GROUNDWATER TECHNOLOGY ®

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OPERATION AND MAINTENANCE PLAN

PHILIPS COMPONENTS
DISCRETE PRODUCTS DIVISION
SAUGERTIES, NEW YORK

GTI Project 011105019

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Document Purpose and Scope 1
1.2 Site Description and Background Information 2
1.3 Project Personnel and Location 4

2.0 REMEDIATION SYSTEM DESIGN AND OPERATION 5
2.1 Remediation System Overview 5
2.2 Description of Remediation System and Operating Parameters 5
2.2.1 Air Sparging System 5
2.2.2 Soil Vapor Extraction System 6
2.2.3 Groundwater Pumping System 9
2.2.4 Groundwater Treatment System 9
2.3 Performance Objectives 10

3.0 REMEDIATION SYSTEM MAINTENANCE 11
3.1 Remediation System Maintenance and Troubleshooting Procedures 11
3.1.1 Air Sparging System 12
3.1.2 Soil Vapor Extraction System 13
3.1.3 Groundwater Pumping System 14
3.1.4 Groundwater Treatment System 15

4.0 REMEDIATION SYSTEM MONITORING 15
4.1 Remediation System Monitoring and Response Procedures 15
4.1.1 Air Sparging System 15
4.1.2 Soil Vapor Extraction System 16
4.1.3 Groundwater Treatment System 18
4.1.4 Groundwater Sampling 18
4.1.5 Homeowner Well Sampling 18

5.0 PROGRESS REPORTS 19

FIGURES

1-1 Site Location Map 3

TABLES

2-1 Remediation System Equipment List 7
2-2 Groundwater Quality Objectives 11
3-1 Remediation System Maintenance Table 12
4-1 Remediation System Monitoring Table 16

APPENDIXES

A. Maps and Drawings
B. Process Exhaust and Ventilation System Permit Application
C. Equipment Manufacturers' Catalogs and Literature
D. Health and Safety Plan

1.0 INTRODUCTION

1.1 Document Purpose and Scope

This Operation and Maintenance Manual was prepared by Groundwater Technology, Inc. for Philips Components, Discrete Products Division. This manual is intended to be a comprehensive guide to the air sparge, soil vapor extraction (SVE), groundwater extraction and treatment systems operating at the Saugerties, New York facility. It is, therefore, subject to revision and update as required to ensure an accurate description of system equipment, operation and required maintenance.

Objectives for the document include:

- Specify procedures for effective operation of the remediation system.
- Specify procedures for effective maintenance of the remediation system, resulting in the maximum operating time ("up time") of the remediation system.
- Specify monitoring procedures that measure the progress of the remediation system toward its objectives, and ensure the protection of public health and safety.

This manual is designed to provide the information need for maintenance of the remediation system both by persons familiar and those unfamiliar with the project. This necessitates incorporation of the following information:

- Site Information (section 1.0)
- Remediation System Design and Operation (section 2.0)
- Remediation System Maintenance and Troubleshooting (section 3.0)
- Remediation System Monitoring and Response Actions (section 4.0)
- Progress Reports (section 5.0)
- Maps and Drawings (appendix A)
- Vapor Discharge Permit Information (appendix B)
- Equipment manufacturers' catalogs and literature (appendix C).
- Safety Information - HASP (appendix D)

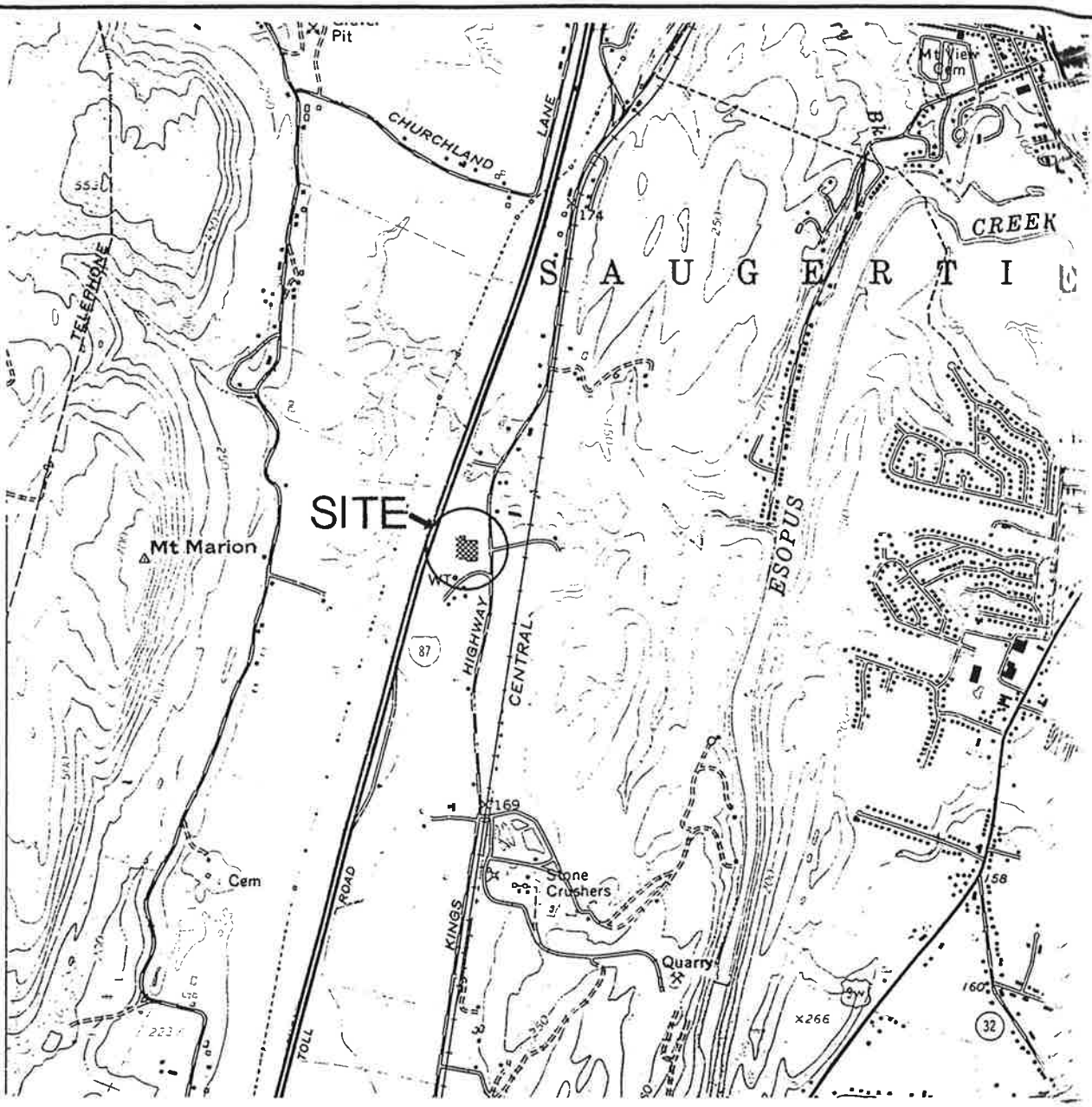
1.2 Site Description and Background Information

The Philips Components, Discrete Products Division facility (formerly Ferroxcube Division of Amperex Electronics Corporation) is located at 1033 Kings Highway in the Town of Saugerties, New York. The site is bounded by Kings Highway to the east and the New York State Thruway to the west. The plant manufactures electronic components and employs approximately 275 people **(figure 1-1, Site Location Map)**.

The manufacturing complex is comprised of several buildings. Building 1 began operations in 1961, while Building 2 was constructed in 1964 for office space and manufacturing. In 1966, a solvent storage building was constructed adjacent to the northeast corner of Building 2. Building 2A was constructed in 1975 and Building 2B was constructed in 1977. Historically, halogenated solvents have been used on site for degreasing and cleaning operations **(drawing Y-1, appendix A)**.

In 1982 the Ulster County Health Department sampled local residential wells as part of their regional groundwater quality assessment. The presence of volatile organic compounds (VOCs) was detected in these samples. Subsequent investigations revealed the presence of VOCs on the Ferroxcube property:

- Dunn Geoscience Corporation installed additional wells and collected supplemental groundwater data. Progress Reports were prepared in 1983 and 1984.
- O'Brien & Gere Engineers, Inc. (O'Brien & Gere) implemented a work plan to continue investigation of groundwater quality and subsurface conditions at the site. The work plan included initiating groundwater recovery from two wells near Building 2A/2B in an effort to decrease the levels of VOCs present in the groundwater. The findings of this work were reported in a ***Hydrogeologic Investigation Report***, dated January 1988.
- O'Brien and Gere further defined the distribution of VOCs in the subsurface by completing a soil vapor survey. The results of this testing were reported in the ***Soil Vapor Investigation Report*** dated August 1990.
- Groundwater Technology, Inc. (Groundwater Technology) developed a ***Conceptual Remedial Plan*** (April 8, 1991) which presented a technical approach to augment the existing remedial systems. The ***Remedial Plan*** contained work phases intended to further define the subsurface distribution of VOCs adjacent to Building 2, to pilot test and evaluate proposed remedial technologies in the remedial target area, and to implement and install the selected remedial alternative.



SOURCE: U.S.G.S. TOPOGRAPHIC QUADRANGLE
SAUGERTIES, N.Y. QUADRANGLE
7.5 MINUTE SERIES
DATE: 1963/REVISED 1978

QUAD LOCATION

SCALE 1:24,000

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SCALE FEET

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GROUNDWATER TECHNOLOGY

1245 KINGS ROAD
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DESIGNED: RAH	**SITE LOCATION MAP**
DETAILED: DEO	CLIENT: PHILIPS COMPONENTS
CHECKED:	LOCATION: 5083 KINGS HIGHWAY SAUGERTIES, NEW YORK

- Groundwater Technology completed the ***Remedial Investigation/Feasibility Study*** (RI/FS) and submitted the report documenting these findings on May 10, 1992. These reports delineated a remediation target area on the east side of Building 2A/2B and evaluated alternatives to remedy VOCs in various media.

- The New York State Department of Environmental Conservation (NYSDEC) required additional site work to complete the remedial investigation. The focus of the work was to investigate the existence of a dense, non-aqueous phase liquid (DNAPL) within the remediation target area on-site. Groundwater Technology completed this work in December 1992; the findings were presented in the ***Remediation Investigation/Feasibility Study Addendum*** dated February 1993.

- The ***Record of Decision*** (ROD) was published by NYSDEC in March 1993. The selected remedy for the Ferroxcube remediation target area included air sparging of saturated zone soils to remove VOCs, installation of vapor extraction wells in unsaturated soils to remove VOCs, and pumping groundwater through the facility's cooling tower to remove VOCs from the groundwater and to provide containment.

- Design and construction work for the selected remedy were completed in accordance with the ***Remedial Design/Remedial Action (RD/RA)*** workplan, prepared pursuant to an Order on Consent.

- A ***Final Engineering Report*** was prepared in December 1994 describing the system in its as-built configuration.

- This document (***Operations and Maintenance Plan***) specifies the procedures and personnel responsible for operations and maintenance of the remedial system.

