6 CHAR	**DIGITAL INPUTS (12)**				
NO.	**LABEL**	**DESCRIPTION**	**TYPE**	**NOTES**		
1	**RESET**	RESET BUTTON ON PANEL DOOR	DIGITAL	RESETS ALARMS,STARTS PUMP		
2	**MSLO**	MOISTURE SEP. LOW LEVEL		STOPS M/S EFFL. PUMP		
3	**MSEHI**	MOISTURE SEP. HIGH LEVEL		M/S HIGH LEVEL ALARM		
4	**SVETMR**	SVE TIMER		TIME OF DAY OPER. OF SVE		
5	**VFDFLT**	SVE VFD FAULT		VFD FAULT OCCURRED		
6	**VFDRUN**	SVE VFD RUNNING		SVE IS RUNNING		
7	**ESTOP**	EMERGENCY STOP ACTIVE		EMERGENCY STOP PRESSED		
8		SPARE				
9		SPARE				
10		SPARE				
11		SPARE				
12		SPARE				
		TERM. 13-16 NOT USED ON CONN.			**MN**	**MX**
		ANALOG INPUTS (8)			4mA	20mA
17	**FT101**	SVE INLET FLOW	4-20mA	ALLOWS INLET FLOW DISPLAY	0	TBD
18	**VT101**	SVE INLET VACUUM	4-20mA	ALLOWS VACUUM DISPLAY,WARN.	0	TBD
19	**FT102**	SVE DISCHARGE FLOW	4-20mA	ALLOWS DISCH. FLOW DISPLAY	0	TBD
20	**TT101**	SVE DISCHARGE TEMPERATURE	4-20mA	ALLOWS DISCH. TEMP. DISPLAY	0	TBD
21	**VFDHZ**	VFD OPERATING FREQUENCY	4-20mA	ALLOWS VFD OP. FREQ. DISPLAY	0	60
22		SPARE	4-20mA			
23		SPARE	4-20mA			
24		SPARE	4-20mA			
		DIGITAL OUTPUTS (14)				
33	**SVEBLR**	SVE BLOWER (VIA VFD)		CONTROLS SVE BLOWER		
34	**MSEPMP**	M/S EFFLUNT PUMP		CONTROLS M/S EFFLUENT PUMP		
35	**MSHLA**	MOISTURE SEP. HIGH LEVEL ALARM		STOPS SVE BLOWER		
36	**LOVACA**	LOW VACUUM WARNING		PROVIDES WARNING		
37	**HITMPA**	HIGH (DISCHARGE) TEMP. ALARM		STOPS SVE BLOWER		
38	**VFDFTA**	VFD FAULT ALARM		STOPS SVE BLOWER		
39		SPARE				
40	**ADCH1**	AUTODIALER CHANNEL1		INITIATES M/S HIGH LEVEL DIALOUT		
41	**ADCH2**	AUTODIALER CHANNEL2		INITIATES HIGH TEMPERATURE DIALOUT		
42	**ADCH3**	AUTODIALER CHANNEL3		INITIATES VFD FAULT DIALOUT		
43	**ADCH4**	AUTODIALER CHANNEL4		INITIATES LOW VACUUM DIALOUT		
44		SPARE				
45		SPARE				
46		SPARE				

	AUTODIALER INPUT ALLOCATION (SENSAPHONE 400)
CH	**DESCRIPTION**
1	M/S HIGH LEVEL ALARM
2	HIGH TEMPERATURE ALARM
3	VFD FAULT ALARM
4	LOW VACUUM WARNING
	AUTODIALER OUTPUT NOT USED
	NOTE: LIST IS PRELIMINARY

APPENDIX E: SVE COMPONENTS – PRODUCT DATA

MOISTURE SEPARATOR

GENERAL THEORY

The moisture separator removes liquids from the process stream in soil venting applications to help protect the blower from corrosion and mineral deposits caused by water.

DESIGN INFORMATION

NES moisture separators operate on the principles of cyclonic section aided by velocity reduction. The moisture separator inlet pipe is set tangential to the tank wall, a stringer pipe extends down past the separator inlet is placed in the center of the tank. The moisture laden air stream is forced into a cyclonic rotation. The centrifugal force produced throws the water droplets to the outer wall of the separator where they fall and collect at the bottom. Additional efficiency is produced when the velocity is reduced to values between 1500 fpm and 6000 fpm. For a separator of this type, moisture separation efficiency is typically 95% or greater for moisture droplets greater than 10 micron.

CONSTRUCTION

NES moisture separators are constructed of carbon steel with bronze drain valves, removable lid with EPDM gasket, mechanical ball and float assembly standard for drum style separators. Sight glass, emergency high-level switch and pump out switches are optional. Tank style separators are standard with carbon steel construction, bronze drain valves, flanged clean-out port, sight glass and emergency high level switch. Pump-out switches and mist eliminator are optional. All separators are primed and coated with a rust inhibitor to prevent corrosion.

NES
NATIONAL ENVIRONMENTAL SYSTEMS

DRUM STYLE SEPARATOR

TANK STYLE SEPARATOR

NORMAL SERIES OF OPERATION FOR MOISTURE SEPARATOR LEVEL SWITCHES

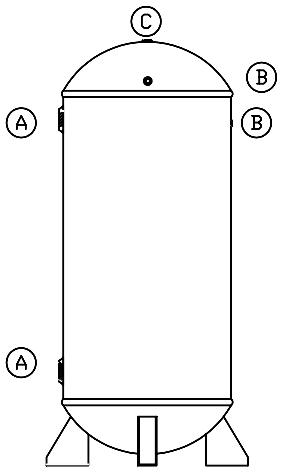
1. Water level rises and actuates low level switch (wired normally open).
2. Switch closes and sends signal to controller.
3. Water level continues to rise and actuates high level switch (wired normally open).
4. Switch closes and sends signal to controller to activate moisture sepaator transfer pump.
5. Water level drops when pump activates.
6. De-energizes high switch.
7. Continues to drop.
8. De-energizes low switch.
9. Controller calls off pump.
10. Series repeats.

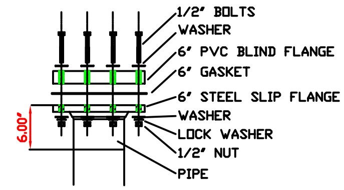
ACTIVATION OF EMERGENCY HIGH LEVEL SWITCH

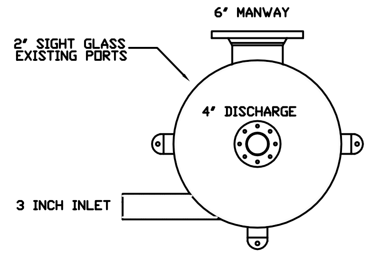
1. Water level rises and actuates low level switch (wired normally open).
2. Switch closes and sends signal to controller.
3. Water level continues to rise and actuates high level switch (wired normally open).
4. Switch closes and sends signal to controller to activate moisture separator transfer pump.
5. Problem with pump, level switch or down stream process, water level does not drop.
6. Water level rises until emergency high switch (wired normally closed) is actuated.
7. Appropriate process equipment is de-energized (i.e. pump, SVE blower)

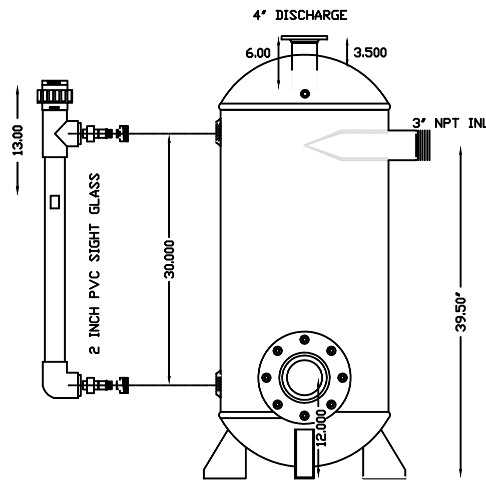
National Environmental Systems
Phone 508-226-1100 Fax 508-226)-1180 84 Dunham Street Attleboro, MA 02703
www.nes-inc.biz

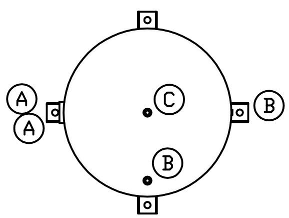
REVISIONS			
REV	DESCRIPTION	DATE	APPR











LIQUID CAPACITY GALLONS +/-			
LOW	HIGH	E HIGH	PUMP-OUT
XX GLN	XX GLN	XX GLN	XX

					OPENINGS (NPT) IN INCHES						
P/N	PSI	GALLON	DIA	HEIGHT	A	B	C				
A10043	200	60	20	49	2.00"	0.25"	0.75"				

NES™
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84 Dunham Street – Attleboro, MA. 02703
508-226-1100 (Phone) / 508-226-1180 (Fax)

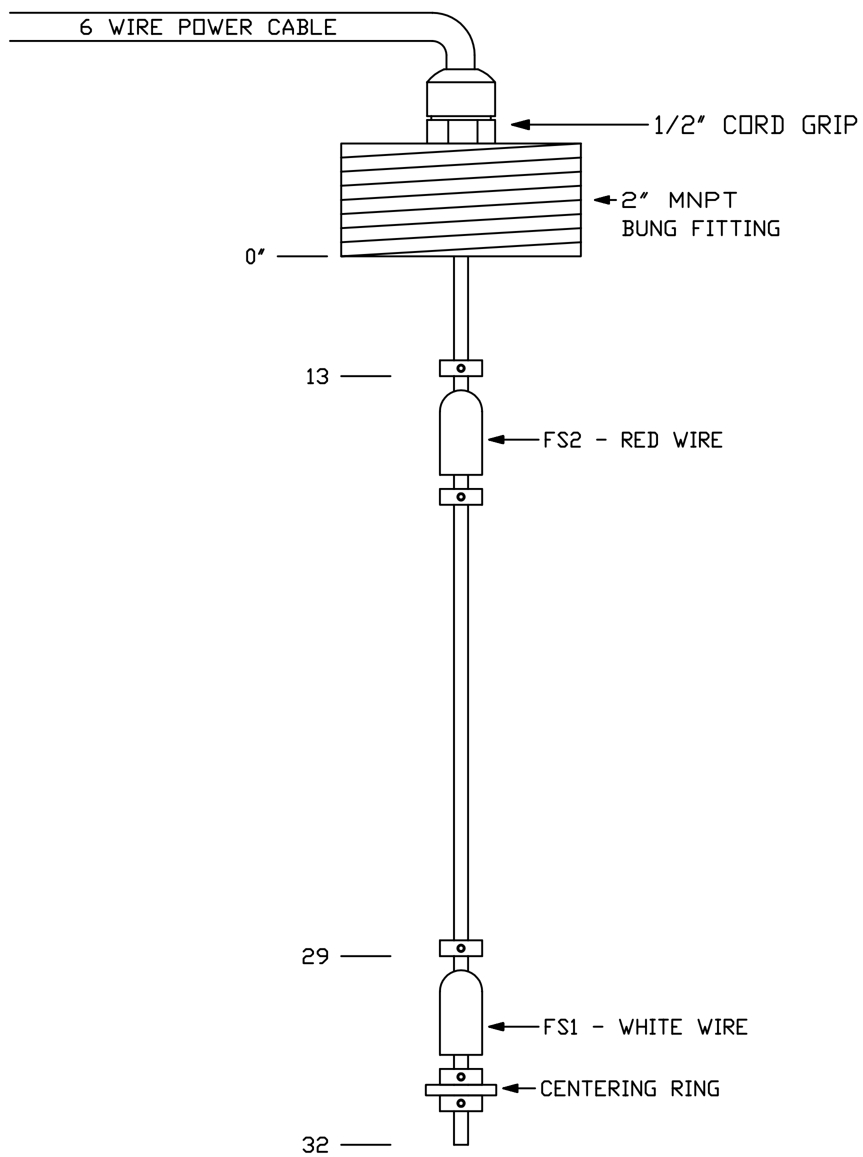
DRWN BY CJJ	DATE 07-12-11	TITLE	Moisture Separator 60 Gallon
CHK BY	DATE	Environmental Assessment & Remediations NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners	JOB NO. 11-177
APPR BY	DATE	SCALE 1"=10" / SIZE C / DWG NO. 11-177-L2	SHEET 1 OF 2 / REV

REVISIONS			
REV 1	ADDED LOW LEVEL FLOAT	7-25-11	CJJ

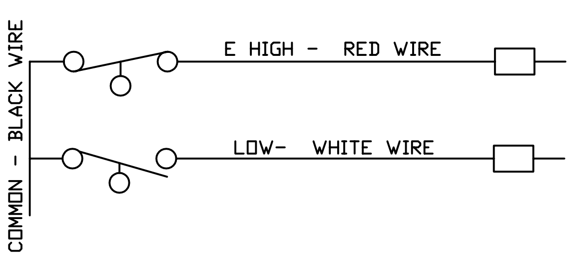
P500-010

CABLE LENGTH

10 FEET



BRASS CONSTRUCTION
WITH BUNA-N FLOATS



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DRWN BY CJJ	DATE 10-25-10	TITLE	MOISTURE SEPARATOR 1-POSITION FLOAT SWITCH		
CHK BY	DATE	Environmental Assessment & Remediations NYSDEC Site No. 1-30-107 Farmingdale Plaza Cleaners		JOB NO. 11-177	
APPR BY	DATE	SCALE N/A	SIZE A	DWG NO. 11-177-L2-R1	SHEET 2 OF 2 / REV. 1

3 FLOAT SIGHT GLASS PROBE
NES P-500

Description:
The 3 float sight glass probe is designed to work in conjunction with a National Environmental Systems control panel to control the liquid level in a tank or sump. The brass float guide and buna floats provide long-term trouble free use and durability against corrosion. The probe is assembled with a standard length cable and a nipple (1/2” mnpt) for electrical junction box attachment.

Operation:
Each probe has three floats positioned with the brass collars at varying lengths from one to another. The top float is referred to as the “e-high”, the middle is referred to as “high”, and the bottom is referred to as “low”, (in some custom applications an additional 1 or 2 floats can be added). The float is constructed to have a specific gravity less then water so it will float in water. As the float (with internal magnet) rises and falls within the stop collars, it opens and closes a small reed switch (electrical contacts) located within the stainless steel float guide. A typical arrangement has the lower float turning a discharge pump off, middle float turning a discharge pump on, and the top float signaling an alarm and turning a feed pump off.
Note: In some cases, if there is product within a tank (such as gasoline) it may not actuate the float because it has lower specific gravity than water.

Installation:
The probe should be installed within a sight glass or tank manufactured by National Environmental Systems. A junction box should also be provided within close proximity to the probe to allow it to be removed easily for repair or maintenance.

Maintenance:
Periodic inspection, cleaning, and testing are recommended to be performed at least once a week after the initial deployment of the probe. This schedule can be adjusted to more or less in frequency, depending upon site conditions.

To clean the probe assembly, power to the control panel should be disconnected. The probe should be removed from the sight glass or tank, and all components cleaned with any type of cleaner compatible with the materials of construction (stainless steel and buna). Great care should be taken not to move the float collars, **they are not readily field adjustable. However collars can be repositioned if instructed properly by NES technical support staff.**

Test Procedures:

1. Disconnect probe wires from the nearest junction box, remove the probe from the sight glass, and move all the floats to the lowest point within the collars.
2. Connect an ohm meter to the red and black leads of the probe, meter should read approximately 0 to 1 ohm (switch closed).
3. Submerge the probe in the water, or manually move the e-high float to the highest point within the collars, the meter should now read infinite ohms or OL on some digital meters (switch open).
4. Connect the ohm meter to the green and black leads of the probe, meter should read infinity (switch open)..
5. Submerge the probe in water, or manually move the high float to the highest point within the collars, the meter should read approximately 0 to 1 ohm (switch closed).
6. Connect the ohm meter to the white and black leads of the probe, meter should read infinity (switch open).
7. Submerge the probe in water, or manually move the low float to the highest point within the collars, the meter should read approximately 0 to 1 ohm (switch closed).

Contact NES if your level sensor needs adjustment or replacement.

ITT

Commercial Water

Goulds Pumps

G&L Series NPE

316L SS

NPE Series End Suction Centrifugal Pumps

Bombas Centrífugas de Succión Final Serie NPE

GOULDS PUMPS

Goulds Pumps is a brand of ITT
Residential and Commercial Water.

*Goulds Pumps es una marca de fábrica
de ITT Agua Residencial y Comercial.*

www.goulds.com

Engineered for life

A Full Range of Product Features
Una Gama Total de Características del Producto

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: *El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.*

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

Model: 1ST1C5E4

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE Product Line Numbering System
Línea de Producto NPE Sistema de Numeración

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal), *Sello Mecánico John Crane Tipo 21 (sello de ⅝")*

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
[redacted]	Carbon	Silicon Carbide	[redacted]	316 SS	[redacted]
4			Viton		10K55
[redacted]			[redacted]		[redacted]
6	Carbide		Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del Impulsor*	Pump Size, *Tamaño de la Bomba* 1 x 1¼ – 6 Diameter	1¼ x 1½ – 6 Diameter	1½ x 2 – 6 Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
[redacted]			
E	4 7/16	[redacted]	
[redacted]			

Driver, *Conductor*
1 = 1 PH, ODP 7 = 3 PH, XP
2 = 3 PH, ODP 8 = 575 V, XP
3 = 575 V, ODP 9 = 3 PH, TEFC
[redacted]
5 = 3 PH, TEFC [redacted]

HP Rating, *HP Potencia*
C = ½ HP [redacted]

Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
[redacted]
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

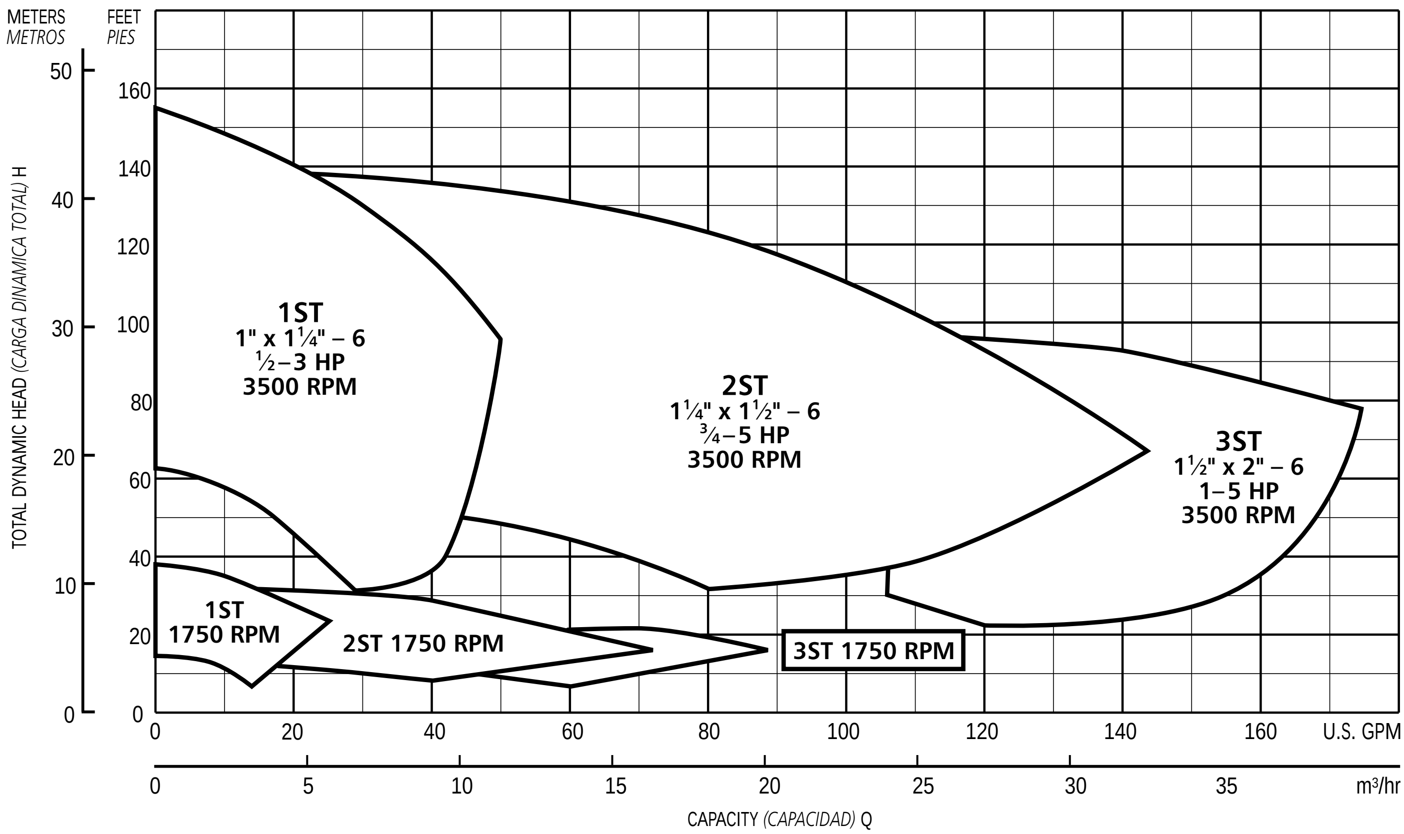
For frame mounted version, substitute the letters "FRM" in these positions.

Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 [redacted]

Performance Coverage (60 Hz)
Alcance de Funcionamiento (60 Hz)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds check available service factor.

NOTAS:

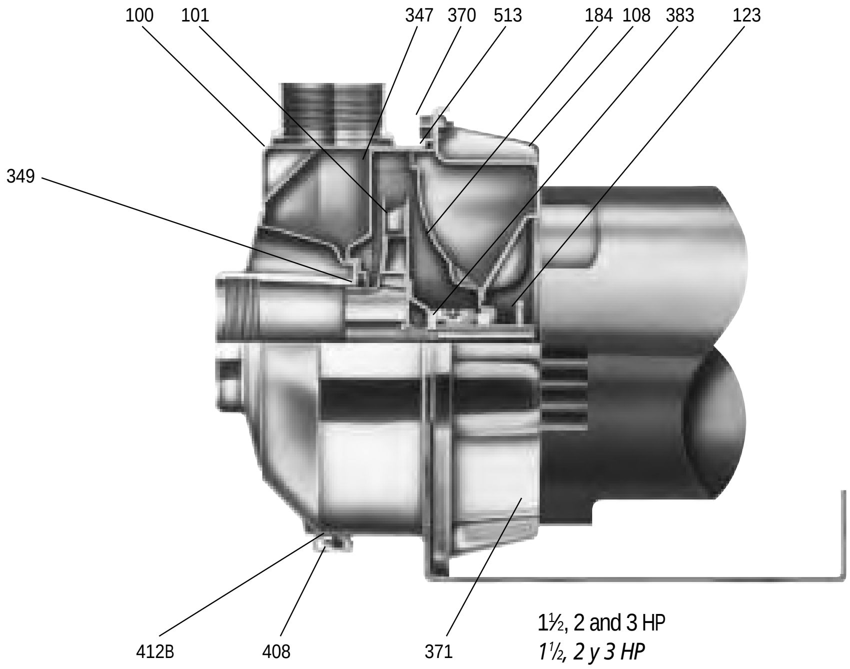
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

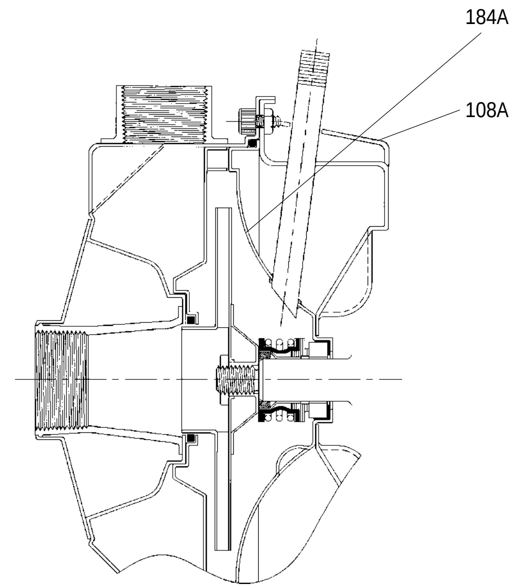
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds.

NPE Close Coupled Pump Major Components: Materials of Construction
Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción



1½, 2 and 3 HP
1½, 2 y 3 HP



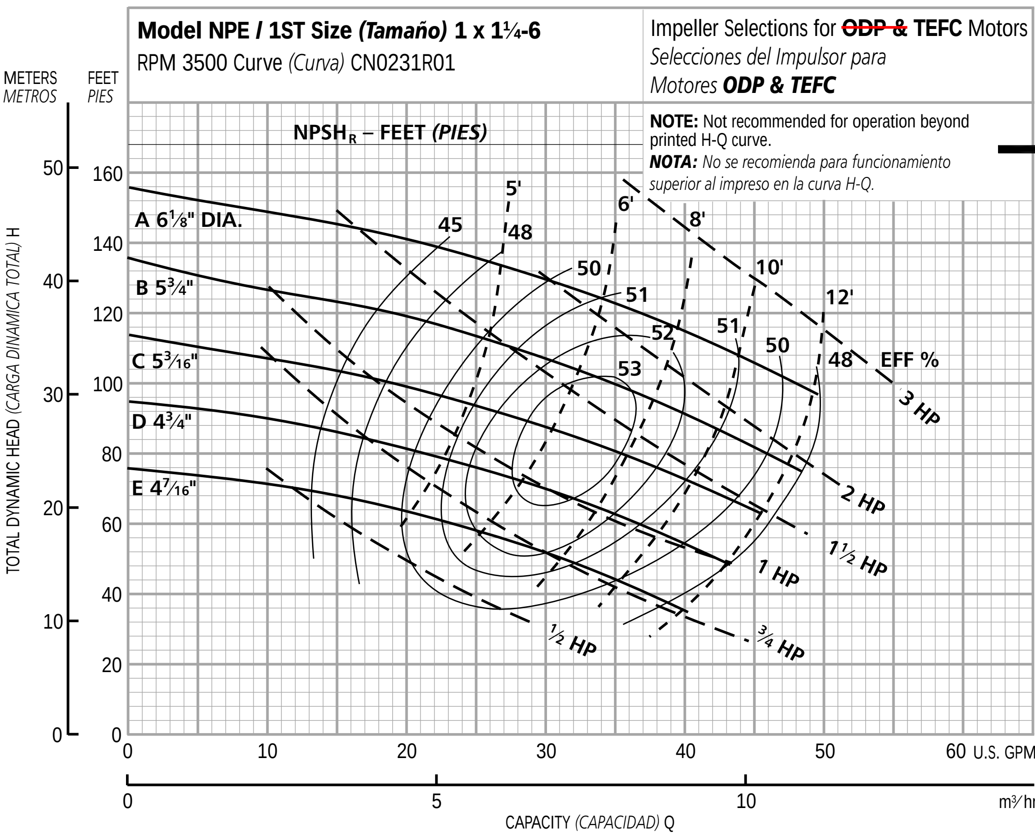
Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing, *Carcasa*	AISI 316L SS, *AISI 316L Acero inoxidable*
101	Impeller, *Impulsor*	
108	Motor adapter, *Adaptador del motor*	
108A	Motor adapter seal vent/flush, *Sello válvula/chorro del adaptador del motor*	
123	Deflector, *Deflector*	BUNA-N
184	Seal housing, *Alojamiento del sello*	AISI 316L SS, *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush, *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane, *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS, *AISI 410 Acero inoxidable*
371	Bolts, motor; *Tornillos, motor*	Plated steel, Acero chapeado
383	Mechanical seal, *Sello mecánico*	**see chart, *ver tabla*
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS, *AISI 316L Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 1750 RPM and 5 HP ODP and TEFC, all explosion proof see page 13.

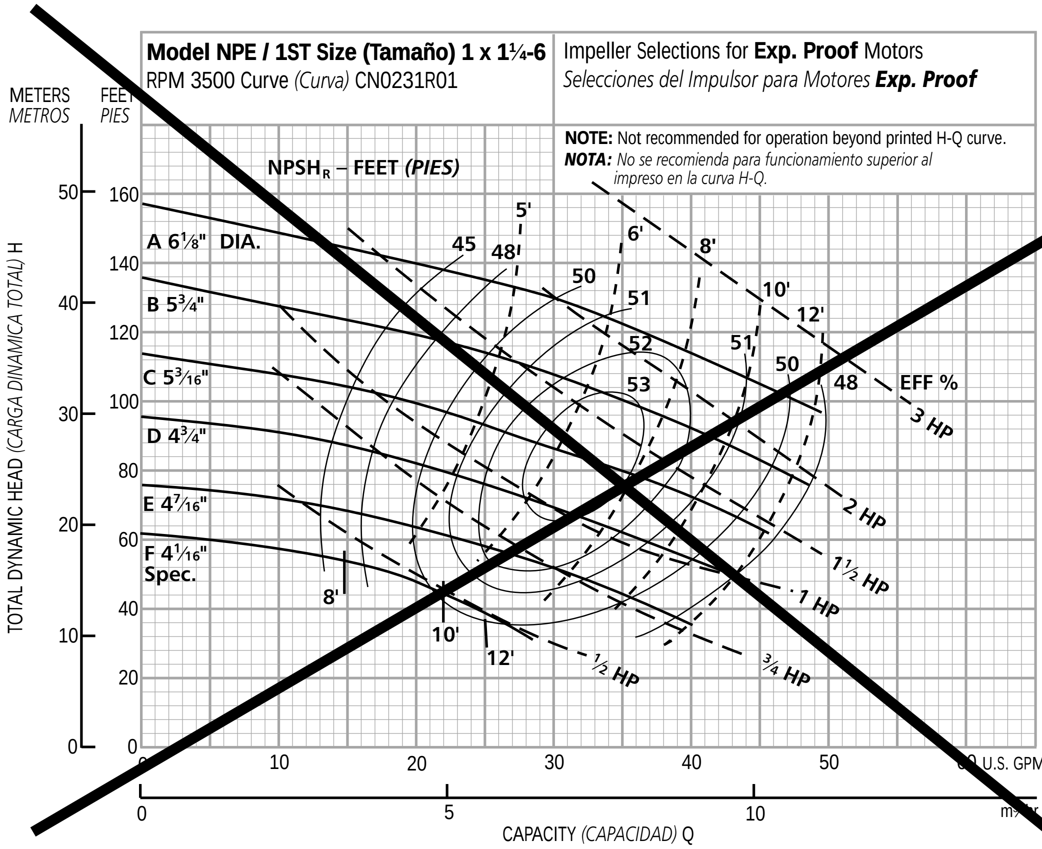
Motor con pie para 1750 RPM, 5 HP ODP y TEFC, a prueba de explosiones en la página 13.



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄16"
D	¾	4¾
C	1	5³⁄16
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄16".*

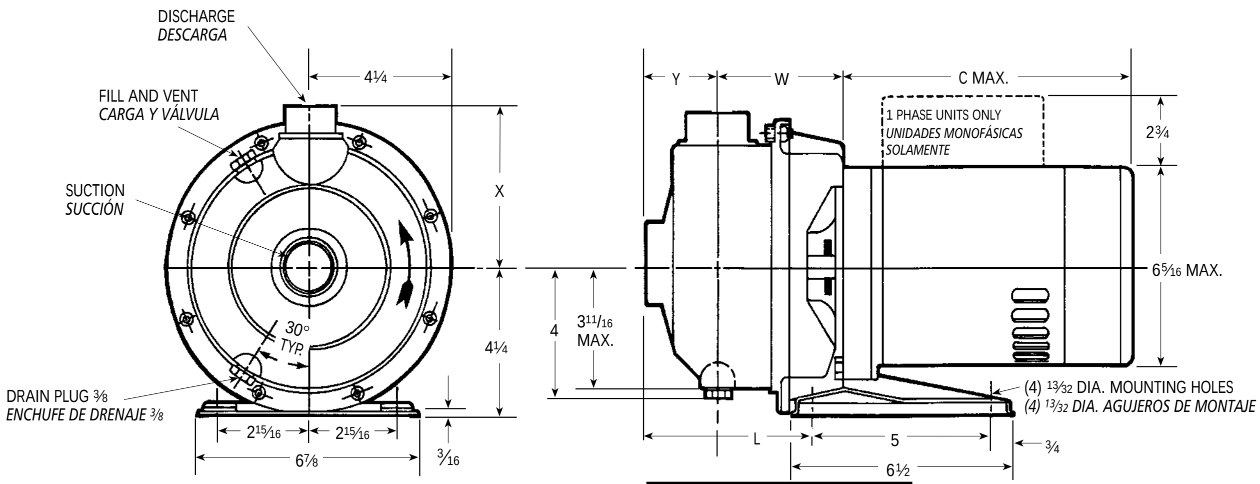


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄16" spec.
E	¾	4⁷⁄16
D	1	4¾
C	1½	5³⁄16
B	2	5¾
A	3	6⅛

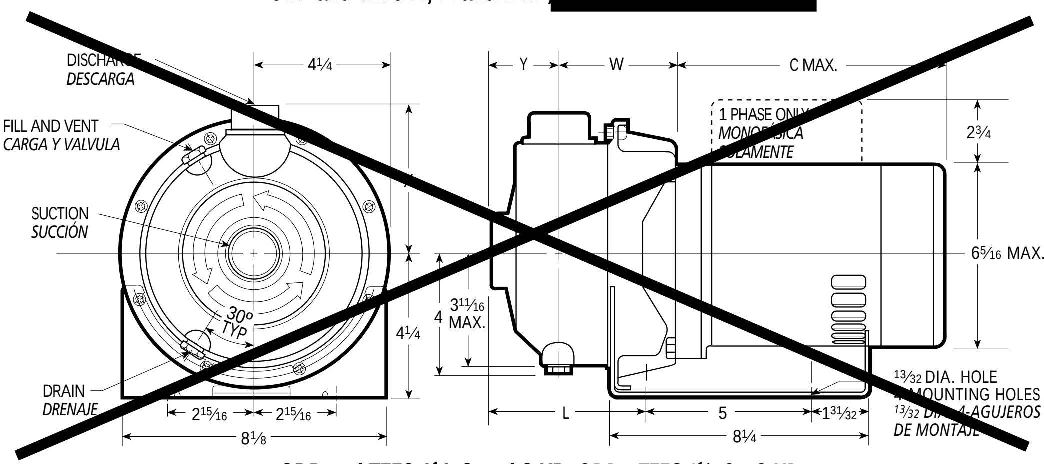
NOTE: Although not recommended, the pump may pass a ¹⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄16".*

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP, [redacted]



ODP and TEFC 1½, 2 and 3 HP, *ODP y TEFC 1½, 2 y 3 HP*

Specifications
Especificaciones

Capacities to:
75 GPM (283L/min) at 1750 RPM
150 GPM (550L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to:
212°F (100°C) with standard seal or 250°F (121°C) with optional high temperature seal.

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or 2 HP explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
75 GPM (283L/min) a 1750 RPM
150 GPM (550L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
212°F (100°C) con sello estándar o 250°F (121°C) con sello opcional para alta temperatura.

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones de 2 HP. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

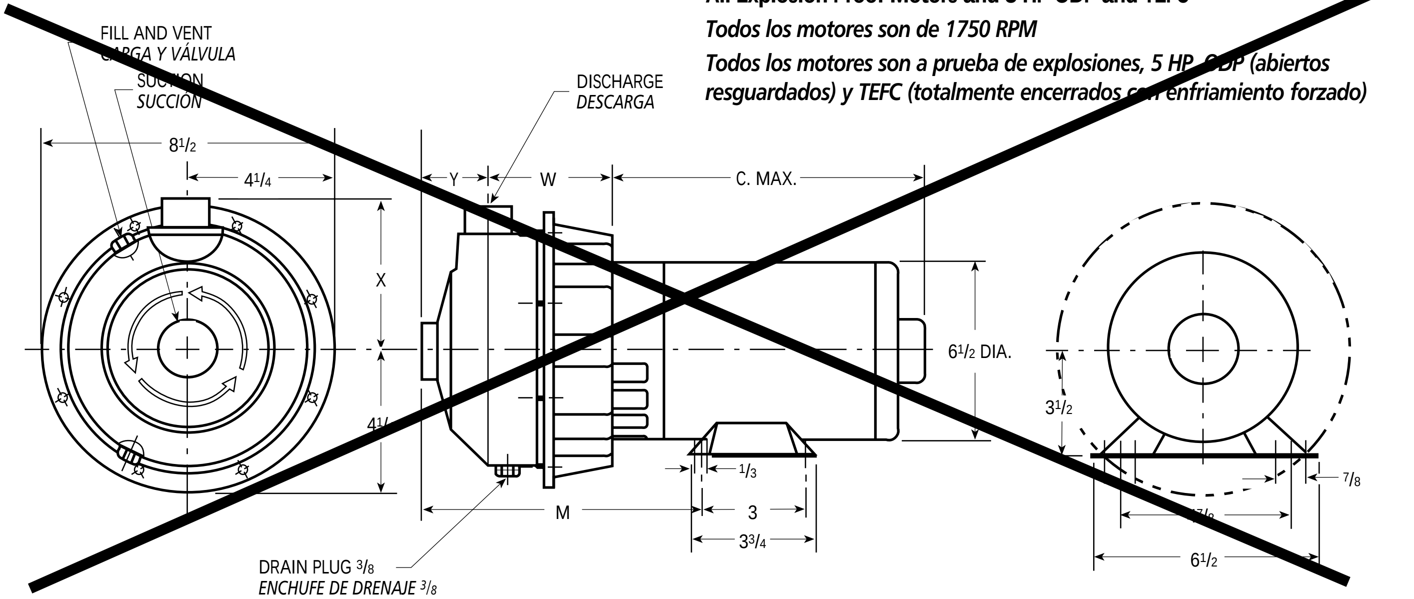
NPE Close Coupled with Footed Motor, 1750 RPM and Explosion-proof Motors
NPE Acople Cerrado con Motor con Patas, 1750 RPM y Motores a Prueba de Explosión

All 1750 RPM Motors

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son de 1750 RPM

Todos los motores son a prueba de explosiones, 5 HP, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)



Dimensions – Determined by Pump,
Dimensiones – Determinadas por la Bomba

Pump, *Bomba*	Suction, *Succión*	Discharge, *Descarga*	HP	W	X	Y	L	M
1ST	1¼	1	½ – 3	3 5⁄16	4 3⁄8	2	4 9⁄16	7 5⁄16
[redacted]								

Available Motor Weights and Dimensions,
Pesos y Dimensiones Disponibles del Motor

HP	Motor Weights, *Pesos del Motor*						C Max. Length, *(Longitud)*
	1 Phase, *Monofásicos*			3 Phase, *Trifásicos*			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
½	[redacted]				18	[redacted]	9 15⁄16
[redacted]							
1	22	26	49	23	21	30	11
1½	28	35	56	27	27	37	11 5⁄16
2	33	39	60	32	33	44	12 1⁄16
3	40	43	—	41	37	—	12 7⁄16
5	42	—	—	42	45	—	14 1⁄4

Dimensions in inches, weights in pounds.
Dimensiones en pulgadas, pesos en libras.

NOTES:
1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:
1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.
2. Las dimensiones del motor puede que varíen con los fabricantes.
3. Dimensiones en pulgadas, pesos en libras.
4. Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.
5. No usar para propósitos de construcción sin certificar.

Commercial Water

Goulds Pumps

G&L SERIES

MODEL NPE/NPE-F

Installation, Operation and
Maintainence Instructions

GOULDS PUMPS

Goulds Pumps is a brand of ITT Water Technology, Inc.
- a subsidiary of ITT Industries, Inc.

www.goulds.com

Engineered for life

Table of Contents

Owner's Information

Pump Model Number: ______________________

Pump Serial Number: ______________________

Dealer: ______________________

Dealer Phone No.: ______________________

Date of Purchase: ______________________

Date of Installation: ______________________

Current Readings at Startup:

1 Ø		3 Ø	L1-2	L2-3	L3-1
Amps:	______	Amps:	______	______	______
Volts:	______	Volts:	______	______	______

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.

This is a **SAFETY ALERT SYMBOL.** When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

DANGER Warns of hazards that **WILL** cause serious personal injury, death or major property damage.

WARNING Warns of hazards that **CAN** cause serious personal injury, death or major property damage.

CAUTION Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. IMPORTANT:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

CAUTION **Always disconnect electrical power when handling pump or controls.**

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	212º F (100º C) with standard seal 250º F (120º C) with optional high temp seal
Pressure:	75 PSI
Starts Per Hour:	20, evenly distributed

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. INSTALLATION:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

CAUTION **Never draw piping into place by forcing the pump suction and discharge connections.**

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units:

2.2.1. Units may be installed horizontally, inclined or vertically.

CAUTION **Do not install with motor below pump. Any leakage or condensation will affect the motor.**

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units:

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure1.

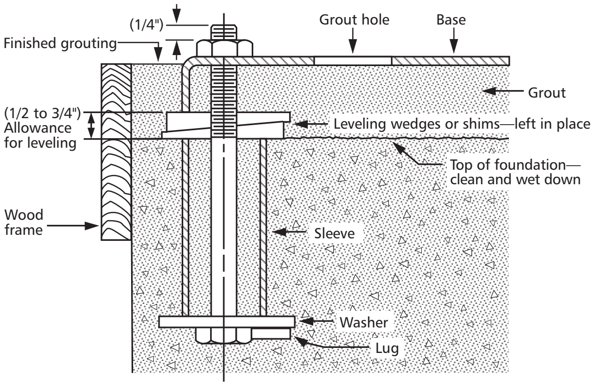


Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. SUCTION PIPING:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply:

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

⚠ CAUTION **Do not use suction isolation valve to throttle pump.**

3.5. Installation with pump above source of supply:

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

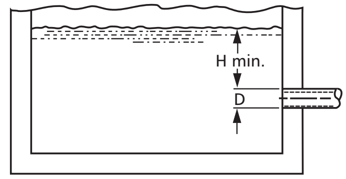


Figure 2

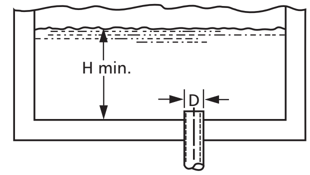


Figure 3

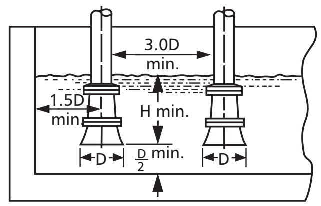


Figure 4

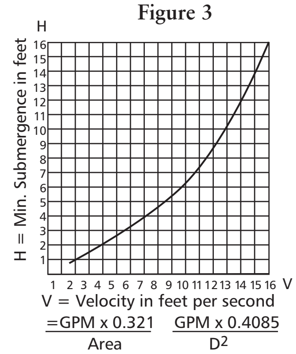


Figure 5

4. DISCHARGE PIPING:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units:

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units:

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.

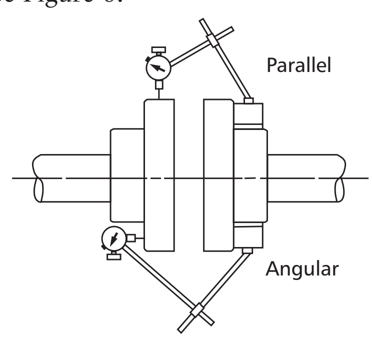


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

⚠ CAUTION **Always recheck both alignments after making any adjustment.**

6. ROTATION:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. OPERATION:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

⚠ CAUTION **Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.**

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. MAINTENANCE:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units:

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End:

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

⚠ CAUTION **Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.**

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

⚠ CAUTION **Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.**

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame:

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 and 168).

10. REASSEMBLY:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame:

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end:

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

⚠ CAUTION **Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.**

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. TROUBLE SHOOTING CHART:

MOTOR NOT RUNNING
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged.
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

NPE STANDARD REPAIR PARTS LIST

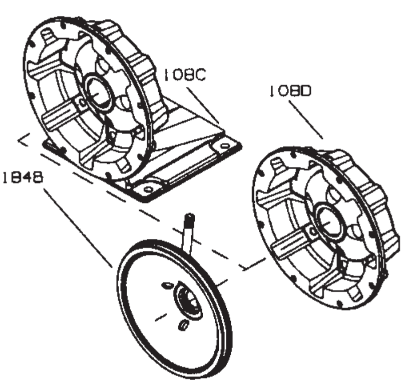
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton (standard)
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton (standard)
		EPR
		BUNA
513	O-Ring, casing	Viton (standard)
		EPR
		BUNA

MECHANICAL SEAL APPLICATION CHART

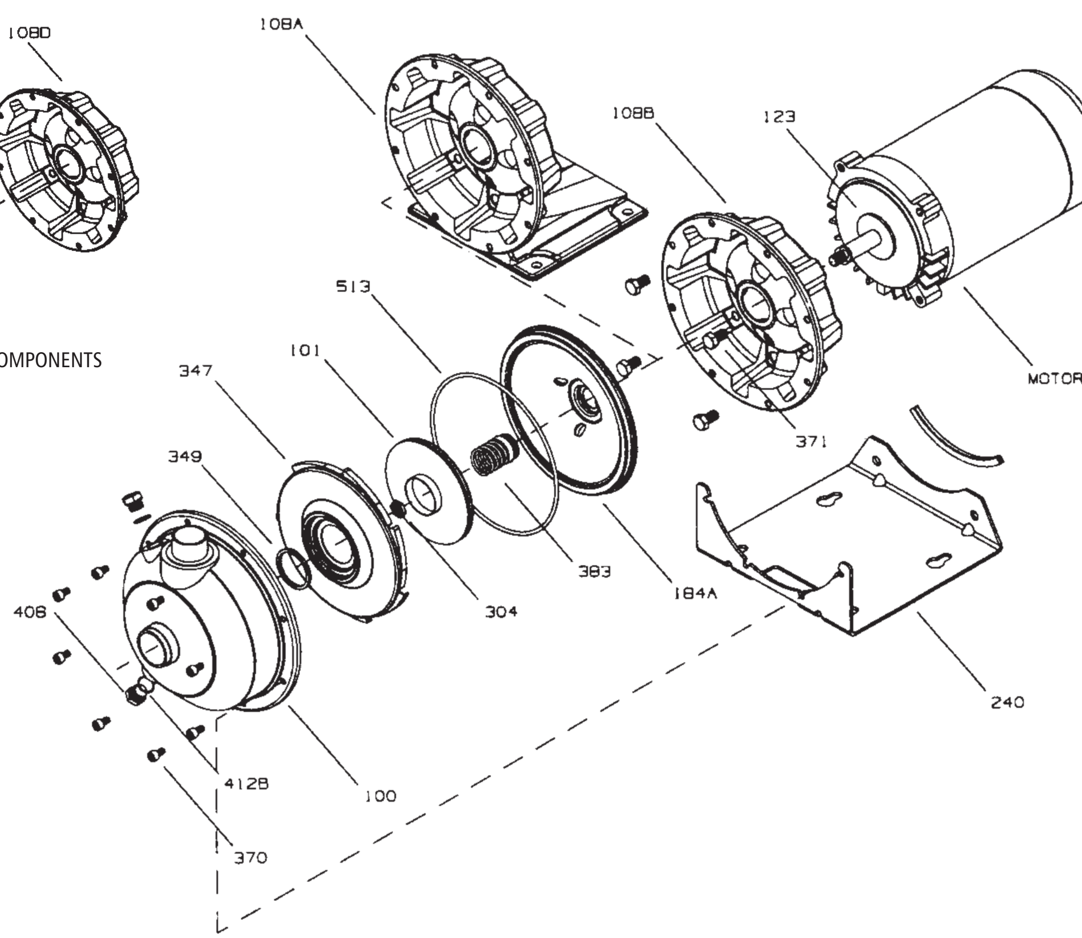
Item 383 Mechanical Seal ($\frac{5}{8}$" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

NOTE: Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



ITT

Commercial Water

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) “Distributor” means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) “Dealer” means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) “Customer” means any entity who buys or leases the subject pumps from a dealer. The “customer” may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

GOULDS PUMPS

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

IM013R07 February, 2006

Engineered for life

GOULDS PUMPS

Repair Parts

MODEL

G&L Series NPE/NPE-F

Goulds Pumps

ITT Industries

Effective June, 2005
RNPE

TABLE OF CONTENTS

NPE END SUCTION

NOTE:
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS.

(3) Mechanical Seal upgrades as noted on page 1.

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F

SEAL VENT/FLUSH OPTION

MECHANICAL SEAL and O-RING

4 = Pre-Engineered Standard

For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (5⁄8" seal)						
Seal Code	**Rotary**	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**	**Casing O-Ring**
2	Carbon	Sil-Carbide	EPR	316 SS	10K18*	EPR
4	Carbon	Sil-Carbide	Viton	316 SS	10K55***	Viton
5	Sil-Carbide	Sil-Carbide	EPR	316 SS	10K81	EPR
6	Sil-Carbide	Sil-Carbide	Viton	316 SS	10K62**	Viton

Note: *Replaces obsolete 10K56 **Replaces obsolete 10K29 ***Replaces obsolete 10K46 and 10K24

Impeller Option Code . . . No Adder Required

For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.

Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	1 x 1¼-6	**1¼ x 1½-6**	**1½ x 2-6**
	Diameter	**Diameter**	**Diameter**
K		6⅛	
G		5 15⁄16	5⅜
H		5½	5
A	6⅛	5¼	4¾
B	5¾	5 1⁄16	4⅝
C	5 3⁄16	4⅞	4⅜
D	4¾	4⅝	4 1⁄16
E	4 7⁄16	4¼	3⅝
F	4 1⁄16	3⅞	

Note: Not recommended for operation beyond printed H-Q curve.

For critical application conditions, consult factory.

Note: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

Note: Impeller diameter is measured at the vane. The overall diameter of the shroud may be greater.

DRIVER

1 = 1PH, ODP   4 = 1 PH, TEFC   7 = 3 PH, XP
2 = 3 PH, ODP   5 = 3 PH, TEFC   8 = 575 V, XP
3 = 575 V, ODP   6 = 575 V, TEFC   0 = 1 PH, XP

HP RATING

C = ½ HP   F = 1½ HP   J = 5 HP
D = ¾ HP   G = 2 HP
E = 1 HP   H = 3 HP

DRIVER: HERTZ/POLE/RPM

1 = 60 HZ, 2 pole, 3500 RPM
2 = 60 HZ, 4 pole, 1750 RPM
3 = 60 HZ, 6 pole, 1150 RPM
4 = 50 HZ, 2 pole, 2900 RPM
5 = 50 HZ, 4 pole, 1450 RPM

MATERIAL

ST = Stainless Steel

PUMP SIZE

1 = 1 x 1¼ - 6   2 = 1¼ x 1½ - 6   3 = 1½ x 2 - 6

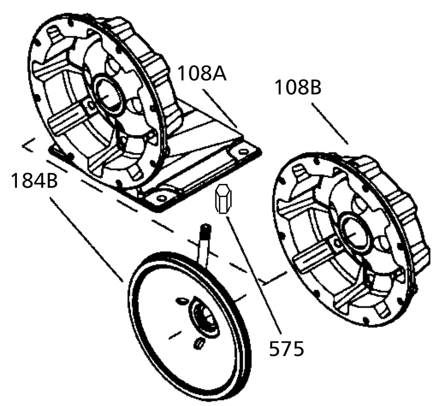
For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QTY.
100	Casing	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller		See Impeller chart on page 4			1
108A	Motor adapter with foot*		1L80			1
108B	Motor adapter less foot*		1L87			
123	Deflector	BUNA-N	5K7			1
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush		1L333			
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 1			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

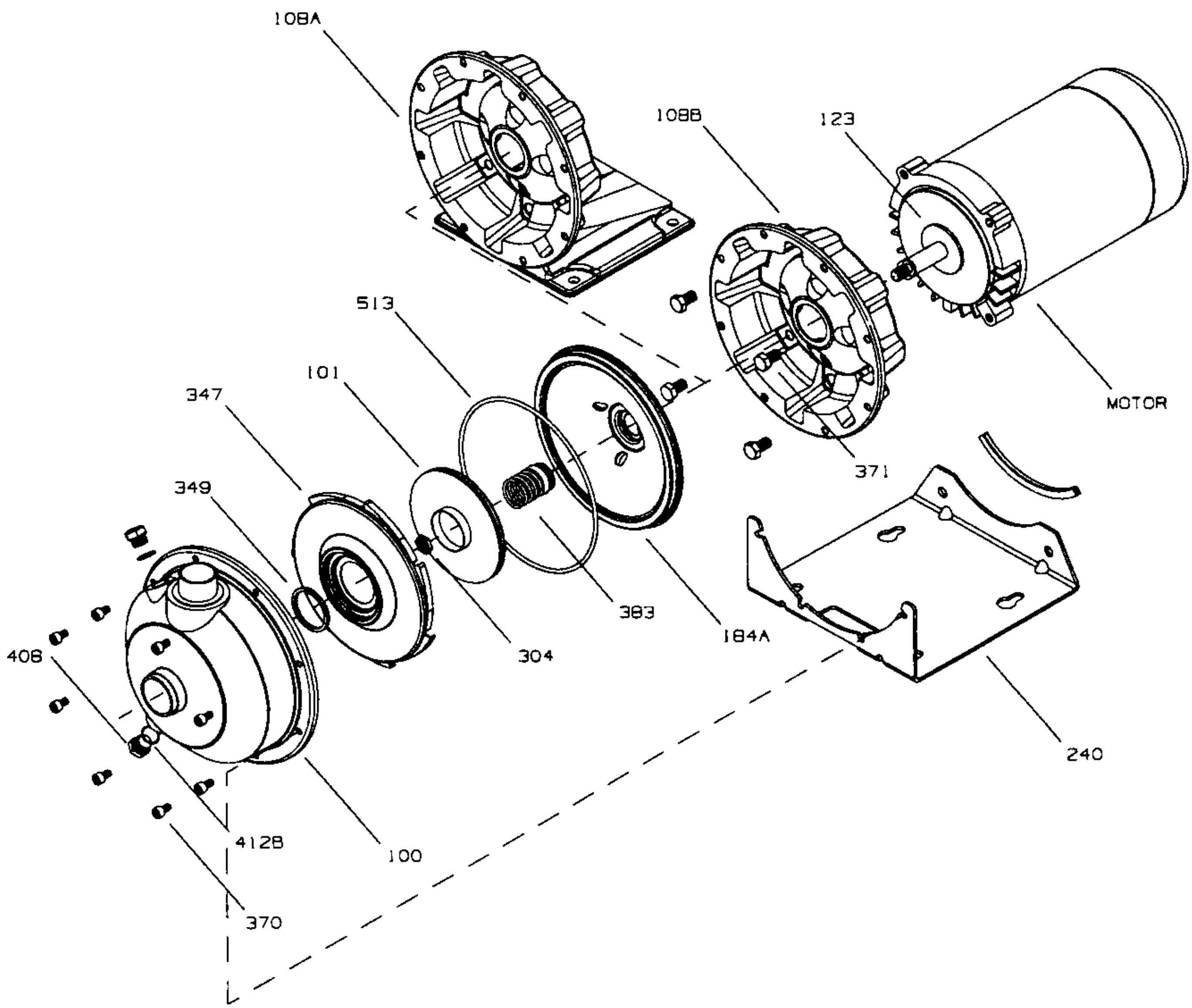
** Flush access hole provided.*

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS



NOTE:
Close-coupled units using motors ½ – 1 HP (TEFC and ODP) will use footed motor adapter as standard.
Close-coupled units using motors 1½ – 3 HP (TEFC and ODP) will use footless motor adapter as standard.
Close-coupled units using motors 5 HP and all X-Proof will have a foot attached to the motor.

NOTE:
Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x $1\frac{1}{4}$-6		$1\frac{1}{4}$ x $1\frac{1}{2}$-6		$1\frac{1}{2}$ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			$6\frac{1}{8}$	2L885		
G			$5\frac{15}{16}$	2L700	$5\frac{3}{8}$	2L702
H			$5\frac{1}{2}$	2L699	5	2L701
A	$6\frac{1}{8}$	2L47	$5\frac{1}{4}$	2L48	$4\frac{3}{4}$	2L49
B	$5\frac{3}{4}$	2L44	$5\frac{1}{16}$	2L54	$4\frac{5}{8}$	2L58
C	$5\frac{3}{16}$	2L46	$4\frac{7}{8}$	2L53	$4\frac{3}{8}$	2L57
D	$4\frac{3}{4}$	2L42	$4\frac{5}{8}$	2L52	$4\frac{1}{16}$	2L56
E	$4\frac{7}{16}$	2L45	$4\frac{1}{4}$	2L51	$3\frac{5}{8}$	2L55
F	$4\frac{1}{16}$	2L59	$3\frac{7}{8}$	2L50		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST ODP/TEFC	2ST ODP/TEFC		3ST ODP/TEFC
$\frac{1}{2}$	C	Repair #	2L45			
		Dia.	$4\frac{7}{16}$			
		Imp. Code	E			
$\frac{3}{4}$	D	Repair #	2L42	2L50		
		Dia.	$4\frac{3}{4}$	$3\frac{7}{8}$		
		Imp. Code	D	F		
1	E	Repair #	2L46	2L51		2L55
		Dia.	$5\frac{3}{16}$	$4\frac{1}{4}$		$3\frac{5}{8}$
		Imp.Code	C	E		E
$1\frac{1}{2}$	F	Repair #	2L44	2L52		2L56
		Dia.	$5\frac{3}{4}$	$4\frac{5}{8}$		$4\frac{1}{16}$
		Imp. Code	B	D		D
2	G	Repair #	2L47	2L53		2L57
		Dia.	$6\frac{1}{8}$	$4\frac{7}{8}$		$4\frac{3}{8}$
		Imp. Code	A	C		C
3	H	Repair #	2L47	2L48		2L49
		Dia.	$6\frac{1}{8}$	$5\frac{1}{4}$		$4\frac{3}{4}$
		Imp. Code	A	A		A
5	J	Repair #		2L700	2L885	2L702
		Dia.		$5\frac{15}{16}$	$6\frac{1}{8}$	$5\frac{3}{8}$
		Imp. Code		G	K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST ODP	1ST TEFC/EXP	2ST ODP		2ST TEFC/EXP	3ST ODP	3ST TEFC/EXP
$\frac{1}{2}$	C	Repair #	2L45	2L59					
		Dia.	$4\frac{7}{16}$	$4\frac{1}{16}$					
		Imp. Code	E	F					
$\frac{3}{4}$	D	Repair #	2L42	2L45	2L50				
		Dia.	$4\frac{3}{4}$	$4\frac{7}{16}$	$3\frac{7}{8}$				
		Imp. Code	D	E	F				
1	E	Repair #	2L46	2L42	2L51		2L50	2L55	
		Dia.	$5\frac{3}{16}$	$4\frac{3}{4}$	$4\frac{1}{4}$		$3\frac{7}{8}$	$3\frac{5}{8}$	
		Imp. Code	C	D	E		F	E	
$1\frac{1}{2}$	F	Repair #	2L44	2L46	2L52		2L51	2L56	2L55
		Dia.	$5\frac{3}{4}$	$5\frac{3}{16}$	$4\frac{5}{8}$		$4\frac{1}{4}$	$4\frac{1}{16}$	$3\frac{5}{8}$
		Imp. Code	B	C	D		E	D	E
2	G	Repair #	2L47	2L44	2L53		2L52	2L57	2L56
		Dia.	$6\frac{1}{8}$	$5\frac{3}{4}$	$4\frac{7}{8}$		$4\frac{5}{8}$	$4\frac{3}{8}$	$4\frac{1}{16}$
		Imp. Code	A	B	C		D	C	D
3	H	Repair #	2L47	2L47	2L48		2L54	2L49	2L58
		Dia.	$6\frac{1}{8}$	$6\frac{1}{8}$	$5\frac{1}{4}$		$5\frac{1}{16}$	$4\frac{3}{4}$	$4\frac{5}{8}$
		Imp. Code	A	A	A		B	A	B
5	J	Repair #			2L700	2L885		2L702	
		Dia.			$5\frac{15}{16}$	$6\frac{1}{8}$		$5\frac{3}{8}$	
		Imp. Code			G	K		G	

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854	26.8/13.4	36	E08821	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854	14.0	40	E09821	11.89	44			
5	E10754	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873	2.6/1.3	19	E04876	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873	3.4/1.7	19	E05876	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873	4.2/2.1	22	E06876	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878	5.8/2.9	25	E07876	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874	6.9/3.3	39	E08876	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874	7.2/3.6	31	E09876	7.6/3.8	37			
5	E10774	7.2/14.4	50	E10876	6.2/12.4	48			

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

GOULDS PUMPS

FPZ, Inc
150 N. Progress Drive
Saukville, WI 53080 - **U.S.A.**
Tel. (262) 268-0180
Fax (262) 268-0415
E-mail usa@fpz.com

REGENERATIVE BLOWERS - **VACUUM**

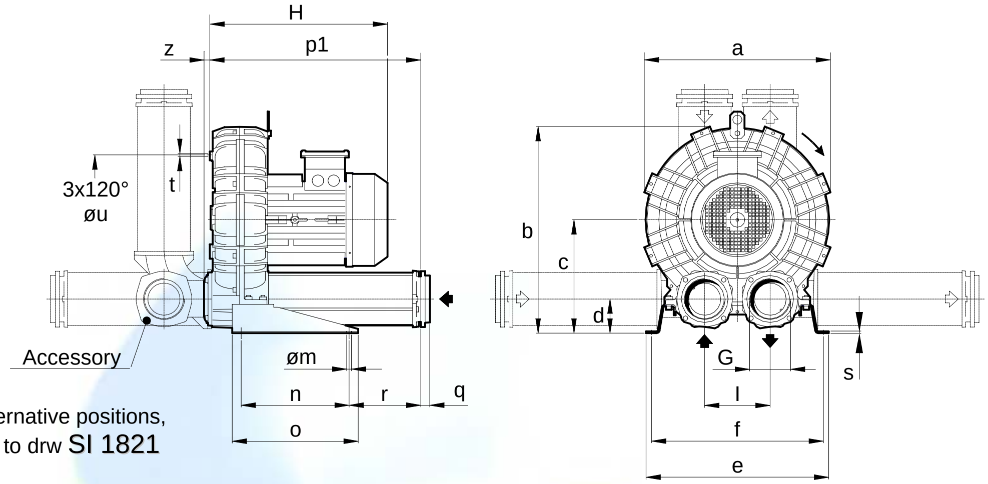
SCL K07 K08 / K09 / K10 / K11 / K12

MS SERIES - MOR RANGE

TECHNICAL CHARACTERISTICS
- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - **cURus** motor

OPTIONS
- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES
- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors



Possible alternative positions, please refer to drw SI 1821

Dimensions in inches.
Dimension for reference only.

Model	a	b	c	d	e	f	G	l	m	n	o	p1	q	r	s	t	u	z
K07-MS	16.69	18.84	10.59	3.23	18.43	17.24	3" NPT	6.10	0.51	11.81	13.78	20.16	0.98	5.39	0.20	M8	11.61	0.63
K08-MS	17.99	19.61	10.59	3.23	18.82	17.64	3" NPT	6.10	0.51	11.81	13.78	20.16	0.98	5.39	0.20	M8	12.2	0.63
K09-MS	19.37	22.09	12.40	3.78	20.00	18.82	4" NPT	7.17	0.51	11.81	13.78	23.07	0.98	7.83	0.20	M8	14.17	0.63
K10-MS	20.31	22.56	12.40	3.78	20.00	18.82	4" NPT	7.17	0.51	11.81	13.78	23.07	0.98	7.83	0.20	M8	14.17	0.63
K11-MS	21.34	23.74	13.07	3.58	21.26	20.00	4" NPT	7.87	0.51	11.81	13.78	23.46	0.98	8.03	0.20	M8	15.35	0.63
K12-MS	21.57	23.82	13.07	3.58	21.26	20.00	4" NPT	7.87	0.51	11.81	13.78	23.58	0.98	8.03	0.20	M8	15.35	0.51

Model	Maximum flow cfm		Installed power Hp		Maximum differential pressure Δp (In Hg)		Noise level Lp dB (A) (1)		Overall dimensions H	Weight
	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	60 Hz 3500 rpm	*50 Hz 2900 rpm*	Inches	Lbs
K07-MS	294	*243*	4	*4*	3.7	*4.6*	77.7	*75.7*	15.45	103.00
			5 ½	*5 ½*	5.6	*6.3*	78.0	*76.0*	15.45	107.10
			7 ½	*7 ½*	9.6	*8.9*	78.3	*76.3*	18.37	145.70
			10	-	11.1	-	78.6	-	18.37	154.50
K08-MS	381	*316*	5 ½	*5 ½*	2.9	*3.8*	78.8	*76.8*	15.45	115.70
			7 ½	*7 ½*	5.9	*6.6*	79.1	*77.1*	18.37	154.30
			10	*10*	8.5	*9.2*	79.4	*77.4*	18.37	163.10
			15	-	11.1	-	79.7	-	19.13	184.00
K09-MS	471	*390*	7 ½	*7 ½*	3.7	*4.6*	79.3	*77.3*	18.84	166.50
			10	*10*	5.9	*7.0*	79.6	*77.6*	18.84	175.10
			15	*15*	10.3	*10.4*	80.1	*78.1*	19.63	196.20
			20	-	11.1	-	80.4	-	23.74	269.00
K10-MS	556	*460*	7 ½	*7 ½*	2.7	*3.8*	79.4	*77.4*	18.84	170.90
			10	*10*	4.7	*5.9*	79.7	*77.7*	18.84	179.50
			15	*15*	8.8	*9.9*	80.2	*78.2*	19.63	200.60
			20	-	11.1	-	80.5	-	23.74	273.40
K11-MS	650	*539*	10	*10*	2.9	*3.9*	82.0	*80.0*	19.04	194.90
			15	*15*	6.0	*7.1*	82.5	*80.5*	19.83	216.00
			20	*20*	9.2	*10.4*	83.0	*81.0*	23.94	288.80
			25	-	11.1	-	83.8	-	24.81	313.10
K12-MS	726	*602*	15	*15*	3.8	*6.6*	83.5	*81.5*	19.95	223.70
			20	*20*	6.3	*9.6*	84.3	*82.3*	24.06	296.50
			25	-	8.8	-	87.2	-	24.92	320.80

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

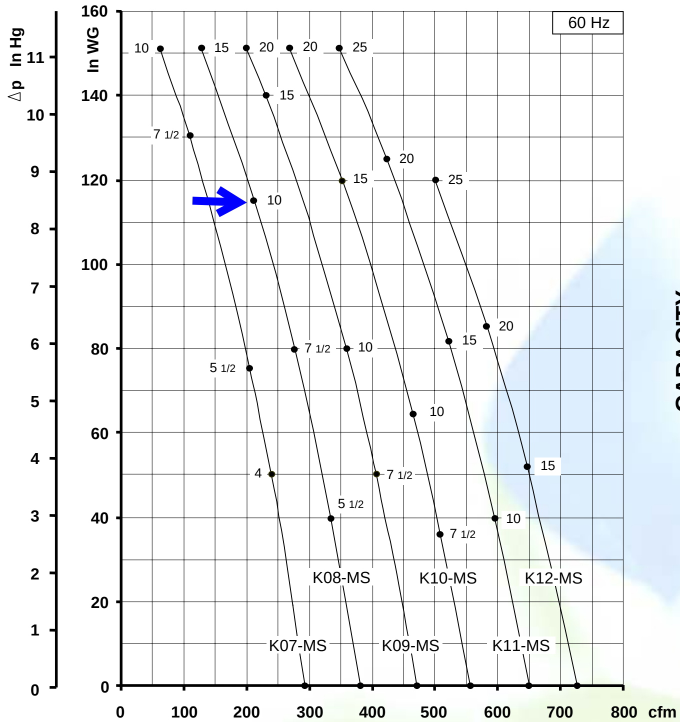
REGENERATIVE BLOWERS - **VACUUM**

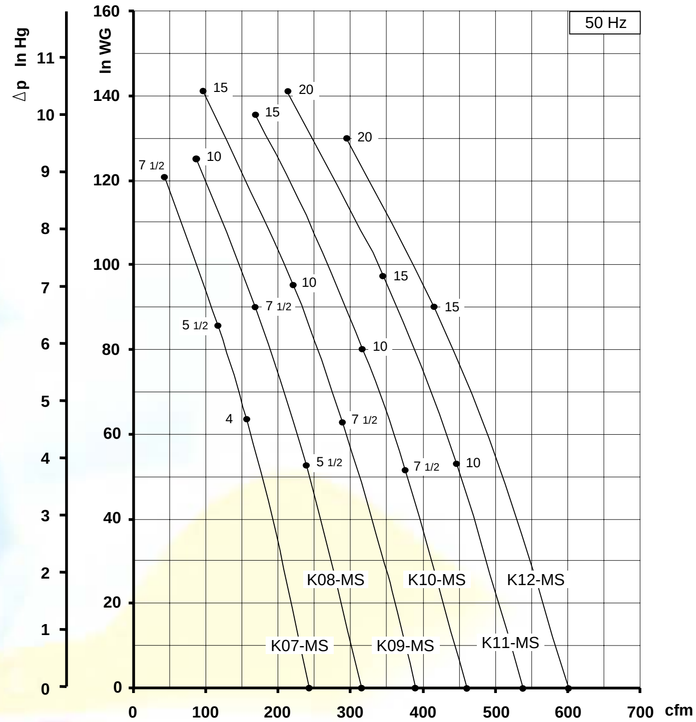
SCL K07 / K08 / K09 / K10 / K11 / K12

MS SERIES - MOR RANGE

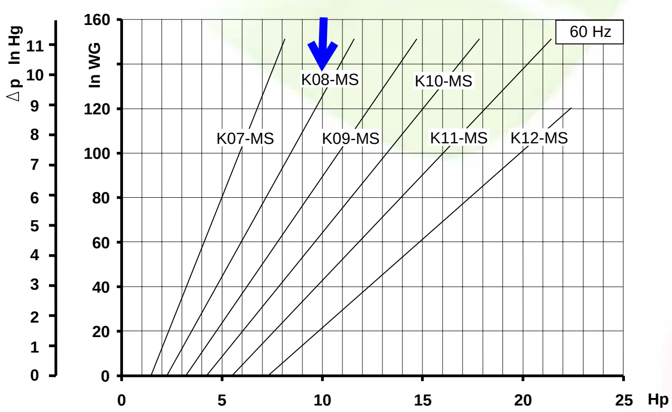
SN 1810-11 2/2

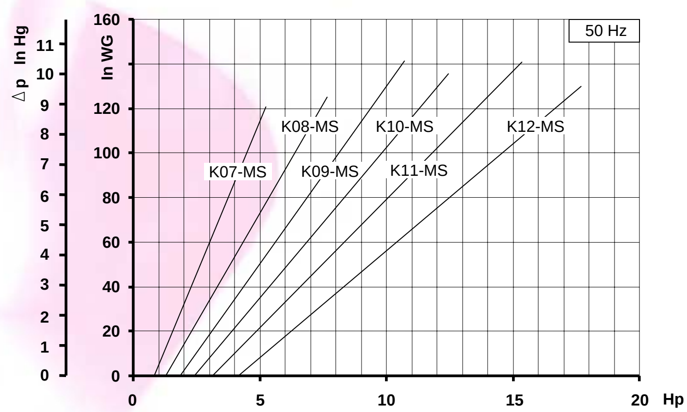
CAPACITY



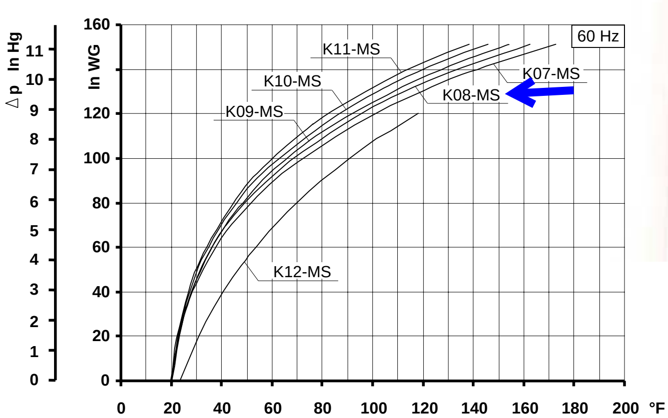


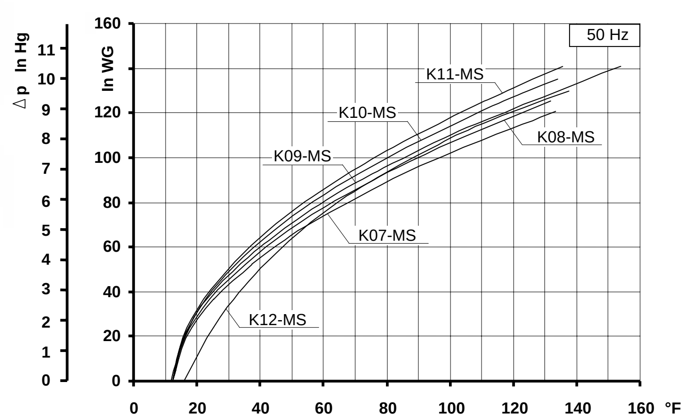
ABSORBED POWER





TEMPERATURE INCREASE





Curves refer to air at 68° F temperature, measured at inlet port and 29.92 In Hg atmospheric backpressure (abs).
Values for flow, power consumption and temperature rise: +/-10% tolerance.
Data subject to change without notice.

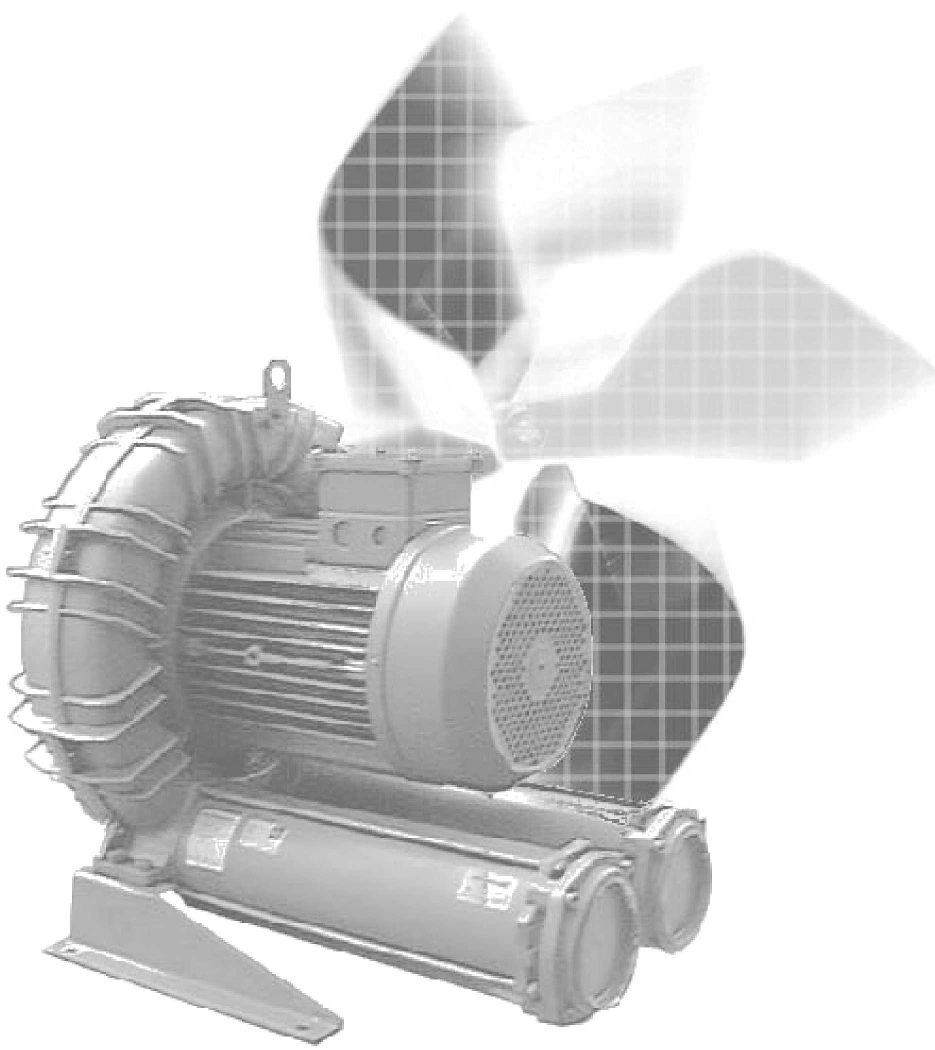
F.P.Z. effepizeta s.r.l.
Via F.lli Cervi 16/18
20049 Concorezzo - (MI) - **ITALIA**
Tel. +39 039 604 1820
Fax +39 039 604 1296
www.fpz.com

COMPRESSORI - ASPIRATORI A CANALE LATERALE ‘SCL K-MS MOR’	**ISTRUZIONI I**
LATERAL CHANNEL BLOWERS – EXHAUSTERS ‘SCL K-MS MOR’	**INSTRUCTIONS GB**
COMPRESSEURS - ASPIRATEURS A CANAL LATERAL ‘SCL K-MS MOR’	**INSTRUCTIONS F**
SEITENKANALVERDICHTER - VAKUUMPUMPEN BAUREIHE ‘SCL K-MS MOR’	**BETRIEBSANLEITUNG D**
COMPRESORES - ASPIRADORES DE CANAL LATERAL ‘SCL K-MS MOR’	**INSTRUCCIONES E**

LEGGERE ATTENTAMENTE TUTTE LE ISTRUZIONI E CONSERVARLE I
PLEASE READ CAREFULLY ALL INSTRUCTIONS AND KEEP THEM FOR FUTURE REFERENCE GB
LIRE ATTENTIVEMENT TOUTES LES INSTRUCTIONS ET LES CONSERVER F
ALLE ANLEITUNGEN SIND SORGFÄLTIG ZU LESEN UND AUFZUBEWAHREN! D
SIRVASE LEER CUIDADOSAMENTE TODAS LAS INSTRUCCIONES Y CONSERVARLAS PARA FUTURA REFERENCIA E

SN 1968-2

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



effepizeta

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

Unità tipo - *Unit type*

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

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

SI - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	kW		**hPa** (mbar)		**Lp / Lw** (1) **dB (A)**		**Ps** max A	**M**
	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	50 Hz 2900 min^{-1}	*60 Hz* *3500 min^{-1}*	**MPa** (bar)	**kg**
SCL K07-MS	**2.2**	***2.55***	**- 130 / + 130**	***- 100 / + 100***	**76.4**	***78.4***	**0.28 (2.8)**	**46.5**
	3.0	***3.45***	**- 200 / + 200**	***- 175 / + 175***	**76.7**	***78.7***	**0.28 (2.8)**	**47.5**
	4.0	***4.6***	**- 280 / + 280**	***- 250 / + 250***	**77.0**	***79.0***	**0.28 (2.8)**	**51.0**
	5.5	***6.3***	**- 325 / + 400**	***- 375 / + 375***	**77.3**	***79.3***	**0.28 (2.8)**	**61.5**
	-	***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 a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, según la Normativa ISO 3744.

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

US - Unità / Units / Unités / Einheiten / Unidades

Modello Model Modèle Modell Modelo	Potenza installata Installed power Puissance installé Installierte Motorleistung Potencia instalada		Pressione massima differenziale Maximum differential pressure Pression différentielle maxi Druckdifferenz Presión diferencial máxima		Rumorosità massima Max noise level Max niveau sonore Max Schalldruckpegel Rumorosidad máxima		Pressione massima assoluta Maximum absolute pressure Pression absolute maxi Maximal absoluter druck Presión absoluta máxima	Massa Weight Masse Gewicht Peso
	Hp		**In Hg / In WG**		**Lp / Lw** (1) **dB (A)**		**Ps** max	**M**
	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	60 Hz 3500 rpm	*50 Hz* *2900 rpm*	**In Hg**	**lbs**
SCL K07-MS	**4**	**4**	**- 3.7 / + 50**	***- 4.6 / + 63***	***78.7***	**76.7**	**82.7**	**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.
(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.
(1) Niveau de bruit mesuré a 1 m de distance, conduits d'aspiration et refoulement raccordés selon la norme ISO 3744.
(1) Schalldruckpegel, mit angeschlossener Schlauchleitung am Ein- und Auslass, im Abstand von 1 m gemäß ISO 3744 gemessen.
(1) Rumorosidad medida a la distancia de 1 m con vías de acceso de aspiración e impulsión canalizadas, seg+ún la Normativa ISO 3744.

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1. 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 Ps 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/m^3; 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 clogging.

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 Lp / Lw, 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°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 ± 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.

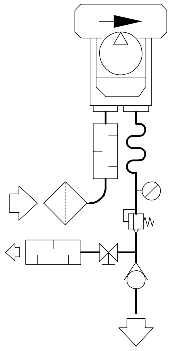
Periodically remove any surface deposits which otherwise can cause the operating temperature to rise.

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 miss-use.

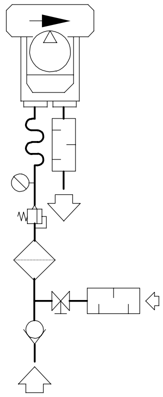
Store the packaging for possible future use.