1.3 Project Personnel and Location

The following personnel have responsibilities for Operation and Maintenance of the Remedial System:

Philips Components, Discrete Products Division:

Plant Engineering Manager:	John Bedell	Office: 914 - 246-2811
Maintenance:	Bob Chappelle	914 - 246-2811
Monitoring:	Al Kryzwonos	914 - 246-2811

Groundwater Technology Personnel:

Project Manager:	Richard Hixon	Office: 518 - 370-5631
Project Engineer:	Michael Sykes	Office: 518 - 370-5631

New York State Department of Environmental Conservation:
Regional Haz. Waste Engineer: Ramanand Pergadia Office: 914 - 256-3000

2.0 REMEDIATION SYSTEM DESIGN AND OPERATION

2.1 Remediation System Overview

Pilot testing and detailed analysis of retained alternatives completed during the Remedial Investigation/Feasibility Study demonstrated that readily available technologies (soil venting, air sparging, groundwater pump and treat) would achieve compliance with state standards, protect the human health and the environment, and would produce greater results in terms of effectiveness, implementability, and cost relative to the other alternatives (see ***Remedial Investigation/Feasibility Study***, May 1992).

A brief description of the technologies in the selected remedial system follows. A list of the equipment installed is also included in **table 2-1**.

2.2 Description of Remediation System and Operating Parameters

The remediation system is designed to remove volatile organic compounds (VOCs) from the site subsurface soils and groundwater. The remediation system is comprised of three (air sparge, soil vapor extractions and groundwater extraction and treatment) integrated systems. Schematics of the systems are provided (**drawings P1, P2, P3, and P4, appendix A**). An overview of system components and operation follows.

2.2.1 Air Sparging System

Air sparging requires the injection of air into the saturated soil and is an effective method of removing adsorbed and dissolved VOCs from the saturated zone. The released vapors are collected by the vapor extraction system.

The quantity of air injected by the air sparging system is limited by design and operation to ½ the volume of soil gas extracted by the soil vapor extraction system (i.e., 120 scfm). This limitation was

designed to maintain overall vacuum in the subsurface soils and prevent the migration of fugitive volatile compounds to surrounding areas and buildings. Each sparge well is operated from 1-8 psi which will deliver up to 12 scfm compressed air to the sub-surface.

Sparge wells were installed with the use of a hollow-stem-auger to a depth equal to the limits of auger refusal (competent bedrock). The sparge wells were constructed of 2-inch FRE for compatibility with the chlorinated compounds detected within the groundwater. The wells have a bottom plug and the length of the screen is 1 foot. The remainder of the sparge well is finished to grade with 2-inch-diameter fiberglass casing to a depth above groundwater where it was converted to PVC casing. The sparge point was sealed with bentonite at a depth 1 foot above the sparge well screened interval and grouted to grade. The top of each sparge well is protected with a 12-inch round, steel valve box installed at grade level.

Air for sparge points is generated by an existing plant air compressor. Each sparge point is individually valved with a shut off valve and a pressure regulating valve. In order to measure and control the air flow to each sparge point, air flow meters were installed for each sparge point. Sparge points are connected via 2-inch PVC lines. All piping joints are National Pipe threaded connections. Sparge air is under low pressure (less than 10 psi) and therefore a low pressure piping system (such as PVC) was suitable for air transport. The sparge layout and construction details are depicted in drawings P4, Y7 and Y8 of the ***As-Built Drawing Package***.

2.2.2 Soil Vapor Extraction System

Pilot testing proved that soil vapor extraction (SVE) was a viable and effective remedial alternative to address adsorbed phase volatile compounds at the Philips Components facility both in terms of the radial area of influence produced by each vent well and the VOC concentrations removed in vapor effluent (see ***Remedial Investigation/Feasibility Study***, May 1992). The system was designed and constructed to remove unsaturated-zone VOCs present in soils at the former storage building. In addition, the soil vapor extraction system collects vapors generated by the air sparging system.

The SVE system consists of one soil vent blower which extract from six vapor extraction points. The blower is controlled by a blower panel with a hand switch. Effluent from the SVE system is discharged to the atmosphere.

The vapor extraction pilot testing during the RI/FS predicted a 23 foot radius of influence would be attained when 175 inches of water column (approximately 13 inches of mercury, Hg) vacuum was

applied to the vapor extraction well head. At this operating vacuum, a calculated 40 cubic feet of soil gas per minute (acfm) would be extracted from each vapor well.

Table 2-1
Remediation System Equipment List

Component	Designation	Specification
Air Sparging System		
Air Compressor	AC1	Sullair Rotary Screw type; 60-hp 3-ph.; 250 cfm @100psi.
Air Sparge Wells	SP-1 - SP-11	2in. FRE; depths 11 to 22 ft; screens 1 or 2 ft. in length.
Flowmeters	FI-326 - FI-336	Dwyer Rotameters Model RMC-122
Soil Vapor Extraction System		
Soil Vapor Extraction Blower	B2	ART system: Roots 36URAI frame; 240 cfm @14 in.Hg; Baldor 15-hp. 460-V 3ph. TEFC motor.
Moisture Separator	MS-1	30 gallon
Soil Vapor Extraction Wells	VEP-1 - VEP-6	2in. FRE; depths 8 - 15 ft.
Filter, moisture effluent, bag type	F-2	Filtration Systems; WCB; 150 psi max.
Transfer Pump, moisture effluent	P-10	Meyers; HJA33S; 2 gpm @ 50ft.TDH
Filter, air, in-sump	F-1	15in. diameter; poly-coated paper.
Groundwater Pumping System		
Recovery Wells	OW-3, OW-4, OW-5, OW-10, RW-1, RW-2, and RW-3	6 - 70 ft.depths
Pneumatic Pumps, submersible, controllerless	Locations RW-1, RW-2, RW-3	Brainard-Killman; 4in.; 7 gpm max.
Centrifugal pumps, surface mount.	Locations OW-3, OW-4, OW-5	Meyers, specification unknown
Pneumatic pumps, submersible, surface-mounted controller	OW-10	ESI
Groundwater Treatment System		
Air Cooling Tower, roof mounted	CT-1	Specifications unknown
Air Blower, roof mounted	B1	300 cfm @5in. W.C.
Totalizer flow meters	FQI-106 - FQI-109; FQI-116 - FQI-118	Instantaneous and total flow readout
Granular activated Carbon liquid filters	GAC-3, GAC-4	75 lbs. carbon

The six vapor extraction wells were constructed to remove the adsorbed phase compounds near the former storage building and contain vapors generated from the air sparging system. One extraction well (VEP-1) was installed during the pilot test. The additional five vapor extraction wells were installed in July 1994 to complete the vapor well extraction system.

The additional five vapor extraction wells were installed with the use of a hollow-stem-drill rig. This caused minimal impacts to site operations and no impacts to adjacent properties. The wells were constructed similar to VEP-1 with 2-inch Fiberglass Reinforced Epoxy™ (FRE) well screen and riser pipe. Fiberglass was used due to the presence of chlorinated compounds associated with the groundwater conditions. The top of each vapor extraction well is protected with a 12-inch-round steel valve box encased in a 18-inch concrete skirt installed at grade level.

Each vapor extraction well is controlled by a 2-inch, PVC ball valve enabling adjustment of the air flow and vacuum at each individual well, and a ¼-inch diameter sampling port for drawing air samples and measuring air flow. The individual wells are connected to a 4-inch main header pipe located in the equipment compound. The 4-inch PVC header pipe is connected to a vacuum pump designed to extract the 240 scfm air flow from the soil vapor wells. The construction details of the piping are presented on drawings P3 and Y8 of the ***As Built Drawing Package***.

PVC piping materials were used to convey soil gas vapors from the well locations to the vapor extraction blower due to the relatively low concentrations of chlorinated solvent vapors in the soil gas (<10 $ppm_{(v)}$).

To prevent short circuiting of air from the surface to the vapor wells a 10 mil polyethylene liner was installed 6-inches below grade over the entire impacted area (50x150 feet).

Vapors from the soil vapor extraction system are extracted with the use of a vacuum blower system. A 15 Horsepower (Hp) motor with a positive displacement vacuum blower and a moisture separator tank (30 gallon) are used to develop the required vacuum. Soil gas vapors from the vapor extraction wells are pulled to the moisture tank via the piping network and the vacuum blower. Moisture associated with the soil gas is collected in the vacuum tank and pumped with a centrifugal pump through a bag filter to the head of the groundwater treatment system. The bag filter was installed to collect silt entrained in the moisture collected by the vacuum blower and prevent it from traveling into the remainder of the groundwater treatment system.

Vapors from the vacuum tank are discharged to atmosphere in accordance with a Process, Exhaust, and Ventilation System (PE&VS) permit. This permit application was presented as appendix H of the ***RD/RA Final Design Report***. The application utilized the existing site data and pilot test data to

evaluate the potential impacts to the atmosphere utilizing emission estimating and impact assessment techniques outlined in NYSDEC ***Air Guide 1.***

After the remediation system was constructed a soil gas sample was collected from the SVE system discharge stack and analyzed according to EPA method TO-14. The results of the sample and an additional impact assessment is attached in **appendix B.** Based upon ***Air Guide 1*** calculations and the start up air sample analysis, off gas treatment will not be required. Additional periodic air samples will be collected and analyzed according to the approved ***Effectiveness Monitoring Plan*** and as described later in this plan.

2.2.3 Groundwater Pumping System

This system pumps out groundwater and transports it through the Groundwater Treatment System (see following section), which removes VOCs from the water. The treated groundwater is then discharged through an existing SPDES outfall into the Mudderkill Stream.

The system is comprised of four existing wells, OW-3, OW-4, OW-5, and OW-10 and three new recovery wells (**drawings P2, Y7**). Three of the existing wells (OW-4, OW-5, and OW-10) are constructed of 2-inch PVC. The three new recovery wells are constructed of 6-inch stainless steel. Well OW-3 was enhanced by overdrilling the existing 2-inch well and installing a six-inch well with 15 feet of stainless steel screen to a depth of 26 feet below grade.

A multiple well pneumatic pumping system is used to recover groundwater from the recovery wells (OW-10, RW-1, RW-2, and RW-3). These systems are operated with compressed air. Surface-mounted electric centrifugal pumps extract the groundwater at wells OW-3, OW-4, and OW-5. These pumps transport the extracted groundwater to the existing equalization tank. An existing centrifugal pump transfers water to the existing cooling tower.

2.2.4 Groundwater Treatment System

Discharge from the cooling tower is directed to granular activated carbon treatment and the on-site water treatment facility for the plant. The treated groundwater is then be discharged in accordance with the facility's State Pollution Discharge Elimination (SPDES) permit (#NY0005860) for Outfall #006. The increased flow through the system (1,150 gpd, estimated) does not require a change in the existing permit conditions. The groundwater recovery and treatment system schematic is depicted on drawing P2 of the ***As-Built Drawing Package.***

The pneumatic pumps are located approximately 1 foot from the bottom of the recovery well. Float controls on the pumps maintain groundwater drawdown in the recovery wells to depths approximately 3 feet from the bottom of the recovery well.