2. INSTALLATION SKETCHES

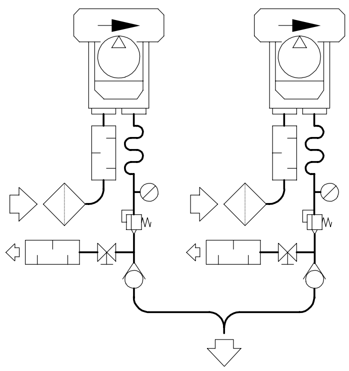
2.1 PRESSURE SERVICE



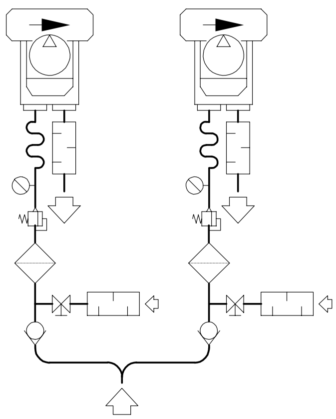
2.4 VACUUM SERVICE



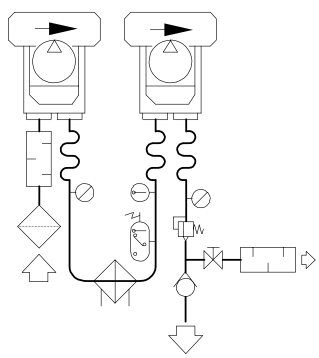
2.2 PARALLEL PRESSURE SERVICE



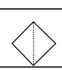
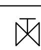
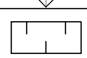
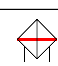
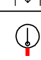
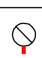
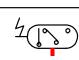
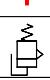
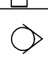
2.5 PARALLEL VACUUM SERVICE



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 accomodate 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.

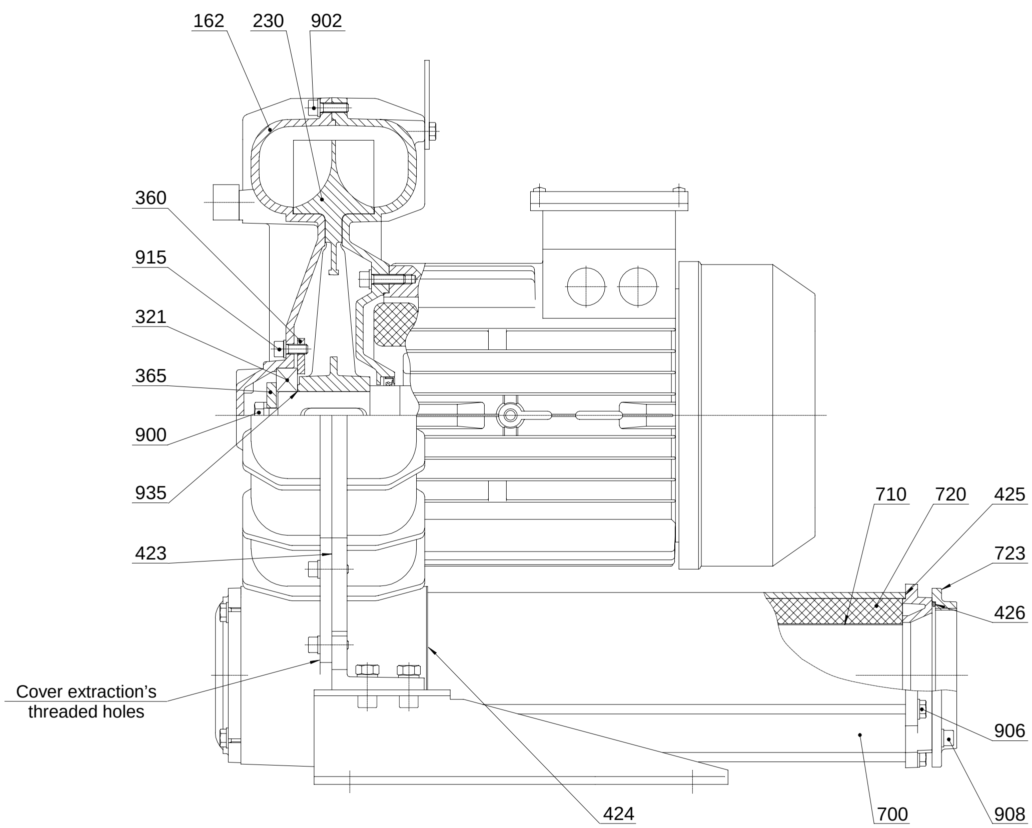
3. Take away the #700 silencers from the unit, being careful not to lose the #424 gaskets.

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;

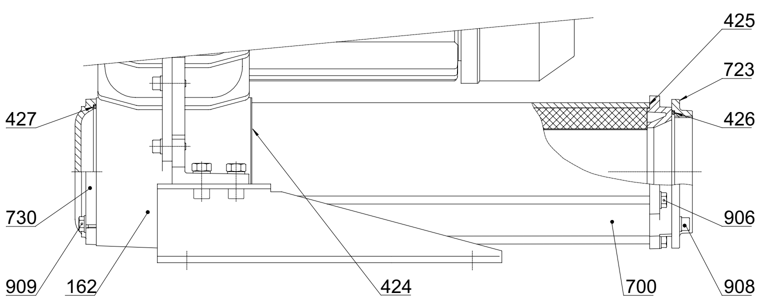
1 x manifold
1 x gasket and
4 x M8x25 UNI 5739 screws.

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.



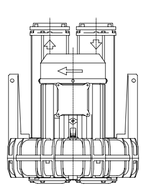


Fig.1

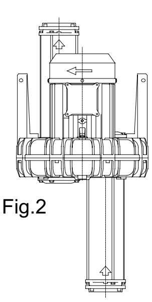


Fig.2

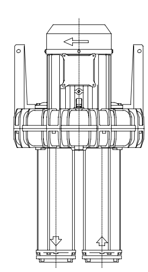


Fig.3

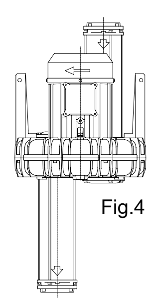


Fig.4

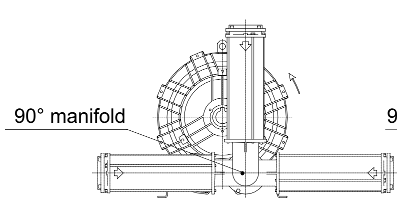


Fig. 2 with 90° manifold

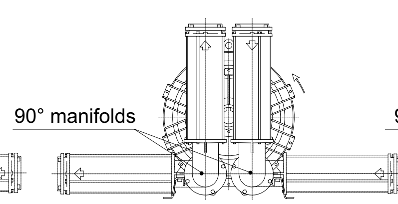


Fig.3 with two 90° manifolds

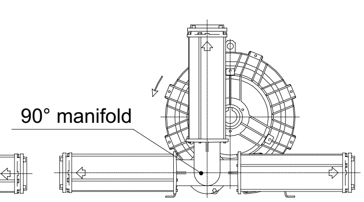


Fig.4 with 90° manifold

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 ± 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.
	Installation position of the unit not suitable.	Install the units on structures that cannot transmit or amplify the noise (tanks, steel plating, etc.).
Abnormal vibrations	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.

COMPACT "T" STYLE VACUUM FILTERS
"CT Series" 2" - 6" FPT

SOLBERG®

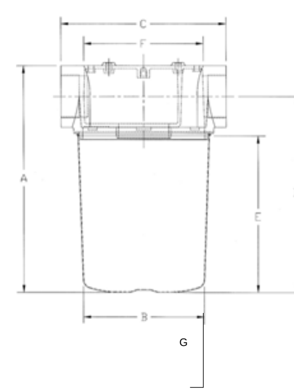
- **Compact Design**
- **Multi-Stage Filtration**
- **Quick Change Out**
- **Vacuum Tested**

BENEFITS

- **Compact** design for space restrictions; **Minimal** service area needed
- **Integrated Inlet Baffle**
- Inlet is above the element to **Extend** element life and maintenance intervals
- "T" style design **Minimizes** piping requirements
- "Drop-Down" housing for easy servicing and containment of particles
- Cast aluminum head **Resists** corrosion
- Pressure differential ports standard for monitoring
- Casting has 4 unthreaded tap holes for mounting bracket
- **Vacuum level**: Typically $1x10^{-3}$ mmHg ($1.3x10^{-3}$ mbar)
- Swing Bolts on 5" & 6" sizes for additional strength

OPTIONS (Inquires Encouraged)

- Various media alternatives
- **See Through Bottom for Visual Inspection Now available for 3" and 4" housings!**
- Swing Bolts for 2" - 4" Sizes



Dimension tolerance ± 1/4"

CT-851/850
2" & 2 1/2" FPT

CT-235P/234P
3" & 4" FPT

CT-275P/274P
5" & 6" FPT

I = Industrial Duty S = Severe Duty E = Extreme Duty

	with Polyester Element	with Paper Element	FPT Inlet & Outlet	DIMENSIONS - inches A	B	C	D	E	Rated Flow SCFM Nominal Rating	Element Rating	Approx. Wt. lbs
I	CT-851-200C	CT-850-200C	2"	13	10 7/8	9	9	18	175	290	16
I	CT-851-250C	CT-850-250C	2-1/2"	13	10 7/8	9	9	18	210	290	15
I	CT-235P-300C	CT-234P-300C	3"	18 7/8	16 1/8	13 1/2	13	25	300	570	30
I	CT-235P-400C	CT-234P-400C	4"	18 7/8	16 1/8	13 1/2	13	25	520	570	26
S	CT-275P-500C	CT-274P-500C	5"	18 1/4	14 3/8	19	9 7/8	20	800	1100	50
I	CT-275P-600C	CT-274P-600C	6"	18 1/4	14 3/8	19	9 7/8	20	1100	1100	45

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Solberg – Discover the Possibilities

Small Compact Filter Silencers
w/ Standard Filter Design
"FS" Series 1/2" - 3" MPT

FILTER SILENCERS
FS, 2G, LQB, BBF, SLCR Series

APPLICATIONS & EQUIPMENT

- Industrial & Severe Duty
- Piston Compressors
- Screw Compressors
- Blowers - Side Channel & P.D.
- Hydraulic Breathers – fine filtration
- Engines
- Construction\Contractor Industry
- Workshop
- Medical\Dental Industry
- Pneumatic Conveying
- Waste Water Aeration
- Nailers and Staplers
- Vacuum Vent Breathers

FEATURES & SPECIFICATIONS

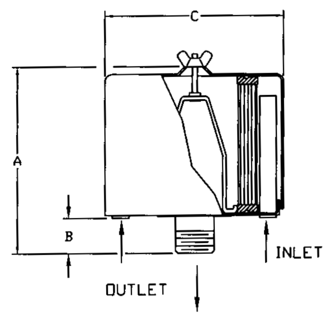
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tube is positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish and powder coated weatherhood
- Interchangeable media: Polyester, Paper, HEPA
- Several element sizes available per given connection (safety factor)
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10"-15" H_2O over initial delta P
- Pressure drop graphs available upon request

OPTIONS (Inquiries Encouraged)

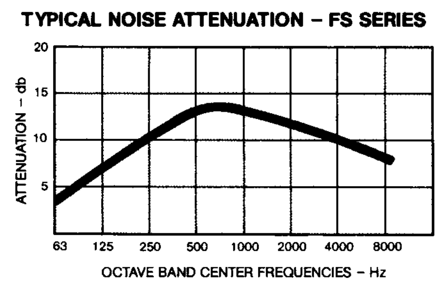
- 1/8" tap holes
- Pressure Drop Indicator
- Available in ***Stainless Steel***
- Epoxy coated housings
- Various media available
- Special connections, BSPT

CONFIGURATION

DRAWING



Dimension tolerance ± 1/4"



- Noise attenuation may vary due to the wide range of applications and machines

I = Industrial Duty S = Severe Duty

	with Polyester Element	with Paper Element	MPT Outlet	DIMENSIONS - inches A	B	C	Rated Flow SCFM Piston	Screw, Blower, Fan	Element Rating	No. of Silencing Tubes	Approx. Wt. lbs
I	FS-15-050	FS-14-050	1/2"	4	1 1/2	6	10	10	35	1	2
I	FS-15-075	FS-14-075	3/4"	4	1 1/2	6	20	25	35	2	2
I	FS-15-100	FS-14-100	1"	4	1 1/2	6	25	35	35	3	2
S	FS-19P-100	FS-18P-100	1"	6 5/8	1 5/8	6	35	55	100	3	3
I	FS-19P-125	FS-18P-125	1 1/4"	6 5/8	1 5/8	6	55	70	100	5	3
I	FS-19P-150	FS-18P-150	1 1/2"	6 5/8	1 5/8	6	70	85	100	5	4
I	FS-31P-200	FS-30P-200	2"	7 1/4	2 1/4	10	85	135	195	5	8
S	FS-231P-200	FS-230P-200	2"	12 1/4	2 1/4	10	135	135	300	5	14
S	FS-231P-250	FS-230P-250	2 1/2"	12 1/2	2 1/2	10	195	195	300	9	15
I	FS-231P-300	FS-230P-300	3"	13	3	10	200	300	300	9	15

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

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®

SOLBERG

Inlet Vacuum Filters Maintenance Manual

www.solbergmfg.com

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

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Rev: MMVF-407

Maintenance Manual

SOLBERG Inlet Vacuum Filters

CONTENTS

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

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Rev: MMVF-407

SOLBERG

Section A

INTRODUCTION

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

WARNING

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

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

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

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

Section B

GENERAL INFORMATION

1. Identification of Solberg Vacuum Inlet Filters.

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

Assembly Model #
Replacement Element #

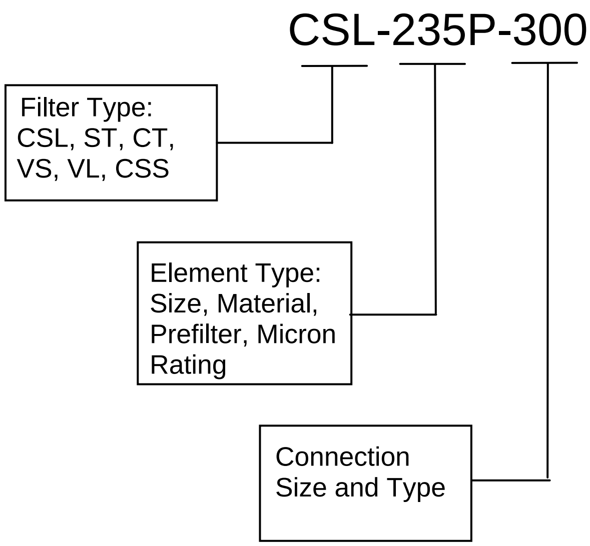
(The exception is OEM supplied units. In this case please enter the OEM part numbers below.)

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

No.	Filter Model Number	Replacement Element
1		
2		
3		
4		
5		

Table 1

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



2. Filtration Rules of Thumb

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

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

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

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

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

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

Table 2

Rule of Thumb #4: Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10” to 15” / 250-380mm H_2O from the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200m^3/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Max Airflow		Pipe Size (inches)	Airflow	
1/4"	6 CFM	10m^3/h	1 ¼"	60 CFM	102m^3/h	6"	1,100 CFM	1870m^3/h
3/8"	8 CFM	14m^3/h	1 ½"	80 CFM	136m^3/h	8"	1,800 CFM	3060m^3/h
1/2"	10 CFM	17m^3/h	2"	135 CFM	230m^3/h	10"	3,300 CFM	5610m^3/h
3/4"	20 CFM	34m^3/h	2 ½"	195 CFM	332m^3/h	12"	4,700 CFM	7990m^3/h
1"	35 CFM	60m^3/h	3"	300 CFM	510m^3/h	14"	6,000 CFM	10200m^3/h
			4"	520 CFM	884m^3/h			
			5"	800 CFM	1360m^3/h			

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

3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C
Filter Change-Out Differential: 10” to 15” / 250-380mm H_2O Over Initial Delta P

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

Table 4

Temperature Range: -15° to 385°F / -26° to 196°C
Filter Change-Out Differential: 10” to 15” / 250-380mm H_2O Over Initial Delta P

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

Table 5

4. **Element Cleaning**

Some types of Solberg inlet filter elements can be cleaned and reused. However, damage can occur to an element during cleaning so it is imperative that care is taken during disassembly, cleaning and re-assembly. Damaged elements can allow particulate bypass, which will damage rotating 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.
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, wingnuts and washers can be supplied upon request.

Section C

PROCEDURES

1. **Installation.**

   A. Maximum inlet gas stream temperature for most Solberg inlet vacuum filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers.

   B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on inlet and outlet ports.

   C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

2. **Disconnecting canister top from canister base.**

   A. ST/CT/Small CSL: Release wire-form clips or loosen wing nut on "claw" bolts.

   B. Large CSL: Loosen wing nut or hex head on T-bolts.

   C. CSS: Twist upper housing to release.

   D. VS/VL: Remove V-clamp by loosening Hex Nut or T-bolt and releasing.

   E. Lift off canister top.

3. **Removing element for service/maintenance.**

   A. Remove retaining hex head/wing-nut and washer carefully, and then remove element. Some elements will have a top plate that should also be removed.

   B. Clean sealing surfaces of housing, top & base plates, and element endcaps so that they are free of dirt or any other particulate.

WARNING

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

4. **Securing Element.**

   A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces.

   B. Place top plate (if necessary) on element by centering on tap bolt.

   C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: DO NOT over tighten!

WARNING

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

5. **Securing canister top to canister base.**

   A. Make sure all surfaces are free from dust and other particulate.

   B. Hemisphere o-ring must rest evenly along canister/casting base o-ring groove.

   C. ST/CT/Small CSL: Hold canister housing against o-ring or sealing ring on main filter head. Re-fasten wire-form clips or “claw” bolts.

   D. Large CSL: Replace housing top plate. Feed T-bolts into corresponding slots and tighten evenly around perimeter. Note: Do NOT over tighten!

   E. VS/VL: Secure V-clamp by disconnecting hex nut or T-bolt portion and placing V-clamp along the diameter of canister o-ring groove. Fasten T-bolt and secure tightly. V-CLAMP LEGS MUST REST UNIFORMLY ALONG ENTIRE O-RING GROOVE.

   F. CSS: Reassemble top housing to bottom housing by aligning tabs and turning into place.

Section D

MAINTENANCE RECOMMENDATIONS

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10” to 15” / 250-380mm H_2O higher pressure drop above the initial reading. Refer to page 4 for instructions.

2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change from Solberg specified parts!

3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.

4. Operate only when a proper seal exists.

5. VS/VL: Never operate without absolute assurance that V-clamp is secured correctly along entire diameter of canisters. Check along V-clamp for wear. Replace if any distortion occurs due to handling and usage.

SPARE PARTS LIST:

CSL/CT/VS/VL Series

		Housing						Element		
Parent Model Model-Element-Connection	Prefilter Model	Top Model No.	O-Ring Model No.	Gasket(s)/ Adapter Model No.	Wingnut(s) Model No.	Washer(s) Model No.	Clips/ Bolts Model No.	Top Plate Model No.	Wingnuts/ Bolt Model No.	Washer(s) Model No.
CSL-825/824-xxx	N/A	T824	OR337	BG224	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-843/842-xxx	PF842	T842	OR550	BG268	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-849/848-xxx	PF848	T848	OR675	BG281	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-851/850-xxx	PF850	T850	OR750	BG412	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-239/238-xxx	PF238	TD238	OR1250	N/A	N/A	N/A	CPWF	N/A	WN38X16	WR38X16
CSL-235/234-xxx	PF234	TC1400	OR1200	N/A	WN38X16	WR38X16	BT38163	T8000437	WN38X16	WR38X16
CSL-335/334-xxx	PF334	TC1400	OR1200	ADEX300	WN38X16	WR38X16	BT38163	T8000437	WN38X16	WR38X16
CSL-245/244-xxx	PF244	TC1850	OR1600	N/A	WN38X16	WR38X16	BT38163	T1000437	WN38X16	WR38X16
CSL-345/344-xxx	PF344	TC1850	OR1600	ADEX300	WN38X16	WR38X16	BT38163	T1000437	WN38X16	WR38X16
CSL-275/274-xxx	PF274	TC1850	OR1600	N/A	WN38X16	WR38X16	BT38163	T12000437	WN38X16	WR38X16
CSL-375/374-xxx	PF374	TC1850	OR1600	ADEX300	WN38X16	WR38X16	BT38163	T12000437	WN38X16	WR38X16
CSL-377/376-xxx	PF376	TC2250	OR2000	N/A	WN38X16	WR38X16	BT38163	T14750625	HN50X13	WR50X13
CSL-384(2)-xxx	PF384(2)	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CSL-685-xxx	PF684	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CSL-485(2)/484(2)-xxx	PF484(2)	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CT-851/850-xxx	PF850	N/A	OR725	BG412	N/A	N/A	CPWF	N/A	N/A	N/A
CT-235/234-xxx	PF234	N/A	GCT1100	ADCT234	N/A	N/A	CPWF	T8000437	BH38X16	WR38X88
CT-275/274-xxx	PF274	N/A	OR386	ADCT234	N/A	N/A	KITCT274	T12000437	BH38450	WR38X16
VS-275/274-xxx	PF274	N/A	OR386	N/A	N/A	N/A	N/A	T12000437	WN38X16	WR38X16
VL-275/274-xxx	PF274	N/A	OR386	N/A	N/A	N/A	N/A	T12000437	WN38X16	WR38X16

*Note: Spare parts are for standard products. See page 4 for replacement element.

Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA
Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Rev: MMVF-407

KUNKLE

Model 215V is Non-code Vacuum Relief.
Model 337 is ASME Section VIII Air/Gas "UV" National Board Certified Safety Valve.
Both are PED Certified for Non-Hazardous Gas.

Features
- Large nozzle design provides high capacity.
- Flat bronze valve seats are lapped for optimum performance.
- Warn ring offers easy adjustability for precise opening with minimum pre-open or simmer.
- Pivot between disc and spring corrects misalignment and compensates for spring side thrust.
- Each Kunkle valve is tested and inspected for pressure setting and leakage.

Model Descriptions
- **Model 337:** has "lift-pin" lift device for easy manual testing.
- All adjustments are factory sealed to help prevent tampering or disassembly.

Option
- Stainless Steel (SS) trim. (nozzle and disc) (variation 03)

Applications
- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

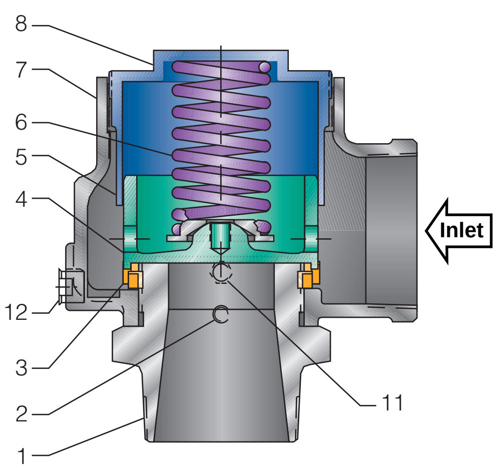
Vacuum Limits
Model 215V:
2" Hg to 29" Hg [67.7 to 982 mbarg]
-20° to 406°F [-29° to 208°C]

Pressure and Temperature Limits
Model 337:
1 to 60 psig [0.07 to 4.1 barg]
-20° to 406°F [-29° to 208°C]

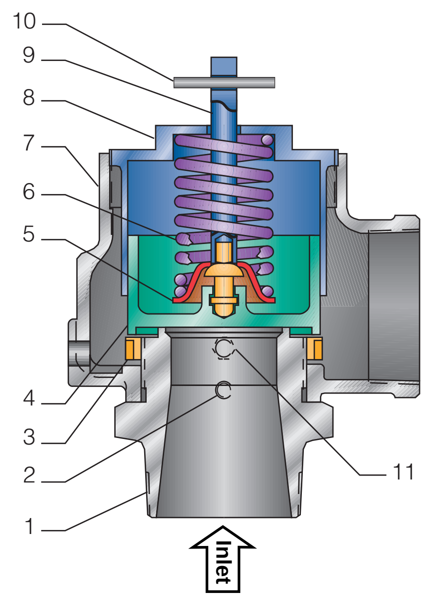
0337-H01ANE00004

tyco Flow Control

Parts and Materials



Model 215V



Model 337

Models 215V and 337

No.	Part Name	215V	337
1	Nozzle[1]	Bronze, SB62 or Brass B283-C48500	Bronze, SB62 or Brass B283-C48500
2	Set Screw	Steel A108-1018 Brass Plated	Steel A108-1018 Brass Plated
3	Regulator Ring	Bronze B584 Alloy 84400	Bronze B584-C84400
4	Disc[1]	Bronze B584 Alloy 84400	Bronze B584-C84400
5	Spring Step	Steel A-109 Coated[3]	Steel A109 Coated[3]
6	Spring	SS, A313 TY 302	SS A313-302
7	Body	Cast Iron A-126, CL A or B	Iron A-126, CL A or B
8	Compression Screw	Bronze, B-584 Alloy 84400	Bronze, B584-C84400
9	Stem[2]	N/A	Brass B16
10	Lift Pin[2]	N/A	Steel, Zinc Plated
11	Regulator Ring Set Screw	N/A	Brass B16
12	NPT Drainplug	Steel A108-1018	N/A

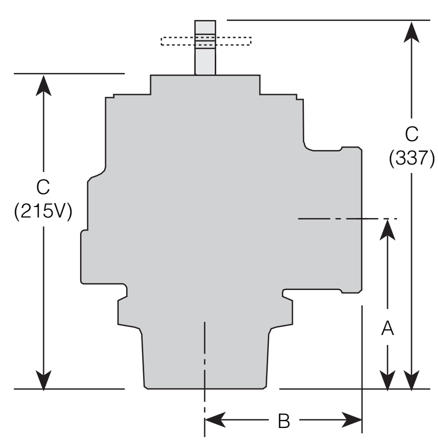
Notes

1. Disc and nozzle available in SSA-479 TY 316.
2. Stem and lift pin available on Model 337 only.
3. Corrosion preventative coating.

Specifications

Size Inlet and Outlet	Dimensions, in [mm] A	B	C 215V	C 337	Weight lb [kg]
2" [50.8 mm]	3 1/4 [82.5]	3 [76.2]	6 1/2 [165.1]	7 [177.8]	8 [3.6]
2 1/2 [63.5 mm]	3 3/4 [95.2]	3 1/2 [88.9]	7 5/8 [194.6]	8 [203.2]	12 [5.4]
3" [76.2 mm]	4 1/4 [107.9]	4 [101.6]	8 1/2 [215.9]	9 [228.6]	20 [9.07]

Dimensions are for reference only.



Model 337

Capacities

Model 337, Non-code[1] and ASME Section VIII Air (SCFM)

Set Pressure (psig)	Valve Inlet and Outlet Size 2"	2 1/2"	3"
	Orifice Area, in² 1.84	2.79	4.04
1	240	364	527
5	531	805	1166
10	741	1124	1628
15	948	1436	2081
20	1092	1656	2399
25	1237	1875	2718
30	1382	2095	3036
35	1542	2337	3386
40	1701	2578	3736
45	1860	2820	4086
50	2020	3061	4436
55	2179	3303	4786
60	2338	3544	5136

Note

1. No code stamp or "NB" on nameplate below 15 psig set.

Model 337, Non-code[1] and ASME Section VIII Air [Metric, Nm³/h]

Set Pressure [barg]	Valve Inlet and Outlet Size 50 mm	63 mm	80 mm
0.5	1049	1589	2303
1.0	1457	2208	3200
1.5	1888	2861	4147
2.0	2235	3387	4910
2.5	2613	3959	5739
3.0	2995	4538	6579
3.5	3377	5117	7418
4.0	3760	5696	8258

Note

1. No code stamp or "NB" on nameplate below 1.1 barg set.

Model 215V, Non-code Vacuum Air (SCFM)

Relief Set (in, HG)	Valve Inlet and Outlet Size 2"	2 1/2"	3"
	Orifice Area, in² 1.84	2.79	4.04
2	229	347	503
5	338	512	742
10	415	630	912
15	426	646	936
20	426	646	936
29	426	646	936

Note

1. Based on 10% accumulation.

Model 215V, Non-code Vacuum Air [Metric, Nm³/h]

Relief Set [mbarg]	Valve Inlet and Outlet Size 5.08 cm	6.35 cm	7.62 cm
	Orifice Area [11.86 cm²]	[17.97 cm²]	[26.05 cm²]
50	328	498	722
100	450	682	988
150	533	807	1170
200	593	899	1303
250	638	966	1400
300	669	1014	1470
350	690	1046	1516
400	701	1062	1540
450	704	1067	1546
500	704	1067	1546
550	704	1067	1546
600	704	1067	1546
650	704	1067	1546
700	704	1067	1546
750	704	1067	1546

Note

1. Based on 10% accumulation.

Model Number/Order Guide

Model Number Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	2	1	5	V	—	H	0	1	A	Q	E	0	0	5	0

Model
215V
0337

Inlet Size
H - 2" [50.8 mm]
J - 2 1/2" [63.5 mm]
K - 3" [76.2 mm]

Variation (01 to 99)
01 - Bronze Disc and Nozzle
03 - SS Disc and Nozzle
60 - BSP Connections

Design Revision
Indicates non-interchangeable revision.
Current Design is at Revision "A."

Valve Service
K - Air ASME Section VIII (Model 337 only)
Q - Vacuum (Model 215V only)
N - Non-code Air/Gas (Model 337 only)

Spring Material
E - SST Type 302
(H-Orifice up to 8 psi; J-Orifice up to 20 psi; K-Orifice up to 25 psi)
M - SST Type 17-7
(H-Orifice above 8 psi; J-Orifice above 20 psi; K-Orifice above 25 psi)

Set Pressure
Model 337, 1 psig [0.7 barg] (0001) to 60 psig [4.1 barg] (0060)
Model 215V, 2" Hg [68 mbarg] (0002) to 29" Hg [982 mbarg] (0029) vacuum

KUNKLE
953 Old U.S. Highway 70
Black Mountain, North Carolina 28711-2549
Customer Service Phone: 1-828-669-3700

www.kunklevalve.com

KUNKLE PRESSURE RELIEF VALVES
Installation and Operating Instructions

Pre-Installation Handling
This pressure relief valve is designed to protect equipment from overpressure. The valve should be handled with care, not subjected to heavy shock loads, and protected to prevent contamination from getting inside. It should be installed correctly per A.S.M.E. Boiler & Pressure Vessel Code requirements. Failure to do so could result in property damage or serious injury to personnel. When hoisting the valve into position for installation, care should be exercised so that lifting straps do not contact the valve lift lever.

Installation
Always wear proper safety equipment, including safety glasses and ear protection.

1. Mount the valve in a vertical position so that the valve body is self-draining. If a body drain port is provided, make sure it is open when required by the ASME code. Do not plug any bonnet vent openings. The inlet piping should be as short as possible, with no elbows, and equal to or greater than the size of the pressure relief valve inlet connection. This will help to limit the inlet pressure drop to 3% or less when the valve is relieving.

2. When discharge piping is connected to valve outlet, make sure it is self draining if a body drain port is not used. The valve should not be connected to any discharge pipe that contains pressure before the valve opens or to any pipe where the pressure build-up is greater than 10% of the set pressure when the valve is open and relieving.

   Discharge piping, other than a short tailpipe, must be supported. For steam service, a drip pan elbow or flexible connection between the valve and the pipe should be used to prevent excessive pipe stress, due to thermal expansion, from being imposed on the valve body.

3. For threaded valves, to prevent sealing compound from entering and damaging the valve, apply a small amount of pipe thread sealing compound to external threads only. Do not put any sealing compound on the first thread or on any internal threads. To do so may cause the sealing compound to enter the valve and cause seat leakage.

   Do not use the valve body or bonnet for installing the valve in threaded connections. Use the wrench flats provided to tighten the valve to the connecting pipe, and do not overtighten. To do so may cause valve leakage.

4. For flanged valves, use new gaskets and tighten the mounting studs evenly.

Operation
1. Maintain a system operating pressure at least 5 psig or 10% below the set pressure of the valve, whichever is greater. Operating too close to the valve set pressure will cause seat leakage and will shorten the time between valve maintenance.

2. Do not use the safety valve as a control valve to regulate system operating pressure. Excessive operation will cause the seat to leak and will require more frequent valve maintenance.

3. ASME Section I and VIII valves equipped with lift levers are designed to be operated only when the system pressure is 75% of set pressure or greater. ASME Section IV valves may be operated at any set pressure. When hand operating the valve, hold it open long enough to purge any foreign matter from the seat area. If a cable or wire is attached to the lift lever for remote actuation, make sure the direction of pull is the same as it would be if the lever were pulled directly by hand.

Maintenance
Maintenance should be performed on a regular basis. An initial inspection interval of 12 months is recommended. Depending on the service conditions and the condition of the valve, the inspection interval may be decreased or increased. Use only Kunkle parts for repair. Depending on the local jurisdictional requirements where the valve is installed, repairs may have to be made by a repair facility holding a VR stamp.

WARNING!

Removal of the seal wires or any attempt to adjust, repair or modify this product by non-qualified or non-authorized persons voids the product guarantee and may cause serious damage to equipment, personal injury, and death. Kunkle Valve is not liable for any damage resulting from misuse or misapplication of its products.

Kunkle Valve Division
Phone: 828-669-5515 953 Old US 70, Black Mountain, NC 28711 Fax: 828-669-4017
Rev B 01/14/2002

<u>Procedure to Reset Kunkle Vacuum Relief Valves</u>

To field reset a Kunkle vacuum relief valve, first turn off the vacuum pump that the valve serves. After the equipment completely stops, you can begin to work on the valve. Note that it is potentially dangerous to adjust the valve while the vacuum pump is in operation.

The valve setting is maintained by compressing a spring which is located within the valve body. This spring is compressed by turning the bronze valve cap clockwise until the necessary compression is obtained.

Begin by clipping the seal on the lock wire holding the two nameplate screws in place. Remove the nameplate screws. You must remove these screws in order to turn the valve body cap. Now rotate the valve body cap on full turn. Replace the nameplate screws. Clear all loose items away from the inlet of the valve. Turn on the vacuum pump and induce the desired relief valve setting vacuum level on the system. If the valve opens you have not sufficiently increased compression. Shut off the pump, remove the nameplate screws and turn the valve cap again one full turn. Follow the test procedure as above. Repeat until the desired set point is obtained. Once the final set point has been reached, replace the nameplate screws and reseal with a new lock wire seal.

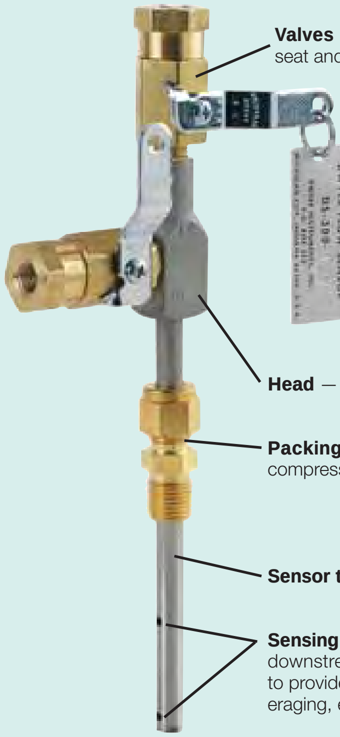
In no case should the et point of the valve be increased in excess of the vacuum pumps maximum design capability or to the point that the motor exceeds its nameplate horse power rating (including service factor).

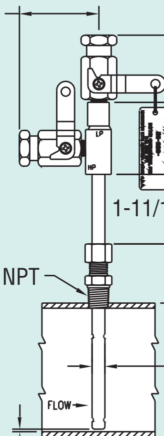
Series DS

In-Line Flow Sensors

Use with the Dwyer® Differential Pressure Gages or Transmitters

Flow





In-Line Flow Sensors are averaging Pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer® Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.

Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer® flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

The Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® gage kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1″ to 10″.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are 1/8″ female NPT. A pair of 1/8″ NPT X 1/4″ SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a Threaded Branch Connection.

Select model with suffix which matches pipe size

DS-300-1″
DS-300-1-1/4″
DS-300-1-1/2″
DS-300-2″
DS-300-2-1/2″
DS-300-3″
DS-300-4″
DS-300-6″
DS-300-8″
DS-300-10″

DS-400-6″
DS-400-8″
DS-400-10″
DS-400-12″
DS-400-14″
DS-400-16″
DS-400-18″
DS-400-20″
DS-400-24″

Options and Accessories

A-160 Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi

A-161 Brass Bushing, 1/4″ x 3/8″

DS-300 Less Valves. To order, add suffix **-LV**

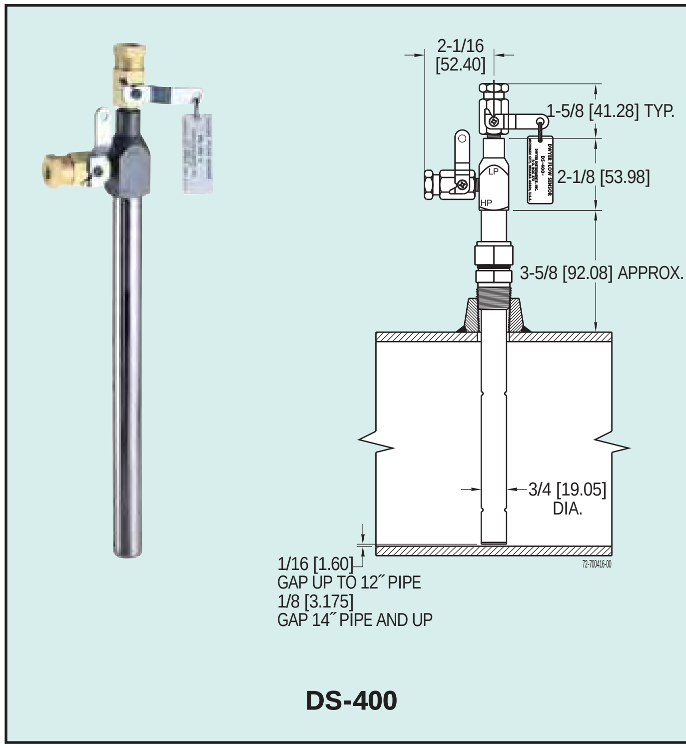
How To Order

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2˝ pipe would be a Model No. DS-300-2˝.

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



DS-400

GAGE RANGE (IN. W.C.)	MEDIA @ 70°F	FULL RANGE FLOWS BY PIPE SIZE (APPROXIMATE)									
		1˝	1-1/4˝	1-1/2˝	2˝	2-1/2˝	3˝	4˝	6˝	8˝	10˝
2	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	4.8 19.0 50.0	8.3 33.0 90.5	11.5 42.0 120.0	20.5 65.0 210.0	30 113 325	49 183 510	86 330 920	205 760 2050	350 1340 3600	560 2130 6000
5	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	7.7 30.0 83.0	14.0 51.0 142.0	18.0 66.0 190.0	34.0 118.0 340.0	47 178 610	78 289 820	138 510 1600	320 1200 3300	560 2150 5700	890 3400 10000
10	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	11.0 41.0 120.0	19.0 72.0 205.0	25.5 93.0 275.0	45.5 163.0 470.0	67 250 740	110 410 1100	195 725 2000	450 1690 4600	800 3040 8100	1260 4860 15000
25	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	18.0 63.0 185.0	32.0 112.0 325.0	40.5 155.0 430.0	72.0 255.0 760.0	108 390 1200	173 640 1800	310 1130 3300	720 2630 7200	1250 4860 13000	2000 7700 22000
50	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	25.0 90.0 260.0	44.0 161.0 460.0	57.5 205.0 620.0	100.0 360.0 1050.0	152 560 1700	247 900 2600	435 1600 4600	1000 3700 10000	1800 6400 18500	
100	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	36.5 135.0 370.0	62.0 230.0 660.0	82.0 300.0 870.0	142.0 505.0 1500.0	220 800 2300	350 1290 3600	620 2290 6500	1500 5000 15000		

Model A-471 Portable Kit

The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5˝ w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32 to 200°F (0 to 93.3°C). Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic® gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1-1/4˝ - 2˝ horizontal or vertical pipe.

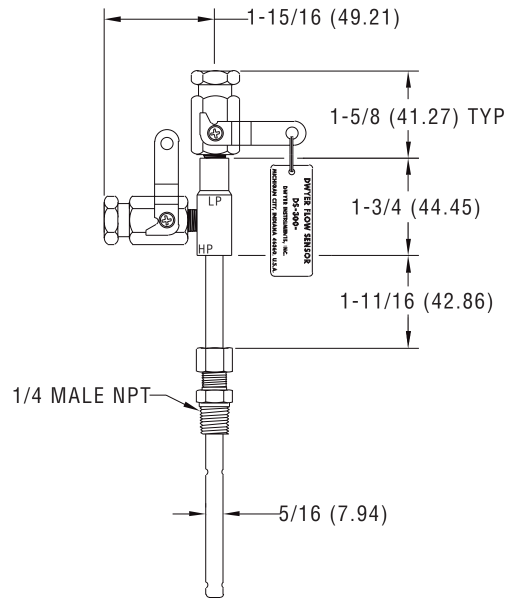
For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings. See pages 8 and 9 for complete information on the Capsuhelic® gage.

CAPSUHELIC® GAGE SHOWN INSTALLED IN A-471 PORTABLE KIT

Bulletin F-50

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8˝ female NPT connections. Accessories include adapters with 1/4˝ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1˝ to 10˝.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

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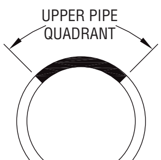
POSITION
Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

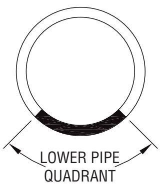
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION
1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4″ x 3/8″) will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16″ to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

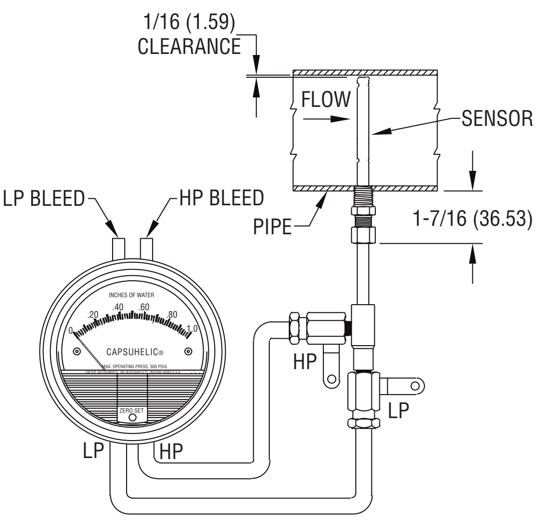
INSTRUMENT CONNECTION
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

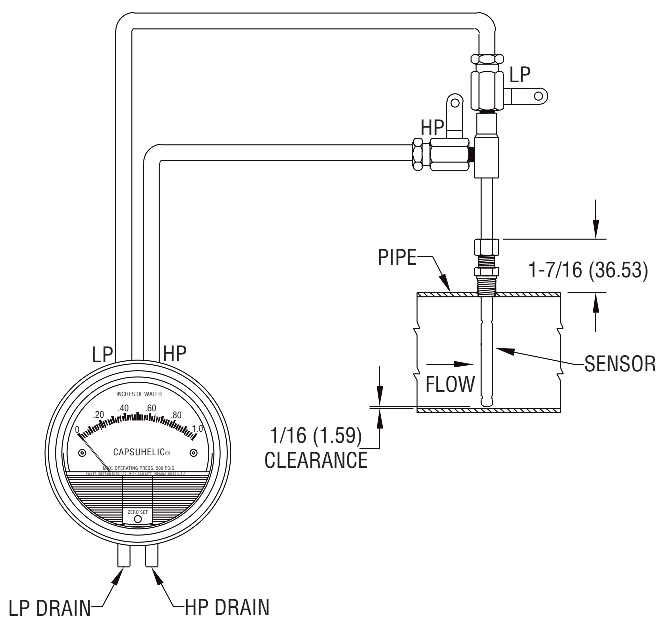
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

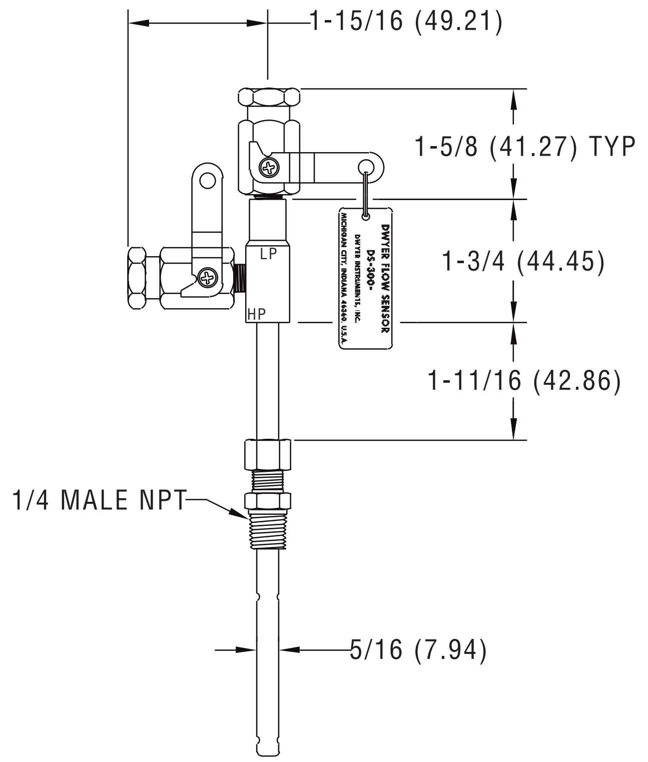
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





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The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

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For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 "Flow of Fluids Through Valves, Fittings and Pipe." It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient "K"	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P/S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$\text{SCFM} = \text{ACFM} \times \left(\frac{14.7 + \text{PSIG}}{14.7}\right)\left(\frac{520^*}{460 + {}^\circ F}\right)$$

$$\text{ACFM} = \text{SCFM} \times \left(\frac{14.7}{14.7 + \text{PSIG}}\right)\left(\frac{460 + {}^\circ F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + \text{PSIG}}\right)\left(\frac{460 + {}^\circ F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + \text{PSIG}}{14.7}\right)\left(\frac{520^*}{460 + {}^\circ F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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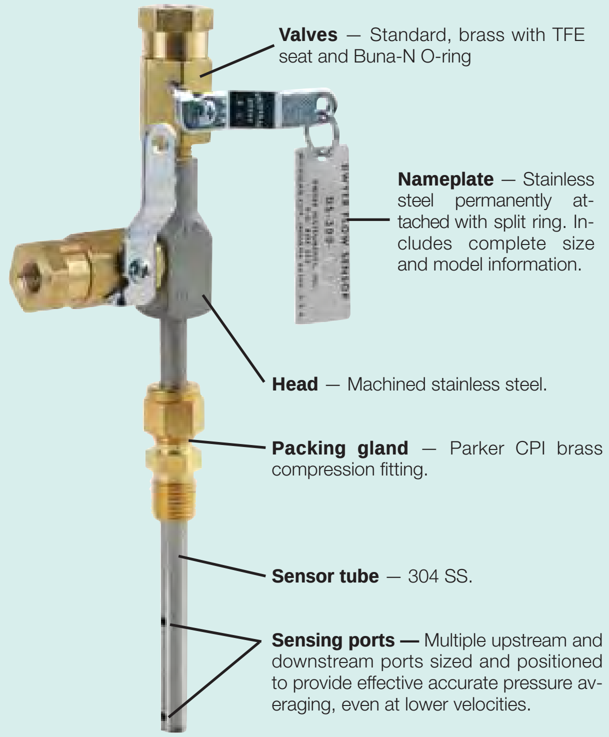
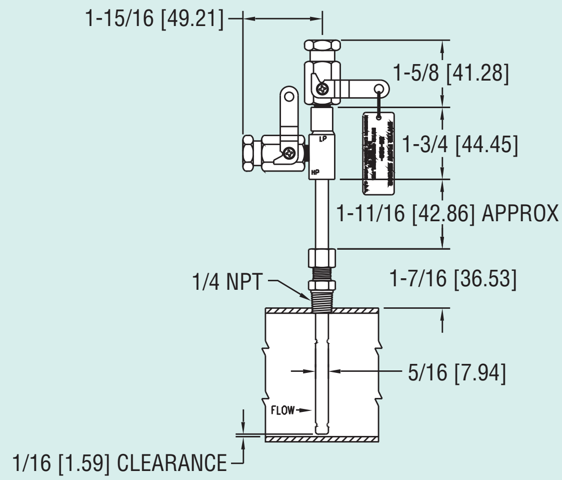
Series DS In-Line Flow Sensors

Use with the Dwyer® Differential Pressure Gages or Transmitters





In-Line Flow Sensors are averaging Pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer® Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.
Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer® flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

The Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® gage kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1″ to 10″.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are 1/8″ female NPT. A pair of 1/8″ NPT X 1/4″ SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a Threaded Branch Connection.

Select model with suffix which matches pipe size

DS-300-1″
DS-300-1-1/4″
DS-300-1-1/2″
DS-300-2″
DS-300-2-1/2″
DS-300-3″
DS-300-4″
DS-300-6″
DS-300-8″
DS-300-10″

DS-400-6″
DS-400-8″
DS-400-10″
DS-400-12″
DS-400-14″
DS-400-16″
DS-400-18″
DS-400-20″
DS-400-24″

Options and Accessories

A-160 Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi
A-161 Brass Bushing, 1/4″ x 3/8″
DS-300 Less Valves. To order, add suffix **-LV**

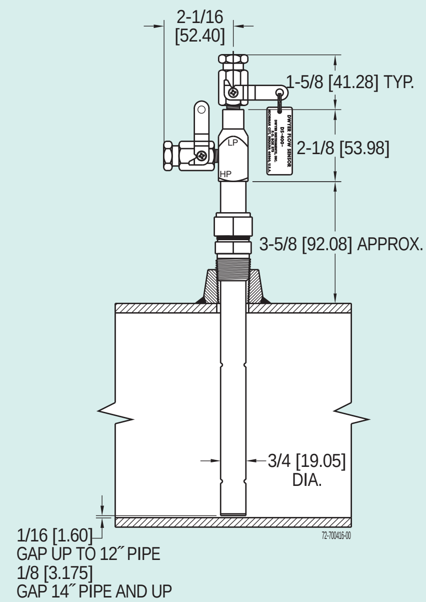
How To Order

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2″ pipe would be a Model No. DS-300-2″.

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



DS-400

GAGE RANGE (IN. W.C.)	MEDIA @ 70°F	FULL RANGE FLOWS BY PIPE SIZE (APPROXIMATE)									
		1″	1-1/4″	1-1/2″	2″	2-1/2″	3″	4″	6″	8″	10″
2	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	4.8 19.0 50.0	8.3 33.0 90.5	11.5 42.0 120.0	20.5 65.0 210.0	30 113 325	49 183 510	86 330 920	205 760 2050	350 1340 3600	560 2130 6000
5	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	7.7 30.0 83.0	14.0 51.0 142.0	18.0 66.0 190.0	34.0 118.0 340.0	47 178 610	78 289 820	138 510 1600	320 1200 3300	560 2150 5700	890 3400 10000
10	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	11.0 41.0 120.0	19.0 72.0 205.0	25.5 93.0 275.0	45.5 163.0 470.0	67 250 740	110 410 1100	195 725 2000	450 1690 4600	800 3040 8100	1260 4860 15000
25	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	18.0 63.0 185.0	32.0 112.0 325.0	40.5 155.0 430.0	72.0 255.0 760.0	108 390 1200	173 640 1800	310 1130 3300	720 2630 7200	1250 4860 13000	2000 7700 22000
50	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	25.0 90.0 260.0	44.0 161.0 460.0	57.5 205.0 620.0	100.0 360.0 1050.0	152 560 1700	247 900 2600	435 1600 4600	1000 3700 10000	1800 6400 18500	
100	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	36.5 135.0 370.0	62.0 230.0 660.0	82.0 300.0 870.0	142.0 505.0 1500.0	220 800 2300	350 1290 3600	620 2290 6500	1500 5000 15000		

Model A-471 Portable Kit

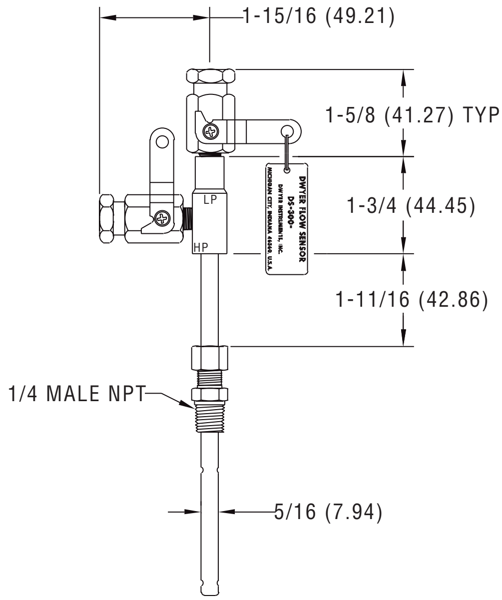
The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5″ w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32 to 200°F (0 to 93.3°C). Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic® gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1-1/4″ - 2″ horizontal or vertical pipe.

For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings. See pages 8 and 9 for complete information on the Capsuhelic® gage.

CAPSUHELIC® GAGE SHOWN INSTALLED IN A-471 PORTABLE KIT

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



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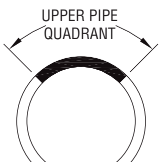
For Air or Gas Flow

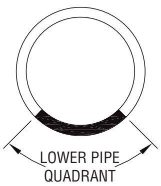
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

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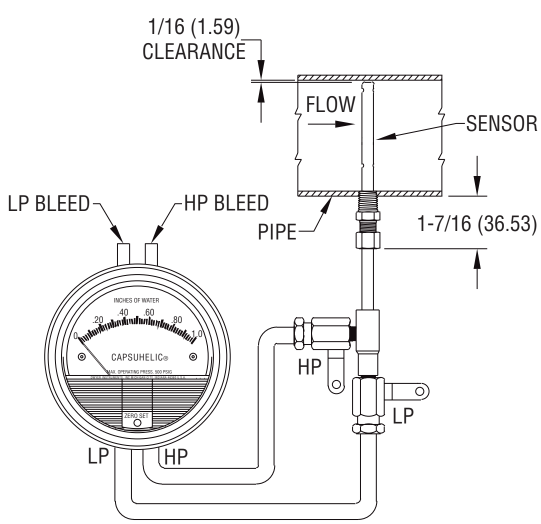

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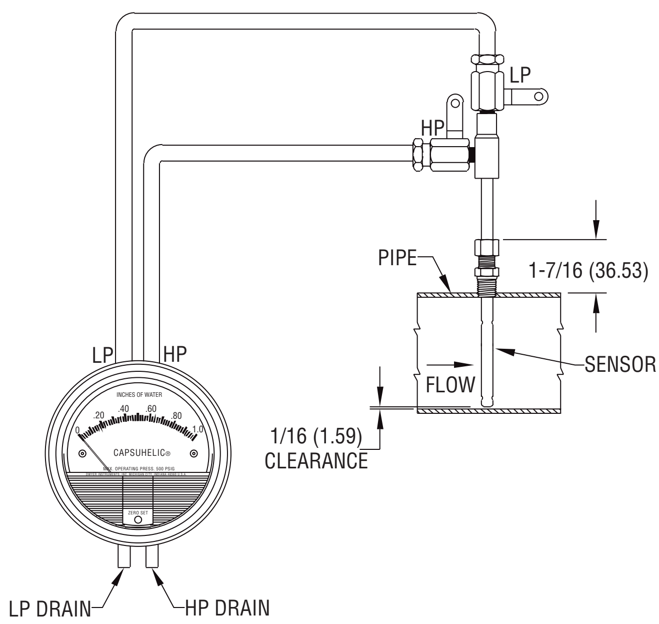

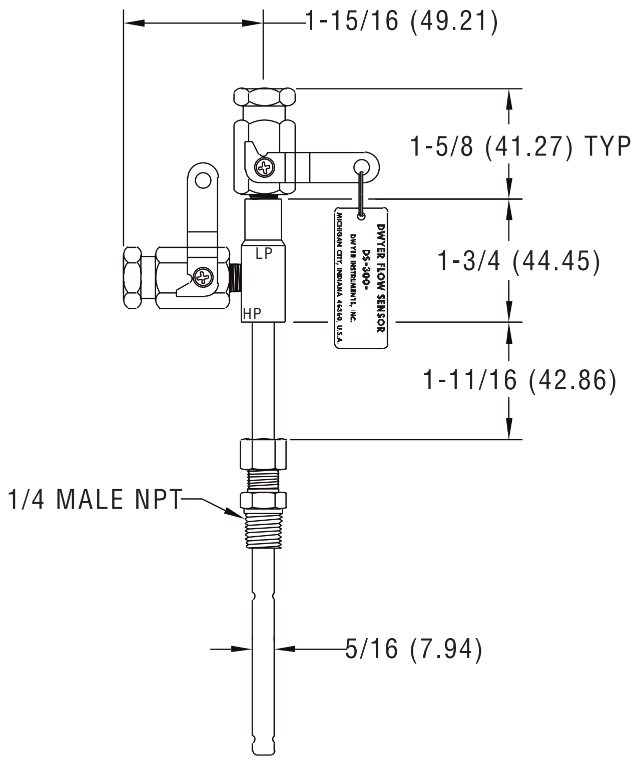

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Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient “K”	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P/S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times Height \times Width}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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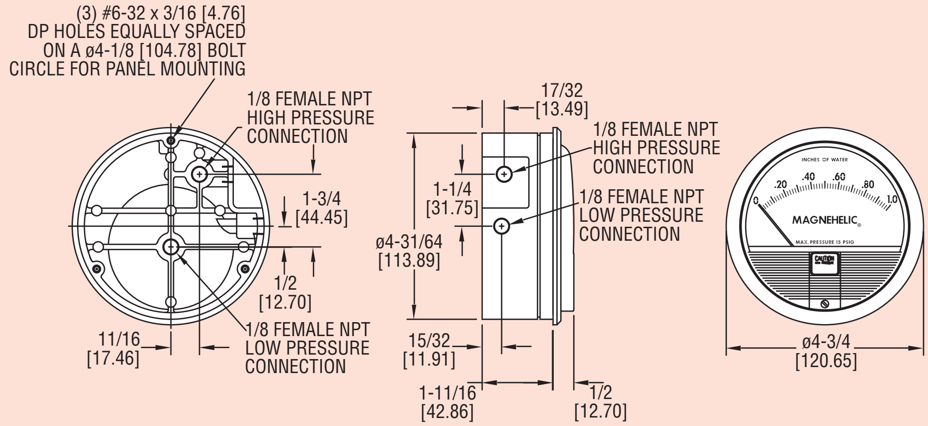
Series 2000

Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

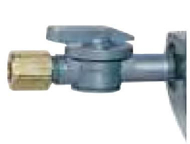
The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen. When ordering a Buna-N diaphragm pressures must be less than 35 psi.

Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional **A-610** Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1-1/4˝ - 2˝ pipe. Although calibrated for vertical position, many ranges above 1˝ may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4-9/16˝ hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

Flush...Surface... or Pipe Mounted



Vent Valves

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

High and Medium Pressure Models

Installation is similar to standard gages except that a 4-13/16˝ hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20˝ Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4˝ (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8˝ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8˝ NPT plugs for duplicate pressure taps, two 1/8˝ pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable Signal Flag
Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

A-432 Portable Kit
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16˝ I.D. rubber tubing, standhang bracket and terminal tube with holder.

A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4˝ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

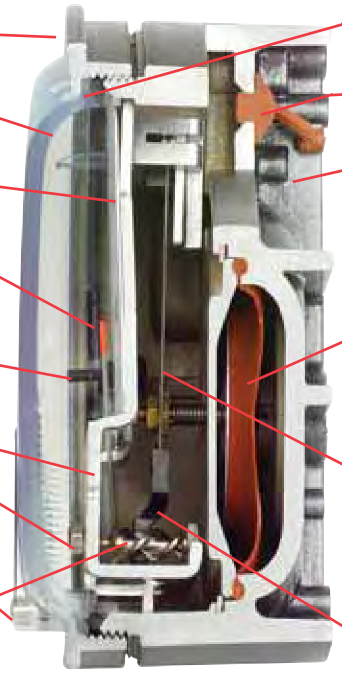
Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Series 2000 Magnehelic® Gage — Models and Ranges
Page V shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, square root scales for volumetric flow, etc., contact the factory.

Model	Range Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180	0-180
2250	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

Model	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

Model	Range MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10

Model	Range, Pa
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-100 x 10
Zero Center Ranges	
Model	**Range, Pa**
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

Model	Range in W.C./ Velocity F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2005AV	0-5.0/2000-8800
2010AV	0-10/2000-12500

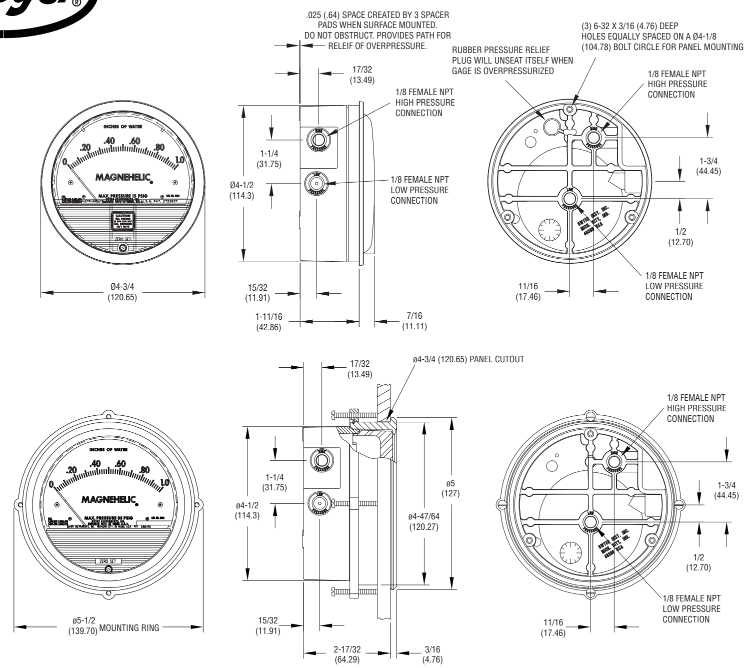
Dual Scale English/Metric Models

Model	Range, In. W.C.	Range, Pa or kPa
2000-OOD†••	0-.25	0-62 Pa
2000-OD†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

ACCESSORIES
A-299, Surface Mounting Bracket
A-300, Flat Flush Mounting Bracket
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-448, 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-605, Air Filter Kit
A-610, Pipe Mount Kit

OPTIONS — To order, add suffix: I.E. 2001-ASF
ASF, Adjustable Signal Flag
HP, High Pressure Option
LT, Low Temperatures to -20°F
MP, Med. Pressure Option
SP, Setpoint Indicator
Scale Overlays, Red, Green, Mirrored or Combination, Specify Locations

Magnehelic® Differential Pressure Gage



**The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.*

STANDARD GAGE ACCESSORIES: Two 1/8˝ NPT plugs for duplicate pressure taps, two 1/8˝ pipe thread to rubber tubing adapters and three flush mounting adapters with screws.

MP AND HP GAGE ACCESSORIES: Mounting ring and snap ring retainer substituted for 3 adaptors, 1/4” compression fittings replace 1/8” pipe thread to rubber tubing adaptors.

OVERPRESSURE PROTECTION: Standard Magnehelic® Differential Pressure Gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (excludes MP and HP models). To provide a free path for pressure relief, there are four spacer pads which maintain .023˝ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

SPECIFICATIONS

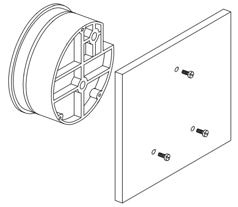
Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. (MP model has polycarbonate cover).
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on -00, - 00N, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20˝ Hg to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
Temperature Limits: 20 to 140°F (-6.67 to 60°C). *Low temperature models available as special option.
Size: 4˝ (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8˝ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).

†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.
Note: May be used with hydrogen when ordering Buna-N diaphragm. Pressure must be less than 35 psi.

INSTALLATION

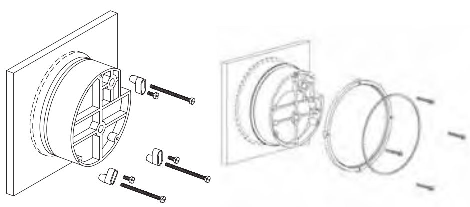
Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.
All standard Magnehelic® Differential Pressure Gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range models of 0.5” w.c. plus 0.25” w.c. and metric equivalents must be used in the vertical position only.

SURFACE MOUNTING



Locate mounting holes, 120° apart on a 4-1/8” dia. circle. Use No. 6-32 machine screws of appropriate length.

FLUSH MOUNTING



Provide a 4-9/16” dia. (116 mm) opening in panel. Provide a 4-3/4” dia. (120 mm) opening for MP and HP models. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place.

PIPE MOUNTING

To mount gage on 1-1/4” - 2” pipe, order optional A-610 pipe mounting kit.

TO ZERO GAGE AFTER INSTALLATION

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

OPERATION

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.
Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.
Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.
When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8” pipe thread to rubber tubing adapter and connect to source of pressure with flexible rubber or vinyl tubing.
B. For permanent installation, 1/4” O.D., or larger, copper or aluminum tubing is recommended.

MAINTENANCE

No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves should be used in permanent installations. The Series 2000 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

WARNING

Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended.

TROUBLE SHOOTING TIPS

Gage won’t indicate or is sluggish.
1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or “O”ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.

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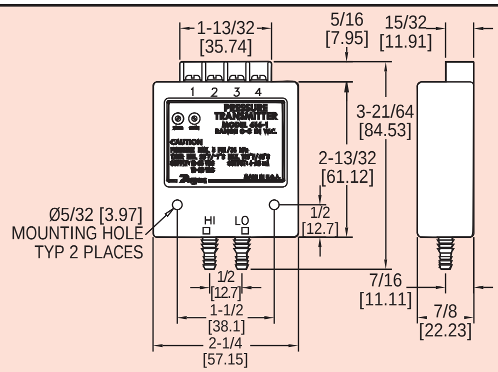
Series 616 Differential Pressure Transmitter

Ranges from 0-1 in. w.c. to 0-100 psid, Accuracy ±0.25%



Series 616 Transmitter features an exceptional ±0.25% accuracy in several factory calibrated ranges. Choose the one just right for your application. Span and Zero controls included for fine tuning and minor re-calibration in the field.

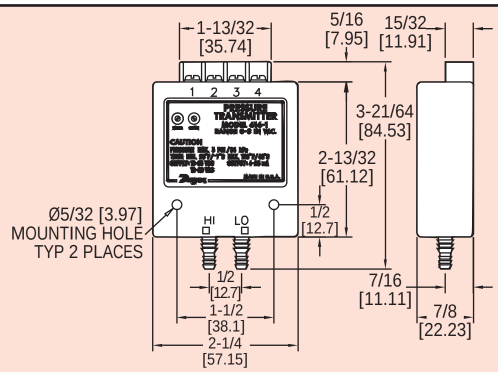
Series 616, models 0.25% accuracy

Model	Range	Max. Press.	Model	Range	Max. Press.
616-00	0-1 in w.c.	2 psig	**616-8**	0-10 psid	29 psig
616-0	0-2 in w.c.	2 psig	**616-9**	0-20 psid	58 psig
616-1	0-3 in w.c.	2 psig	**616-10**	0-30 psid	58 psig
616-2	0-6 in w.c.	5 psig	**616-11**	0-50 psid	150 psig
616-3	0-10 in w.c.	5 psig	**616-12**	0-100 psid	150 psig
616-4	0-20 in w.c.	11 psig	**616-3B**	1.5-0-1.5 in w.c.	2 psig
616-5	0-40 in w.c.	11 psig	**616-6B**	3-0-3 in w.c.	5 psig
616-6	0-100 in w.c.	29 psig	**616-10B**	5-0-5 in w.c.	5 psig
616-7	0-200 in w.c.	29 psig	**616-20B**	10-0-10 in w.c.	11 psig

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±0.25% F.S.
Stability: ±1% F.S./yr.
Temperature Limits: 0 to 140°F (-17.8 to 60°C).
Compensated Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Pressure Limits: See chart.
Thermal Effect: ±0.02% F.S./°F (±0.0012% F.S./°C).
Power Requirements: 10-35 VDC (2-wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Potentiometers for zero and span.
Loop Resistance: DC; 0-1250 ohms maximum.
Current Consumption: DC; 38 mA maximum.
Electrical Connections: Screw-type terminal block.
Process Connections: Barbed, dual size to fit 1/8″ and 3/16″ (3.12 mm and 4.76 mm) I.D. rubber or vinyl tubing.
Weight: 1.8 oz (51 g).
Agency Approvals: CE.

Series 616C Differential Pressure Transmitter

Ranges from 0-1 in. w.c. to 0-100 psid, Accuracy 1% F.S.



Series 616C Transmitter features an exceptional 1% accuracy in several factory calibrated ranges. Choose the one just right for your application. Span and Zero controls included for fine tuning and minor re-calibration in the field.

Series 616C, models 1% accuracy

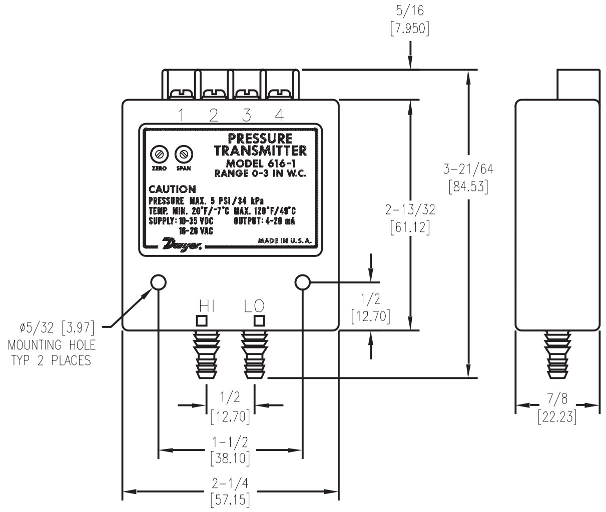
Model	Range	Max. Press.	Model	Range	Max. Press.
616C-1	0-3 in w.c.	2 psig	**616C-8**	0-10 psid	29 psig
616C-2	0-6 in w.c.	5 psig	**616C-9**	0-20 psid	58 psig
616C-3	0-10 in w.c.	5 psig	**616C-10**	0-30 psid	58 psig
616C-4	0-20 in w.c.	11 psig	**616C-11**	0-50 psid	150 psig
616C-5	0-40 in w.c.	11 psig	**616C-12**	0-100 psid	150 psig
616C-6	0-100 in w.c.	29 psig	**616C-3B**	1.5-0-1.5 in w.c.	2 psig
616C-7	0-200 in w.c.	29 psig	**616C-6B**	3-0-3 in w.c.	5 psig
			616C-10B	5-0-5 in w.c.	5 psig
			616C-20B	10-0-10 in w.c.	11 psig

Note: 0-1 in w.c. and 0-2 in w.c. only available in 616 series.

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±1% F.S.
Stability: ±1% F.S./yr.
Temperature Limits: 0 to 140°F (-17.8 to 60°C).
Compensated Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Pressure Limits: See chart.
Thermal Effect: ±0.02% F.S./°F (±0.0012% F.S./°C).
Power Requirements: 10-35 VDC (2-wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Potentiometers for zero and span.
Loop Resistance: DC; 0-1250 ohms maximum.
Current Consumption: DC; 38 mA maximum.
Electrical Connections: Screw-type terminal block.
Process Connections: Barbed, dual size to fit 1/8″ and 3/16″ (3.12 mm and 4.76 mm) I.D. rubber or vinyl tubing.
Weight: 1.8 oz (51 g).

Series 616 Differential Pressure Transmitter

Specifications – Installation and Operating Instructions



The Dwyer Series 616 Differential Pressure Transmitter senses the pressure of air and compatible gases and sends a standard 4-20 mA output signal. A wide range of models are available factory calibrated to specific ranges as listed in the chart below. The span and zero controls are for use when checking calibration. They are not intended for re-ranging to a significantly different span. Versatile circuit design enables operation in 2, 3 or 4-wire current loops.

For applications requiring direct pressure readings or percent of full span output, the optional Model A-701 Digital Readout makes an ideal companion device. It provides a bright red 0.6˝ high, 3-1/2 digit LED display while supplying power to the Series 616 transmitter. For additional information on these and other Dwyer Transmitting instruments, see the Dwyer Full Line catalog.

Series 616 Transmitter Models and Ranges*

Model No.	Range	Max. Press.	Model No.	Range	Max. Press.
616-00	0-1 in. w.c.	5 psig	**616-8**	0-10 psid	58 psig
616-0	0-2 in. w.c.	5 psig	**616-9**	0-20 psid	58 psig
616-1	0-3 in. w.c.	5 psig	**616-10**	0-30 psid	58 psig
616-2	0-6 in. w.c.	5 psig	**616-11**	0-50 psid	150 psig
616-3	0-10 in. w.c.	5 psig	**616-12**	0-100 psid	150 psig
616-4	0-20 in. w.c.	11 psig	**616-3B**	1.5-0-1.5 in. w.c.	5 psig
616-5	0-40 in. w.c.	11 psig	**616-6B**	3-0-3 in. w.c.	5 psig
616-6	0-100 in. w.c.	29 psig	**616-10B**	5-0-5 in. w.c.	5 psig
616-7	0-200 in. w.c.	29 psig	**616-20B**	10-0-10 in. w.c.	11 psig

***All models available with 0.25% F.S. Accuracy.**
Models available with 1.0% F.S. Accuracy include 616-1 through 616-20B.

SPECIFICATIONS
Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult Factory.
Accuracy: 616: ±0.25% F.S.; 616C: ±1.0% F.S.
Stability: ± 1% F.S./yr.
Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Pressure Limits: See Chart.
Thermal Effect: 616: ±0.055% F.S./°F (0.099% F.S./°C); 616C: ±0.070% F.S./°F (0.125% F.S./°C).
Power Requirements: 10-35 VDC (2, 3 or 4 wire); 16-26 VAC (4 wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Potentiometers for zero and span.
Loop Resistance: DC: 0-1250 ohms maximum. AC: 0-1200 ohms maximum.
Current Consumption: DC: 38 mA maximum. AC: 76mA maximum.
Electrical Connections: Screw-type terminal block.
Process Connections: Barbed, dual size to fit 1/8˝ and 3/16˝ (3.12 mm and 4.76 mm) I.D. rubber or vinyl tubing.
Mounting Orientation: Vertical, consult factory for other position orientations.
Weight: 1.8 oz. (51 grams).

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Installation

1.0 Location

Select a clean, dry mounting location free from excess vibration where the temperature will remain between 20 and 120°F (-6.7 and 48.9°C). Distance from the receiver is limited only by total loop resistance. See Electrical Connections below. The tubing supplying pressure to the instrument can be practically any length required, but long lengths will increase response time slightly.

2. Position

A vertical position, with pressure connections pointing down, is recommended. That is the position in which all standard models are spanned and zeroed at the factory. They can be used at other angles, but final spanning and zeroing must be done while transmitter is in that alternate position.

Pressure Connections

Two integral barbed tubing connections are provided. They are dual-sized to fit both 1/8″ and 3/16″ (3.12 and 4.76 mm) I.D. tubing. Be sure the pressure rating of the tubing exceeds that of the operating ranges. On ranges over 20 psi, we recommend use of a suitable hose clamp to assure the integrity of the connection.

Electrical Connections

CAUTION: Do not exceed specified supply voltage ratings. Permanent damage not covered by warranty will result. This unit is not designed for 120 or 240 volts AC line operation.

Electrical connections are made to the terminal block located on the top of the transmitter. Terminals are marked 1, 2, 3 and 4 *(see Fig. B below)*. Determine which of the following circuit drawings applies to your application and wire accordingly.

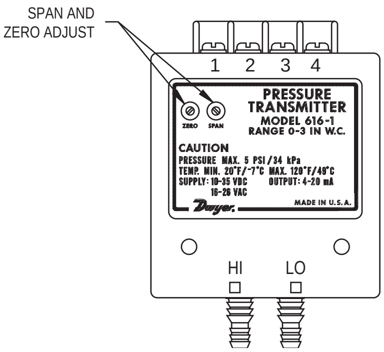

Figure B

Wire Length

The maximum length of wire connecting transmitter and receiver is a function of wire size and receiver resistance. Wiring should not contribute more than 10% of the receiver resistance to total loop resistance. For extremely long runs (over 1000 feet), choose receivers with higher resistance to minimize size and cost of connecting leads. Where wiring length is under 100 feet, hook-up wire as small as 22 AWG can be used.

2-Wire Operation

An external power supply delivering 10-35 VDC with minimum current capability of 40 mA DC (per transmitter) must be used to power the control loop. *See Fig. C for connection of the power supply, transmitter and receiver.* Note the jumper between terminals 3 and 4. The range of appropriate receiver load resistance (R_L) for the DC power supply voltage available is expressed by the formula and graph in *Fig. F.* Shielded two wire cable is recommended for control loop wiring. If grounding is required, use the negative side of the control loop after the receiver. Otherwise, in 2-wire operation it is not necessary to observe polarity of control loop connections.

2-Wire Connections

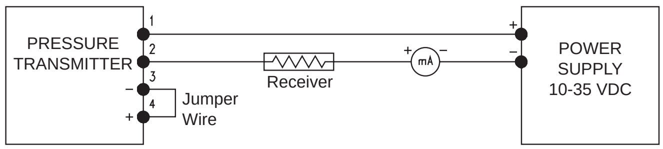

Figure C

3-Wire Operation

An external power supply delivering 10-35 VDC with minimum current capability of 40 mA DC (per transmitter) is required. *See Fig. D for connection of power supply, transmitter and receiver.* The range of appropriate receiver load resistance (R_L) for the DC power supply available is expressed by the formula and graph in *Fig. F.* Shielded cable is recommended for control loop wiring. Do not employ a separate ground in 3-wire operation. Unit will not function properly and/or damage could result. Control loop polarity must be observed in the following respect. Although power supply terminals 1 and 2 are not polarized, the receiver must be connected between terminal 3 of transmitter and negative side of power supply.

3-Wire Connections

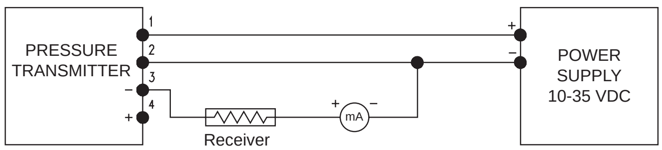

Figure D

4-Wire Operation

An external power supply delivering 10-35 VDC with a minimum current capability of 40 mA DC (per transmitter) or 16-26 VAC with a minimum current capability of 80 mA AC (per transmitter) is required. *See Fig. E for connection of power supply, transmitter and receiver.* The range of appropriate load resistance (R_L) for the DC or AC power supply available is expressed by the formulas and graphs in *Fig's. F and G.*

Shielded cable is recommended for control loop wiring. Do not employ a separate ground in 4-wire operation. Unit will not function properly and/or damage could result. Control loop polarity must be observed; terminal 3 is negative and terminal 4 is positive.

4-Wire Connections

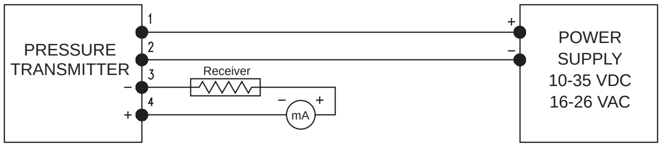

Figure E

Power Supply Voltage – VDC (2, 3 or 4-wire)

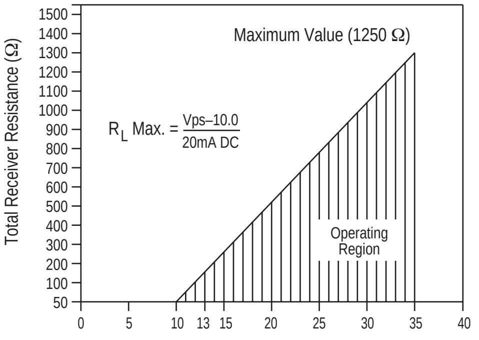

Figure F

Power Supply Voltage – VAC (4-Wire)

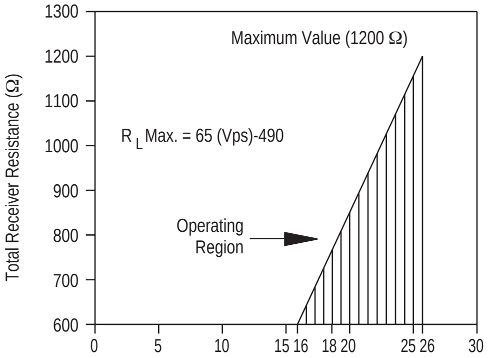

Figure G

Calibration Check

Each Series 616 Transmitter is factory calibrated to the range given in the model chart. To check calibration and adjust if necessary, the following procedure should be used. For purposes of clarification in these instructions, range is defined as that pressure which, applied to the transmitter, produces 20 milliamps of current in the loop. Zero pressure is always assumed to be 4 milliamps.

1. With the transmitter connected to the companion receiver, insert an accurate milliameter in series with the current loop. Full scale range should be approximately 30 mA.

2. Connect a controllable pressure source to one leg of a tee with the other two legs connected to the high pressure port of the transmitter and the third leg to an accurate test gage or manometer, in an appropriate range. The low pressure port should be vented to atmosphere. Calibration must be performed with the unit in the same position in which it will be mounted.