2.3 Performance Objectives

The remedial system designed for this site was developed to meet the following objectives:

- remove adsorbed and vapor-phase VOCs from the soils above and below the water table, within the remediation target area,
- provide hydraulic control of overburden groundwater to prevent migration of VOCs from the target area,
- create no adverse impacts to other environmental media (air),
- protect human health during construction and operation, and
- reduce groundwater concentrations of compounds specified by NYSDEC in the ROD (**table 2-2**).

The effectiveness of the remediation system will be primarily based on two criteria. The first criterion will be the ability of the system to emulate the contamination reduction rate for the Miles domestic well as specified in **table 2-2**. The second criterion will be the calculated mass removal for VOCs based on laboratory data and calibrated field screening of the SVE system effluent.

The remediation system will be augmented if the first criterion is not met. If the first criterion is met, but continued operation of the system does not produce a progressive reduction of the mass of VOCs at the site, the operation of the system will be discontinued. The operation will be resumed if the concentrations of VOCs then rebound (increase) by a statistically significant amount at the Miles domestic well.

An annual review of the data will be undertaken to determine whether the groundwater quality standards will likely be met within five years, and to determine the need for any additional remediation work. In making this assessment, two key readings from the Miles domestic well (annual maximum concentrations of Perchloroethene and total VOCs) will be compared with the theoretical concentrations as noted below and specified in the ROD:

Table 2-2 Groundwater Quality Objectives for the Miles Domestic Well		
No. of Years of Remedial Operation	**Theoretical Concentration of PCE (ppb)**	**Theoretical Concentration of Total VOC (ppb)**
1	200	875
2	80	510
3	30	295
4	15	170
5	5	100

Additionally, on-site monitoring well trends will be utilized to evaluate interim clean-up progress.

3.0 REMEDIATION SYSTEM MAINTENANCE

3.1 Remediation System Maintenance and Troubleshooting Procedures

Maintenance of the remediation system will occur with the goal of minimizing downtime and thereby removing the subsurface VOCs as rapidly as possible.

A description of critical maintenance activities is included below, and is listed in **table 3-1**. The maintenance table specifies the routine maintenance each component will receive, the frequency or schedule for maintenance, and the person(s) responsible for the maintenance activity. The maintenance frequencies stated are based on the current information regarding system operation and will be modified in response to changes in system operating parameters.

Detailed procedures for repair and replacement of various components and troubleshooting specific operational problems can also be found in the Equipment Manufacturers' Catalogs and Literature (**appendix C**).

All site maintenance activities will be performed in accordance with the site *Health and Safety Plan*, including following such procedures as vapor monitoring of the work area and locking/tagging (de-energizing) air, water, and electric-generating sources (**appendix D**).

All site maintenance activities will be performed in accordance with the site *Health and Safety Plan*, including following such procedures as vapor monitoring of the work area and locking/tagging (de-energizing) air, water, and electric-generating sources (**appendix D**).

3.1.1 Air Sparging System

Major components of the air sparging system and critical maintenance include:

- **Air Compressor:**
  Maintenance consists of checking oil and changing at the specified frequencies. The air filter is also checked and replaced if necessary on a monthly basis. There is a moisture filter at the compressor that is checked on a monthly basis and one just outside the equipment room that is checked on a weekly basis.

- **Flowmeters:**
  The rotameter-type flowmeters are relatively maintenance-free but should be inspected and cleaned if necessary on a monthly basis.

Table 3-1
Remediation System Maintenance Table

Component	Designation	Maintenance Activity	Maintenance Schedule	Person(s) responsible
Air Sparging System				
Air Compressor	AC1	Check oil level Change oil Check in-line filters	Daily Semi-Annual Weekly	PCM PCM PCM
Flowmeters	FI-326 - FI-336	Check for moisture, clean as necessary	Weekly Monthly	PCM GTI FSG
Soil Vapor Extraction System				
Soil Vapor Extraction Blower	B2	Change oil; inspect for unusual noises	Monthly	GTI FSG
Moisture Separator	MS-1	Check tank contents; clean if necessary	Monthly	GTI FSG
Filter, moisture effluent, bag type	F-2	Check filters, clean if necessary	Weekly	PCM
Transfer Pump	P-8	Check flow, hour meter, and probe operation	Monthly	GTI FSG
Filter, air, in-sump	F-1	Check for silt, clean if necessary	Monthly	GTI FSG
Groundwater Pumping System				
Recovery Wells	OW-3, OW-4, OW-5, OW-10, RW-1, RW-2, and RW-3	Check water level	Quarterly	GTI FSG

Table 3-1
Remediation System Maintenance Table

Component	Designation	Maintenance Activity	Maintenance Schedule	Person(s) responsible
Pneumatic Pumps, submersible	OW-10, RW-1, RW-2, RW-3	Check controller valves.	As indicated by monitoring data (flowmeter readings)	GTI FSG
Centrifugal pumps, surface mount.	Locations OW-3, OW-4, OW-5	Check probe function.	As indicated by monitoring data (flowmeter readings)	GTI FSG
Groundwater Treatment System				
Air Cooling Tower, roof mounted	CT-1	Service cooling passages	As indicated by change in flow	PCM
Air Blower, roof mounted	B1	Service blower (bearings, etc)	Yearly	PCM
Granular activated Carbon liquid filters	GAC-3, GAC-4	Change carbon	As indicated by change in flow or water quality data.	PCM

KEY:
PCM Philips Components Maintenance personnel
GTI FSG Groundwater Technology, Inc. Field Services Group

Monthly

3.1.2 Soil Vapor Extraction System

Major components of the soil vapor extraction system and critical maintenance include:

- **Soil Vapor Extraction Blower:**
  The soil vapor extraction system should be inspected monthly. Operating pressures are checked and recorded, making sure they are within the range desired for the remediation design. The oil in the Roots™ blower crankcase should be changed monthly, using a non-detergent oil having a viscosity of 1000 - 1200 SSU (SAE grade 40 weight). A good compressor oil of these specifications will suffice. Any unusual noises (belt slap, bearing noises) should be investigated and repaired as necessary.

- **Moisture Separator:**
  The contents of accumulator tank located on the influent side of the soil vent blower should be inspected. Solid material (primarily silt) should be removed and disposed of properly with the plants waste stream.

- **In-line Filter:**
  This filter is located inside the moisture separator. This filter should be inspected and cleaned (it may be tapped out or rinsed off) on a monthly basis.

- **Moisture Effluent Filter:**
  This filter unit should be inspected weekly and the bag filters replaced or cleaned by rinsing. As the quantities of soil moisture have decreased since start-up, the frequency of this procedure may be modified in the future.

- **Transfer pump:**
  Check flow, probe operation, and hour meter.

3.1.3 Groundwater Pumping System

- **Pneumatic Pumps, submersible:**
  These pumps normally do not require servicing. Each bottom-loading pump (except OW-10) is set one foot above the bottom of the well. The internal control valve activates the pump when the water level approaches the top of the pump. The water levels should fluctuate within one and three feet above the bottom of the well.

  If pumping ceases from any well location or if the well yield changes unrelated to seasonal water table changes, the pumps should be inspected. Possible trouble areas include siltation of the pump intake or internal controller valve and may be remedied by cleaning.

- **Centrifugal pumps, surface mount:**
  These pumps should be inspected monthly and examined for bearing noise. If pumping ceases from any well location or if the well yield changes unrelated to seasonal water table changes, the pump function should be checked by manually overriding the probe relay boxes. If the pumps run satisfactorily, the probes should be examined and cleaned, and the probe function checked.

3.1.4 Groundwater Treatment System

- **Air Cooling Tower, roof mounted:**
  This unit should be inspected on a yearly basis for signs of siltation or other obstruction of the cooling passages.

- **Air Blower, roof mounted:**
  This unit should be inspected on a yearly basis with the cooling tower, and bearing service performed if sounds indicating inadequate bearing lubrication are detected.

- **Granular activated Carbon liquid filters:**
  Carbon changeouts will be performed as indicated by changes in flow (inability to pump down sump pit) or increases in VOC content in effluent water.

4.0 REMEDIATION SYSTEM MONITORING

4.1 Remediation System Monitoring and Response Procedures

Monitoring of the remediation system will be performed as described in the ***Effectiveness Monitoring Plan.*** A description of critical monitoring activities and response actions is included below.
A list of tasks, schedule, and responsibility assignments for monitoring activities is included as **table 4-1.**

Data collected from the remedial system (flow rates, temperature, water level etc.) will be recorded on a site monitoring forms which will be retained and reported on a quarterly basis **(see section 5.0, Progress Reports).**

4.1.1 Air Sparging System

Monitoring will consist of determining that the desired rate of airflow into the sparge wells is occurring. An interim indication of sparge performance will be obtained by observation of dissolved oxygen levels from monitoring wells. The objective will be to maintain elevated levels of dissolved

oxygen (as compared to baseline readings) as an indicator that the sparge system is maintaining airflow in the subsurface.

If dissolved oxygen readings do not indicate that adequate airflow is occurring to a particular area, the flow rate to that area will be increased, within the limits of the design parameters.

4.1.2 Soil Vapor Extraction System

Monitoring of the soil vent will be performed to measure the rate of airflow extracted and the VOC concentrations in the extracted soil vapor. The quantities (pounds) of VOCs extracted by the soil vapor system will also be calculated. Changes in the extraction rate will be compared to the concentration of VOCs measured in groundwater in the adjacent remedial target area monitoring wells to determine if the extraction rate is limited by the diminishing mass of VOCs or by their diffusion rate through the soil matrix.

Table 4-1
Remediation System Monitoring Table

Component	Designation	Monitoring Activity	Schedule	Person(s) responsible
Air Sparging System				
Air Pressure	PI-315 - PI-325	Record pressures, adjust to design specification.	Monthly	GTI FSG
Flowmeters	FI-326 - FI-336	Record flows, adjust to desired flowrates.	Monthly	GTI FSG
Soil Vapor Extraction System				
Sampling Port, Influent Lines	SP-A1 - SP-A6	With system shut down, measure VOCs with PID and FID and record.	Monthly	GTI FSG
Vacuum gauges, Influent lines	PI-200 - PI-205	Measure and record line vacuum.	Monthly	GTI FSG
Sampling Port, Main Trunk Influent Line	SP-A7	With system shut down, measure VOCs with PID and FID and record. With system operating, measure airflow and vacuum and record.	Monthly	GTI FSG
Sampling Port, Main Trunk Effluent Line	SP-A8	With system operating, fill a Tedlar bag with system off-gas; measure VOCs with PID and FID and record. Measure airflow rate and vacuum and record.	Monthly	GTI FSG
Sampling Port, Main Trunk Effluent Line	SP-A8	With system operating, fill Summa canister with system off-gas and forward for laboratory analysis.	Quarterly	GTI FSG
Hour Meter	KI-203	Record reading	Monthly	GTI FSG

4.1.3 *Groundwater Treatment System*

Sampling of the groundwater treatment system will be performed to assist Philips Components in meeting its SPDES discharge point criteria. The results of sampling for VOCs in the water discharge from the treatment system will support decisions on activities such as changeout of the Granular Activated Carbon filters.