3. Apply electrical power to the unit and allow it to stabilize for 10 minutes.

4. With no pressure applied to the transmitter, adjust ZERO control so that loop current is 4 mA.

5. Apply full range pressure and adjust loop current to 20 mA using SPAN control.

6. Relieve pressure and allow transmitter to stabilize for 2 minutes.

7. Zero and span controls are slightly interactive, so repeat steps 4 through 6 until zero and full range pressures consistently produce currents of 4 and 20 mA respectively.

8. Remove the milliameter from the current loop and proceed with final installation of the transmitter and receiver.

Voltage Input

Series 616 Transmitters can be easily adapted for receivers requiring 1-5 or 2-10 VDC inputs. Insert a 249 ohm, 1/2 watt (1-5 VDC) or 499 ohm (2-10 VDC) resistor in series with the current loop but in parallel with the receiver input. Locate this resistor as close as possible to the input. Because resistor accuracy directly influences output signal accuracy, we recommend use of a precision ±0.1% tolerance resistor to minimize this effect. See Fig. H and J below.

3-Wire Connection (1-5 or 2-10 VDC Output)

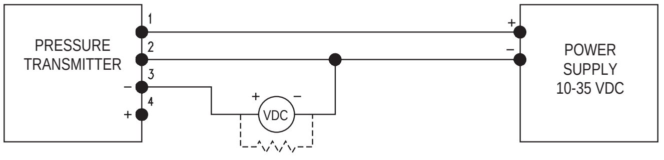

Figure H

4-Wire Connection (1-5 or 2-10 VDC Output)

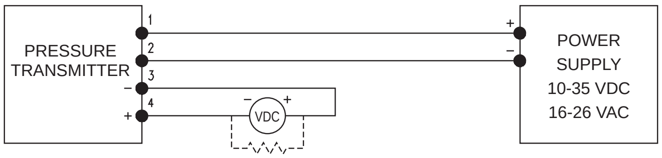

Figure J

Multiple Receiver Installation

An advantage of the standard 4-20 mA DC output signal produced by the Series 616 Transmitter is that any number of receivers can be connected in series in the current loop. Thus, an A-701 Digital Readout, an analog panel meter, a chart recorder, process controlling equipment or any combination of these devices can be operated simultaneously. The only requirement is that each component be equipped for a standard 4-20 mA input and the proper polarity of the input connections be observed when inserting the device in the current loop. If any of the units display a negative or downscale reading, the signal input leads are reversed.

Maintenance

Upon final installation of the Series 616 Differential Pressure Transmitter and the companion receiver, including the A-701 Digital Readout, no routine maintenance is required. A periodic check of the system calibration is recommended following the procedures explained on page 3 under *Calibration Check.* The Series 616 Transmitter is not field serviceable and should be returned, freight prepaid, to the factory if repair is required. Please enclose a description of the problems encountered plus any available application information. The A-701 should be returned directly to its manufacturer for service. See the A-701 instructions for address.

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Dwyer®

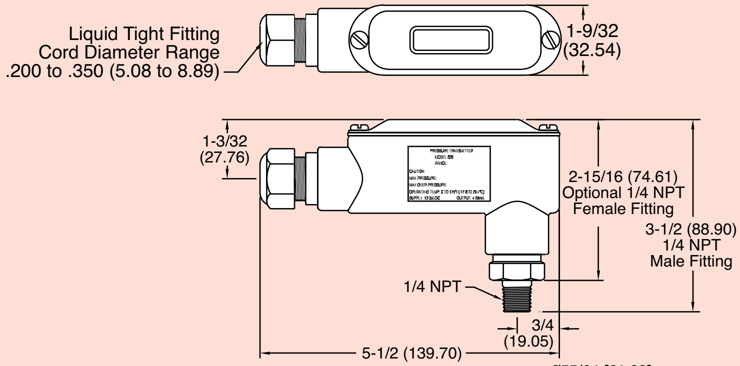
Series 626 & 628

Industrial Pressure Transmitter

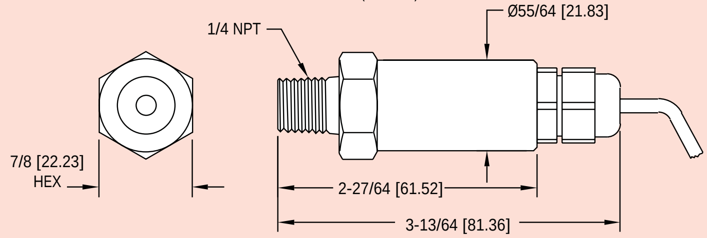
Complete Offering of Ranges, Connections and Outputs

CE

Conduit Housing (-CH)



General Purpose Housing (-GH)



The Series 626 Pressure Transmitters possess a highly precise 0.25% piezo-resistive sensor contained in a compact, rugged, NEMA 4X stainless steel general purpose housing or cast aluminum conduit housing.

The Series 628 Pressure Transmitters are ideal for OEMs with 1% full scale accuracy sensors. The transmitter is also available in the general purpose stainless steel housing and the cast aluminum conduit housing.

The highly corrosive resistant 316L stainless steel wetted parts allow the Series 626 and 628 transmitters to measure the pressure in a multitude of processes from hydraulic oils to chemicals. The Series 626 and 628 are available in ranges of vacuum, compound to 5000 psi with a variety of optional outputs, process connections and electrical terminations to allow you to select the right transmitter for your application.

APPLICATIONS

- Compressors
- Pumping Systems
- Irrigation Equipment
- Hydraulic
- Industrial Process Monitoring

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Type 316 SS, 316L SS.
Accuracy: 626: 0.25% full scale. 628: 1% full scale (includes linearity, hysteresis, and repeatability).
Temperature Limit: 0 to 200°F (-18 to 93°C).
Compensated Temperature Range: 0 to 175°F (-18 to 79°C).
Thermal Effect: 626: ±0.02% FS/°F. 628: ±0.04% FS/°F (includes zero and span).
Pressure Limits: See table.
Power Requirements: 13 to 30 VDC.
Output Signal: 4 to 20 mA. Optional 0-5, 1-5, 0-10, 1-6 or 2-10.
Response Time: 50 msec.
Loop Resistance: 0 - 1300 ohms maximum for current. For voltage outputs, minimum load resistance: 2000 ohms.
Current Consumption: 38 mA (maximum).
Electrical Connections: Conduit Housing (-CH): terminal block, 1/2″ female NPT conduit. General Purpose Housing (-GH): cable, DIN connector or 4 pin M-12.
Process Connection: 1/4″ male or female NPT and BSPT.
Enclosure Rating: NEMA 4X (IP66).
Mounting Orientation: Mount in any position.
Weight: 10 oz (283 g).
Agency Approvals: CE.

PRESSURE LIMITS

Range Number	Pressure Range (psig)	Maximum Pressure (psig)	Over Pressure (psig)	Range Number	Pressure Range (psig)	Maximum Pressure (psig)	Over Pressure (psig)
00	30″ Hg-0	30	150	11	0-150	300	750
01	30-0-15	30	150	12	0-200	400	1000
02	30-0-30	60	300	13	0-300	600	1500
03	30-0-45	100	300	14	0-500	1000	2500
04	30-0-60	200	500	15	0-1000	2000	5000
05	30-0-100	200	500	16	0-1500	3000	5000
06	0-5	10	50	17	0-2000	4000	5000
07	0-15	30	150	18	0-3000	6000	7500
08	0-30	60	300	19	0-5000	7500	10000
09	0-50	100	300	26	0-8000	10000	12000
10	0-100	200	500				

MODEL ORDERING CHART

Accuracy	626							0.25% Full Scale Accuracy
	628							1.0% Full Scale Accuracy
Range		-00						0-30˝ Hg Vacuum
		-01						30-0-15 psi
		-02						30-0-30 psi
		-03						30-0-45 psi
		-04						30-0-60 psi
		-05						30-0-100 psi
		-06						0-5 psi
		-07						0-15 psi
		-08						0-30 psi
		-09						0-50 psi
		-10						0-100 psi
		-11						0-150 psi
		-12						0-200 psi
		-13						0-300 psi
		-14						0-500 psi
		-15						0-1000 psi
		-16						0-1500 psi
		-17						0-2000 psi
		-18						0-3000 psi
		-19						0-5000 psi
		-26						0-8000 psi
Housing			-CH					Conduit Housing
			-GH					General Purpose Housing
Process Connection				-P1				1/4˝ male NPT
				-P2				1/4˝ female NPT
				-P3				1/4˝ male BSPT
				-P4				1/4˝ female BSPT
				-P5				Refrigerant Valve Depressor
Electrical Connection					-E1			Cable Gland with 3’ of Prewired Cable
					-E2			Cable Gland with 6’ of Prewired Cable
					-E3			Cable Gland with 9’ of Prewired Cable
					-E4			DIN Connector Available with -GH Housing Only
					-E5			1/2˝ female NPT Conduit Available with -CH Housing Only
					-E6			M-12 4 Pin Connector
Signal Output						-S1		4-20 mA
						-S2		1-5 Volt
						-S3		2-10 Volt
						-S4		0-5 Volt
						-S5		0-10 Volt
						-S6		1-6 Volt
Options							-AT	Aluminum Tag
							-NIST	NIST Traceable Certificate
							-LED	Bright Red LED display. Available with -CH housing only

626 with LED Display (CH housing only)

Note: LED option is not NEMA 4X rated.

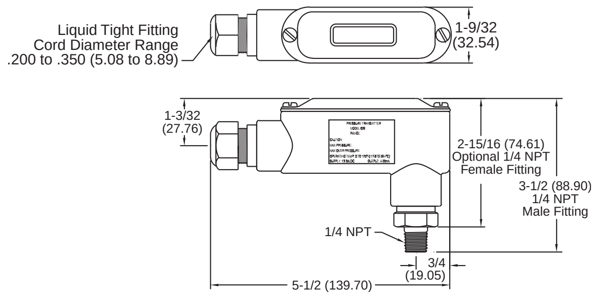
Optional -E4 DIN Connector (GH housing only)

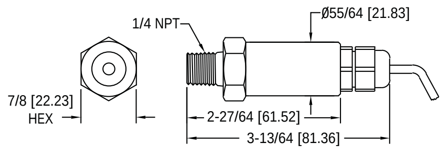
Series 626 & 628 Pressure Transmitters

Specifications - Installation and Operating Instructions

-CH Conduit Housing

-GH General Purpose Housing





The Series 626 and 628 Pressure Transmitters converts a single positive pressure into a standard 4-20 mA output signal. The Series 626 and 628 can be used to accurately measure compatible gases and liquids; Series 626 full scale accuracy is 0.25%; Series 628 full scale accuracy is 1.0% (see specifications). Designed for industrial environments with a NEMA 4X (IP66) housing, this transmitter resists most effects of shock and vibration.

CAUTION: Do not exceed specified supply voltage ratings. Permanent damage not covered by warranty will result. This device is not designed for 120 or 240 volt AC operation. Use only on 13 to 30 VDC.

Pressure Ranges		
Pressure Range (psig)	**Maximum Pressure (psig)**	**Over Pressure (psig)**
30˝ Hg-0	30	45
30-0-15	60	90
30-0-30	90	130
30-0-45	120	180
30-0-60	150	225
30-0-100	200	300
0-5	10	50
0-15	30	150
0-30	60	300
0-50	100	300
0-100	200	500
0-150	300	750
0-200	400	1000
0-300	600	1500
0-500	1000	2500
0-1000	2000	5000
0-1500	3000	5000
0-2000	4000	5000
0-3000	6000	7500
0-5000	7500	10000
0-8000	10000	12000
0-30˝ Hg (vacuum)	30	150

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: Type 316L SS; Ceramic Ranges: Type 316 SS, ceramic, fluoroelastomer.
Accuracy: 626: 0.25% full scale;
626 ceramic ranges: 0.5% full scale;
628: 1% full scale.
(Includes linearity, hysteresis, and repeatability.)
Temperature Limit: 0 to 200°F (-18 to 93°C).
Compensated Temperature Range: 0 to 175°F (-18 to 79°C).
Thermal Effect: 626: ±0.02% FS/°F. 628: ±0.04% FS/°F (includes zero and span).
Pressure Limits: See table.
Power Requirements: 13 to 30 VDC.
Output Signal: 4 to 20 mA. Optional 0-5, 1-5, 0-10, 1-6 or 2-10.
Response Time: 50 msec.
Loop Resistance: 0 - 1300 ohms maximum for current.
For voltage outputs, minimum load resistance: 2000 ohms.
Current Consumption: 38 mA (maximum).
Electrical Connections: Conduit Housing (-CH): terminal block, 1/2˝ female NPT conduit. General Purpose Housing (-GH): cable or DIN connector.
Process Connection: 1/4˝ male or female NPT and BSPT.
Enclosure Rating: NEMA 4X (IP66).
Mounting Orientation: Mount in any position.
Weight: 10 oz (283 g).
Agency Approvals: CE.
*Note: Transmitters with ceramic sensor are not CE approved.

INSTALLATION

1. Location: Select a location where the temperature of the transmitter will be between 0 and 175°F (-18 to 79°C). Distance from the receiver is limited only by total loop resistance. The tubing or piping supplying pressure to the unit can be practically any length required but long lengths will increase response time slightly.
2. Position: The transmitter is not position sensitive. However all standard models are originally calibrated with the unit in a position with the pressure connection downward. Although they can be used at other angles, for best accuracy it is recommended that units be installed in the position calibrated at the factory.
3. Pressure Connection: Use a small amount of plumber's tape or other suitable sealants to prevent leaks. Be sure the pressure passage inside the port is not blocked.
4. Electrical Connections
Wire Length - The maximum length of wire connecting the transmitter and receiver is a function of wire size and receiver resistance. Wiring should not contribute more than 10% of the receiver resistance to total loop resistance. For extremely long runs (over 1000 feet), choose receivers with higher resistance to minimize the size and cost of connecting leads. Where wiring length is under 100 feet, wire as small as 22 AWG can be used.

CURRENT (4-20 mA) OUTPUT OPERATION

An external power supply delivering 13-30 VDC with minimum current capability of 40 mA DC (per transmitter) is required to power the control loop. See Fig. A for connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistance (R_L) for the DC power supply voltage available is expressed by the formula:

$$R_L \text{ Max} = \frac{\text{Vps} - 13}{20 \text{ mA DC}}$$

Shielded cable is recommended for control loop wiring.

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Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**

Current Output

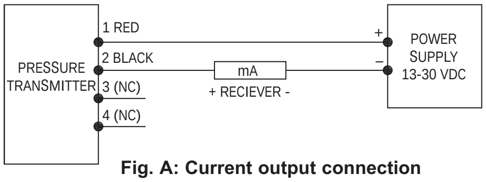

Fig. A: Current output connection

4a. Conduit Housing (-CH) Electrical connections to the pressure transmitters are made to the terminal block located inside the housing. Remove the screws and lift off the cover. Wire as shown in Fig. A, B or C. Use Fig. A for current output connection. Use Fig. B for current output with optional LED display. Use Fig. C for current output with optional LED display using two power supplies.

If ordering optional pre-wired cable, black wire is negative (-) and red wire is positive (+).

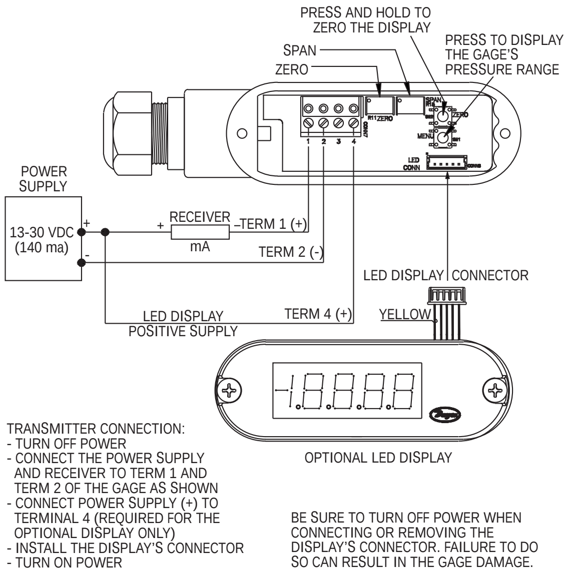

Fig. B: Current output with optional LED display connection

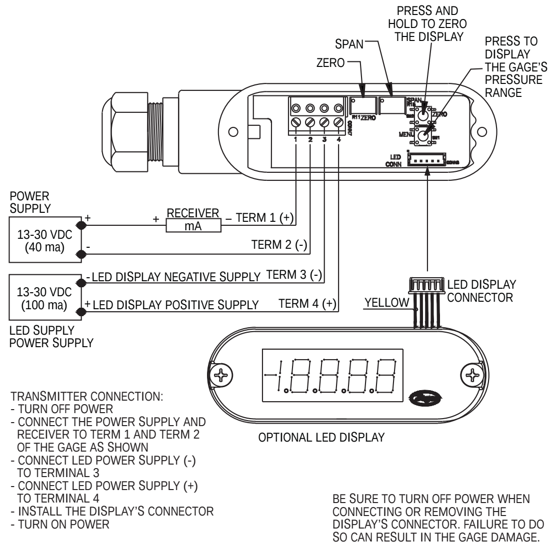

Fig. C: Current output with optional LED display using two power supplies

MAINTENANCE

After final installation of the pressure transmitter and its companion receiver, no routine maintenance is required. A periodic check of system calibration is suggested. The Series 626 and 628 transmitters are not field repairable 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.

4b. General Purpose Housing (-GH) When using cable version of -GH General Purpose Housing, black wire is negative (-) and red wire is positive (+). When using optional Heirschman DIN Plug, remove top-center screw and lift off the terminal block assembly. Wire to terminals shown below in Fig. D. For optional 4-pin M-12 connector, wire to pins as shown in Fig. E.

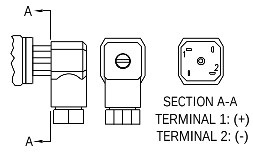

Fig. D

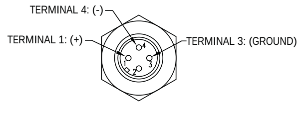

Fig. E

VOLTAGE (0-5, 1-5, 0-10, 1-6 or 2-10 Volt) OUTPUT OPERATION

(Other outputs contact the factory) See Fig. F for connection of the power supply, transmitter and receiver.

Voltage Output

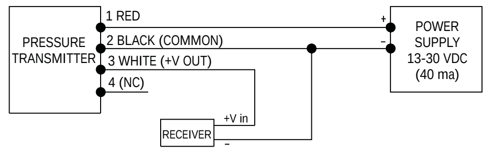

Fig. F: Voltage output connection

4c. Conduit Housing (-CH) Electrical connections to the pressure transmitters are made to the terminal block located inside the housing. Remove the screws and lift off the cover. Wire as shown in Fig. F or Fig. G. Use Fig. F for voltage output connection. Use Fig. G for voltage output with optional LED display connection. If ordering optional pre-wired cable, black wire is negative (-), red wire is positive (+) and white wire is +Vout.

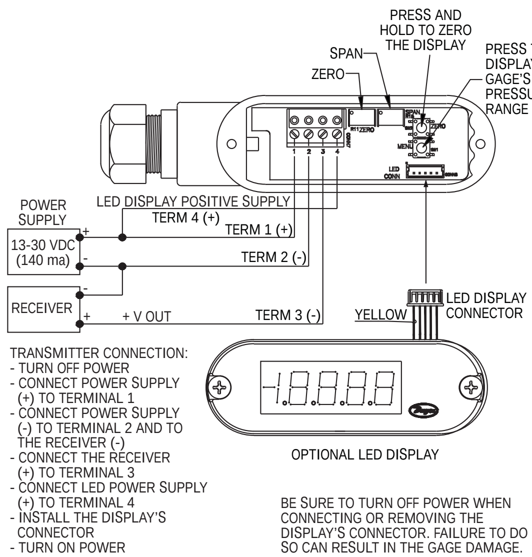

Fig. G: Voltage output with optional LED display connection

4d. General Purpose Housing (-GH) When using cable version of -GH General Purpose Housing, black wire is negative (-), red wire is positive (+) and white wire is output. When using optional Heirschman DIN Plug, remove top-center screw and lift off the terminal block assembly. Wire to terminals shown below in Fig. H. For optional 4-pin M-12 connector, wire to pins as shown in Fig. I. If utilizing optional A-164 cable for M-12 connection, brown wire corresponds to pin #1, white #2, blue #3, and black #4.

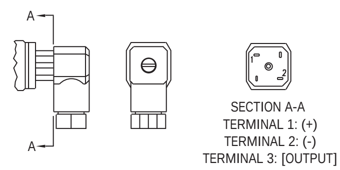

Fig. H

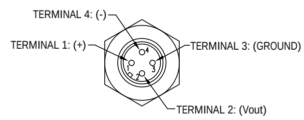

Fig. I

Printed in U.S.A. 8/09

FR# 01-443271-00 Rev.10

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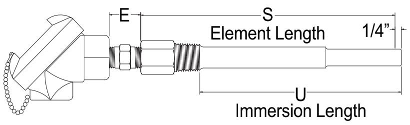
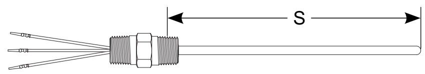
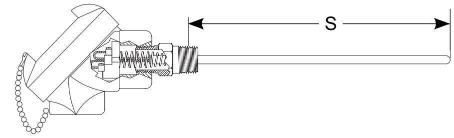
Configuration Code GP03

Spring-Loaded RTD/Thermowell Assemblies with General Purpose Connection Heads

Spring-Loaded RTD Thermowell Assemblies with General Purpose Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the RTD assembly below, the thermowell from the thermowell section of this catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. They are supplied with a 316 stainless steel sheath and are available in various initial accuracies and temperature ranges as noted in the tables below. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed postition. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.







ORDER CODES

Example Order Number:

1-0	1-1	1-2		2-0		3-0		4-0	4-1	4-2	
R1T185L	48	3	-	Select Thermowell Part # or Insert 3 Digit Length Code	-	SL	-	8HN	31,	T-	Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements
α = 0.003 85 ºC^{-1}

CODE		INITIAL ELEMENT ACCURACY 0 ºC
LOW RANGE WIRE WOUND (-200 to 204) ºC		
SINGLE	***DUPLEX***	
R1T185L	R1T285L	± 0.1%
R5T185L	R5T285L	± 0.01%
LOW RANGE THIN FILM (-40 to 204) ºC		
RBF185L	RBF285L	± 0.12%
RAF185L	RAF285L	± 0.06%
HIGH RANGE WIRE WOUND (-200 to 600) ºC		
R1T185H	R1T285H	± 0.1%

1-1 Sheath Diameters

CODE	DIAMETERS (inches) 316 SS
38	3/16
48	1/4

1-2 Element Connection

CODE	DESCRIPTION
2	2 wire
3	3 wire
4[1]	4 wire
[1] Not available in duplex or with 440 Series Transmitter	

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

3-0 Element Options

CODE	DESCRIPTION
SL[1]	Spring-loaded element
SC	Self-contained spring-loaded element
SN	Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max.
[1] Not available with option 35T-642A	

4-0 Head Mounting Fittings

CODE	DESCRIPTION	CODE	DESCRIPTION
STEEL FITTINGS		*316SS FITTINGS*	
6HN	1/2" x 1/2" NPT hex nipple 1" length	8HN	1/2" x 1/2" NPT hex nipple 1" length
6PN_	1/2" NPT pipe nipple (specify "E" length in inches)	8PN_	1/2" NPT pipe nipple (specify "E" length in inches)
6PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)	8PU_ [1]	1/2" NPT union/nipple (specify "E" length in inches)
[1] 4" Minimum length required			

4-1 Head and Sheath Terminations

CODE	DESCRIPTION
22	3" Individual Teflon® leads with terminal pins
31	Aluminum screw cover head
34	Cast iron screw cover head
35T-642A	(4 to 20) mA HART® Field Transmitter with aluminum general purpose housing
49	Flip-top aluminum head
53	Grey Delrin® screw cover head
62	White DIN form B polypropylene head
63	White polypropylene head
91	316 L stainless steel screw cover head
92	DIN form B 316 stainless steel screw cover head
4-2	**Options**
W[1]	Epoxy Coating
GS	Ground screw
I	Stainless tag
NB	1/2" NPT nylon conduit reducer bushing
SB	1/2" NPT conduit reducer bushing
T-440[2]	(4 to 20) mA head mounted RTD transmitter
T-441[3]	(4 to 20) mA Isolated head mounted transmitter
T-442[3]	(4 to 20) mA Isolated Hart® head mounted transmitter
See transmitter ordering information in back of section.	
[1] Available with option 31 only. [2] Available with option 31, 34, 49, 53, 63, 91 only. [3] Available with option 31, 49, 62, 92 only.	

Series 440 Installation and Operating Instructions

1 SAFETY NOTES
Safe and secure operation of the head transmitter can only be guaranteed if the operating instructions and all safety notes contained are understood and followed.

1.1 Correct Use
The unit is a universal, presettable temperature transmitter for resistance thermometer (RTD). The unit is constructed for mounting in a connection head and a field housing. The manufacturer cannot be held responsible for damage caused by misuse of the unit.

1.2 Installation, commissioning and operation
The unit is constructed using the most up-to-date production equipment and complies with the safety requirements of the EU guidelines. If it is installed incorrectly or is misused, certain application dangers can occur. Trained personnel must do installation, wiring, and maintenance of the unit. These personnel must have read and understood these instructions and must follow them to the letter.

2 FUNCTION AND SYSTEM CONSTRUCTION
2.1 Function
Provides electronic monitoring of input signals into an analog output signal in industrial temperature measurement. The head transmitter is mounted in a connection head or separated from the sensor in a field housing. Setting up of the head transmitter is done using PC and configuration software. The configuration kit is required for setting up the head transmitter.

2.2 Measurement system
Transforming the following input signals:
• Resistance thermometers (RTD) (in 2 or 3 wire connection systems)

Fault monitoring of:
• Measurement range override or undercut
• Sensor breakage and short circuit

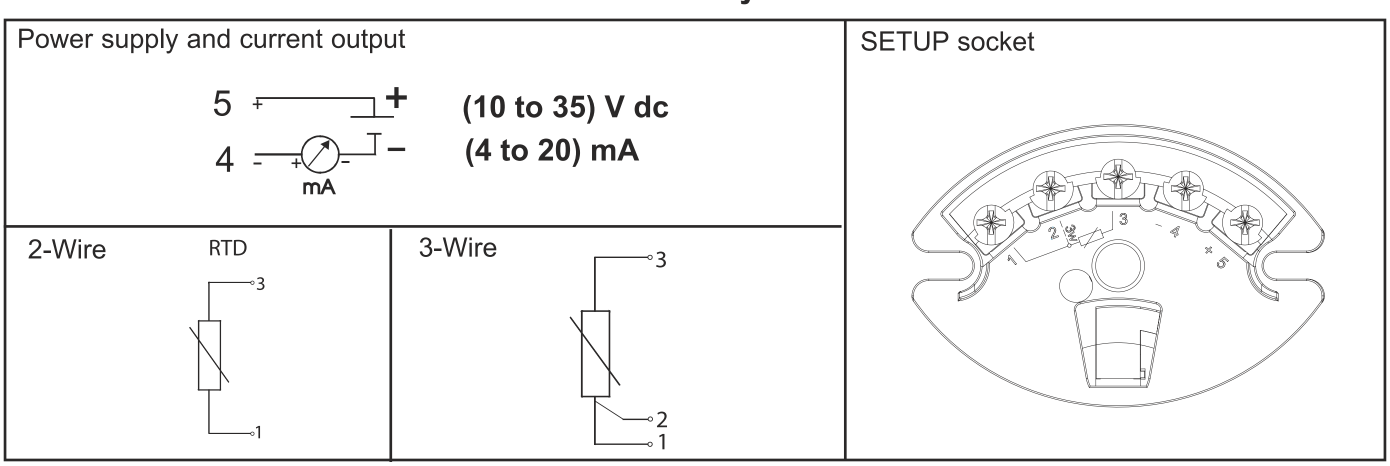
3 INSTALLATION
3.1 Installation conditions
Ambient temperature: (-40 to 85) °C [-40 to 185] °F
Installation area: Field housing; connection head
Installation angle: No limit

Safety notes: The unit must only be powered by a power supply that operates using an IEC 61010-1 compliant energy limited circuit.

3.2 Installation
• Feed the sensor leadwires through the central hole in the head transmitter
• Position the head transmitter in the connection head
• Feed the installation screws through the slots in the head transmitter.
• Screw the head transmitter into the field housing using a screwdriver while not over tightening.

4 WIRING
4.1 Overview

Terminal layout



4.2 Measurement unit connection

Attention: Switch off power supply before opening the housing cover. Do not install or connect the unit to mains power. If this is not followed parts of the electronic circuit will be damaged.

- Sensors:
  Connect the sensor leads to the respective head transmitter terminals (Terminals 1 to 3) by following the wiring diagram (see figure 4.1).

- Output signal and power supply:
  Open the PG cable gland on the head transmitter or field housing. Feed the cable through the opening in the PG cable gland and then connect the cable cores to terminals 4 and 5 according to the wiring diagram (see figure 4.1).

- PC configuration (SETUP socket):
  Open the flap on the SETUP socket (Figure 4.1) and connect the SETUP connection cable.

Hint: The screws on the terminals must be screwed tightly. Head transmitter configuration during measurement operation is possible. There is no need to disconnect leads.

Potential leveling
Please take note when installing the head transmitter remotely in a field housing. The screen on the (4 to 20) mA signal output must have the same potential as the screen at the sensor connections. When using earthed thermocouples, screening of the output (4 to 20) mA cable is recommended. In plants with strong electromagnetic fields, screening of all cables with a low ohm connection to the transmitter housing is recommended.

5 OPERATION
5.1 Short form instructions (SETUP)

PRESETTABLE PARAMETERS	
Standard settings	• Sensor type • Connection mode (2 or 3 wire connection) • Units (°C or °F) • Measurement range start (depends on sensor) • Measurement range end (depends on sensor)
Expanded settings	• Compensation resistance (0 to 20) Ω on 2 wire connection • Fault condition reaction (≤ 3.6 mA or ≥ 21.0 mA) • Output (analog standard/inverse) • Damping (0 to 8) s • Offset (-9.9 to +9.9) ˚C [-17.8 to +17.8] ˚F • Measurement point identification/TAG Service functions
Service functions	• Simulation (on/off)

For detailed TransComm operating instructions, please read the online documentation contained in the software.

5.2 Communication
The head transmitter must be set up using a PC and configuration kit. The following points must be taken into account if trouble free setting up is to be achieved:
- Configuration software installation.
- Connect the head transmitter to the PC using the connection cable from the configuration kit.

CONFIGURATION SOFTWARE INSTALLATION	
System conditions	• IBM PC or compatible computer (minimum Pentium 166 MHz) • Windows 95/98/ME/NT4.0/2000 • 64 MB RAM • Minimum 30 MB free memory on hard drive • CD-ROM drive • Screen resolution 800 x 600 Pixel • Free serial interface
Recommended minimum configuration	• Pentium 400 MHz • 128 MB main RAM • 120 MB free hard drive memory • Screen resolution 1024 x 768 Pixel
Installation start	Start Windows 1. Place installations-CD in the respective drive 2. Start “Setup.exe” and follow the installation instructions 3. If required, the help/operating manual can be printed once the software has been successfully installed.

Connecting the head transmitter to the PC using the configuration kit connection cable

1. Connect the SETUP connector of the interface cable to the SETUP socket in the head transmitter (see figure 4.1).

2. Connect the RS232C connector to a free serial interface socket on the PC. In order to achieve optimum connection, tighten the RS232C connector screws to the PC.

Note: Configuration of the head transmitter can be done with or without power applied.

6 COMMISSIONING

6.1 Installation check

Monitor all connections making sure they are tight. In order to guarantee fault free operation, the terminal screws must be tight onto the connection cables. The unit is now ready for operation.

6.2 Commissioning

Once the power supply has been connected the head transmitter is operational.

Set up using the PC configuration software

The head transmitter left the factory with a default parameter configuration. If no customer specific configuration was mentioned on the order the default parameter configuration is constructed as follows:

Sensor	Pt100 (RTD)
Connection mode	3-wire
Measurement range and units	(0 to 100) °C

Hint: If a change has been made to the measurement point the head transmitter can be re-configured. In order to re-configure the parameters follow these instructions:

- Install the configuration software and make connection to the PC (see Chapter 5, Operation).
- For detailed operating instructions for the PC configuration software, please read the online documentation contained in the software.

Interactive setting up of the temperature transmitter

Customer specific linearization and sensor matching is done using the TransComm configuration software. The program calculates the linearization coefficients X0 to X4, that need to be entered into the PC configuration software.

6.3 Function check

Measuring the analogue (4 to 20) mA output signal or following failure signals:

Measurement range undercut	Linear fall to 3.8 mA
Measurement range excess	Linear rise to 20.5 mA
Sensor break; sensor short circuit	≤ 3.6 mA or ≥ 21.0 mA selectable

7 MAINTENANCE

The head transmitter is maintenance free.

8 FAULT FINDING

8.1 Repair concept and disposal

Due to its construction, the head transmitter cannot be repaired. When disposing of the head transmitter please take note of local disposal regulations.

8.2 Faultfinding and repairs

Trouble shooting in general

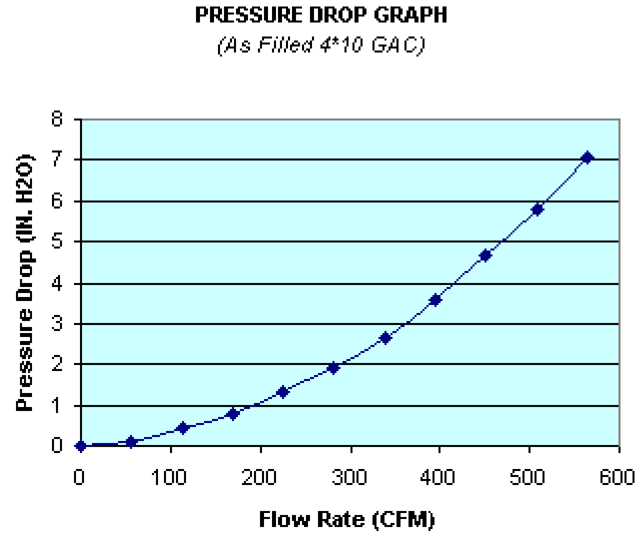
FAULT	CAUSE	ACTION/CURE
No communication	2 wire connection incorrect	Re-connect correctly (see connection diagram)
	No power supply to the 2 wire connection	Check the current loop
	Power supply too low (< 10 V dc)	Check power supply
	Interface cable defective	Check the interface cable
	PC-interface defective	Check the interface of your PC
	Head transmitter defective	Replace head transmitter

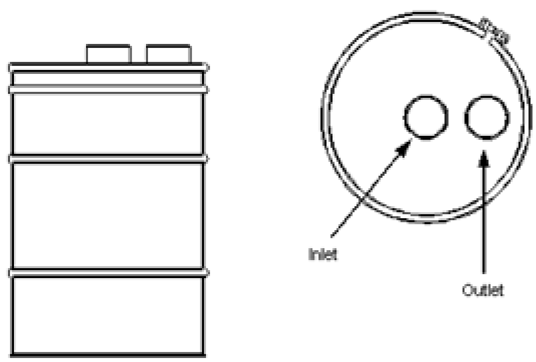
Trouble shooting on RTDs (Pt100)

FAULT	CAUSE	ACTION/CURE
Current (≤ 3.6 or ≥ 21.0) mA	Sensor defective	Check sensor
	Incorrect RTD connection	Connect the cables correctly (see connection diagram)
	Incorrect 2 wire connection	Connect the cables correctly (see connection diagram)(Polarity)
	No power supply on the 2 wire connection	Check the current loop; the supply should be > 10 V dc
	Incorrect transmitter programming (number of wires)	Change parameter ‘connection mode’ (see chap. Operation)
	Programming	Thermocouple set up (see chap. Operation). Change to RTD
	Head transmitter defective	Replace head transmitter
Incorrect or inaccurate measured value	Sensor is incorrectly installed	Reinstall sensor correctly
	Heat dissipation via sensor	Monitor sensor installation positioning
	Incorrect transmitter programming (number of wires)	Change parameter ‘connection mode’
	Transmitter programming faulty (scale)	Change scale
	Wrong RTD set up	Change parameter ‘sensor type’
	Sensor connection (2 wire)	Monitor sensor connection
	Sensor cable resistance not compensated (2 wire)	Compensate cable resistance
	Offset incorrectly set up	Monitor offset

APPENDIX F: GRANULAR ACTIVATED CARBON SYSTEM – PRODUCT DATA

VR-140
High Flow Radial Design Vapor Phase Filter





VR-140 SPECIFICATIONS			
Overall Height	3'2"	Vessel/Internal Piping Materials	CS/ SCH 40 PVC
Diameter	23"	Internal Coating	Polyamide Epoxy Resin
Inlet / Outlet (FNPT)	4"	External Coating	Urethane Enamel
Drain / Vent (FNPT)	OPT	Maximum Pressure / Temp	6 PSIG / 150° F
GAC Fill (lbs)	140	Cross Sectional Bed Area	5.6 FT^2
Shipping / Operational Weight (lbs)	200/225	Bed Depth/Volume	7.25 IN / 5 FT^3

Operation & Maintenance Manual

VFD ● VFV ● VF ● VR SERIES

Tetrasolv Filtration Vapor Filters

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

CONTENTS

1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat vapor. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

The most common application utilizes activated carbon as the adsorption media. Typically vapor which contains low levels of organic contaminants flows upward through the column of activated carbon where the larger organic molecules adhere to the porous structure of the activated carbon granules. This adsorption begins at the bottom of the “bed” and continues upward as the original adsorptive area becomes saturated.

Complete saturation of the carbon is dependent upon many factors such as contaminant levels, temperature, compounds being adsorbed, humidity, etc. Typically a carbon isotherm has been run on the influent stream to determine the expected rate of consumption of the activated carbon media. When monitoring has determined discharge air no longer meets discharge requirements the carbon will have to be removed and replaced ***(refer to section 5.0)***.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system. If you have any questions please contact Tetrasolv Filtration at the number listed below or support@tetrasolv.com.

- ***WARNING: Where system pressure may exceed design pressure we strongly recommend the use of a relief device. Exceeding the maximum pressure of the filter could result in catastrophic failure***

of the vessel.

- Always adhere to “lockout/tagout” procedures when servicing the system.

- Wear appropriate safety equipment when operating system.

♦ ***WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.***

♦ ***WARNING: High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehydes, organic acids and sulphur may cause severe temperature rises.***

- Understand the potential hazards of the stream being treated by the system. The activated carbon may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the carbon may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

♦ ***WARNING: Failure to follow the procedures outlined below can result in catastrophic damage to the system.***

Crane Lift - If a crane lift is to be used we recommend the following method. A “spreader” equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

3.3 Inspection

Perform the following inspections after un-loading the system. Note any discrepancies and contact TetraSolv immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.

- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.

- If the filters are shipped without carbon visually inspect the interior of the vessel for damaged internals.

- Inspect the carbon discharge, drain and vent valves for damage

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it’s maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped loose with the system.

The outlet piping if connected to a stack or vent should be designed to prevent the introduction of water or debris into the adsorber piping. Discharge piping should be sized equal to or greater than the diameter of the system piping or back pressure could occur creating excess pressure drop on the system.

Flowrates greater than 60 cfm / sq ft can produce bed fluidization in vapor phase filters. When this occurs carbon granules can be lifted and propelled out of the carbon bed in up-flow applications. In extreme cases large amounts of carbon can be expelled. If the system will be operating near or greater than the amount stated above please contact Tetrasolv for recommendations.

Carbon filters can be manifold in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

Vapor conditions such as high humidity and high temperature (> 125º F) can cause inefficient adsorbtion to occur. If these conditions exist contact Tetrasolv for support. Also, any free water or product and debris should be eliminated with a knockout filter prior to the vapor stream entering the system. Many other vapor issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

4.0 OPERATION

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.

4.3 Monitoring

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate media breakdown or presence of high moisture. Rapid increase in pressure drop could indicate adsorber failure.

Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

5.0 ADSORBER SERVICING

The Adsorber may be serviced on-site using a vacuum removal method. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber be checked thoroughly and any minor maintenance conducted.

5.1 Carbon Loading - Bulk Bag

- ***WARNING - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.***

Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasping it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

5.2 Carbon Loading - Vacuum Method

In this method dry-activated carbon will be loaded into to the adsorbers using a vacuum rig. To add the carbon to the filters use the following method:

WARNING: Due to the low vacuum rating of the VF series adsorbers (< 60" H_20) only experienced change-out personnel should attempt this method of re-filling. Exceeding the recommend vacuum rating could lead to failure of the superstructure of the vessel.

1. Connect a 3" vacuum source to the auxiliary connection of the adsorber to be filled.

2. Install a 16" bolted transfer lid onto the manway opening of the adsorber to be filled.

3. Turn on the vacuum and check for good flow of air through the adsorber. Connect the fill line to the transfer lid and lead enough hose to reach the fresh carbon source (Note: This should be as short of a distance as possible).