4.1.4 *Groundwater Sampling*

Sampling of groundwater from monitoring wells on-site and on adjacent properties for VOCs by EPA Method 8260 will be completed on a quarterly basis. An additional set of wells will be sampled on annual basis. In addition, several wells will also be sampled on a quarterly basis for Dissolved Oxygen content.

The performance of the remediation system relative to the project groundwater objectives will be measured at the Miles well as described in a preceding section. However, the interim performance of the remediation system will be indicated by comparison of quarterly groundwater samples to previous sampling data.

Groundwater elevation data will also be collected during the sampling events. This data will be used to indicate if the pumps in the recovery wells are maintaining drawdown within the range of the pump and probe settings at each well.

4.1.5 *Homeowner Well Sampling*

Wells used for domestic water supply purposes will be sampled to determine the concentrations of dissolved VOCs, in order to ensure the quality of this potable water.

The quality of supply water will be monitored on a monthly basis at four homes as specified in table 4-1. The wells will be sampled for the parameters included in EPA Method 501, plus Freon-113.

5.0 PROGRESS REPORTS

The operational status and significant modifications of the remediation system will be documented in the monthly progress reports as per the requirements set forth in the *Order on Consent*. Operating data will be compiled and evaluated in quarterly status reports.

The quarterly status reports will include the following data:

- System operating status summary.
- Groundwater treatment system and soil vapor extraction system discharge sampling data.
- VOC mass removal calculations.
- System operating performance data (flows, pressures, hours of operation).
- VOC removal trend evaluation and graph.
- Groundwater VOC level trend evaluation and graph.
- Groundwater elevation trend and contour map.

APPENDIX A

Maps and Drawings

GROUNDWATER AND SOIL REMEDIATION SYSTEMS

AS-BUILT DRAWINGS

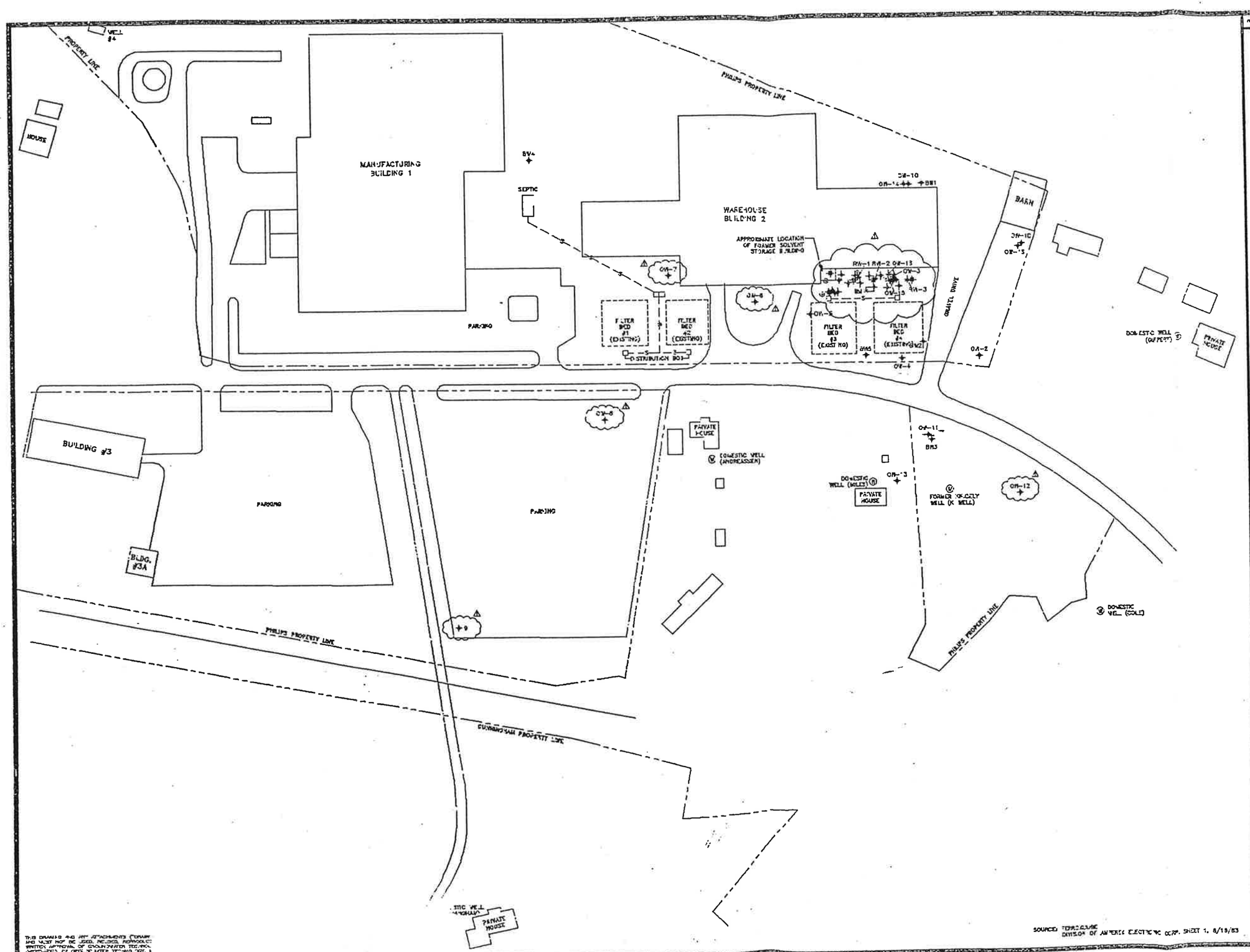
PHILIPS COMPONENTS
1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

DECEMBER, 1994

SHEET INDEX	
DWG. NO.	TITLE
Y1	SITE PLAN
Y2	REMEDIAL SYSTEM LAYOUT AND TRENCHING DETAILS
Y3	SITE PLAN SHOWING GEOLOGIC CROSS SECTION AREAS
Y4	GEOLOGIC CROSS SECTIONS
Y5	VOC DISTRIBUTION IN SOILS
Y6	VOC DISTRIBUTION IN GROUNDWATER
Y7	CONSTRUCTION DETAILS (WELLS)
Y8	CONSTRUCTION DETAILS (PIPING)
P1	PIPING AND INSTRUMENTATION DIAGRAM LEGEND
P2	PIPING AND INSTRUMENTATION DIAGRAM (GROUNDWATER EXTRACTION AND TREATMENT SYSTEM)
P3	PIPING AND INSTRUMENTATION DIAGRAM (SOIL VAPOR EXTRACTION SYSTEM)
P4	PIPING AND INSTRUMENTATION DIAGRAM (AIR SPARGING SYSTEM)
E1	ELECTRICAL LEGEND
E2	ELECTRICAL ONE-LINE DIAGRAM AND HAZARD AREA CLASSIFICATION

1245 KINGS ROAD
SCHENECTADY, NY
1518

GROUNDWATER TECHNOLOGY



NO.	DATE	BY	REVISION
1	11/29/94	MPS	AS-BUILT DETAILS ABANDONED WELLS NEW SPARGE/VENT/ RECOVERY WELLS

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY

1243 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-6831

PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

SITE PLAN

DESIGNED BY:	DETAILED BY:	CHECKED BY:
RAH	DEO	

DRAWING DATE:	ACAD FILE:
3/5/94	5019-Y1
PROJECT NO.: C111C-5019	CONTRACT:
DRAWING: Y1	REVISION: 1

SPARGE AND PUMP AIR FROM COMPRESSOR (EXISTING)

COOLING TOWER (EXISTING)

GAC 1 AND 2 (EXISTING)

SUMP PUMP, P9 (EXISTING)

(EXISTING)

MW-16

MW-10

MW1

WAREHOUSE BUILDING 2

GRAVEL

COMPRESSED AIR LINE (EXISTING)

WATER LINE (EXISTING)

APPROXIMATE LOCATION OF FORMER SOLVENT STORAGE BUILDING

LOCATION OF 4" SVE DISCHARGE STACK

DETAIL A1 / Y8

WATER LINE (EXISTING)

DETAIL A2 / Y8

EQUIPMENT AREA

ELECTRIC SWITCH GEAR

UTILITY TRENCH

CHLORINE HOUSE

ACCESS TO CHLORINE HOUSE

LIMIT OF 10 mil POLYETHYLENE COVER

COVER FOLLOWS NATURAL GRADE (MIN 0.5% SLOPE)

LIMIT OF 10 mil POLYETHYLENE COVER

DISTRIBUTION BOX

DISTRIBUTION BOX

2' HIGH SILT FENCE REMOVED

4' HIGH SNOW FENCE EROSION SIGNS EVERY 40' (REMOVED)

DRIVEWAY

GRAVEL

FILTER BED (EXISTING)

NOTE: CONTRACTOR NEEDS TO CONFIRM LOCATION OF ALL UTILITY LINES

THIS DRAWING AND ANY ATTACHMENTS CONTAINED MUST NOT BE USED, REUSED, REPRODUCED WITHOUT APPROVAL OF GROUNDWATER TECHNOLOGY, INCORPORATION OF SPECIFICATION TECHNOLOGY, INC.

NO.	DATE	BY	REVISION
1	11/28/94	MPS	AS-BUILT DETAILS REMOVE SILT FENCE AND SNOW FENCE ADD STORM SEWER

LEGEND

- MONITORING WELL
- SPARGE OBSERVATION WELL
- SPARGE WELL
- VAPOR EXTRACTION WELL
- RECOVERY WELL
- SOIL BORING
- SEWER LINE
- WATER LINE
- COMPRESSED AIR LINE
- TRENCH LIMITS

10 0 10 20
SCALE FEET

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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1249 KINGS ROAD
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PHILIPS COMPONENTS

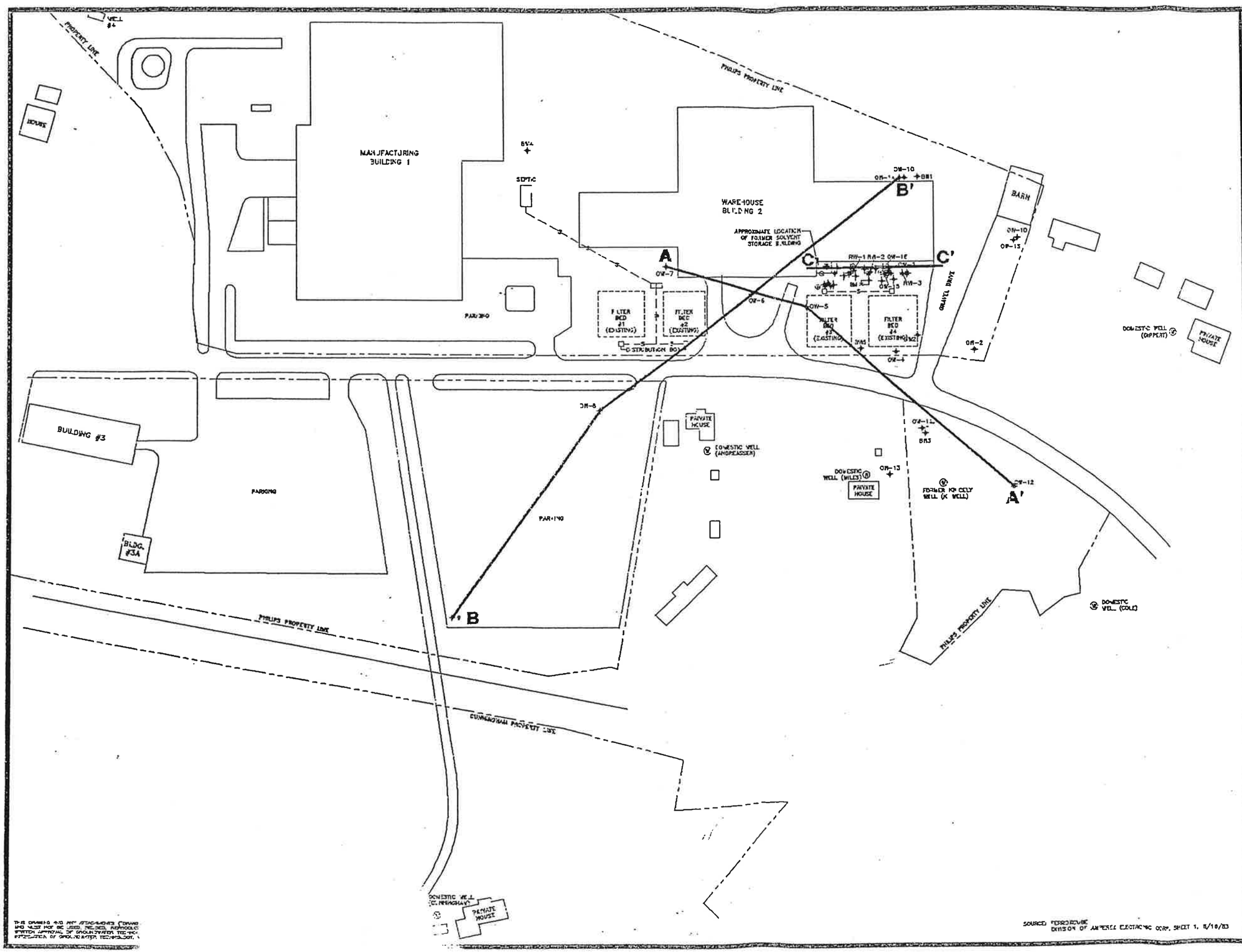
1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

REMEDIAL SYSTEM AND TRENCHING LAYOUT

DESIGNED BY:	DETAILED BY:	CHECKED BY:
MPS	DEO	

DRAWING DATE:	ACAD FILE:
3/15/94	5019-Y2
PROJECT NO.:	CONTRACT:
C1'10-5019	

DRAWING: Y2 REVISION: 1



NO.	DATE	BY	REVISION
1	11/29/94	MPS	AS-BUILT DETAILS BASE MAP

LEGEND

- MONITORING WELL
- SO-1 SPARGE OBSERVATION WELL
- SPARGE POINT
- VAPOR EXTRACTION WELL
- RECOVERY WELL
- --S-- SEWER LINE

N

60 0 60 120
SCALE FEET

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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PHILIPS COMPONENTS

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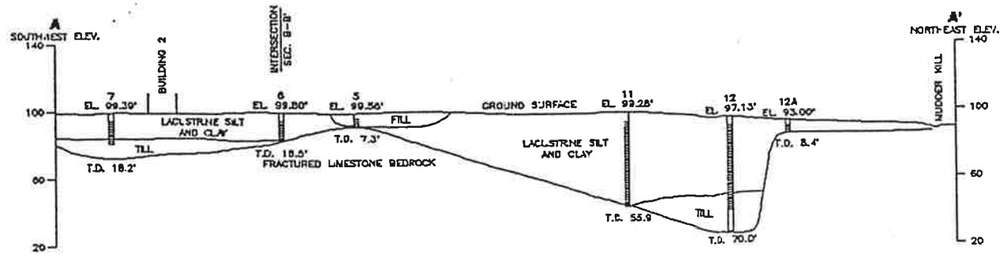
SAUGERTIES, NEW YORK

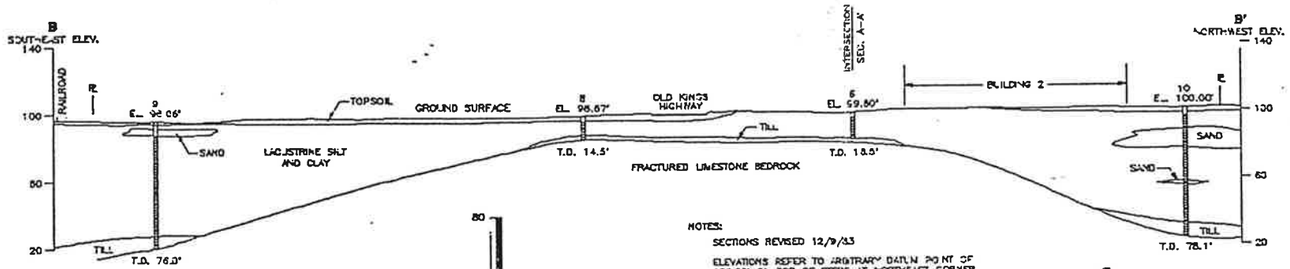
SITE PLAN SHOWING GEOLOGIC CROSS SECTION AREAS

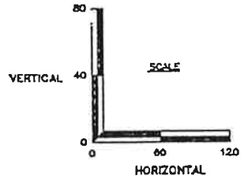
DESIGNED BY:	DETAILED BY:	CHECKED BY:
MPS	DEO	

DRAWING DATE:	ACAD FILE:
3/16/94	5019-Y3
PROJECT NO.: 01110-5019	CONTRACT:
DRAWING: Y3	REVISION: 1



GEOLOGIC CROSS SECTION A-A'





NOTES:

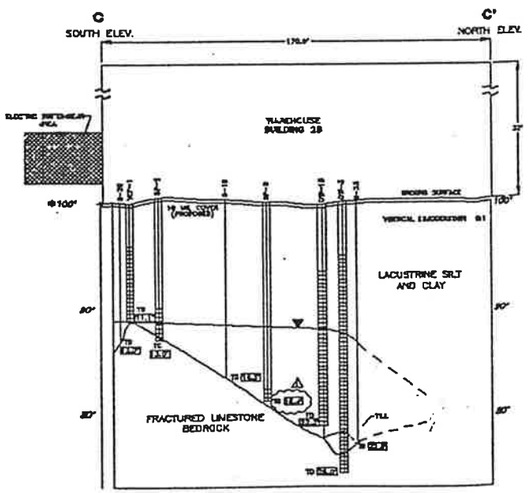
SECTIONS REVISED 12/9/83

ELEVATIONS REFER TO ARBITRARY DATUM POINT OF 100.00' ON TOP OF STEPS AT NORTHEAST CORNER OF BUILDING 2

SOURCE:

DUNN GEOSCIENCE CORP 10/3/83

GEOLOGIC CROSS SECTION B-B'

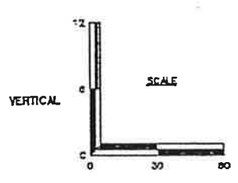


LEGEND

18.5' REFUSAL DEPTH AT BOTTOM OF BORING POLE

▼ WATER LINE

* (ELEVATION ASSIGNED TO BENCHMARK)



GEOLOGIC CROSS SECTION C-C'

NO.	DATE	BY	REVISION
1	11/29/84	MPS	AS-BUILT DETAILS TOTAL DEPTH SB-8

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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PHILIPS COMPONENTS

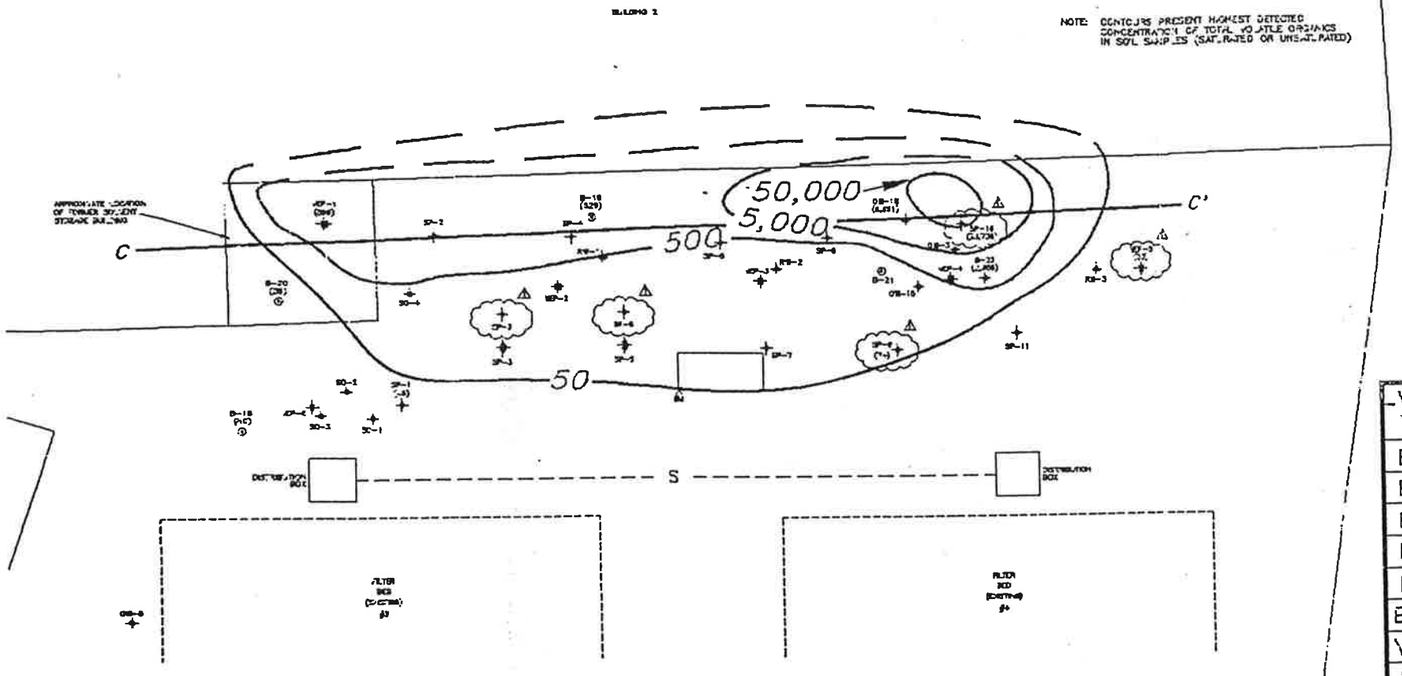
1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