4. Begin vacuuming carbon into the adsorber. It is important to note that the loading method is actually conveying and not true vacuum. The hose should contain 1/3 air with the carbon. Closely view the adsorber being filled. If the adsorber is collasping in excessively take less carbon and more air. This is something from experience and cannot be adequately explained here.

5. When transfer is complete the transfer lid should be removed and the carbon in the adsorber should be leveled out to insure even pressure drop across the bed.

6. Close the manway and turn the adsorber back on.

> ***Note: When the system if first started up small amounts of fines may be present in the discharge stream. This is normal and should discontinue within a short period of time.***

6.0 MAINTENANCE

6.1 Extended Shutdown

If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

Monitor the system closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

TETRASOLV

VAPOR PHASE FILTRATION MEDIA :
4x10 RE-ACTIVATED CARBON

GENERAL DESCRIPTION

Select Re-Activated carbon from domestic sources is quality screened during our purchasing process for activity, density and fines. The use of re-activated carbon is recommended as a lower cost alternative for most sites where drinking water quality is not necessary. In many cases our re-activated carbon meets and exceeds imported virgin carbon. In addition all carbon either sold by itself or installed in our filtration units is traced by lot number to the installation or sale.

4*10 (Vapor Phase) Standard Specifications:	Standard	Value
Carbon Tetrachloride Activity Level	ASTM D-3467	40 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	4x10 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

Packaging:		
50 Pound Bags	50 Pound Drums	Bulk Tanker
1,000 Pound Bulk Sacks	200 Pound Drums	

APPENDIX G: INSPECTION CHECKLIST

DEC-FARMINGDALE480 **Date:**
Farmingdale Plaza Cleaners **Technician:**

SVE SYSTEM STARTUP INSPECTION CHECKLIST

Visual Inspection

_________ Check container exterior for damage/penetrations
_________ Check process piping and piping/equipment connections
_________ Check process piping mounting assemblies
_________ Check Valves (open & close valves to ensure proper operation)
_________ Check gauges (all in place? Labeled?)
_________ Check instrumentation (all in place? Labeled?)
_________ Check equipment (Damage? Defects? Labeled?)
_________ Inlet filter installed?

Electrical Inspection

_________ Main power off, locked, and tagged? (if no, do not proceed)
Check control panel interior & exterior
 _________ Free of dirt/debris/water?
 _________ Mounting hardware ok?
 _________ Free of defects?
Check wiring and connections
 _________ Wiring insulation ok?
 _________ VFD connections ok?
 _________ Telephone line connections and jacks ok?
 _________ Control panel connections ok?
 _________ EOS and autodialer connections ok?
 _________ Data loggingequipment connections ok?

Equipment Testing

_________ SVE-1, SVE-3 & SVE-5 header lines disconnected from manifold
_________ Dilution valve open 50%

SVE Blower
 record readings-
 Aux. line vac (VI-102): System influent vac (VI-104):
 SVE Blower vac (VI-106): System Influent airflow (FI-101):
 System eff. airflow (FI-102): Blower eff. pressure (PI-101):

Moisture Separator Transfer Pump
 _________ Powered on ok?
 _________ Pump turns ok?

DEC-FARMINGDALE480 **Date:**
Farmingdale Plaza Cleaners **Technician:**

SVE SYSTEM STARTUP INSPECTION CHECKLIST

System Testing

_________ SVE-1, SVE-3 & SVE-5 header lines disconnected from manifold
_________ Dilution valve open 50%

W/ System operating-
_________ Control panel lights working?
Check Gauges
_________ VI-102
_________ VI-104
_________ VI-105
_________ VI-106
_________ PI-101
_________ TI-101
_________ TI-102
_________ PI-102
_________ FI-101
_________ FI-102

APPENDIX H: DEFICIENCY REPORT FORM

DEFICIENCY REPORT

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

E.A.R. Site ID: DEC-Farmingdale480
Site Location:

Farmingdale Plaza Cleaners
450 Main Street
Farmingdale, NY

Report Date:

Reported By:

Approved By:

Control No.:

Project Name: Farmingdale Plaza Cleaners
Site No: 130107

Ref.	Item/Component	Deficiency Description

Recommended Corrective Actions

Copies To: File NYSDEC
AECOM

APPENDIX I: SITE DATA INFORMATION SHEET

FARMINGDALE PLAZA CLEANERS
450-480 Main Street
Farmingdale, NY
Site No. 130107
EAR ID: DEC-Farmingdale480

DATE:
TECHNICIAN:

PARAMETER	LOCATION		UNITS	BEFORE ADJUSTMENTS	AFTER ADJUSTMENTS	COMMENTS
Vacuum	SVE-1 Influent (Manifold)	VI-101	Inches of Water			
	SVE-3 Influent (Manifold)		Inches of Water			
	SVE-5 Influent (Manifold)	VI-102	Inches of Water			
	System Influent	VI-104	Inches of Water			
	Moisture Separator	VI-105	Inches of Water			
	SVE Blower	VI-106	Inches of Water			
Pressure	SVE Blower Effluent	PI-101	Inches of Water			
		PI-102	Inches of Water			
Air Flow	System Influent (ΔP)	FI-101	Inches of Water			
	SVE Blower Effluent (ΔP)	FI-102	Inches of Water			
	SVE-1 Influent (Manifold)	Instr	FPM			
	SVE-3 Influent (Manifold)	Instr	FPM			
	SVE-5 Influent (Manifold)	Instr	FPM			
Temperature	Pre Moisture Separator	TI-101	°F			
	SVE Blower Effluent	TI-102	°F			
	SVE-1 Influent (Manifold)	Instr	°F			
	SVE-3 Influent (Manifold)	Instr	°F			
	SVE-5 Influent (Manifold)	Instr	°F			
Concentrations	SVE-1 Influent (Manifold)	Instr	ppm			
	SVE-3 Influent (Manifold)	Instr	ppm			
	SVE-5 Influent (Manifold)	Instr	ppm			
	Moisture Separator	Instr	ppm			
	Pre-Carbon	Instr	ppm			
	Mid Carbon	Instr	ppm			
	Post Carbon	Instr	ppm			
Level	Moisture Separator Liquid Level	T-101	Inches			
	Condensate Storage Drum		% Full			
Misc	Dilution Valve		% Open			
	Heater		On/Off			
	Ventilation		On/Off			
	VFD		Hz			
				TIME	**HR METER READING**	
Runtime	Control Power Hour Meter		Hours			
	SVE Blower Hour Meter		Hours			

Notes:

APPENDIX J: INSPECTION, MAINTENANCE & LUBRICATION SCHEDULE

FARMINGDALE PLAZA CLEANERS
450-480 Main Street
Farmingdale, NY
Site No. 130107
EAR ID: DEC-Farmingdale480

DATE:
TECHNICIAN:

ENVIRONMENTAL ASSESSMENT & REMEDIATIONS

Inspection, Maintenance & Lubrication Schedule

Maintenance Item		Frequency	Completed (yes/no)	Date Last Conducted	Comments
Dilution Air Filter					
-Inspect		bi-weekly			
Blower Inlet Filter					
-Inspect		bi-weekly			
-Replace		as required			
SVE Blower	**B-101**				
-Inspect		bi-weekly			
-Replace Bearings		Every 25,000 working hours			
Moisture Separator					
-Inspect		bi-weekly			
-Test LSHH Switch		monthly			
-Pumped Out		as required			
Transfer Pump	**TP-101**				
-Inspect		monthly			
-Lubricate		close-coupled - no lubrication necessary			
GAC Vessel #1	**VGAC-201**				
-Inspect		bi-weekly			
-Note lead, lag, or bypassed		bi-weekly			
GAC Vessel #2	**VGAC-202**				
-Inspect		bi-weekly			
-Note lead, lag, or bypassed		bi-weekly			
Alarms		quarterly			
Heater		as required			
Ventilation		as required			
Lighting		monthly			
Piping		bi-weekly			
Gauges		bi-weekly			
Container		bi-weekly			
Fenced Enclosure		bi-weekly			
Manholes		bi-weekly			
Well Caps/Plugs		monthly			

Notes:

APPENDIX K: LAB ANALYTICAL REPORT – CONDENSATE SAMPLE

ANALYTICAL REPORT

Job Number: 460-35505-1

Job Description: 130107 DEC Farmingdale 480

For:
Long Island Environmental Assessment
dba Env Assessment & Remediation
225 Atlantic Avenue
Patchogue, NY 11772

Attention: Mr. Ian Hofmann

Approved for release.
Larry Decker
Project Manager I
1/17/2012 1:49 PM

Larry Decker
Project Manager I
larry.decker@testamericainc.com
01/17/2012

The test results in this report meet all NELAP requirements unless specified within the case narrative. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory. All questions regarding this report should be directed to the TestAmerica Edison Project Manager.

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TestAmerica Laboratories, Inc.
TestAmerica Edison 777 New Durham Road, Edison, NJ 08817
Tel (732) 549-3900 Fax (732) 549-3679 www.testamericainc.com

Table of Contents

CASE NARRATIVE

Client: Long Island Environmental Assessment

Project: 130107 DEC Farmingdale 480

Report Number: 460-35505-1

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

It should be noted that samples with elevated Reporting Limits (RLs) as a result of a dilution may not be able to satisfy customer reporting limits in some cases. Such increases in the RLs are unavoidable but acceptable consequence of sample dilution that enables quantification of target analytes or interferences which exceed the calibration range of the instrument.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The samples were received on 01/07/2012; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 2.1 C.

Note: All samples which require thermal preservation are considered acceptable if the arrival temperature is within 2C of the required temperature or method specified range. For samples with a specified temperature of 4C, samples with a temperature ranging from just above freezing temperature of water to 6C shall be acceptable. Samples that are hand delivered immediately following collection may not meet these criteria, however they will be deemed acceptable according to NELAC standards, if there is evidence that the chilling process has begun, such as arrival on ice, etc.

IGNITABILITY
Sample 460-35505-1 was analyzed for Ignitability in accordance with EPA SW-846 Method 1020A. The samples were analyzed on 01/13/2012.

No difficulties were encountered during the Ignitability analysis.

All quality control parameters were within the acceptance limits.

TOTAL METALS
Sample 460-35505-1 was analyzed for total metals in accordance with EPA SW-846 Method 6010B. The samples were prepared on 01/11/2012 and analyzed on 01/12/2012.

No difficulties were encountered during the metals analysis.

All quality control parameters were within the acceptance limits.

TOTAL MERCURY
Sample 460-35505-1 was analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared and analyzed on 01/11/2012.

No difficulties were encountered during the mercury analysis.

All quality control parameters were within the acceptance limits.

VOLATILE ORGANIC COMPOUNDS (GC-MS)
Sample 460-35505-1 was analyzed for volatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 01/12/2012.

No difficulties were encountered during the volatiles analysis.

All quality control parameters were within the acceptance limits.

SEMIVOLATILE ORGANIC COMPOUNDS (GC-MS)

Sample 460-35505-1 was analyzed for semivolatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 8270C. The samples were prepared on 01/11/2012 and analyzed on 01/12/2012.

Atrazine failed the recovery criteria low for LCS 460-98698/2-A. Benzaldehyde and Benzo[a]pyrene failed the recovery criteria high. Atrazine failed the recovery criteria low for LCSD 460-98698/3-A. Benzaldehyde and Benzo[a]pyrene failed the recovery criteria high. Refer to the QC report for details.

No other difficulties were encountered during the semivolatiles analysis.

All other quality control parameters were within the acceptance limits.

TOTAL ORGANIC HALIDES

Sample 460-35505-1 was analyzed for total organic halides in accordance with EPA SW-846 Method 9020B. The samples were prepared and analyzed on 01/12/2012.

No difficulties were encountered during the TOX analysis.

All quality control parameters were within the acceptance limits.

EXECUTIVE SUMMARY - Detections

Client: Long Island Environmental Assessment　　　　Job Number: 460-35505-1

Lab Sample ID / Analyte	Client Sample ID	Result	Qualifier	Reporting Limit	Units	Method
460-35505-1	**CONDENSATE**					
Acetone		12		5.0	ug/L	8260B
2-Butanone		5.8		5.0	ug/L	8260B
Barium		223		200	ug/L	6010B
Ignitability		>160			Degrees F	1020A

METHOD SUMMARY

Client: Long Island Environmental Assessment — Job Number: 460-35505-1

Description	Lab Location	Method	Preparation Method
Matrix: Water			
Volatile Organic Compounds (GC/MS)	TAL EDI	SW846 8260B	
Purge and Trap	TAL EDI		SW846 5030B
Semivolatile Organic Compounds (GC/MS)	TAL EDI	SW846 8270C	
Liquid-Liquid Extraction (Separatory Funnel)			SW846 3510C
Metals (ICP)	TAL EDI	SW846 6010B	
Preparation, Total Metals			SW846 3010A
Mercury (CVAA)	TAL EDI	SW846 7470A	
Preparation, Mercury			SW846 7470A
Ignitability, Setaflash Closed-Cup Method	TAL EDI	SW846 1020A	
Organic Halides, Total (TOX)	TAL SAV	SW846 9020B	
Carbon Trap Preparation			EPA-17 Carbon Trap

Lab References:

TAL EDI = TestAmerica Edison

TAL SAV = TestAmerica Savannah

Method References:

EPA-17 = "Method 1650, Revision A, Adsorbable Organic Halides By Adsorption And Colormetric Titration," EPA, February 1992

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

METHOD / ANALYST SUMMARY

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method	Analyst	Analyst ID
SW846 8260B	Desai, Saurab	SD
SW846 8270C	Crocco, Michael	MC
SW846 6010B	Chang, Churn Der	CDC
SW846 7470A	Sheikh, Razia B	RBS
SW846 1020A	Carlone, John	JC
SW846 9020B	Nelson, Christopher	CN

SAMPLE SUMMARY

Client: Long Island Environmental Assessment   Job Number: 460-35505-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
460-35505-1	Condensate	Water	01/05/2012 1130	01/07/2012 1722

SAMPLE RESULTS

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Client Sample ID: Condensate

Lab Sample ID: 460-35505-1 | Date Sampled: 01/05/2012 1130
Client Matrix: Water | Date Received: 01/07/2012 1722

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	c64478.d
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 1547			Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 1547				

Analyte	Result (ug/L)	Qualifier	MDL	RL
Dichlorodifluoromethane	1.0	U	0.29	1.0
Chloromethane	1.0	U	0.21	1.0
Bromomethane	1.0	U	0.31	1.0
Vinyl chloride	1.0	U	0.13	1.0
Chloroethane	1.0	U	0.45	1.0
Trichlorofluoromethane	1.0	U	0.16	1.0
Freon TF	1.0	U	0.28	1.0
Methylene Chloride	1.0	U	0.19	1.0
Acetone	12		2.5	5.0
Carbon disulfide	1.0	U	0.15	1.0
Methyl acetate	2.0	U	0.33	2.0
1,1-Dichloroethene	1.0	U	0.14	1.0
1,1-Dichloroethane	1.0	U	0.10	1.0
cis-1,2-Dichloroethene	1.0	U	0.20	1.0
trans-1,2-Dichloroethene	1.0	U	0.14	1.0
MTBE	1.0	U	0.18	1.0
Chloroform	1.0	U	0.15	1.0
1,2-Dichloroethane	1.0	U	0.24	1.0
2-Butanone	5.8		0.82	5.0
1,1,1-Trichloroethane	1.0	U	0.25	1.0
Cyclohexane	1.0	U	0.13	1.0
Carbon tetrachloride	1.0	U	0.19	1.0
Bromodichloromethane	1.0	U	0.093	1.0
1,2-Dichloropropane	1.0	U	0.090	1.0
cis-1,3-Dichloropropene	1.0	U	0.11	1.0
Trichloroethene	1.0	U	0.18	1.0
Methylcyclohexane	1.0	U	0.090	1.0
Dibromochloromethane	1.0	U	0.11	1.0
1,1,2-Trichloroethane	1.0	U	0.10	1.0
Benzene	1.0	U	0.13	1.0
trans-1,3-Dichloropropene	1.0	U	0.12	1.0
Bromoform	1.0	U	0.10	1.0
Isopropylbenzene	1.0	U	0.21	1.0
4-Methyl-2-pentanone	5.0	U	0.68	5.0
2-Hexanone	5.0	U	0.55	5.0
Tetrachloroethene	1.0	U	0.20	1.0
Toluene	1.0	U	0.090	1.0
1,1,2,2-Tetrachloroethane	1.0	U	0.090	1.0
Chlorobenzene	1.0	U	0.16	1.0
Ethylbenzene	1.0	U	0.25	1.0
Xylenes, Total	3.0	U	0.43	3.0
Styrene	1.0	U	0.13	1.0
1,2-Dibromo-3-Chloropropane	1.0	U	0.15	1.0
1,3-Dichlorobenzene	1.0	U	0.22	1.0
1,4-Dichlorobenzene	1.0	U	0.15	1.0
1,2-Dichlorobenzene	1.0	U	0.16	1.0

Analytical Data

Client: Long Island Environmental Assessment　　　　Job Number: 460-35505-1

Client Sample ID: **Condensate**

Lab Sample ID:	460-35505-1	Date Sampled:	01/05/2012 1130
Client Matrix:	Water	Date Received:	01/07/2012 1722

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	c64478.d
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 1547			Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 1547				

Analyte	Result (ug/L)	Qualifier	MDL	RL
1,2,4-Trichlorobenzene	1.0	U	0.44	1.0
1,2-Dibromoethane	1.0	U	0.090	1.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	115		70 - 122
Toluene-d8 (Surr)	97		69 - 125
Bromofluorobenzene	102		69 - 135

Analytical Data

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Client Sample ID: **Condensate**

Lab Sample ID: 460-35505-1 | Date Sampled: 01/05/2012 1130
Client Matrix: Water | Date Received: 01/07/2012 1722

8270C Semivolatile Organic Compounds (GC/MS)

Analysis Method:	8270C	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Prep Method:	3510C	Prep Batch:	460-98698	Lab File ID:	z13279.d
Dilution:	1.0			Initial Weight/Volume:	980 mL
Analysis Date:	01/12/2012 0438			Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Benzaldehyde	10	U *	2.0	10
Phenol	10	U	0.83	10
Bis(2-chloroethyl)ether	1.0	U	0.29	1.0
2-Chlorophenol	10	U	2.2	10
2-Methylphenol	10	U	1.8	10
Acetophenone	10	U	2.8	10
N-Nitrosodi-n-propylamine	1.0	U	0.26	1.0
Hexachloroethane	1.0	U	0.26	1.0
Nitrobenzene	1.0	U	0.31	1.0
Isophorone	10	U	2.8	10
2-Nitrophenol	10	U	2.4	10
2,4-Dimethylphenol	10	U	3.5	10
Bis(2-chloroethoxy)methane	10	U	2.7	10
2,4-Dichlorophenol	10	U	2.7	10
Naphthalene	10	U	2.8	10
4-Chloroaniline	10	U	2.0	10
Hexachlorobutadiene	2.0	U	0.58	2.0
Caprolactam	10	U	2.6	10
4-Chloro-3-methylphenol	10	U	2.6	10
2-Methylnaphthalene	10	U	3.1	10
Hexachlorocyclopentadiene	10	U	1.7	10
2,4,6-Trichlorophenol	10	U	2.4	10
2,4,5-Trichlorophenol	10	U	2.7	10
2-Chloronaphthalene	10	U	2.8	10
2-Nitroaniline	20	U	5.0	20
Dimethyl phthalate	10	U	2.9	10
Acenaphthylene	10	U	2.8	10
2,6-Dinitrotoluene	2.0	U	0.62	2.0
3-Nitroaniline	20	U	5.1	20
Acenaphthene	10	U	2.8	10
2,4-Dinitrophenol	31	U	5.5	31
4-Nitrophenol	31	U	6.8	31
Dibenzofuran	10	U	2.9	10
2,4-Dinitrotoluene	2.0	U	0.48	2.0
Diethyl phthalate	10	U	3.0	10
4-Chlorophenyl phenyl ether	10	U	2.6	10
Fluorene	10	U	2.9	10
4-Nitroaniline	20	U	5.9	20
4,6-Dinitro-2-methylphenol	31	U	4.8	31
N-Nitrosodiphenylamine	10	U	3.0	10
4-Bromophenyl phenyl ether	10	U	2.6	10
Hexachlorobenzene	1.0	U	0.30	1.0
Atrazine	10	U *	3.1	10
Pentachlorophenol	31	U	5.4	31
Phenanthrene	10	U	3.2	10
Anthracene	10	U	2.9	10

Analytical Data

Client: Long Island Environmental Assessment　　Job Number: 460-35505-1

Client Sample ID: **Condensate**

Lab Sample ID: 460-35505-1　　Date Sampled: 01/05/2012 1130
Client Matrix: Water　　Date Received: 01/07/2012 1722

8270C Semivolatile Organic Compounds (GC/MS)

Analysis Method:	8270C	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Prep Method:	3510C	Prep Batch:	460-98698	Lab File ID:	z13279.d
Dilution:	1.0			Initial Weight/Volume:	980 mL
Analysis Date:	01/12/2012 0438			Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Carbazole	10	U	3.3	10
Di-n-butyl phthalate	10	U	3.0	10
Fluoranthene	10	U	3.3	10
Pyrene	10	U	3.0	10
Butyl benzyl phthalate	10	U	2.6	10
3,3'-Dichlorobenzidine	20	U	5.0	20
Benzo[a]anthracene	1.0	U	0.28	1.0
Chrysene	10	U	3.2	10
Bis(2-ethylhexyl) phthalate	10	U	2.0	10
Di-n-octyl phthalate	10	U	1.5	10
Benzo[b]fluoranthene	1.0	U	0.27	1.0
Benzo[k]fluoranthene	1.0	U	0.27	1.0
Benzo[a]pyrene	1.0	U *	0.14	1.0
Indeno[1,2,3-cd]pyrene	1.0	U	0.15	1.0
Dibenz(a,h)anthracene	1.0	U	0.092	1.0
Benzo[g,h,i]perylene	10	U	2.0	10
Diphenyl	10	U	2.9	10
4-Methylphenol	10	U	1.6	10
bis (2-chloroisopropyl) ether	10	U	2.0	10

Surrogate	%Rec	Qualifier	Acceptance Limits
2-Fluorophenol	58		10 - 65
2-Fluorobiphenyl	90		53 - 108
Phenol-d5	38		10 - 48
Nitrobenzene-d5	93		56 - 112
2,4,6-Tribromophenol	82		46 - 122
Terphenyl-d14	102		50 - 122

Analytical Data

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Client Sample ID: Condensate

Lab Sample ID: 460-35505-1 Date Sampled: 01/05/2012 1130
Client Matrix: Water Date Received: 01/07/2012 1722

6010B Metals (ICP)

Analysis Method:	6010B	Analysis Batch:	460-98806	Instrument ID:	ICP4
Prep Method:	3010A	Prep Batch:	460-98614	Lab File ID:	01122012.asc
Dilution:	1.0			Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 1437			Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				

Analyte	Result (ug/L)	Qualifier	MDL	RL
Arsenic	5.0	U	3.7	5.0
Barium	223		5.9	200
Cadmium	5.0	U	0.82	5.0
Chromium	10.0	U	4.5	10.0
Lead	5.0	U	4.0	5.0
Selenium	10.0	U	5.8	10.0
Silver	10.0	U	1.3	10.0

7470A Mercury (CVAA)

Analysis Method:	7470A	Analysis Batch:	460-98677	Instrument ID:	LEEMAN3
Prep Method:	7470A	Prep Batch:	460-98621	Lab File ID:	98620hg1.PRN
Dilution:	1.0			Initial Weight/Volume:	30 mL
Analysis Date:	01/11/2012 1636			Final Weight/Volume:	30 mL
Prep Date:	01/11/2012 1117				

Analyte	Result (ug/L)	Qualifier	MDL	RL
Mercury	0.20	U	0.16	0.20

General Chemistry

Client Sample ID: Condensate

Lab Sample ID: 460-35505-1
Client Matrix: Water

Date Sampled: 01/05/2012 1130
Date Received: 01/07/2012 1722

Analyte		Result	Qual	Units	MDL	RL	Dil	Method
Halogens, Total Organic		0.020	U	mg/L	0.0070	0.020	2.0	9020B
	Analysis Batch: 680-226034	Analysis Date: 01/12/2012 1723						
	Prep Batch: 680-226032	Prep Date: 01/12/2012 0730						
TOX Result 1		0.020	U	mg/L	0.0070	0.020	2.0	9020B
	Analysis Batch: 680-226034	Analysis Date: 01/12/2012 1723						
	Prep Batch: 680-226032	Prep Date: 01/12/2012 0730						
TOX Result 2		0.020	U	mg/L	0.0070	0.020	2.0	9020B
	Analysis Batch: 680-226034	Analysis Date: 01/12/2012 1723						
	Prep Batch: 680-226032	Prep Date: 01/12/2012 0730						

Analyte		Result	Qual	Units	Dil	Method
Ignitability		>160		Degrees F	1.0	1020A
	Analysis Batch: 460-98956	Analysis Date: 01/13/2012 1740				

DATA REPORTING QUALIFIERS

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Section	Qualifier	Description
GC/MS VOA		
	U	Analyzed for but not detected.
GC/MS Semi VOA		
	U	Analyzed for but not detected.
	*	LCS or LCSD exceeds the control limits
Metals		
	U	Indicates analyzed for but not detected.
General Chemistry		
	U	Indicates analyzed for but not detected.

QUALITY CONTROL RESULTS

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

QC Association Summary

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
GC/MS VOA					
Analysis Batch:460-98737					
LCS 460-98737/3	Lab Control Sample	T	Water	8260B	
MB 460-98737/4	Method Blank	T	Water	8260B	
460-35505-1	Condensate	T	Water	8260B	

Report Basis
T = Total

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
GC/MS Semi VOA					
Prep Batch: 460-98698					
LCS 460-98698/2-A	Lab Control Sample	T	Water	3510C	
LCSD 460-98698/3-A	Lab Control Sample Duplicate	T	Water	3510C	
MB 460-98698/1-A	Method Blank	T	Water	3510C	
460-35505-1	Condensate	T	Water	3510C	
Analysis Batch:460-98777					
LCS 460-98698/2-A	Lab Control Sample	T	Water	8270C	460-98698
LCSD 460-98698/3-A	Lab Control Sample Duplicate	T	Water	8270C	460-98698
MB 460-98698/1-A	Method Blank	T	Water	8270C	460-98698
460-35505-1	Condensate	T	Water	8270C	460-98698

Report Basis
T = Total

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

QC Association Summary

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
Metals					
Prep Batch: 460-98614					
LCS 460-98614/2-A	Lab Control Sample	T	Water	3010A	
MB 460-98614/1-A	Method Blank	T	Water	3010A	
460-35505-1	Condensate	T	Water	3010A	
Prep Batch: 460-98621					
LCS 460-98621/2-A	Lab Control Sample	T	Water	7470A	
MB 460-98621/1-A	Method Blank	T	Water	7470A	
460-35505-1	Condensate	T	Water	7470A	
Analysis Batch:460-98677					
LCS 460-98621/2-A	Lab Control Sample	T	Water	7470A	460-98621
MB 460-98621/1-A	Method Blank	T	Water	7470A	460-98621
460-35505-1	Condensate	T	Water	7470A	460-98621
Analysis Batch:460-98806					
LCS 460-98614/2-A	Lab Control Sample	T	Water	6010B	460-98614
MB 460-98614/1-A	Method Blank	T	Water	6010B	460-98614
460-35505-1	Condensate	T	Water	6010B	460-98614
Analysis Batch:460-98855					
MB 460-98614/1-A	Method Blank	T	Water	6010B	460-98614

Report Basis
T = Total

Lab Sample ID	Client Sample ID	Report Basis	Client Matrix	Method	Prep Batch
General Chemistry					
Analysis Batch:460-98956					
460-35505-1	Condensate	T	Water	1020A	
460-35505-1DU	Duplicate	T	Water	1020A	
Prep Batch: 680-226032					
460-35505-1	Condensate	T	Water	Carbon Trap	
460-35505-1MS	Matrix Spike	T	Water	Carbon Trap	
460-35505-1MSD	Matrix Spike Duplicate	T	Water	Carbon Trap	
Analysis Batch:680-226034					
460-35505-1	Condensate	T	Water	9020B	680-226032
460-35505-1MS	Matrix Spike	T	Water	9020B	680-226032
460-35505-1MSD	Matrix Spike Duplicate	T	Water	9020B	680-226032

Report Basis
T = Total

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Surrogate Recovery Report

8260B Volatile Organic Compounds (GC/MS)

Client Matrix: Water

Lab Sample ID	Client Sample ID	DCA %Rec	TOL %Rec	BFB %Rec
460-35505-1	Condensate	115	97	102
MB 460-98737/4		115	97	105
LCS 460-98737/3		107	100	102

Surrogate	Acceptance Limits
DCA = 1,2-Dichloroethane-d4 (Surr)	70-122
TOL = Toluene-d8 (Surr)	69-125
BFB = Bromofluorobenzene	69-135

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Surrogate Recovery Report

8270C Semivolatile Organic Compounds (GC/MS)

Client Matrix: Water

Lab Sample ID	Client Sample ID	2FP %Rec	FBP %Rec	PHL %Rec	NBZ %Rec	TBP %Rec	TPH %Rec
460-35505-1	Condensate	58	90	38	93	82	102
MB 460-98698/1-A		57	91	38	93	94	96
LCS 460-98698/2-A		56	87	37	87	82	94
LCSD 460-98698/3-A		54	87	35	86	83	94

Surrogate	Acceptance Limits
2FP = 2-Fluorophenol	10-65
FBP = 2-Fluorobiphenyl	53-108
PHL = Phenol-d5	10-48
NBZ = Nitrobenzene-d5	56-112
TBP = 2,4,6-Tribromophenol	46-122
TPH = Terphenyl-d14	50-122

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method Blank - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	MB 460-98737/4	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64461.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0921	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0921				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Dichlorodifluoromethane	1.0	U	0.29	1.0
Chloromethane	1.0	U	0.21	1.0
Bromomethane	1.0	U	0.31	1.0
Vinyl chloride	1.0	U	0.13	1.0
Chloroethane	1.0	U	0.45	1.0
Trichlorofluoromethane	1.0	U	0.16	1.0
Freon TF	1.0	U	0.28	1.0
Methylene Chloride	1.0	U	0.19	1.0
Acetone	5.0	U	2.5	5.0
Carbon disulfide	1.0	U	0.15	1.0
Methyl acetate	2.0	U	0.33	2.0
1,1-Dichloroethene	1.0	U	0.14	1.0
1,1-Dichloroethane	1.0	U	0.10	1.0
cis-1,2-Dichloroethene	1.0	U	0.20	1.0
trans-1,2-Dichloroethene	1.0	U	0.14	1.0
MTBE	1.0	U	0.18	1.0
Chloroform	1.0	U	0.15	1.0
1,2-Dichloroethane	1.0	U	0.24	1.0
2-Butanone	5.0	U	0.82	5.0
1,1,1-Trichloroethane	1.0	U	0.25	1.0
Cyclohexane	1.0	U	0.13	1.0
Carbon tetrachloride	1.0	U	0.19	1.0
Bromodichloromethane	1.0	U	0.093	1.0
1,2-Dichloropropane	1.0	U	0.090	1.0
cis-1,3-Dichloropropene	1.0	U	0.11	1.0
Trichloroethene	1.0	U	0.18	1.0
Methylcyclohexane	1.0	U	0.090	1.0
Dibromochloromethane	1.0	U	0.11	1.0
1,1,2-Trichloroethane	1.0	U	0.10	1.0
Benzene	1.0	U	0.13	1.0
trans-1,3-Dichloropropene	1.0	U	0.12	1.0
Bromoform	1.0	U	0.10	1.0
Isopropylbenzene	1.0	U	0.21	1.0
4-Methyl-2-pentanone	5.0	U	0.68	5.0
2-Hexanone	5.0	U	0.55	5.0
Tetrachloroethene	1.0	U	0.20	1.0
Toluene	1.0	U	0.090	1.0
1,1,2,2-Tetrachloroethane	1.0	U	0.090	1.0
Chlorobenzene	1.0	U	0.16	1.0
Ethylbenzene	1.0	U	0.25	1.0
Xylenes, Total	3.0	U	0.43	3.0
Styrene	1.0	U	0.13	1.0
1,2-Dibromo-3-Chloropropane	1.0	U	0.15	1.0
1,3-Dichlorobenzene	1.0	U	0.22	1.0
1,4-Dichlorobenzene	1.0	U	0.15	1.0

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Method Blank - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	MB 460-98737/4	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64461.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0921	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0921				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
1,2-Dichlorobenzene	1.0	U	0.16	1.0
1,2,4-Trichlorobenzene	1.0	U	0.44	1.0
1,2-Dibromoethane	1.0	U	0.090	1.0

Surrogate	% Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	115	70 - 122
Toluene-d8 (Surr)	97	69 - 125
Bromofluorobenzene	105	69 - 135

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Control Sample - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	LCS 460-98737/3	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64459.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0831	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0831				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Dichlorodifluoromethane	20.0	14.9	75	46 - 145	
Chloromethane	20.0	19.3	97	58 - 146	
Bromomethane	20.0	14.6	73	55 - 153	
Vinyl chloride	20.0	16.6	83	61 - 144	
Chloroethane	20.0	17.4	87	69 - 145	
Trichlorofluoromethane	20.0	17.3	87	69 - 147	
Freon TF	20.0	21.3	106	47 - 139	
Methylene Chloride	20.0	20.2	101	79 - 119	
Acetone	20.0	17.2	86	45 - 156	
Carbon disulfide	20.0	18.2	91	58 - 139	
Methyl acetate	20.0	17.9	89	50 - 151	
1,1-Dichloroethene	20.0	18.8	94	56 - 139	
1,1-Dichloroethane	20.0	19.3	97	78 - 122	
cis-1,2-Dichloroethene	20.0	18.4	92	80 - 120	
trans-1,2-Dichloroethene	20.0	19.0	95	75 - 122	
MTBE	20.0	20.3	101	71 - 115	
Chloroform	20.0	19.7	98	82 - 123	
1,2-Dichloroethane	20.0	20.6	103	74 - 118	
2-Butanone	20.0	16.5	82	65 - 114	
1,1,1-Trichloroethane	20.0	17.9	90	74 - 128	
Cyclohexane	20.0	17.2	86	58 - 133	
Carbon tetrachloride	20.0	18.2	91	73 - 120	
Bromodichloromethane	20.0	18.5	92	79 - 119	
1,2-Dichloropropane	20.0	17.9	89	80 - 120	
cis-1,3-Dichloropropene	20.0	19.8	99	80 - 120	
Trichloroethene	20.0	17.4	87	78 - 119	
Methylcyclohexane	20.0	18.1	90	61 - 129	
Dibromochloromethane	20.0	18.7	94	80 - 120	
1,1,2-Trichloroethane	20.0	18.7	93	79 - 119	
Benzene	20.0	18.8	94	83 - 124	
trans-1,3-Dichloropropene	20.0	19.4	97	78 - 118	
Bromoform	20.0	16.5	82	73 - 123	
Isopropylbenzene	20.0	17.8	89	80 - 125	
4-Methyl-2-pentanone	20.0	17.8	89	53 - 120	
2-Hexanone	20.0	16.7	84	53 - 121	
Tetrachloroethene	20.0	18.0	90	68 - 139	
Toluene	20.0	18.3	91	80 - 120	
1,1,2,2-Tetrachloroethane	20.0	19.7	98	74 - 126	
Chlorobenzene	20.0	19.0	95	81 - 121	
Ethylbenzene	20.0	18.2	91	79 - 126	
Xylenes, Total	60.0	56.7	94	76 - 121	

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Lab Control Sample - Batch: 460-98737

Method: 8260B
Preparation: 5030B

Lab Sample ID:	LCS 460-98737/3	Analysis Batch:	460-98737	Instrument ID:	VOAMS3
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	c64459.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	5 mL
Analysis Date:	01/12/2012 0831	Units:	ug/L	Final Weight/Volume:	5 mL
Prep Date:	01/12/2012 0831				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Styrene	20.0	19.4	97	69 - 112	
1,2-Dibromo-3-Chloropropane	20.0	19.2	96	70 - 116	
1,3-Dichlorobenzene	20.0	19.2	96	81 - 126	
1,4-Dichlorobenzene	20.0	18.7	93	83 - 123	
1,2-Dichlorobenzene	20.0	18.7	94	82 - 122	
1,2,4-Trichlorobenzene	20.0	16.6	83	66 - 120	
1,2-Dibromoethane	20.0	18.5	93	78 - 118	

Surrogate	% Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	107	70 - 122
Toluene-d8 (Surr)	100	69 - 125
Bromofluorobenzene	102	69 - 135

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Method Blank - Batch: 460-98698

Method: 8270C
Preparation: 3510C

Lab Sample ID:	MB 460-98698/1-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13274.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0239	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Benzaldehyde	10	U	2.0	10
Phenol	10	U	0.81	10
Bis(2-chloroethyl)ether	1.0	U	0.28	1.0
2-Chlorophenol	10	U	2.2	10
2-Methylphenol	10	U	1.8	10
Acetophenone	10	U	2.7	10
N-Nitrosodi-n-propylamine	1.0	U	0.25	1.0
Hexachloroethane	1.0	U	0.25	1.0
Nitrobenzene	1.0	U	0.30	1.0
Isophorone	10	U	2.7	10
2-Nitrophenol	10	U	2.4	10
2,4-Dimethylphenol	10	U	3.4	10
Bis(2-chloroethoxy)methane	10	U	2.6	10
2,4-Dichlorophenol	10	U	2.6	10
Naphthalene	10	U	2.7	10
4-Chloroaniline	10	U	2.0	10
Hexachlorobutadiene	2.0	U	0.57	2.0
Caprolactam	10	U	2.5	10
4-Chloro-3-methylphenol	10	U	2.5	10
2-Methylnaphthalene	10	U	3.0	10
Hexachlorocyclopentadiene	10	U	1.7	10
2,4,6-Trichlorophenol	10	U	2.4	10
2,4,5-Trichlorophenol	10	U	2.6	10
2-Chloronaphthalene	10	U	2.7	10
2-Nitroaniline	20	U	4.9	20
Dimethyl phthalate	10	U	2.8	10
Acenaphthylene	10	U	2.7	10
2,6-Dinitrotoluene	2.0	U	0.61	2.0
3-Nitroaniline	20	U	5.0	20
Acenaphthene	10	U	2.7	10
2,4-Dinitrophenol	30	U	5.4	30
4-Nitrophenol	30	U	6.7	30
Dibenzofuran	10	U	2.8	10
2,4-Dinitrotoluene	2.0	U	0.47	2.0
Diethyl phthalate	10	U	2.9	10
4-Chlorophenyl phenyl ether	10	U	2.5	10
Fluorene	10	U	2.8	10
4-Nitroaniline	20	U	5.8	20
4,6-Dinitro-2-methylphenol	30	U	4.7	30
N-Nitrosodiphenylamine	10	U	2.9	10
4-Bromophenyl phenyl ether	10	U	2.5	10
Hexachlorobenzene	1.0	U	0.29	1.0
Atrazine	10	U	3.0	10
Pentachlorophenol	30	U	5.3	30
Phenanthrene	10	U	3.1	10

Client: Long Island Environmental Assessment　　Job Number: 460-35505-1

Method Blank - Batch: 460-98698　　**Method: 8270C**
Preparation: 3510C

Lab Sample ID:	MB 460-98698/1-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13274.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0239	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Anthracene	10	U	2.8	10
Carbazole	10	U	3.2	10
Di-n-butyl phthalate	10	U	2.9	10
Fluoranthene	10	U	3.2	10
Pyrene	10	U	2.9	10
Butyl benzyl phthalate	10	U	2.5	10
3,3'-Dichlorobenzidine	20	U	4.9	20
Benzo[a]anthracene	1.0	U	0.27	1.0
Chrysene	10	U	3.1	10
Bis(2-ethylhexyl) phthalate	10	U	2.0	10
Di-n-octyl phthalate	10	U	1.5	10
Benzo[b]fluoranthene	1.0	U	0.26	1.0
Benzo[k]fluoranthene	1.0	U	0.26	1.0
Benzo[a]pyrene	1.0	U	0.14	1.0
Indeno[1,2,3-cd]pyrene	1.0	U	0.15	1.0
Dibenz(a,h)anthracene	1.0	U	0.090	1.0
Benzo[g,h,i]perylene	10	U	2.0	10
Diphenyl	10	U	2.8	10
4-Methylphenol	10	U	1.6	10
bis (2-chloroisopropyl) ether	10	U	2.0	10

Surrogate	% Rec	Acceptance Limits
2-Fluorophenol	57	10 - 65
2-Fluorobiphenyl	91	53 - 108
Phenol-d5	38	10 - 48
Nitrobenzene-d5	93	56 - 112
2,4,6-Tribromophenol	94	46 - 122
Terphenyl-d14	96	50 - 122