GEOLOGIC CROSS SECTIONS

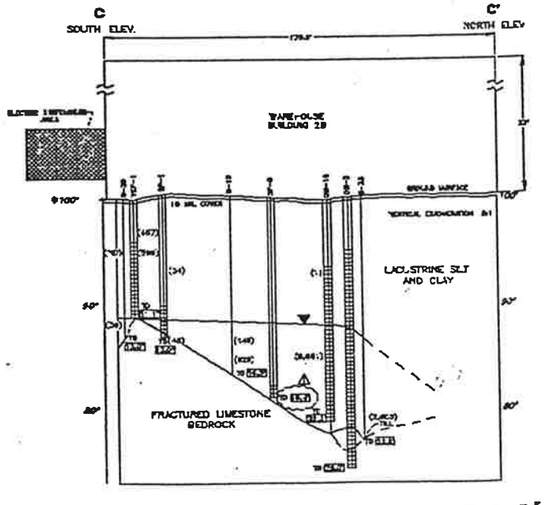
DESIGNED BY:	DETAILED BY:	CHECKED BY:
RAH	DEO	

DRAWING DATE:	ACAD FILE:
3/16/84	5019-Y4
PROJECT NO.: 01110-5019	CONTRACT:
DRAWING: Y4	REVISION: 1

NOTE: CONTOURS PRESENT HIGHEST DETECTED CONCENTRATION OF TOTAL VOLATILE ORGANICS IN SOIL SAMPLES (SATURATED OR UNSATURATED)



WELL I.D.	SAMPLING LOCATION	TOTAL VOC's IN SOIL (ppb)
B-18	8 - 10'	ND
B-19	16 - 16.5'	629
B-20	12 - 13'	39
B-21	5' - 7'	ND
B-22	NOT SHOWN	ND
B-23	20.2 - 22.2'	2,655
VEP-1	8 - 10'	596
SP-1	12 - 13.2'	45
OW-16	14 - 16'	6,661
VEP-5	13 - 15'	33
SP-9	8 - 10'	74
SP-10	18 - 20'	53,730



OLOGIC CROSS SECTION C-C'

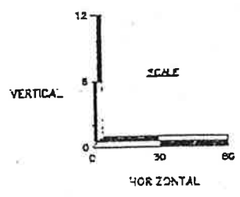
LEGEND

18.51 DEPTH AT BOTTOM OF BORING HOLE

▼ WATER LINE

(NUMBER) VOLATILE ORGANIC COMPOUNDS (ppb)

* (ELEVATION ASSIGNED TO BENCHMARK)



NO.	DATE	BY	REVISION
1	11/28/94	MPS	AS-BUILT DETAILS SAMPLE CONCENTRATIONS SPARGE/VENT/RECOVERY WELL LOCATIONS TOTAL DEPTH OF SP-6 50,000 ppb CONTOUR

LEGEND

- MONITORING WELL
- SPARGE OBSERVATION WELL
- SPARGE POINT
- VAPOR EXTRACTION WELL
- RECOVERY WELL
- SOIL BORING
- SEWER LINE
- 500 — INFERRED CONTOUR LINE OF TOTAL VOLATILE ORGANIC COMPOUNDS
- (NUMBER) TOTAL VOLATILE ORGANIC COMPOUNDS IN 1000's
- ppb PARTS PER BILLION
- (ND) NO DATA

SCALE: 1" = 20' (10 0 10 20 FEET)

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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1033 KINGS HIGHWAY
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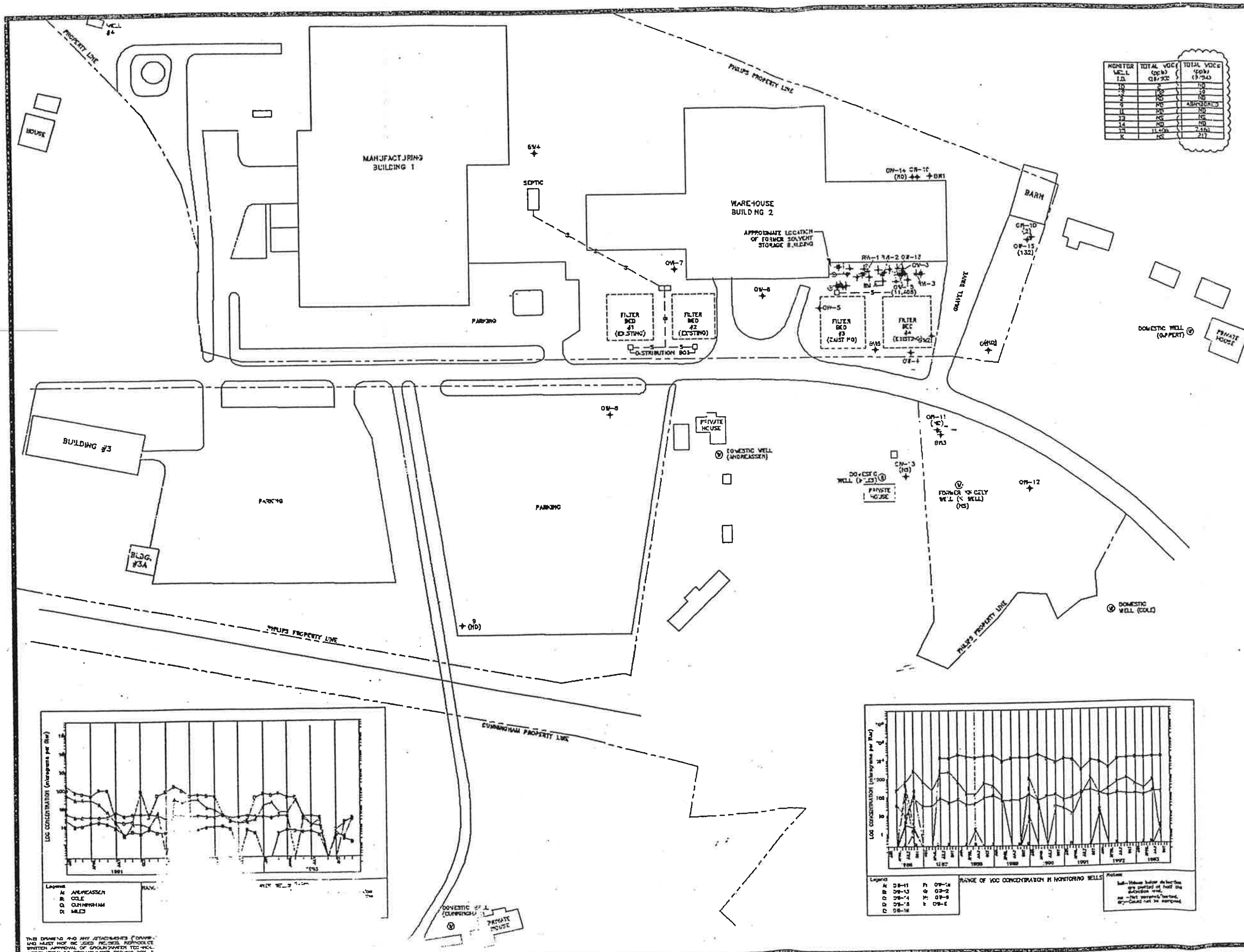
VOC DISTRIBUTION IN SOIL

DESIGNED BY:	DETAILED BY:	CHECKED BY:
RAH	DEO	

DRAWING DATE:	ACAD FILE:
3/15/94	5019-Y5
PROJECT NO.: 01110-5019	CONTRACT:
DRAWING: Y5	REVISION: 1



MONITOR WELL I.D.	TOTAL VOCs (ppb) (10/93)	TOTAL VOCs (ppb) (9/94)
10	2	ND
[illegible]	132	39
2	ND	ND
9	ND	ABANDONED
11	ND	ND
13	NS	NS
14	ND	ND
15	11,406	7,363
K	NS	217

NO.	DATE	BY	REVISION
1	11/28/94	MPS	AS-BUILT DETAILS SPARGE/VENT/RECOVERY WELL LOCATIONS 9/94 SAMPLE DATA

LEGEND

- MONITORING WELL
- SO-1 SPARGE OBSERVATION WELL
- SPARGE POINT
- VAPOR EXTRACTION WELL
- RECOVERY WELL
- — —S— — SEWER LINE
- (132) VOCs IN GROUNDWATER (ppb) SAMPLE DATE 10/93

N

SCALE 60 0 60 120 FEET

SOURCE: FERROXCUBE DIVISION OF AMPEREX ELECTRONIC CORP. SHEET 1, 6/16/83

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY
1245 KINGS ROAD
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PHILIPS COMPONENTS

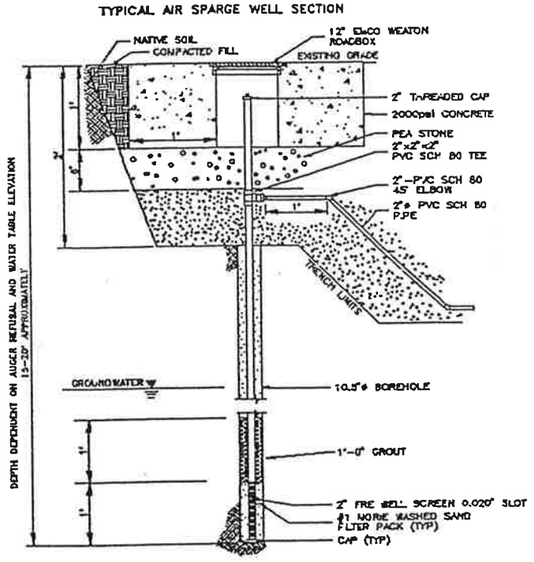
1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

VOC DISTRIBUTION IN GROUNDWATER

DESIGNED BY:	DETAILED BY:	CHECKED BY:
RAH	DEO	

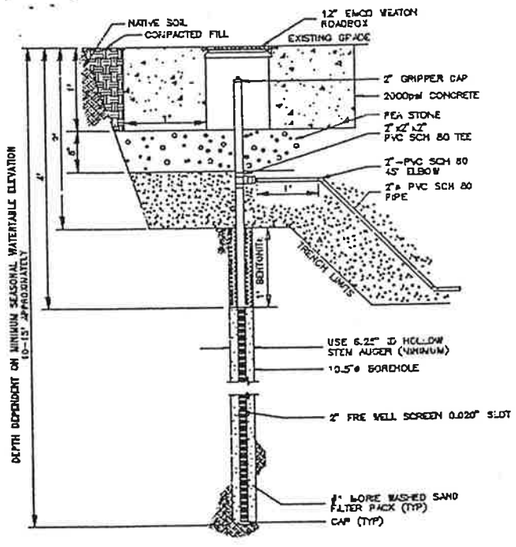
DRAWING DATE:	ACAD FILE:
3/16/94	5019-Y6
PROJECT NO.: 01110-5019	CONTRACT:
DRAWING: Y6	REVISION: 1

TYPICAL AIR SPARGE WELL SECTION



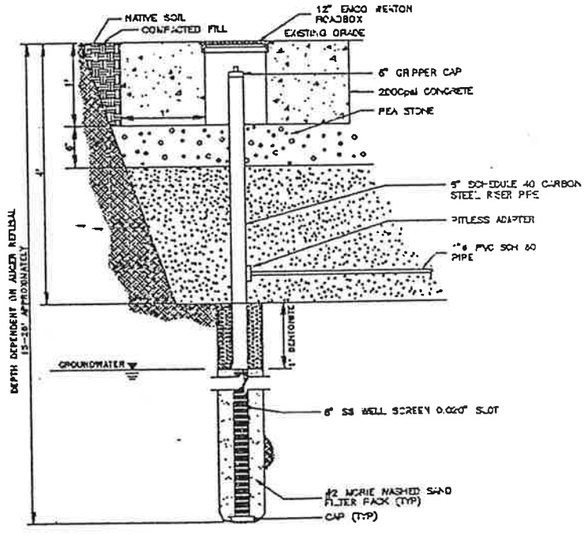
NOT TO SCALE

TYPICAL SVE WELL SECTION



NOT TO SCALE

TYPICAL RECOVERY WELL SECTION



NOT TO SCALE

NO.	DATE	BY	REVISION

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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1245 KINGS ROAD
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PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

CONSTRUCTION DETAILS

DESIGNED BY:	DETAILED BY:	CHECKED BY:
MPS	DEO	
DRAWING DATE: 3/15/94		ACAD FILE: 5019-Y7
PROJECT NO.: C1'10-5019		CONTRACT:
DRAWING: Y7		REVISION:

VALVE AND PIPING SYMBOLS

- GLOBE VALVE
- GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- PLUG VALVE
- 3-WAY VALVE
- ANGLE VALVE
- RELIEF OR SAFETY VALVE
- DIAPHRAGM VALVE
- BALL VALVE
- GLOBE VALVE
- SELF-CONTAINED PRESSURE REGULATING VALVE W/RELIEF
- KNIFE GATE VALVE
- BP BACKFLOW PREVENTER
- NO NORMALLY OPEN
- NC NORMALLY CLOSED
- SP SAMPLE PORT
- FLEXIBLE HOSE
- HOSE BARB
- BASKET TYPE STRAINER
- Y-TYPE STRAINER
- DUPLEX STRAINER
- SLEEVE COUPLING (SC)
- FLOOR DRAIN
- EQUIPMENT DRAIN
- CLEANOUT (CO)
- REMOVABLE PLUG
- REMOVABLE CAP
- BF BLIND FLANGE
- EXHAUST TO ATMOSPHERE (INSIDE)
- EXHAUST TO ATMOSPHERE (OUTSIDE)
- REDUCER
- UNION
- QUICK DISCONNECT COUPLING
- GAUGE SEAL
- DAMPER
- PITLESS ADAPTER
- CAMLOCK

VALVE OPERATOR SYMBOLS

- S SOLENOID
- M MOTOR, ELECTRIC
- DIAPHRAGM
- DIAPHRAGM WITH POSITIONER
- HANDWHEEL OR LEVER
- CHAINWHEEL

PRIMARY ELEMENT SYMBOLS - FLOW

- ORIFICE PLATE
- PITOT TUBE
- AVERAGING PITOT TUBE
- VENTURI OR FLOW TUBE
- TOTALIZING FLOWMETER
- FLUME
- WEIR
- TURBINE OR PROPELLER TYPE METER
- MAGNETIC FLOW METER
- ROTAMETER

EQUIPMENT SYMBOLS

- SUBMERSIBLE PUMP
- PUMP
- PNEUMATIC PUMP
- BLOWER

GENERAL INSTRUMENT SYMBOLS

ONE VARIABLE	TWO VARIABLES	
○	○○	LOCALLY MOUNTED
⊖	⊖⊖	PANEL MOUNTED
⊖	⊖⊖	REAR-OF-PANEL MOUNTED
◇ I		INTERLOCK
◇ P		PURGE

LINE SYMBOLS

- PROCESS PIPES OR CHANNELS
- CONNECTION TO PROCESS, MECHANICAL LINK OR INSTRUMENT SUPPLY
- PNEUMATIC SIGNAL
- ELECTRIC SIGNAL
- CAPILLARY TUBING (FILLED SYSTEM)
- HYDRAULIC SIGNAL
- ELECTROMAGNETIC OR SONIC SIGNAL NO WIRING OR TUBING

INSTRUMENT IDENTIFICATION TABLE

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME				
C	CONDUCTIVITY			CONTROL	
D	DENSITY (SP. GR.)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAUGING (DIMENSIONAL)		GLASS		
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY				MIDDLE
N					
O			ORIFICE		
P	PRESSURE OR VACUUM		POINT (TEST)		
Q	QUANT. OR EVENT	INTEGRATE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED OR FREQ.	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION		
V	VISCOSITY			VALVE OR DAMPER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED		
Y				RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE	

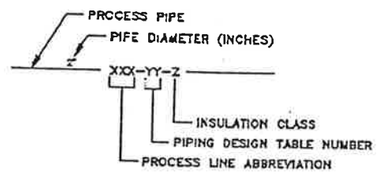
PROCESS LINE ABBREVIATIONS

AIR	AIR, ATMOSPHERIC PRESSURE
BW	BACKWASH
CA	COMPRESSED AIR
CGW	CONTAMINATED GROUNDWATER
D	DRAIN
EFF	EFFLUENT
EXH	EXHAUST
GW	GROUNDWATER
NPW	NON-POTABLE WATER
P	PRODUCT
PW	POTABLE WATER
S	SANITARY
SL	SLUDGE
SP	SAMPLE PORT
SS	STORM SEWER
TF	TOTAL FLUIDS
V	VENT
VAP	VAPOR

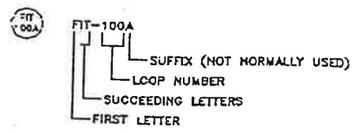
PIPING MATERIAL IDENTIFICATION

CPVC	CHLORINATED POLYVINYL CHLORIDE
CSP	CARBON STEEL PIPE
COP	COPPER
CMP	CORRUGATED METAL PIPE
CIP	CAST IRON PIPE
DIP	DUCTILE IRON PIPE
GAL	GALVANIZED STEEL PIPE
PE	POLYETHYLENE PIPE
PP	POLYPROPYLENE PIPE
PVC	POLYVINYL CHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
RUB	RUBBER HOSE
SS	STAINLESS STEEL PIPE
VCP	VITRIFIED CLAY PIPE

PROCESS PIPING IDENTIFICATION



INSTRUMENT IDENTIFICATION



FUNCTION ABBREVIATIONS

DO	DISSOLVED OXYGEN	OC	OPEN-CLOSE
FC	FAIL CLOSED	OO	ON-OFF (MAINTAINED)
FI	FAIL INDETERMINATE	ORP	OXIDATION REDUCTION POTENTIAL
FL	FAIL LOCKED	OSC	OPEN-STOP-CLOSE (MOMENTARY)
FO	FAIL OPEN	SS	START-STOP (MOMENTARY)
H/A	HAND-OFF-AUTOMATIC	>	HIGH SELECT
I/A	CURRENT-TO-CURRENT	<	LOW SELECT
I/P	CURRENT-TO-PNEUMATIC	√	SQUARE ROOT
LEL	LOWER EXPLOSIVE LIMIT	Σ	ADD OR TOTALIZE
L/R	LOCAL-REMOTE		

NO.	DATE	BY	REVISION

APPROVALS

	SIGNATURE	DATE
REVIEW ENGR:		
PROJECT ENGR:		
PROJECT MGR:		
CLIENT:		

GROUNDWATER TECHNOLOGY
1243 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-6531

PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

PIPING & INSTRUMENTATION DIAGRAM LEGEND

DESIGNED BY:	DETAILED BY:	CHECKED BY:
---	---	

DRAWING DATE:	ACAD FILE:
3/4/94	5019-P1
PROJECT NO.: 91110-5019	CONTRACT:
DRAWING: P1	REVISION:

ONE-LINE DIAGRAM SYMBOLS

- CIRCUIT AND EQUIPMENT INSTALLED BY THIS CONTRACT
- EQUIPMENT ENCLOSURE
- CONTROL OR INTERLOCK CIRCUIT
- CONNECTION
- MOLDED CASE CIRCUIT BREAKER
- FUSE
- FUSED DISCONNECT SWITCH
- FULL VOLTAGE, NON-REVERSING (FVNR) MAGNETIC MOTOR STARTER
- MANUAL MOTOR STARTER
- AS — AMMETER SWITCH
- VS — VOLTMETER SWITCH
- A — AMMETER
- V — VOLTMETER
- RECEPTACLE-CLASS I, DIVISION 1, GROUPS C, D
- FUSED POTENTIAL TRANSFORMERS
- CURRENT TRANSFORMER
- POWER TRANSFORMER
- LIGHTNING OR SURGE ARRESTER
- GROUND CONNECTION
- KWH — KW-HOUR METER SOCKET. METER FURNISHED BY UTILITY.
- 5 — MOTOR - NUMBER INDICATES HP

PLAN SYMBOLS

- NEW CONSTRUCTION
- EXISTING CONSTRUCTION
- EXISTING CONSTRUCTION TO BE REMOVED
- CONDUIT EXPOSED
- CONDUIT CONCEALED IN WALL, CEILING OR HIDDEN FROM VIEW
- CONDUIT CONCEALED IN FLOOR OR UNDERGROUND
- FLEXIBLE CONDUIT (LIQUID TIGHT)
- GROUND CABLE
- BOLTED GROUND CONNECTION
- WELDED GROUND CONNECTION
- GROUND ROD
- HOMERUN. ARROWHEADS INDICATE NUMBER OF CIRCUITS
- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- CONDUIT WITH BUSHING
- CONDUIT TERMINATED OR CAPPED
- POWER PANEL-480V, 3ø
- LIGHTING PANEL-120/240V, 1ø OR 208/120, 3ø
- DISCONNECT (SAFETY) SWITCH
- MS — MANUAL MOTOR STARTER
- MAGNETIC MOTOR STARTER
- COMBINATION MAGNETIC MOTOR STARTER
- 5 — MOTOR (NUMBER INDICATES HP)
- P — PULLBOX
- J — JUNCTION BOX
- EXIT LIGHT
- L-1 — FLUORESCENT LUMINAIRE TYPE L-1
- L-1 / L-1 — INCANDESCENT OR H.I.D. LUMINAIRE TYPE L-1
- EMERGENCY LIGHTING UNIT
- EMERGENCY FLUORESCENT LIGHTING FIXTURE
- DUPLEX RECEPTACLE WP-WEATHERPROOF GFCI-GROUND FAULT CIRCUIT INTERRUPTER
- RECEPTACLE-CLASS I, DIVISION 1, GROUPS C, D
- T — THERMOSTAT
- S — SINGLE POLE SWITCH
- S3 — THREE-WAY POLE SWITCH
- S4 — FOUR-WAY POLE SWITCH