Quality Control Results

Client: Long Island Environmental Assessment — Job Number: 460-35505-1

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 460-98698

Method: 8270C
Preparation: 3510C

LCS Lab Sample ID:	LCS 460-98698/2-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13291.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0926	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

LCSD Lab Sample ID:	LCSD 460-98698/3-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13292.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0949	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

	% Rec.						
Analyte	LCS	LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Benzaldehyde	205	202	52 - 150	2	30	*	*
Phenol	43	41	12 - 44	4	30		
Bis(2-chloroethyl)ether	80	78	62 - 108	3	30		
2-Chlorophenol	93	90	53 - 101	3	30		
2-Methylphenol	85	82	40 - 90	3	30		
Acetophenone	73	72	68 - 109	2	30		
N-Nitrosodi-n-propylamine	87	84	70 - 109	4	30		
Hexachloroethane	83	79	50 - 99	4	30		
Nitrobenzene	87	85	66 - 106	3	30		
Isophorone	81	80	68 - 108	2	30		
2-Nitrophenol	94	93	65 - 107	1	30		
2,4-Dimethylphenol	94	94	55 - 100	0	30		
Bis(2-chloroethoxy)methane	92	90	69 - 108	2	30		
2,4-Dichlorophenol	97	95	64 - 107	2	30		
Naphthalene	86	84	63 - 101	3	30		
4-Chloroaniline	86	85	58 - 105	1	30		
Hexachlorobutadiene	85	84	52 - 99	1	30		
Caprolactam	26	26	10 - 30	2	30		
4-Chloro-3-methylphenol	96	95	57 - 106	1	30		
2-Methylnaphthalene	84	83	66 - 102	1	30		
Hexachlorocyclopentadiene	72	69	40 - 105	4	30		
2,4,6-Trichlorophenol	96	96	67 - 111	0	30		
2,4,5-Trichlorophenol	97	96	67 - 114	0	30		
2-Chloronaphthalene	93	91	65 - 107	3	30		
2-Nitroaniline	89	87	73 - 116	2	30		
Dimethyl phthalate	98	96	69 - 111	2	30		
Acenaphthylene	90	88	67 - 107	2	30		
2,6-Dinitrotoluene	98	96	68 - 114	1	30		
3-Nitroaniline	103	101	59 - 108	2	30		
Acenaphthene	92	89	66 - 108	3	30		
2,4-Dinitrophenol	36	36	19 - 113	2	30		
4-Nitrophenol	36	34	10 - 44	4	30		
Dibenzofuran	91	89	68 - 105	2	30		
2,4-Dinitrotoluene	98	94	65 - 113	3	30		
Diethyl phthalate	97	95	66 - 109	3	30		

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 460-98698

Method: 8270C
Preparation: 3510C

LCS Lab Sample ID:	LCS 460-98698/2-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13291.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0926	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

LCSD Lab Sample ID:	LCSD 460-98698/3-A	Analysis Batch:	460-98777	Instrument ID:	BNAMS11
Client Matrix:	Water	Prep Batch:	460-98698	Lab File ID:	z13292.d
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	1000 mL
Analysis Date:	01/12/2012 0949	Units:	ug/L	Final Weight/Volume:	2 mL
Prep Date:	01/11/2012 2056			Injection Volume:	1 uL
Leach Date:	N/A				

	% Rec.						
Analyte	LCS	LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
4-Chlorophenyl phenyl ether	93	91	68 - 105	2	30		
Fluorene	91	90	68 - 105	1	30		
4-Nitroaniline	107	105	49 - 119	2	30		
4,6-Dinitro-2-methylphenol	59	62	58 - 115	5	30		
N-Nitrosodiphenylamine	103	102	71 - 121	1	30		
4-Bromophenyl phenyl ether	98	97	66 - 110	0	30		
Hexachlorobenzene	95	94	65 - 107	1	30		
Atrazine	49	49	56 - 116	1	30	*	*
Pentachlorophenol	63	64	55 - 116	0	30		
Phenanthrene	93	93	68 - 110	0	30		
Anthracene	92	91	68 - 108	1	30		
Carbazole	92	91	67 - 110	1	30		
Di-n-butyl phthalate	97	95	68 - 111	2	30		
Fluoranthene	86	84	68 - 108	3	30		
Pyrene	100	98	61 - 110	2	30		
Butyl benzyl phthalate	103	100	66 - 115	3	30		
3,3'-Dichlorobenzidine	99	99	69 - 129	0	30		
Benzo[a]anthracene	90	88	65 - 106	2	30		
Chrysene	97	93	68 - 112	4	30		
Bis(2-ethylhexyl) phthalate	103	100	66 - 114	3	30		
Di-n-octyl phthalate	89	88	51 - 115	1	30		
Benzo[b]fluoranthene	101	96	65 - 111	5	30		
Benzo[k]fluoranthene	102	98	66 - 114	4	30		
Benzo[a]pyrene	106	102	58 - 101	4	30	*	*
Indeno[1,2,3-cd]pyrene	119	113	68 - 121	5	30		
Dibenz(a,h)anthracene	123	118	67 - 124	4	30		
Benzo[g,h,i]perylene	132	126	65 - 134	5	30		
Diphenyl	78	76	66 - 112	2	30		
bis (2-chloroisopropyl) ether	84	80	68 - 107	4	30		

Surrogate	LCS % Rec	LCSD % Rec	Acceptance Limits
2-Fluorophenol	56	54	10 - 65
2-Fluorobiphenyl	87	87	53 - 108
Phenol-d5	37	35	10 - 48
Nitrobenzene-d5	87	86	56 - 112
2,4,6-Tribromophenol	82	83	46 - 122

Surrogate	LCS % Rec	LCSD % Rec	Acceptance Limits
Terphenyl-d14	94	94	50 - 122

Client: Long Island Environmental Assessment | Job Number: 460-35505-1

Method Blank - Batch: 460-98614

Method: 6010B
Preparation: 3010A

Lab Sample ID:	MB 460-98614/1-A	Analysis Batch:	460-98806	Instrument ID:	ICP4
Client Matrix:	Water	Prep Batch:	460-98614	Lab File ID:	01122012.asc
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 1451	Units:	ug/L	Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Barium	200	U	5.9	200
Cadmium	5.0	U	0.82	5.0
Chromium	10.0	U	4.5	10.0
Lead	5.0	U	4.0	5.0
Selenium	10.0	U	5.8	10.0
Silver	10.0	U	1.3	10.0

Method Blank - Batch: 460-98614

Method: 6010B
Preparation: 3010A

Lab Sample ID:	MB 460-98614/1-A	Analysis Batch:	460-98855	Instrument ID:	ICP4
Client Matrix:	Water	Prep Batch:	460-98614	Lab File ID:	01122012A.asc
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 2354	Units:	ug/L	Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Arsenic	5.0	U	3.7	5.0

Lab Control Sample - Batch: 460-98614

Method: 6010B
Preparation: 3010A

Lab Sample ID:	LCS 460-98614/2-A	Analysis Batch:	460-98806	Instrument ID:	ICP4
Client Matrix:	Water	Prep Batch:	460-98614	Lab File ID:	01122012.asc
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	100 mL
Analysis Date:	01/12/2012 1441	Units:	ug/L	Final Weight/Volume:	100 mL
Prep Date:	01/11/2012 1004				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Arsenic	2000	1898	95	80 - 120	
Barium	2000	2000	100	80 - 120	
Cadmium	50.0	50.13	100	80 - 120	
Chromium	200	200.8	100	80 - 120	
Lead	500	512.6	103	80 - 120	
Selenium	2000	1858	93	80 - 120	
Silver	50.0	48.58	97	80 - 120	

Quality Control Results

Client: Long Island Environmental Assessment　　　　Job Number: 460-35505-1

Method Blank - Batch: 460-98621

Method: 7470A
Preparation: 7470A

Lab Sample ID:	MB 460-98621/1-A	Analysis Batch:	460-98677	Instrument ID:	LEEMAN3
Client Matrix:	Water	Prep Batch:	460-98621	Lab File ID:	98620hg1.PRN
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	30 mL
Analysis Date:	01/11/2012 1643	Units:	ug/L	Final Weight/Volume:	30 mL
Prep Date:	01/11/2012 1117				
Leach Date:	N/A				

Analyte	Result	Qual	MDL	RL
Mercury	0.20	U	0.16	0.20

Lab Control Sample - Batch: 460-98621

Method: 7470A
Preparation: 7470A

Lab Sample ID:	LCS 460-98621/2-A	Analysis Batch:	460-98677	Instrument ID:	LEEMAN3
Client Matrix:	Water	Prep Batch:	460-98621	Lab File ID:	98620hg1.PRN
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	30 mL
Analysis Date:	01/11/2012 1628	Units:	ug/L	Final Weight/Volume:	30 mL
Prep Date:	01/11/2012 1117				
Leach Date:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Mercury	1.00	0.942	94	80 - 120	

Quality Control Results

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Duplicate - Batch: 460-98956

Method: 1020A
Preparation: N/A

Lab Sample ID:	460-35505-1	Analysis Batch:	460-98956	Instrument ID:	No Equipment
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	1.0	Leach Batch:	N/A	Initial Weight/Volume:	
Analysis Date:	01/13/2012 1746	Units:	Degrees F	Final Weight/Volume:	1.0 mL
Prep Date:	N/A				
Leach Date:	N/A				

Analyte	Sample Result/Qual	Result	RPD	Limit	Qual
Ignitability	>160	>160	NC	10	

Client: Long Island Environmental Assessment Job Number: 460-35505-1

Matrix Spike/
Matrix Spike Duplicate Recovery Report - Batch: 680-226032

Method: 9020B
Preparation: Carbon Trap

MS Lab Sample ID:	460-35505-1	Analysis Batch:	680-226034	Instrument ID:	TOX1
Client Matrix:	Water	Prep Batch:	680-226032	Lab File ID:	N/A
Dilution:	2.0	Leach Batch:	N/A	Initial Weight/Volume:	50 mL
Analysis Date:	01/12/2012 1723			Final Weight/Volume:	50 mL
Prep Date:	01/12/2012 0730				
Leach Date:	N/A				

MSD Lab Sample ID:	460-35505-1	Analysis Batch:	680-226034	Instrument ID:	TOX1
Client Matrix:	Water	Prep Batch:	680-226032	Lab File ID:	N/A
Dilution:	2.0	Leach Batch:	N/A	Initial Weight/Volume:	50 mL
Analysis Date:	01/12/2012 1723			Final Weight/Volume:	50 mL
Prep Date:	01/12/2012 0730				
Leach Date:	N/A				

	% Rec.						
Analyte	MS	MSD	Limit	RPD	RPD Limit	MS Qual	MSD Qual
TOX Result 1	86	102	60 - 140	17	40		
TOX Result 2	86	102	60 - 140	17	40		

TestAmerica Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Phone (203) 929-8140 Fax (203) 929-8142

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact: Ian Hofman	**Field Sampler:** EAR / ES	**TAT Required (business days):** Standard 10-Day	**Lab PM/Contact:**
Company: E.A.R.	**Mobile/Field Number:**		**Lab Job Number (Lab Use Only):**
Address: 225 Atlantic Ave.	**E-Mail:**	**Deliverable Type (Report/EDD):**	**Passed Rad Screen (Lab Use Only):** [✓] Yes [ ] No
City, State, Zip: Patchogue, NY, 11772	**PO #:**	**Sample Disposal:** [ ] Return to Client [ ] Disposal by Lab [ ] Archive for __ Months (A fee may be assessed if samples are retained for longer than 1 month)	**Cooler Temperatures (Lab Use Only):**
Phone: (631) 447-6400	**WO #:**		
Email:	**Project #:**		
Project Name/Site Location (State): DEC-Farmingdale 480 (NY)	**SSOW#:**	**State Regulatory QC Criteria Requirements:**	

COC Number: 21802
Page ___ **of** ___
Carrier Tracking
Notes: 35505

Samples submitted for analysis will be subject to TestAmerica Terms and Conditions

TA #	Field Sample Identification (Containers for each sample may be combined on one line)	Collection Date	Collection Time (24-Hour Clock)	Matrix Aq=Aqueous, S=Solid, W=Waste/Oil, O=Other	MS/ MSD (Yes or No)	Unpreserved	H2SO4	HNO3	HCL	NaOH	ZnAc/NaOH	Other	6010 B ~~RCRA~~ 9470A Merc. RCRA8 Analyte	8260B (OLM04.2 Comp. list)	1020A (Ignitability)	8270C (OLM04.2 Compound List)	9020B (Regular TOX (in duplicate)				Comments
	Condensate	1-5-12	1130	Aq		3	1	1	3				X	X	X	X	X				Category A Deliverables 1

No. of Containers/Preservatives; Analysis (Attach list if more space is needed)

Relinquished by: [signature]	Date/Time: 1-5-12 / 1300	Company: EAR	Received by: EAR Fridge	Date/Time: 1-5-12 / 1300	Company: EAR
Relinquished by: EAR SAMPLE FRIDGE	Date/Time: 1-6-12 / 1340	Company: EAR	Received by: William A Vigliotta	Date/Time: 1-6-12 1340	Company: EAR
Relinquished by: William A Vigliotta	Date/Time: 1-6-12 / 1340	Company: EAR	Received by: [signature]	Date/Time: 1/6/12 1340	Company: TA-CT

Comments: [signature] 1/6/12 1639 TACT Relinquished Jennifer Cyr 1/6/12 17:22

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy
Field Sampling / Shipping Instructions and Laboratory Sample Receipt Policy included on Reverse Side of COC

TAL-0015 (0609) Fedex Fedex 1/7/12 C Hall 1/7/12 1155 TA. 2.1°C #5C

TestAmerica Edison
Sample pH Receipt Log

Job No. 35505 page ___ of ___

Sample No.	Ammonia (pH<2)	COD (pH<2)	Metals (pH<2)	Nitrate Nitrite (pH<2)	O & G (pH<2)	Pest (pH 5-9)	PHC (pH<2)	Phenols (pH<2)	Sulfide (pH>9)	TKN (pH<2)	TOC (pH<2)	Total Cyanide (pH>12)	Total Phos (pH<2)	Other TOX
1			<2											<2

Initials: CHer Date: 1/7/12

EDS-WI-038, Rev 1, 11/21/07

Login Sample Receipt Checklist

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Login Number: 35505
List Number: 1
Creator: Hall, Alonzo

List Source: TestAmerica Edison

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	Not present
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	2.1° C IR 50
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Long Island Environmental Assessment

Job Number: 460-35505-1

Login Number: 35505
List Number: 1
Creator: Barnett, Eddie T

List Source: TestAmerica Savannah
List Creation: 01/11/12 01:19 PM

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX L: WARRANTY

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.

Table 4: SVE System Operation and Maintainace Logs
Former Farmingdale Plaza Cleaners
Project: 450 Main Street, Farmingdale, NY
Project Number: 16-0005

Date	Blower Flow Rate CFM	Moisture Seperator Condensate vol. Gal. I.W.	PID Influent PPB	PID Corrected for response factor PPMv	Removal Rate lbs/hr	PID Effluent GAC #1 PPBv	Treatment Efficiency %	Blower Hours	Inflent Vac. SVE-3	Inflent Vac. SVE-5	Comment

Notes:
I.W. : inches of water. PPM : parts per million.
PPBv : parts per million by volume. lbs/hr : pounds per hour.
% : Percent.
PID Correction Factor = (0.57 x 1.00) = 0.57
ppmv= PID reading x 0.57
lbs/hr = ((PID reading x 0.57) / 1,000,000) x (cfm) x (lb mole/387 ft3) x (avg. molecular weight) x (60 min/hr)
lbs/hr = ((PID reading x 0.57) / 1,000,000) x (cfm) x (lb mole/387 ft3) x (165.8) x (60 min/hr)
lbs/hr = (PID reading) x (cfm) x 0.0000146
Average Molecular Weight used is 165.8 g/mol

APPENDIX 7 EXCAVATION WORKPLAN (EWP)

3-1 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 3A 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 2.

Table 3A: Notifications*

Farmingdale Commons, LLC Alexander Opper	201-474-0444 alex@oppergroup.com
Thomas Andrews, P.E. - Qualified Environmental Professional	609-275-8500 tandrews@insituoxidation.com
Brian Jankauskas – NYSDEC DER Project Manager	518-402-9626 brian.jankauskas@dec.ny.gov
Walter Parish – NYSDEC Regional HW Engineer	631-444-0240 walter.perish@dec.ny.gov
Kelly Lewendowski – NYSDEC Site Control	518-402-9553 derweb@dec.ny.gov
Brooke Briganti Environmental Logic, LLC Project Manager	609-910-0720, Extension 180 BBriganti@env-logic.com
Katrina VanDeusen Environmental Logic, LLC Project Manager	(609) 910-0720 Extension 181 KVanDeusen@env-logic.com
Dale Desnoyers	518-426-2288 dale@allendesnoyers.com

* 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 of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

3-2 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 3-6 AND 3-7 of this Appendix.

3-3 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. Hay bales will be replaced if damaged.

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.

3-4 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.

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.

3-5 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.

Truck transport routes will be established after an assessment of the traffic flow is performed and a traffic route plan developed. 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.

3-6 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).

3-7 MATERIALS REUSE ON-SITE

Material reuse on-site will comply with the requirements of NYSDEC DER-10 Section 5.4(e)4.

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.

3-8 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.

3-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the appropriate cover system will be restored in a manner that complies with the Record of Decision. The existing cover system is comprised of a minimum of impervious surfaces asphalt pavement, concrete covered sidewalks and concrete building, etc. The demarcation layer, will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. 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.

3-10 BACKFILL FROM OFF-SITE SOURCES

It is not anticipated that excavation at the site will require the addition of soils as the site has already been redeveloped. However, to the extent that fill is needed, it will comply with this section.

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.

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

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, soil quality standards will be prepared in the event that backfill is required. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

3-11 STORMWATER POLLUTION PREVENTION

No excavations greater than an acre are proposed for future uses of the site but if excavation is required a Stormwater Pollution Prevention Plan will be drafted to address site specific considerations. 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.

3-12 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.

3-13 COMMUNITY AIR MONITORING PLAN

In the event that the subsurface soils will be disturbed, community air monitoring of the volatile organic compounds (VOC) will be performed on the perimeter of the Site. A weather station will be set up to determine the wind speed and direction prior to setting upwind and downwind stations. A DUST RAM and PID (or equivalent) will be contained in each weather station to monitor both dust levels and VOC emissions. These stations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations. The dust meter and PID will alarm if exceedances of the NYSDEC action levels are exceeded. 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. Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

3-14 ODOR CONTROL PLAN

An odor control plan is capable of controlling emissions of nuisance odors off-site during disturbance of soils. Specific odor control methods to be used on a routine basis will include Cherry Suppression Foam. 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.

3-15 DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

3-16 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.

HEALTH AND SAFETY PLAN

REMEDIATION SERVICES

FORMER FARMINGDALE COMMONS

450 Main Street

Farmingdale

Nassau COUNTY, NY

Prepared for:

Environmental Logic

11 Princess Road, Suite C

Lawrenceville, NJ 08648

Prepared by:

Denis Crayon, CHST

Experience Safety Institute, LLC

Building 81, Chimney Rock Road

Bridgewater, NJ 08807

Date: December 20, 2017

Revised: __________, 2018

HEALTH AND SAFETY PLAN

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DO NOT TRANSPORT SERIOUSLY INJURED

CALL LOCAL RESCUE

HEALTH AND SAFETY PLAN

1.0 Project Organization and Responsibilities

Prepared by: Denis Crayon, CHST

Date: December 20, 2017

Date revised: _______________, 2018

Date plan expiration: December 20, 2018

INTRODUCTION

Site Name: Former Farmingdale Plaza Cleaners

Project #: 16-0005

Original Safety Plan: Yes __ X______ No ______

Location: Farmingdale Commons, LLC

450 Main Street,

Farmingdale, Nassau County, New York

Property Owner: Farmingdale Commons, LLC

Site/Incident Description

A.	Urban	___X_	Residential	______	Commercial	___X__
	Industrial	__X___	Rural	______	Remote	______
	Active	______	Inactive	____	Landfill	______
B.	Spill	__X___	Air Release	______	Fire	______
	Brownfield	______	Superfund:	___X___	Other:	______

C.	Containers involved?	Yes _____	No __X__
		Drums: ___	# ______
		Tanks: ____	# ______
D.	Map attached:	Yes __X__	No _____

Key Personnel

Title	Name	Office Phone	Cell Phone
Senior Project Manager	Brooke Ann Briganti	609-910-0720, x180	973-415-7177
Site Project Manager/Supervisor	Katrina VanDeusen	609-910-0720	908-591-0361
Health & Safety Officer (HSO)	Brooke Ann Briganti	609-910-0720	973-415-7177
Site Safety Officer (SSO)	Sean Collins	609-910-0720	609-553-5618
Senior Staff Scientist	Akanksha Garg	609-910-0720	609-553-8486

1.1 Corporate Health and Safety Policy / Commitment to Safety

Env-Logic recognizes that our people drive the business. As the most critical resource, employees will be safeguarded through training, provision of appropriate work surroundings, and procedures that foster protection of health and safety. All work conducted by Env-Logic employees will take into account the intent of this policy. No duty, no matter what its perceived result, will be deemed more important than employee health and safety.

Env-Logic is firmly committed to the safety of our employees. We will do everything possible to prevent workplace incidents and we are committed to providing a safe work environment for all employees.

We value our employees not only as employees but also as human beings critical to the success of their family, the local community, and Env-Logic.

A key factor in implementing this policy will be the strict compliance to all applicable federal, state, local, and company policies and procedures. Failure to comply with these policies may result in disciplinary actions.

Respecting this, Env-Logic will make every reasonable effort to provide a safe and healthful workplace that is free from any recognized or known potential hazards. Additionally, Env-Logic subscribes to these principles:

1. All incidents are preventable through implementation of effective health and safety control policies and programs.
2. Health and safety controls are a major part of our work every day.

3. Incident prevention is good business. It minimizes human suffering, promotes better working conditions for everyone, holds Env-Logic in higher regard with customers, and increases productivity. Env-Logic will comply with all health and safety regulations that apply to the course and scope of our operations.

4. Management is responsible for providing the safest possible workplace for employees. Consequently, management of Env-Logic is committed to allocating and providing all of the resources needed to promote and effectively implement this health and safety policy.

5. Employees are responsible for following safe work practices and company rules, and for preventing incidents and injuries. Management will establish lines of communication to solicit and receive comments, information, suggestions and assistance from employees where health and safety are concerned.

6. Managers and supervisors of Env-Logic will set an exemplary example with good attitudes and strong commitment to health and safety in the workplace. Toward this end, management must monitor company health and safety performance, working environments and conditions to ensure that program objectives are achieved.

7. Our health and safety program applies to all employees and persons affected or associated in any way by the scope of this business. Everyone's goal must be to constantly improve safety awareness and to prevent incidents and injuries.

8. All Env-Logic employees have the responsibility to ensure that all on-site employees adhere to this established plan for all work activities to occur on this site.

Everyone at Env-Logic must be involved and committed to health and safety. This must be a team effort. Together, we can prevent incidents and injuries. Together, we can keep each other healthy and safe in the work that provides our livelihood.

President/Principal

1.2 Work Site Lines of Authority/Project Personnel Responsibilities

On site personnel designations/responsibilities are defined as follows:

Site Project Manager/Site Supervisor: Katrina VanDeusan

The Site Project Manager (PM) will be on-site for all site activities. He/She has Stop Work Authorization, which he/she will execute upon determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation. Authorization to proceed with work will be issued by the PM after such action. The PM is responsible for ensuring that labor personnel have the appropriate training and medical surveillance. The PM is responsible for enforcing labor personnel compliance with personal protective equipment (PPE) requirements and for enforcing compliance with this SSHASP.

Health & Safety Officer (HSO)/ Industrial Hygiene Technician:

Site Safety Officer (SSO): variable

If applicable, the SSO or HSO would be responsible for conducting work zone air monitoring, managing the perimeter air monitoring stations, and providing health and safety oversight for Env-Logic personnel. The HSO would obtain and review applicable health and safety documents for Env-Logic and subcontractor site personnel. The HSO would determine the level of personal protective equipment and have stop-work authority when situations arise regarding health and safety or air monitoring results dictate that work stoppage is required. He/she would ensure that the level of personal protection by the workers follows those dictated by the action levels set in Section 7.

Env-Logic Site Personnel (Labor):

Env-Logic labor personnel in conjunction with and under the direct supervision of the PM will perform all job task as directed by the Env-Logic PM. All Env-Logic personnel are responsible for adhering to the requirements of this SSHASP, and following the direction of the PM and HSO (if applicable). All Env-Logic labor personnel have Stop Work Authority and must report any potentially unsafe condition to the PM, their immediate supervisor, and the HSO (if applicable). They will not be permitted or required to work until all unsafe conditions have been resolved.

2.0 Training Requirements

2.1 OSHA and General Training Requirements

All personnel performing activities covered by this plan must be trained in accordance with the requirements of 29 CFR 1910.120(e) & 1926.65. The Senior Project Manager will verify and document that all Env-Logic personnel meet the applicable training requirements prior to the start of site work, including:

- OSHA 1910.120 initial 40-hour training.
- OSHA annual eight-hour refresher training within the last year.

- At least one Env-Logic personnel will have National Safety Council (or equivalent) First Aid and CPR training, and will be present on-site at all times.

Subcontractors chosen to perform any site activities where the potential exists for contact with contaminants must provide written documentation of HAZWOPER training, for each of his/her employees who will be involved in activities at this site before the start of work.

2.2 Tailgate Meeting

A tailgate meeting reviewing the SSHASP for all proposed work location personnel shall be held. This meeting shall be prior to the commencement of any on-site activities. The Tailgate Meeting will include, but is not limited to:

- Site history.
- Utility clearance information.
- Scope of work.
- Location of nearest medical facility (both hospital and emergency care clinic).
- SSHASP/APP, JSAs, JHAs, PSAs, SOPs, or other definitive job/task specific guidelines.
- Facility specific training to include Contaminants of Concern (CoCs) on-site, evacuation routes, alarm systems, support zones, and rally points.

2.3 First Aid/CPR Training

At least one member of the Env-Logic staff assigned to the project will have American Red Cross or National Safety Council (or equivalent) first aid and cardiopulmonary resuscitation (CPR) training. At least one trained individual will be present on-site at all times. Training documentation will be maintained by Env-Logic Senior Project Manager and subcontractor documentation will be made available to the Env-Logic Project Manager to provide to client upon request.

3.0 Medical Surveillance Requirements

3.1 General Medical Surveillance Requirements

All personnel performing activities covered by this plan must be active participants in an ongoing medical monitoring program in accordance with the requirements of 29 CFR 1910.120(f). Subcontractors chosen to perform selected site activities must provide written documentation of such, for each employee who will be involved in activities at this site, before the start of work.

3.2 Drug and Alcohol Compliance

All personnel performing activities covered by this plan must have had a negative drug and alcohol screen performed within the last 12 months. All personnel are expected to maintain a current status with respect to Env Logic's drug and alcohol testing program. Env-Logic maintains an annual schedule of updated medical examinations to include annual drug and alcohol screening.

3.3 Accident/Incident Medical Surveillance

As a follow-up to a work-related injury, all employees are entitled and encouraged to seek medical attention. All accidents and potential exposures must be reported **immediately** to the Env-Logic Site Project Manager, who will coordinate with the Senior Project Manager to arrange for appropriate medical attention. Depending on the type of incident, it may be critical to perform drug and alcohol tests immediately or within 24 to 48 hours. *Failure to report an injury or incident immediately may result in disciplinary action.*

4.0 Hazard Assessment

4.1 Chemical Hazards

4.1.1 Contaminant Characterization and Potential Routes of Exposure

A. The main routes of exposure for field personnel include:

- Inhalation of contaminant vapors
- Inhalation of contaminated particulate matter
- Inhalation of contaminated material
- Injection of contaminated material
- Absorption of contaminated material
- Ingestion of contaminated material

B. Site personnel can reduce their exposure potential by:

- Using the proper PPE
- Practicing contamination avoidance
- Following proper decontamination procedures
- Observing good personal hygiene

C. Safety Data Sheets (SDSs) for all chemicals on site or brought on site by Env-Logic shall be included in the SSHASP. Any chemicals on-site not introduced by Env-Logics shall have SDSs made immediately available to Env-Logic employees by personnel (subcontractors, etc) bringing the chemical to site.

4.1.2 Introduction to Work Site

4.1.3 Site History: Former gas station, auto repair facility, and auto storage.

Constituents of Environmental Concern (Contaminants of Concern) in soils and groundwater at the site include: BTEX (Benzene, Toluene, Ethylbenzene and Xylenes) compounds and various heavy metals in soil and groundwater.

4.1.4 Scope of Work

A. Task(s) / Oversight:

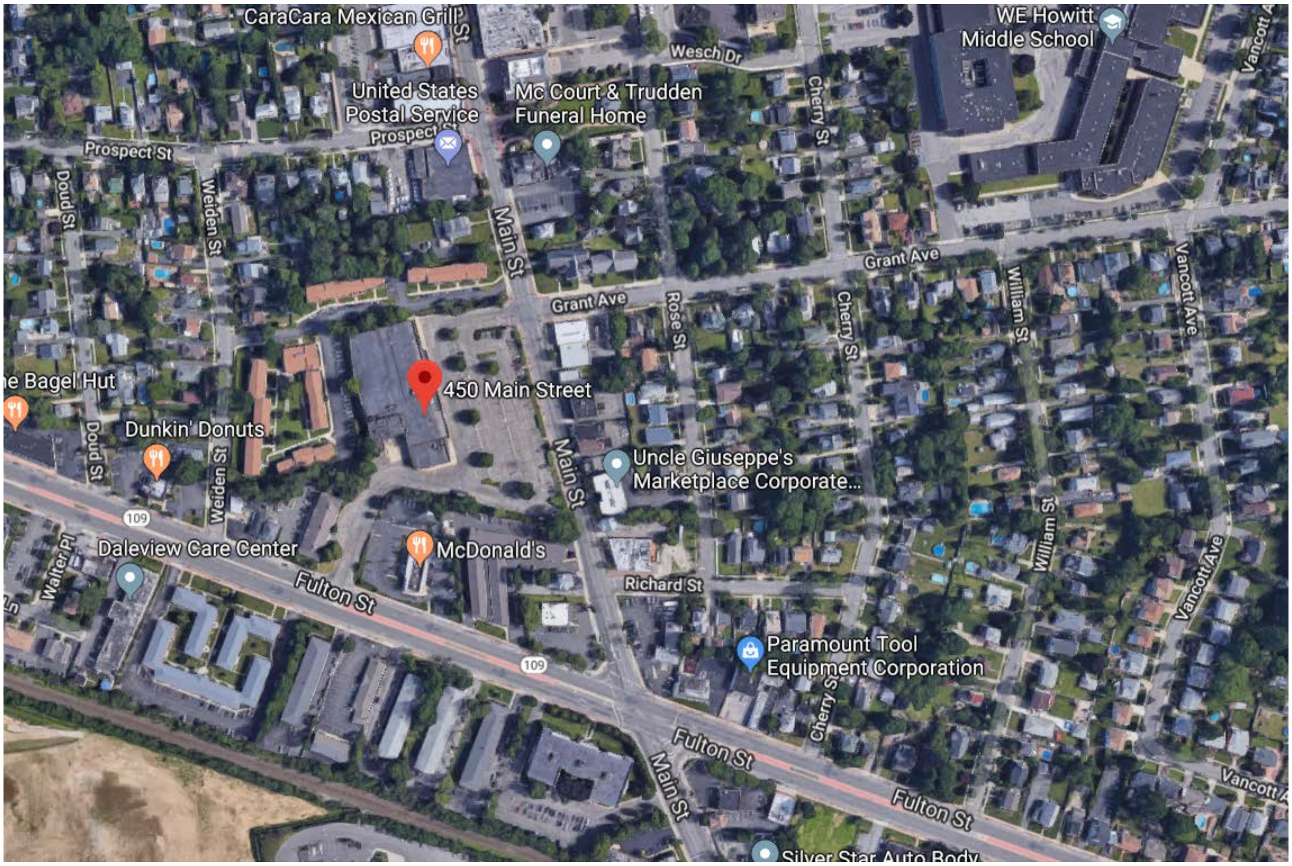
Phase I / Phase II:

Subsurface Investigations - Groundwater Investigation	X
Expedited Site Investigations - Subsurface Investigation	_____
Geophysical Survey	_____
Passive and Active Soil Gas Survey	_____
State and Federal Contamination Assessment Report	_____
Brownfields Assessment	_____
Dry Cleaner Investigation	_____
UST/ AST Investigations	X
Air Quality (Sick Building Surveys)	_____
Asbestos Air Surveys	_____
Asbestos Inspection	_____
Asbestos AHERA/ASHARA/OSHA Bulk Surveys (Pre- Renovation/ Demolition Surveys)	_____
Indoor Air Quality Studies	_____
Lead Bulk Surveys	_____
Lead Exposure Surveys	_____
Mold Surveys	_____

B. Scope of Work (narrative): Provide direction and oversight for excavation, soil sampling, UST removal, *chemical injection, *monitoring well installation, and *groundwater sampling.

*Potential future scope of work

C. Site Map:



5.0 Physical Hazards

A variety of physical hazards may be present, but these hazards are similar to those associated with any field project (detailed in Table 1). Caution should be taken in and around the property, as risks still pose a threat to human safety.

5.1 Slip/Trip/Falls

- Utilize proper housekeeping practices, such as removal of debris and tools from the work area to keep the area clear of trip hazards.
- Use caution tape or barricade fencing where warranted preventing unauthorized personnel from entering the work area.
- Replace manhole covers immediately and securely to prevent tripping and vehicle accidents.
- Walkways and work spaces will be kept clear of cords, hoses, pipes, etc. that cause trip hazards.
- If trip hazards cannot be removed from the work area, they shall be secured and cones shall be placed to identify the hazard.

5.2 Excessive Noise

- Use hearing protection during loud mechanical operations such as operating drill rigs, jackhammers, and compressor operations.
- Ear muffs and ear plugs are issued to all employees, training is performed annually, and audiograms performed annually during medical surveillance.

5.3 **Airborne Particulates (eyes, ears, nose, mouth)**

- Safety glasses (ANSI 87.1) are to be worn at all times on site.
- Personnel with prescription eye wear may wear side shields attached to their eye glasses provided the lenses meet ANSI 87.1 specifications.
- Spoggles shall be issued to all employees and are required to be worn in dusty environments.
- Respiratory protection is to be worn when site activities cause excessive particulates, such as asbestos or lead abatement, air rotary drilling and mixing of Portland or gravel mix. If windy conditions exist/persist sufficient to remove nuisance dusts, respiratory protection may not be required dependent upon air monitoring results.

5.4 **On-site Traffic**

- Hi-viz safety vests shall be worn in all work zones and wooded areas to alert hunters.
- Use 36” traffic cones, 6’ double pendant flags, and caution tape and vehicles to delineate work zones.
    - Whenever possible, use work vehicles as barriers to prevent vehicles from contacting workers.
- Use fencing or barricades where warranted preventing unauthorized personnel from entering work areas.

5.5 **Ladder Safety:**

- Ladders must be inspected prior to use and any damaged ladder will be discarded immediately.
- Painted ladders are forbidden.
- Never stand on the top step (cap) of the ladder.
- Extension ladders must extend 36” beyond landing.
- Pitch ladders at a 4:1 ratio.
- Extension and straight ladders must be tied off.
- Fall protection must be worn when working at heights six (6) feet or more above ground.

5.6 **Air Compressors**

- Eye protection and hearing protection is to be worn at all times on site.

- Whip checks and cotter pins shall be used on all connections as required.
- Compressed air can damage skin upon contact.
- Use proper pressure relief valves before performing O&M on an air compressor.

5.7 <u>Electrical</u>

- Inspect all electrical equipment and extension cords prior to use.
- All electrical circuits and equipment must be grounded in accordance with the NEC regulations.
- Lockout/Tagout procedures will be in effect if equipment is to be removed/repaired.
- Use three-pronged plugs and heavy-duty extension cords.
- A GFCI is required on any extension cord not attached to a GFCI protected outlet.
- A GFCI is required on any power tool that uses water (e.g., core drill).
- Workers must not have wet hands or be standing in water while plugging/unplugging energized equipment.
- Plugs and receptacles will be kept out of water (unless they are approved for submersion).

5.8 <u>Power Tools</u>

- Equipment will be inspected for defects prior to use.
- Eye protection is to be worn at all times on site.
- Employees using tools that may subject their hands to an injury, such as cuts, abrasions, punctures, or burns will wear protective gloves.
- Loose or frayed clothing, dangling jewelry, or loose long hair shall not be worn when working with power tools.
- A GFCI will be used with all power tool operations when not plugged into permanent (fixed) wiring.
- Shielding or machine guards will not be removed for any reason.

5.9 <u>Hand Tools</u>

- Use hose cutters when cutting piping/hose.
- Use self-retracting-blade-guarded issued utility knives when cutting electrical tape, plastic sheeting, well material bags, etc.
- Use Geoprobe® liner cutters when opening acetate soil sample liners.
    - Use Geoprobe® liner cutter guard when using Geoprobe® liner cutters.
- Class 4 Kevlar® gloves must be worn when cutting.
- Do not tape wooden handles of any hand tool to allow for inspection.

5.10 **Back Strain**

- Utilize proper lifting procedures when loading and unloading heavy equipment.
- Get a firm footing.
- Keep feet apart (shoulder width) for a stable base.
- Point toes out.
- Bend the knees.
- Face the object squarely.
- Don't bend at the waist.
- Keep the principles of leverage in mind.
- Do not exert more than necessary.
- Maintain the three natural back curves (of a straight back).
- Place one foot beside the load, the other behind it.
- Tighten stomach muscles.
- Abdominal muscles support the spine when lifting, to offset the force of the load.
- Train muscle groups to work together.
- Grip the load with both hands.
- Lift with the legs.
- Let the powerful leg muscles do the work of lifting, not the weaker back muscles.
- Maintain the three natural back curves (of a straight back) – 2nd mention.
- Keep the load close.
- Don't hold the load away from the body.
- The closer the load is to the spine, the less force it exerts in the back.
- Use your pre-planned carry route, keep your view.
- Keep the back upright.
- Whether lifting or putting down the load, don't add the weight of the body to the load.
- Avoid twisting, which can cause injury.
- To change directions, turn the entire body.
- Set the load down carefully.
- Use a mechanical lifting device or a lifting aid such as handcarts, drum dollies or lift gates when lifting heavy objects.

5.11 <u>Site Security</u>

- Do not permit anyone who is not authorized, properly trained and outfitted with the appropriate PPE to enter the Exclusion Zone or Contamination Reduction Zones (this includes Env-Logic personnel, clients, etc.).
- Use caution tape or barricade fencing where warranted preventing unauthorized personnel from entering the work area.
- If potential for theft exists, equipment will either be secured or removed from site during off duty work hours.
- Unauthorized personnel (includes transients, homeless, curious visitors, locals) seen on site shall be reported to the Client Project Manager/Property Manager/Owner immediately. Avoid making contact with visitors and if contact is unavoidable, continue attempting to separate yourself from them and refer them to the Client Project Manager/Property Manager/Owner. Document all contacts with daily paperwork and verbally inform the specific Env-Logic Project Manager concerning contacts.

5.12 <u>Biological Hazards</u> (Insects, snakes, poisonous plants and animals)

- Wasp/Bee/Hornet Stings: Determine if any field crew members are allergic to wasp/bee stings and ask if an Epinephrine® pen (Epi-pen®) is available.
  - If Epi-pen is administered, anaphylactic shock is still a ***MEDICAL EMERGENCY (CALL 911)***
  - Spray any wasp/bee/hornet nests with an insect repellant from a safe distance recommended by the product's manufacturer.
- Poisonous Plants: Do not touch or contact poisonous plants, such as poison ivy and poison oak, poison sumac or giant hogweed. If available, apply an over-the-counter barrier cream, such as Ivy Block® to prevent contact with plant oils.
  - Spray paint all poisonous plants upon identification to alert others of their existence.
  - Wash hands and arms immediately with soap and water if skin contacts the plants.
  - Wear long pants with socks pulled over legs to prevent skin contact with plants and insects.
- Do not approach, touch, or antagonize snakes or wild animals. This includes domestic pets such as cats and dogs. If there are animals in the work area/property, Stop Work and notify

local pest control authority with the assistance of Client Project Manager/ Property Manager/Owner.

- Brown Recluse and Black Widow Spiders: Be aware both spiders are native to the northeast and contacts with both have been documented. Both spiders have the potential to cause serious injury to humans and should be avoided at all costs. If visual contact is made, maintain a minimum distance of at least ten feet and inform all other affected/impacted individuals. If physical contact is made (i.e., you have been or believe you may have been bitten), attempt to take a photo of the spider or collect the specimen and report immediately to the nearest medical facility for treatment.


- Lyme Disease / Tick Contact
    - Lyme Disease is a bacterial infection transmitted by the bite of a deer tick. About 50 percent of deer ticks carry the bacteria. To prevent the bite of a deer tick, stay on pathways, avoid overgrown or grassy areas when possible. Wear protective clothing (light colored) with long sleeves and pants tucked inside of socks. In potentially heavily infested areas, wear white non-laminated tyvek or use duct tape to seal socks to pants. Apply repellent containing "Permethrin" or "Deet" to clothing only and not directly on the skin. Perform self-inspections immediately following exposure to an area which may contain deer ticks.
        - Symptoms: headache, flu-like symptoms, a spreading ring-like rash, swelling and pain of the joints. The distinctive bulls-eye rash is NOT always present at a bite site.
        - Tick removal: remove attached tick immediately using tweezers to grasp the tick's head, near the skin, and slowly pull straight out. Save the tick for laboratory analysis, if possible.

- Report any incidents involving contact with poisonous plants, wasp/bee stings, and spider or deer tick bites to the Director of Health & Safety immediately upon discovery, regardless of presence of allergic reaction(s).

5.13 <u>Heat Stress/Hyperthermia</u>

- Know and recognize the signs and symptoms of heat-related illnesses, as follows:
  - Heat cramps
  - Heat exhaustion:
    - Cool, moist, pale, or flushed skin
    - Headache
    - Nausea
    - Dizziness, weakness and exhaustion
  - Heat stroke is a ***MEDICAL EMERGENCY (CALL 911):***
    - Red, hot, dry skin
    - Rapid, weak pulse
    - Rapid, shallow breathing
    - Incoherence
    - Lack of muscle control
    - Loss of consciousness
- Hydration for anticipated high heat/humidity should begin the evening before and the recommended water intake is 8 ounces every 15 minutes of work activity.
- Adjust work schedules to provide time intervals for intake of juices, juice products and water in an area free from contamination using the chart below. Schedules are subject to change based upon an individual's acclimatization and level of activity.

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

5.14 Cold Stress/Hypothermia:

- Know and recognize the signs and symptoms of cold-related illnesses, as follows:
  - Lack of feeling in the affected area.
  - Skin that appears waxy, is cold to the touch or is discolored (flushed, white, yellow or blue).
- Hypothermia:
  - Shivering
  - Numbness
  - Glassy stare
  - Apathy
  - Loss of consciousness
- Have appropriate clothing available and dress in layers to protect against cold weather.
- Adjust work schedules to provide sufficient rest periods in a heated area for warming up during operations conducted in cold weather.

Wind Chill Temperature Table

Wind Speed (mph) ↓ / Air Temperature (°F)

Wind Speed (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
0	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95

GREEN LITTLE DANGER (frostbite occurs in >2 hours in dry, exposed skin)

YELLOW INCREASED DANGER (frostbite could occur in 45 minutes or less in dry exposed skin)

RED GREAT DANGER (frostbite could occur in 5 minutes or less in dry, exposed skin)

5.15 Confined Space (CS) Entry:

- Confined space entry is prohibited unless authorized by the Senior Project Manager.
- Confined space entry is only permitted by those trained to perform this duty and awareness training documentation will be maintained by the Senior Project Manager.
- All Confined Space Entry procedures must be followed, including and not limited to air monitoring, presence of attendant and permit completion.

5.16 Fall Hazards:

- Fall protection equipment may only be worn by trained personnel.
- ANSI-approved man-lifts and ladders will be used for access to elevated locations.
- Employees must wear a harness with lanyard attached to the boom or basket when working from a man-lift.
- Scissor lifts do not require fall protection.
- If the elevated location is inaccessible by a man-lift, the Senior Project Manager shall be contacted to determine the appropriate fall protection.

5.17 Hot Work:

- Hot work is defined as any activity creating sparks or open flames: use of a torch (oxygen/acetylene, MAP gas, or propane), welding, cutting steel with a cut saw or grinder, or grinding any material that creates or has the potential to create sparks.
- A Hot Work permit will be completed prior to the start of the work.
- The Site Safety Officer will conduct a safety briefing on Hot Work rules and procedures, and all Hot Work participants will sign the permit.
- Hot Work will not be performed if there is a possibility of an explosive atmosphere or an oxygen-enriched atmosphere.
- The Site Safety Officer will designate a person for fire watch duty, who will have access to a properly rated fire extinguisher and will remain on-duty for one-half hour after the Hot Work is complete.
- All Hot Work equipment will be inspected daily prior to use and if the equipment is found to be defective, it will be removed from the site and tagged with a "Do Not Use" sign until repaired.
- All welding and cutting personnel will be trained in the safe operation of their equipment.

5.18 <u>Radiological Hazards:</u>

If site-specific potential radiological information is available, the hazards will be addressed in an addendum to the site-specific HASP. Any field personnel designated to work on radiological sites will be trained by the CIH or a site representative as a competent authority to train.

5.19 <u>Sanitation</u>

- Env-Logic employees are considered mobile crews and must have prompt access to nearby toilet facilities. For example, in general, toilets would be considered "nearby" if it would take less than 10 minutes to get to them and transportation (their work vehicles) is readily available.
- Potable water shall be available and provided by Env-Logic in the form of 5 gallon coolers with disposable cups. Common drinking cups are prohibited.

5.20 <u>Illumination:</u>

If work activities occur before sunrise and/or after sunset, lighting should be provided at each work area to meet the requirements of 29 CFR 1910.120(m). The Standard states that while any work is in progress:

- General site areas shall be lighted to not less than 5 foot-candles.
- Drilling areas, excavation, waste areas, access ways, active storage areas, loading platforms, and field maintenance areas shall be lighted to not less than 3 foot-candles.

- First aid stations not less than 30 foot-candles.

5.21 Weather (see 5.13 & 5.14 for Hyperthermia & Hypothermia)

If severe weather occurs that may affect the safety of site workers, any site worker may initiate Stop Work and will stop all site activities. The NOAA 30/30 rule will be followed for resuming operations. The NOAA 30/30 rule requires retreat under shelter in the event of severe weather appearance (heavy clouds, high winds), thunder, and/or lightning. Outdoor work activities can resume 30 minutes following the last thunder clap/lightning strike.

6.0 Site Control Measures

6.1 Site Zones

The need to formally establish specific work zones (Exclusion, Contamination Reduction, and Support Zones) during site activities will be determined by the site HSO. It is important for the safety of all concerned that appropriate barriers (cones, flags, caution tape, wooden horses, plastic fencing etc.) are in place to keep vehicles and pedestrians away from Work Zones.

A controlled work area should be established in the immediate vicinity of the site activities covered by this plan. Only those persons who can comply with the requirements of this plan should be allowed into this area during any work activities, which may result in exposure to the hazards associated with the specific task being performed. When activities involve invasive activities on sites in which Env-Logic has determined the area to be highly-contaminated, a three-zone system will be used to control the potential spread of contamination. For the purpose of this plan, the following definition of terms is provided:

- Exclusion Zone: The immediate area of the work activity to be performed or an area fully enclosing the hazards present.
- Contamination Reduction Zone: The transition area between the contaminated area and the uncontaminated area. Decontamination procedures take place within this zone.
- Support Zone: The uncontaminated area where exposure to hazardous conditions is not anticipated.

6.2 Buddy System: A buddy system is required for all site work involving levels of protection or potentially representing a risk to personnel.

6.3 Site Communications Plan

Emergency numbers are listed in Table 2 of this SSHASP. Work will not be conducted on-site without access to a telephone, and site personnel will be informed of the nearest available telephone. If a telephone is not available on site, a cell phone will be made available for emergency use. Successful communications between field teams and contact with personnel in the Support Zone is also essential and required. The following communication systems will be available within Secure Zones:

• Normal verbal communication, which can include 2-way radios.

Radios	______	Air Horn	______
Whistle	______	Megaphone	______
Hand Signals	X	Voice	X

• Hand signals for Level B and C are as follows:

Hand Signals		**Definition**
Hands clutching throat	=	Out of air / cannot breath
Hands on top of head	=	Need assistance
Thumbs up	=	OK / I am all right / I understand
Thumbs down	=	No / Negative
Arms waving upright	=	Send backup support
Grip partners wrist	=	Exit area immediately

7.0 Personal Protective Equipment (PPE)

7.1 General

The level of protection worn by site personnel will be enforced by the Site Project Manager. Levels of protection may be upgraded or downgraded at the discretion of the HSO or Senior Project Manager, based on real-time air monitoring data and prior site experience. Any change in the level of protection will be documented. Levels of protection less than those designated in this SSHASP must first be approved by the Senior Project Manager. The Personal Protection Equipment (PPE) Program, with emphasis on the Hazard Assessment Selection Guide should be referred to concerning types and applicability of PPE offered by Env-Logic.

7.2 Level D Protection (anticipated level of protection)

Level D PPE provides minimal protection against chemical hazards. A respirator is not required. Level D PPE includes:

- Cotton coveralls or long pants and shirt with sleeves
- Reflective high visibility safety vest

- Safety glasses with splash protection, spoggles, or ***monogoggle, and if face shield is worn***, safety glasses must accompany.
- Steel-toed work boots (disposable over-boots may be required under certain conditions).
- Chemical Resistant Gloves/Nitriles should be worn under all primary hand protection (leather, rubber, or Kevlar ®) when working with potential to contaminant exposure.
- Hearing protection (as required by task).
- Hard Hat (as required by task).
- Chemical resistant gloves (as required by task).
- N95 dust mask for nuisance dust.
- Tyvek coveralls, laminated or non-laminated (as required by task).
- Flame Resistant Clothing (FRC).

7.3 Modified Level C Protection (not anticipated level of protection)

Modified Level C PPE includes the items listed in Section 7.2 above, and the following items:

- Full-face Air Purifying Respirator or half-face APR respirator equipped with the appropriate chemical cartridge.
- Full body fabric (laminated or non-laminated) Tyvek coveralls.

7.4 Level C Protection (not anticipated level of protection)

Level C PPE provides a higher level of respiratory and skin protection against chemical hazards than Level D. Level C PPE includes the items listed in Section 7.2 above, and the following items:

- Poly-coated Tyvek (yellow, blue, or gray laminated) or Saranex® (shiny white laminated)
- Steel-toed work boots and chemical resistant over-boots, or chemical resistant steel-toed boots
- Inner chemical resistant gloves
- Chemical resistant outer gloves
- Seal arm, leg, and zipper joints with duct tape, as required
- Half-face or full-face, air-purifying respirator equipped with appropriate cartridge

7.5 Level A and B Protection (not anticipated level of protection)

- Level A PPE should be worn when the highest level of respiratory and skin protection is needed, or if the contaminants of concern are unknown.
  - The following constitute Level A equipment; it may be used as appropriate;

- Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
- Totally-encapsulating chemical-protective suit.
- Coveralls.(1)
- Long underwear.(1)
- Gloves, outer, chemical-resistant.
- Gloves, inner, chemical-resistant.
- Boots, chemical-resistant, steel toe and shank.
- Hard hat (under suit).(1)
- Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).
  - Footnote (1) Optional, as applicable.

- Level B should be worn when the highest level of respiratory protection is necessary but a lesser level of skin protection is needed.
  - The following constitute Level B equipment; it may be used as appropriate.
    - Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved).
    - Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
    - Coveralls.(1)
    - Gloves, outer, chemical-resistant.
    - Gloves, inner, chemical-resistant.
    - Boots, outer, chemical-resistant steel toe and shank.
    - Boot-covers, outer, chemical-resistant (disposable).(1)
    - Hard hat.(1)
    - Face shield.(1)
      - Footnote (1) Optional, as applicable.
- Separate HASPs will be developed for Level A or B investigations and for Emergency Responses, which may involve the use of Level A/B health and safety measures

7.6 <u>Personal Protective Equipment Failure</u>

- If any site worker experiences a failure or alteration of protective equipment that affects the protection factor that person and his/her buddy, if applicable, shall immediately leave the Exclusion Zone. Reentry shall not be permitted until the equipment has been repaired or replaced.

8.0 Decontamination

8.1 General

At a minimum, the procedures outlined below shall be followed for decontamination:

- Remove gross contamination from tools, respirator, monitoring equipment, boots, etc., prior to leaving the "exclusion zone", using spray water bottles, brushes, paper towels, handi-wipes, etc.
- Completely decontaminate soiled equipment in the Contamination Reduction Zone using steam cleaners, power washers, detergent and water and dispose of all cleaning materials as follows with approval of on-site client:
  - Lightly contaminated decontamination fluids should either be treated via a site treatment system prior to discharge or disposed of via the sanitary sewer system. Moderately or highly contaminated decontamination fluids must be stored in labeled drums and proper disposal arrangements must be made.
  - Dispose of contaminated gloves, Tyvek suits, used cartridges, paper towels, etc., by placing in a plastic bag and storing in a labeled drum and proper disposal arrangements must be made
- Wash hands and face thoroughly with soap and water before coffee breaks, lunch, and as soon as practical after finishing work for the day
- Particular care should be taken to protect any skin injuries. If open wounds exist on hands or forearms, handling chemicals should be restricted or eliminated.
- Shower as soon as possible.
- If injury occurs within the exclusion or decontamination zone and decon is necessary, see Section 9.2 and 9.3 below.

9.0 Emergency Action Plan

9.1 Identify location of the following during the site orientation:

___X___ First Aid Kit: Env-Logic vehicle. Eye Wash: Env-Logic vehicle_____

_______ Stretcher: ____________________ Emergency Shower: ________________

___X___ Bloodborne Pathogen Kit: Env-Logic vehicle

___X___ Fire Extinguisher: Env-Logic vehicle

_______ Public Telephone: ____

_______ Site Telephone: ____

___X____ Mobile Telephone: with Env-Logic field crew _________________________

_______ Two-Way Radios: _____________________________________

___X___ Telephone Contact lists: with this HASP on-site in client and Env-Logic vehicles.

_______ SCBA's: ____

Escape Packs: ____

9.2 Personal Injury within the Exclusion Zone

Site operations shall be temporarily halted and all site personnel shall assemble in the Contamination Reduction Zone. The Site Supervisor shall evaluate the nature of the injury and, if indicated by the hazards present on site, the injured person shall be decontaminated to the extent possible prior to movement to the Support Zone.

Contact shall be made for an ambulance if necessary and with the designated medical facility (if required). An individual certified in Standard First Aid and Adult CPR may choose to initiate the appropriate first aid. No persons shall reenter the Exclusion Zone until:

a. The conditions resulting in the emergency have been corrected;
b. The hazards have been reassessed;
c. The Site Safety Plan has been reviewed; and
d. Site personnel have been briefed on any change to the Site Safety Plan.

9.3 Personal Injury within the Decontamination Zone

The Site Supervisor shall evaluate the nature of the injury and, if indicated by the hazards present on site, the injured person shall be decontaminated to the extent possible prior to movement to the Support Zone. Contact shall be made for an ambulance and with the designated medical facility (if required). An individual certified in Standard First Aid and Adult CPR may choose to initiate the appropriate first aid. If the injury increases risk to other site workers, all site personnel shall move to the

Contamination Reduction Zone and site activities will stop until the risks can be assessed and either removed or minimized.

9.4 Personal Injury within the Support Zone

The Site Supervisor shall evaluate the nature of the injury and determine if the cause of injury or loss of the injured person will affect continuation of site operations. If the injury will not affect the safety or performance of other site workers, operations may continue, with the person certified in first aid initiating the appropriate first aid and necessary follow up as stated above. If the injury increases risk to other site workers, all site personnel shall remain in the Support Zone and site activities will cease until the risks can be assessed and either removed or minimized.

9.5 Personal Protective Equipment Failure

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor that person and his/her buddy, if applicable, shall immediately leave the Exclusion Zone. Reentry shall not be permitted until the equipment has been repaired or replaced.

9.6 Fire/Explosion

If a fire is observed in the incipient phase (i.e., when it begins) and if the site personnel witnessing the fire feel secure in attempting to control the fire, the individual can attempt to extinguish the fire by using the on-site fire extinguisher. The fire extinguisher should be a minimum 20 pound dry chemical, Class A, B, and C extinguisher and adequate for paper and wood based products (A), flammable and combustible liquids (B), and electrical (C) type fires.

If there is no fire extinguisher available or if site personnel do not feel secure in attempting to extinguish the fire, site personnel shall perform the following:

- Secure the site, if possible but do not lock doors
- Evacuate the area using the nearest safe pathway from the area
- Proceed to the nearest phone and call 911 and provide the emergency operator all required information and this will activate the emergency response system
- PERSONNEL NOT TRAINED IN FIRE EXTINGUISHER USE ARE PROHIBITED FROM ATTEMPTING TO FIGHT A FIRE

If more than one individual is on the site team, the individual activating the evacuation plan shall verbally communicate to the other site personnel that there is an emergency condition and that they should evacuate from the work area. An agreed upon evacuation point with planned route and alternate shall be determined during the Tailgate Safety Meeting. If contact cannot be made verbally with the other site personnel, any of the following systems can be used as long as the system is audible above background noise. The system can be a vehicle horn, whistle, air horn, or other acceptable device. The system used for initiating an evacuation from the site shall be discussed during the tailgate meeting with the other site personnel prior to beginning the workday. The system that is decided upon shall be documented on the site health & safety tailgate meeting form for the shift.

9.7 Equipment Failure

If any equipment on site fails to operate properly, the Site Supervisor shall be notified and then determine the effect of this failure on continuing operations. If the failure will affect the safety of personnel, all personnel shall leave the Exclusion Zone until the situation is evaluated and appropriate actions are taken.

9.8 Emergency Contact/Notification System

All incidents, injuries and near-misses must be reported to the Env-Logic Senior Project Manager (609-9100720/cell: 973-415-7177) as soon as possible. The Env-Logic Incident/Injury or Loss Report must be completed by the affected employee and any witnesses and returned to the Senior Project Manager with 24 hours of the incident. In the event of an injury, incident or Near Loss, all work will immediately stop and the incident must be immediately reported to the Senior Project Manager, Site Project Manager, and HSO. All contact information can be found in Table 2. The client will be made aware of any injury, incident or "near loss". Work will resume once the incident is reported, the cause of the incident is determined and work practices are modified to eliminate the potential hazard(s). The client Incident/ Injury Report and Env-Logic Incident/Injury or Loss Report must be completed by the affected employee and any witnesses and returned to the Senior Project Manager within 24 hours of the incident.

9.9 Medical Emergencies

This information shall be immediately available to all on-site personnel. A copy of this SSHASP shall be located on the dash board of the primary support vehicle for the project to protect it from environmental conditions that may damage it. Any person who becomes ill or injured must be decontaminated to the maximum extent possible. First aid should be administered, if necessary, while awaiting an ambulance or paramedics. A map with directions to the nearest hospital follows:

HOSPITAL DRIVING DIRECTIONS AND MAP:

Saint Joseph Hospital

4295 Hempstead Tpke, Bethpage, NY 11714

Phone: (201) 291-6070 (confirmed)

Begin: Site Address

450 Main Street

Farmingdale, NY 11735

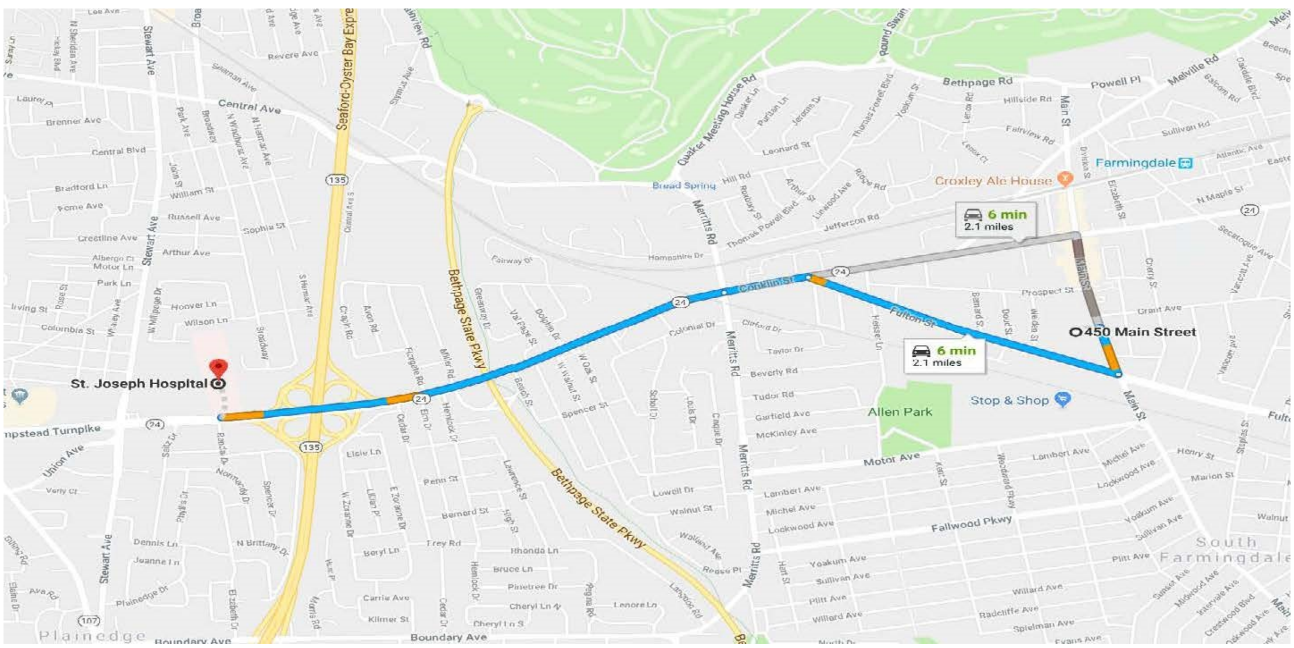
Head south on Main Street toward Richard Street	**0.1 mi**
Turn right onto Fulton Street	**0.7 mi**
Use any lane to turn left onto Conklin St/ Fulton St	**0.2 mi**
Continue onto Hempstead Turnpike	**1.1 mi**
Destination will be on the right	

Arrive: Hospital

St. Joseph Hospital

4295 Hemstead Turnpike, Bethpage, NY 11714

HOSPITAL DRIVING MAP



CLINIC DRIVING DIRECTIONS AND MAP:

PromptCareMD, Walk-In Urgent Care

1037 Fulton Street, Farmingdale, NY 11735

(516) 520-220 (confirmed)

Begin: Site Address

Begin: Site Address

450 Main Street, Farmingdale, NY 11735

Head south on Main St toward Richard St **(0.1 mi)**

Turn left onto Fulton St **(0.9 mi)**

Use the middle lane to continue on Farmingdale Rd/Fulton St **(0.3 mi)**

Use the right lane to merge onto NY-110 N/Broadhollow Rd via the ramp to Huntington **(0.2 mi)**

Turn right to merge onto NY-109 W/Farmingdale Rd/Fulton St toward Hempstead

Continue to follow NY-109 W/Fulton St and Destination will be on right **(0.6 mi)**

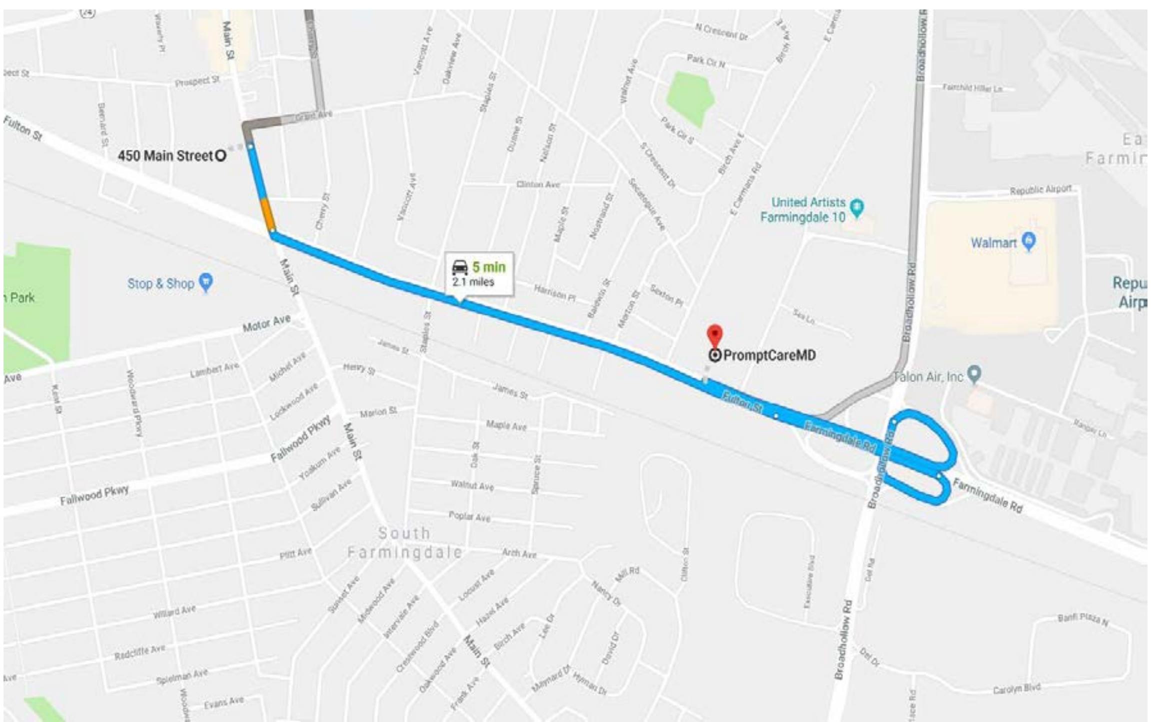
Arrive: Urgent Care

PromptCareMD, Walk-In Urgent Care 1037

Fulton Street, Farmingdale, NY 11735

(631) 460-5451 (confirmed)

URGENT CARE DRIVING MAP



9.10 <u>Spills or Leaks</u>

In the event of a spill or a leak, site personnel will:

- Inform their supervisor immediately.
- Locate the source of the spillage and stop the flow if it can be done safely; and,
- Begin containment and recovery of the spilled materials with sorbent (vermiculite, etc.).

10.0 Standard Operating Safety Procedures, Engineering Controls, and Work Practices

10.1 Work Permits

Work permits are required for confined space entry and Hot Work. Permits shall be obtained from the clients Local Health and Safety Officer prior to site work.

10.2 Job Safety Analyses (JSAs)

Job Safety Analyses should be made available and reviewed prior to each on-site activity. If a JSA is not available to perform a specific routine task where a JSA should be available, one should be created on site in the standard format of all other Env-Logic J SAs. JSAs for this project shall be provided to the Senior Project Manager prior to project commencement and forwarded upon client request (if applicable).

10.3 General Site Rules

The following general site rules apply to all personnel while on the site:

- Before daily site operation begins, the daily site safety checklist will be completed, the subcontractor's training documentation will be reviewed (as required by section 3 of this plan), and a pre-entry briefing will be held to review the site's health and safety plan concerns and emergency procedures. This meeting will be registered in the site specific health and safety plan. Attendance will be documented.
- One site worker will be assigned to keep the daily log for all health- and safety-specific site activities, unless otherwise specified.
- All personnel will wear all required PPE as noted in the JSAs and section 7 of this plan regardless of task.
- Eye protection and reflective high visibility safety vest will be worn at all times while on site.
- Possession of alcohol or illegal substances on the job site or consumption of same during hours of site operation is strictly prohibited. Any employee taking over-the-counter (OTC)

medications that can affect their ability to operate a motor vehicle or equipment shall report the condition to their supervisor immediately and shall be prohibited from performing any work. Any field personnel unfit to work shall not be permitted to leave the facility without making contact with their supervisor.

- Food, beverages, tobacco products are not permitted in the site's Exclusion or Contamination Reduction Zones. Food, beverages, and smokeless tobacco products may be permitted in the Support Zone, with permission from the site client and if proper decontamination procedures are being followed.
- Smoking is not permitted on the site.
- Cell phone use is restricted on all sites at the discretion of the property manager/owner or client
- Field personnel shall not stand with their head directly over a well when work is being performed.
- First aid kit(s) with 4 oz. eye wash and 20lb fire extinguisher(s) will be available in all company vehicles and/or within 50 feet of the working area

NOTE: Hot Work activities require that a trained person on-site shall act as a fire watch with a 20lb Class A, B, C dry chemical extinguisher within 10 feet of the activity, and all other required Hot Work requirements are satisfied.

11.0 Air Monitoring Plan

Env-Logic will perform air monitoring for the contaminants of concern. Each contaminant will be evaluated by the CIH and parameters established prior to commencement of activities. A photoionization detector (PID) will be used to monitor the breathing space during intrusive field activities, and to field screen all soil, groundwater, and/or subsurface air samples once removed from the borehole to determine the potential presence of volatile organic vapors. Air monitoring equipment will also be used to identify airborne asbestos, lead, or mold (depending upon investigation{s}). Respirators will be donned if the PID readings indicate unsafe breathing conditions and Stop Work will be utilized to upgrade from Level D to Level C, if necessary. A CIH will be consulted for Maximum Use Concentrations to determine at what levels upgrade to Levels A or B will be implemented.

11.1 General

In many instances, it will be necessary to monitor the atmospheric conditions during on-site work activities to identify and quantify airborne contaminants; to assist in defining work zones; and, to determine the level of work protection needed. Air monitoring shall be performed wherever the possibility of worker exposure to hazardous substances exists. Air monitoring will be performed at the worker's breathing zone. Upgrades/downgrades to personal protective equipment (PPE) will be made based on air monitoring results in the breathing zone. In general, work shall be initiated in Level D PPE with a contingency to upgrade the level of PPE based on action levels.

11.2 Monitoring During Site Operations

Volatile organics and dust levels will be continuously monitored during all activities that have the potential for soil disturbance. Real-time monitoring will also be conducted at locations such as in any of the staging areas as part of determining atmospheric background levels. Background levels will be established before conducting real-time monitoring in any restricted or Exclusion Zone work area.

Air monitoring exceedance and/or odor will be documented and actions will be taken in accordance with the Action Level Table. Odor and dust control measures will be implemented if needed. Dust control measures may include the use of water to control dust levels during work activities. Odor control measures will include the application of an odor suppressant. Air monitoring will be repeated 15-minutes following the application of an engineering control; the monitoring will be conducted at the perimeter and downwind.

Periodic monitoring shall be conducted when significant dust generation has occurred or when there is indication that exposures may have risen over permissible exposure limits (PEL) or published exposure levels since prior monitoring.

11.2.1 Exclusion Zone Monitoring:

The frequency of real-time monitoring in exclusion zone work areas will be determined by the HSO according to the task being conducted and whether potentially hazardous soil will be contacted. Real-time monitoring in restricted work zone areas will be conducted under the following conditions: prior to the beginning of any new job task; prior to the beginning of a job task in any new area; periodically for a long-term job task; during an activity which would have the highest probability of worker exposure as determined by the HSO; visible presence of contamination; or at the discretion of the HSO. Based on the previous investigations and the tasks to be performed, the HSO will perform monitoring in the work area during excavation activities.

11.2.2 Perimeter Monitoring

Volatile organics and dust levels (e.g., asbestos, lead) will be continuously monitored at the perimeter of the work area during all activities that have the potential for airborne particles. A total of four (4) perimeter stations should be deployed for the perimeter air monitoring.

Table 11-1 shows the type of instruments that should be utilized to monitor potential site contaminants.

11.2 Action Level Criteria

A summary of the action levels to be used, action required and the types of instrumentation which may be utilized at the discretion of the HSO will be found in Appendix C.

11.3 Air Monitoring Equipment – (Revise as applicable) with Site Specific Air Monitoring Requirements

- MultiRAE Plus or equivalent i.e. Carbon monoxide/CO, flammable gases & vapors i.e. lower explosion limit/LEL, hydrogen sulfide/H_2S, oxygen/O_2, and volatile organic compounds VOC i.e. total concentration/PPM

Site air monitoring equipment shall be calibrated, maintained and operated in accordance with the manufacturers' instructions.

Table 11- 1. Air Monitoring Instrumentation

Air Monitoring Instrument Name	Acronym	Contaminant(s) Monitored
Photoionization Detector	PID (perimeter monitoring)	Organic Vapors (to detect the presence of volatile organic chemicals)
Combination Photoionization Detector and Combustible Gas Indicator	PID / CGA (work zone monitoring)	Organic Vapors (to detect the presence of volatile organic chemicals) / Oxygen, carbon monoxide, lower explosive limit, hydrogen sulfide
Total Dust Meter	Work zone and perimeter	Total Dust
Draeger Tube	Draeger (work zone)	Chemical specific measuring device for detecting (e.g., vinyl chloride, benzene.

11.4 Calibration

All monitoring equipment should be calibrated daily prior to work start and should have been factory serviced/calibrated within the past year.

Air monitoring shall be conducted for asbestos abatement, lead abatement, mold abatement, groundwater monitoring wells installation, groundwater monitoring well abandonment, geotechnical investigations, installation of gas vent system, and ongoing operation and maintenance activities with exposure to groundwater, subsurface air and soil health hazards to include:

- Carbon monoxide/CO i.e. real time PPM
- Lower explosion limit/LEL i.e. real time flammable gases & vapors percentage (%)
- Hydrogen sulfide/H_2S i.e. real time PPM
- Oxygen/O_2 i.e. real time percentage (%)
- Volatile Organic Compounds/VOC i.e. real time total concentrations PPM

11.5 <u>Air Monitoring Procedures - (Revise as applicable) with Site Specific Air Monitoring Requirements</u>

Site air monitoring for airborne dust concentrations, carbon monoxide/CO, lower explosion limit/LEL i.e. flammable gases & vapors, hydrogen sulfide/H_2S, oxygen/O_2 and volatile organic compounds shall be conducted during prior to and during site work to include:

- Asbestos, Lead or Mold Abatement
- Groundwater monitoring wells installation
- Groundwater monitoring well abandonment
- Groundwater monitoring well sampling

11.6 <u>Air Monitoring Action Levels/Limits - (Revise as applicable) with Site Specific Air Monitoring Requirements</u>

• Carbon monoxide/CO	≥35PPM; Stop work, evacuate area(s) & notify SPM[1]
• LEL i.e. flammable gases/vapors	≥10%; Stop work, evacuate area(s) & notify SPM [1]
• Hydrogen sulfide/H_2S	≥10PPM; Stop work, evacuate area(s) & notify SPM[1]
• Oxygen/O_2	≤19.5% ≥23.5%; Stop work, evacuate area(s) & notify SPM[1]
• Volatile Organic Compounds/VOC	≥10PPM above background sustained for fifteen (15) minutes; Stop work, evacuate area(s), & notify SPM[1]

[1]Conduct air rescreening after five (5) minutes to determine absence or presence of safety and health hazards; resume work based upon air monitoring result i.e. < action levels and/or limits or continue stop work > action levels and/or limits and notify Senior Project Manager.

11.7 <u>Air Monitoring Daily Log</u>

Site air monitoring daily log shall include but is not limited to:

- Date and time
- Air monitoring location i.e. restricted work zone(s) and/or general work zone(s)

- Make and model of air monitoring equipment
- Real time air monitoring data
- Corrective actions

11.8 Initial Monitoring for Lead

Initial area monitoring in accordance with 29 CFR 1926.62 will be conducted to determine the presence of lead in airborne soil during ground intrusive activities.

- If initial monitoring indicates the potential for employee exposure at or above the 30 ug/m3 Action Level, personal exposure monitoring for lead will be conducted for one employee in each task.
- If personal exposure monitoring indicates employee exposure below the action level, monitoring may be discontinued.
- If personal exposure monitoring indicates employee exposure at or above the action level but below the permissible exposure limit, the monitoring must be repeated at least six (6) months. Repeat monitoring must be conducted until two (2) consecutive measurements taken at least seven (7) days apart are at or below the action level.
- If the personal exposure monitoring indicates employee exposure at or above the permissible exposure limit, the monitoring must be repeated at least every three (3) months. Repeat monitoring must be conducted until two (2) consecutive measurements taken at least seven (7) days apart are at or below the permissible exposure limit.

12.0 Standing Orders

- No smoking, eating, or drinking within the formal/informal work zone.
- No horseplay at any time anywhere.
- No matches or lighters within the informal support and work zone.
- Implement the communications system: cell phone use permitted as directed by client.
- Seatbelts required on all moving equipment prior to starting engine.
- Stop Work Authority is always in place to manage imminent hazards.
- Show Hands Policy is always required when working as a 2 or more man crew.
- No weapons permitted.

13.0 Acknowledgement

I have read, understood, and agreed with the information set forth in this Site-Specific Health and Safety Plan and will adhere to the protocols specified herein.

Env-LOGIC PERSONNEL:

Brooke Ann Briganti

Health & Safety Officer

12-23, 2017

Date

Katrina VanDeusen, Senior Project Manager

Dec. 23, 2017

Date

TABLE 1

POTENTIAL PHYSICAL HAZARDS

Farmingdale Commons, LLC

450 Main Street

Farmingdale

Nassau County, NY

Hazard	**Description**	**Control Measures**
Skin contact with contaminated material	Material falls on skin; gets in eye	Wear proper clothing; follow safe work practices
Lacerations and abrasions	Many opportunities working with hand tools	Inspect equipment being used for sharp edges, wear proper hand protection; follow safe work practices
Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting and general material handling techniques
Slips, trips, and falls	Any number of injuries from slips, trips, and falls in carrying out these tasks	Good housekeeping at site, constant awareness and focus on the task
Heat Stress	Stress or exhaustion related to high temperatures	Hydrate and rest as needed
Bites and stings	Bee stings, ticks, snake bites	Wear proper PPE, be watchful, follow safe work practices
Vehicle Traffic	Vehicles traveling on the property	Wear hi- vests at all times and use of protective barriers, cones/flags, caution tape, follow safe work practices

TABLE 2

EMERGENCY NOTIFICATION

LIST FORMER TOOL TOWN

450 Main Street

Farmingdale, NY

Nassau County, NY

TITLE	CONTACT	PHONE NUMBER
Police	NY State Police Department 7140 Republic Airport Farmingdale, NY 11735	Non-Emergency: (631) 756-3300 (CONFIRMED) Emergency: 911
Fire Company	Farmingdale Fire Department 361 Main St #2 Farmingdale, NY 11735	Non-Emergency: (516) 249-3710 (CONFIRMED) Emergency: 911
Hospital	Saint Joseph Hospital 4295 Hempstead Tpke, Bethpage, NY 11714	Non-Emergency: (201) 291-6070 (CONFIRMED) Emergency: 911
Emergency (Urgent Care) Clinic	PromptCareMD, Walk-In Urgent Care 1037 Fulton Street, Farmingdale, NY 11735	(516) 520-220 (confirmed))
National Response Center (NRC)		800-424-8802
Poison Control Center		800-222-1222
Chemtrec		800-424-9300
Center for Disease Control (CDC)		404-488-4100
Env-Logic Project Manager	Katrina VanDeusan	Office: (609) 910-0720 Cell: (908) 591-0361
Env-Logic Site Contact	Katrina VanDeusan	Office: (609) 910-0720 Cell: (908) 591-0361
Env-Logic HSO	Variable	Office: (609) 910-0720 Cell:
Subcontractor Project Manager, If applicable		Office: (732) 000-0000 Cell: (732) 000-0000

Appendix A

Air Monitoring Procedure, if applicable

Appendix B

Air Monitoring Documentation Form

Env-LOGIC AIR MONITORING REPORT

Project Name:		Date:		
Project Location:		Project No.:		
		Page:	1	2

INSTRUMENT CALIBRATION:

Instrument	Calibrated By:	Date	Time(s)	

PERIMETER & PERSONNEL SAMPLING:

Perimeter Samples Collected:	
Perimeter and Personnel Sample Results from Previous Days (Provide Data When Received, Indicate Date on Which Sample Was Collected):	

METEOROLOGICAL DATA:

Temperature:		ºF Wind Direction:		Humidity:		%

Provided by Experience Safety Institute (ESI) Denis Crayon, CHST

Env-LOGIC AIR MONITORING REPORT

Project Name:		Date:			
Project Location:		Project No.:			
		Page:	1		2
Weather Condition (e.g., Gusty, Rain, Snow, Sun, Etc.)					

COMMENTS:

OPERATION MONITORED: (If instruments have recorders, attach tape to report. Note when action levels are exceeded. Indicate response taken.)

Instrument	Sampling Location	Sample Time	Reading	Action Level Exceeded?		Action(s) Taken
				Yes	No	

REPORT PREPARED BY:

(Printed Name)	(Signature)

Env-LOGIC AIR MONITORING REPORT

	Project Name:		Date:				
	Project Location:		Project No.:				
			Page:	1		2	
(Date)							

Appendix C

Job Safety Analyses (JSAs) – Project Specific, if applicable

Appendix D

Sign In Roster/Attendance

Sign In Roster/Attendance

Name	Signature	Company	Date

Provided by Experience Safety Institute (ESI)

Denis Crayon, CHST