SCHEMATIC DIAGRAM SYMBOLS

- TERMINAL
- CONDUCTOR CONNECTION
- NO CONNECTION
- CONTACT NORMALLY OPEN (NO)
- CONTACT NORMALLY CLOSE (NC)
- SWITCH
- SELECTOR SWITCH
- PUSHBUTTON-NORMALLY OPEN MOMENTARY
- PUSHBUTTON-NORMALLY CLOSED MOMENTARY
- PRESSURE OR VACUUM SWITCH-CLOSES WITH INCREASING PRESSURE OR DECREASING VACUUM
- PRESSURE OR VACUUM SWITCH-OPENS WITH INCREASING PRESSURE OR DECREASING VACUUM
- FLOW SWITCH-CLOSES ON FLOW
- LIMIT SWITCH NC
- LIMIT SWITCH NC-HELD OPEN
- NO TIME DELAY CONTACT. TIME DELAY CLOSING AFTER ENERGIZATION
- NC TIME DELAY CONTACT. TIME DELAY OPENING AFTER ENERGIZATION
- NO TIME DELAY CONTACT. TIME DELAY OPENING AFTER DE-ENERGIZATION
- NC TIME DELAY CONTACT. TIME DELAY CLOSING AFTER DE-ENERGIZATION
- M — MOTOR STARTER COIL
- RELAY COIL
- INDICATING LIGHT-COLOR INDICATED (A-AMBER, BL-BLUE, G-GREEN, Y-YELLOW, W-WHITE)
- SOLENOID VALVE COIL
- THERMAL OVERLOAD RELAY CONTACT
- FLOW SWITCH-OPENS WITH INCREASING FLOW
- LIQUID LEVEL SWITCH-CLOSES ON RISING LEVEL
- LIQUID LEVEL SWITCH-OPENS ON RISING LEVEL
- TEMPERATURE SWITCH-CLOSES ON RISING TEMPERATURES
- TEMPERATURE SWITCH-OPENS ON RISING TEMPERATURES
- LIMIT SWITCH NO
- LIMIT SWITCH NO-HELD CLOSED
- FUSE
- CONTROL POWER TRANSFORMER (CPT)
- GROUND
- H — HORN
- B — BELL

GENERAL ABBREVIATIONS

A, AUTO	AUTOMATIC	H	HAND	PLC	PROGRAMMABLE LOGIC CONTROLLER
ACK	ACKNOWLEDGE	HI	HIGH	REM	REMOTE
AFF	ABOVE FINISH FLOOR	HS	HIGH SPEED	REV	REVERSE
AFG	ABOVE FINISH GRADE	IL	INDICATING LIGHT	SOL	SOLENOID (OTHER THAN VALVE)
BC	BARE COPPER	INST	INSTANTANEOUS	SP	SPARE
C	CONDUIT	L	LOW	SS	SELECTOR SWITCH
CB	CIRCUIT BREAKER	LOC	LOCAL	SV	SOLENOID VALVE
CL	CLOSE	LS	LOW SPEED	T, T-STAT	THERMOSTAT
CPT	CONTROL POWER TRANSFORMER	MAN	MANUAL	TDAE	TIME DELAY AFTER ENERGIZATION
CR	CONTROL RELAY	MCC	MOTOR CONTROL CENTER	TDAF	TIME DELAY AFTER DE-ENERGIZATION
CS	CONTROL SWITCH	NC	NORMALLY CLOSED	TDR	TIME DELAY RELAY
CT	CURRENT TRANSFORMER	NL	NIGHT LIGHT (UNSWITCHED FIXTURE)	TEMP	TEMPERATURE
DWG	DRAWING	NO	NORMALLY OPEN	TMR	TIMER
ETM	ELAPSED TIME METER	O	OFF	WP	WEATHERPROOF
FU	FUSE	OL	THERMAL OVERLOAD RELAY	XFMR	TRANSFORMER
FWD	FORWARD	OP	OPEN	XP	EXPLOSIONPROOF-CLASS I, DIVISION I, GROUPS C, D
GND	GROUND	PB	PUSHBUTTON		

NO.	DATE	BY	REVISION

SIGNATURE	DATE
ENG MGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY
1243 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-5631

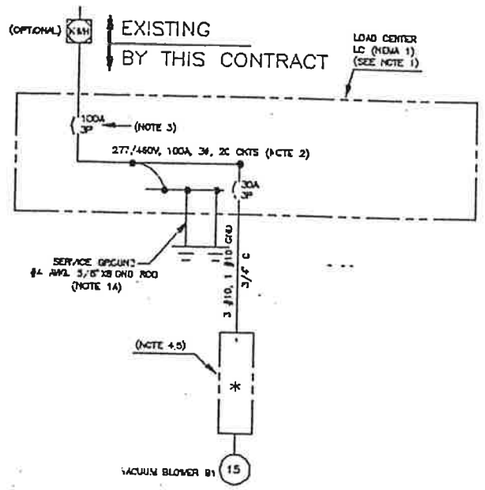
PHILIPS COMPONENTS

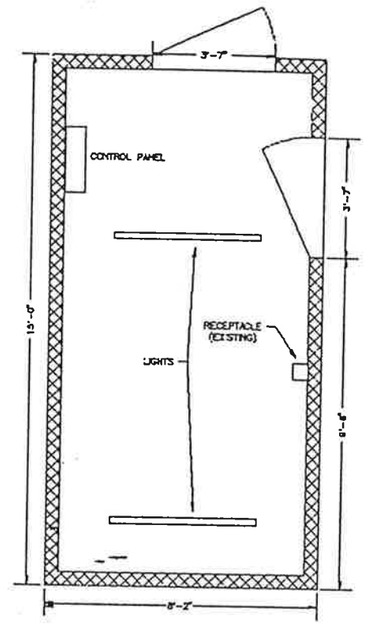
1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

ELECTRICAL LEGEND

DESIGNED BY:	DETAILED BY:	CHECKED BY:
---	---	

DRAWING DATE: 3/4/94	ACAD FILE: 5019-E1
PROJECT NO.: 91110-5019	CONTRACT:
DRAWING: E1	REVISIONS:





RENEDIATION EQUIPMENT COMPOUND

HAZARDOUS AREA CLASSIFICATION:

ALL AREAS OF REMEDIATION SITE ARE NON-CLASSIFIED DUE TO NON-EXISTENCE OF FLAMMABLE OR EXPLOSIVE VAPORS OR LIQUIDS

ELECTRICAL NOTES:

1: PROVIDE NEMA 1 POWER DISTRIBUTION PANEL 100 AMP 277/480 VOLT THREE PHASE 20 CIRCUIT MAIN BREAKER DISCONNECT.

1A: GROUNDING: ELECTRICAL INSTALLATIONS MUST BE GROUNDED BY USING TWO 5/8"X8'-0" GALVANIZED RODS DRIVEN INTO THE GROUND A MINIMUM OF 8 FEET APART. A #4 BRAIDED COPPER WIRE MUST BE INSTALLED IN A CLOSED LOOP FASHION STARTING FROM THE VOLTAGE/GROUND BUS BAR IN THE POWER DISTRIBUTION PANEL AND RETURNING THERE AT THE END OF THE RUN. "ACORN" GROUNDING LUGS WILL BE USED FOR THE BOND TO THE GROUND RODS.

2: BRANCH CIRCUIT BREAKERS TO BE RATED AT 10,000 A.I.C.

3: MAIN BREAKER MUST BE RATED AT 100,000 A.I.C. IF SERVICE IS CONNECTED TO MAIN GRID (check with power company).

4: NEMA 1 EQUIPMENT CONTROL PANEL TO BE MOUNTED NEAR POWER DISTRIBUTION PANEL IN INTERIOR OF BUILDING (non-classified section of equipment compound). (Includes motor starters and manual switches to operate all motor and control functions; this will be an integrated control unit designed to monitor all system functions)

5: CONDUCTORS FEEDING MOTOR CIRCUIT FOR SVE EQUIPMENT WILL BE #10 STRANDED COPPER THHN (3). GROUND WILL BE #10 THHN. INTERNAL THERMAL OVERLOAD DEVICE CONTAINED WITHIN THE MOTOR WILL BE WIRED INTO THE CONTROL CIRCUIT FOR THE ENERGIZING COIL OF THE MOTOR STARTER CONTACTOR. (refer to manufacturer's schematic drawings for control wiring) (motor will be 3 phase 15 hp wired for 480 volt operation)

GENERAL NOTES:

ALL WIRING DONE IN THE NON-CLASSIFIED SECTION OF THE EQUIPMENT COMPOUND WILL BE DONE IN EMT USING COMPRESSION TYPE CONNECTORS AND COUPLINGS.

A SEPARATE BONDING WIRE #12 AWG WILL BE RUN THROUGH ALL CONDUITS, FITTINGS, AND ENCLOSURES. THIS WILL BE BONDED TO ALL MOTOR JUNCTION BOXES, ALL LIGHTING AND EQUIPMENT ENCLOSURES AND TERMINATE AT THE MAIN GROUND BUS BAR IN THE POWER DISTRIBUTION PANEL.

NO.	DATE	BY	REVISION

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY
1243 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-6831

PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

ELECTRICAL ONE LINE DIAGRAM

DESIGNED BY:	DETAILED BY:	CHECKED BY:
---	DEO	
DRAWING DATE: 3/15/94		ACAD FILE: 5019-E2
PROJECT NO.: 01110-5019		CONTRACT:
DRAWING: E2		REVISION:

APPENDIX B

Process Exhaust and Ventilation System Permit Application

OF LOCATION FACILITY EMISSION POINT I

A ADD
C CHANGE
D DELETE

READ INSTRUCTIONS CONTAINED IN FORM 76-11-12 BEFORE ANSWERING ANY QUESTION

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

COPY
WHITE - ORIGINAL
GREEN - DIVISON OF AIR
WHITE - REGIONAL OFFICE
WHITE - FIELD REP.
YELLOW - APPLICANT

PROCESS, EXHAUST OR VENTILATION SYSTEM

APPLICATION FOR PERMIT TO CONSTRUCT OR CERTIFICATE TO OPERATE

SEC. A

1. NAME OF OWNER / FIRM: Amperex Electronic Corp.
2. NUMBER AND STREET ADDRESS: Providence Pike
3. CITY - TOWN - VILLAGE: Slatersville
4. STATE: RI
5. ZIP: 02876
6. OWNER CLASSIFICATON: A. ☐ COMMERCIAL C. ☐ UTILITY E. ☐ STATE F. ☐ MUNICIPAL H. ☐ HOSPITAL I. ☐ RESIDENTIAL B. ☒ INDUSTRIAL D. ☐ FEDERAL G. ☐ EDUC. INST. J. ☐ OTHER
7. NAME & TITLE OF OWNERS REPRESENTATIVE: Joseph L. Wolf, Jr. Mgr. Environmental Affairs
8. TELEPHONE: (914) 246-2811
9. NAME OF AUTHORIZED AGENT: GTI
10. TELEPHONE: (518) 370-5631
11. NUMBER AND STREET ADDRESS: 1245 Kings Road
12. CITY - TOWN - VILLAGE: Schenectady
13. STATE: NY
14. ZIP: 12303
15. NAME OF P.E. OR ARCHITECT PREPARING APPLICATION: Basilis Stephanatos
16. N.Y.S. P.E. OR ARCHITECT LICENSE NO.: 69175
17. TELEPHONE: (518) 370-5631
18. SIGNATURE OF OWNERS REPRESENTATIVE OR AGENT WHEN APPLYING FOR A PERMIT TO CONSTRUCT
19. FACILITY NAME (IF DIFFERENT FROM OWNER / FIRM): Ferroxcube
20. FACILITY LOCATION (NUMBER AND STREET ADDRESS): 5083 Kings Highway
21. CITY - TOWN - VILLAGE: Saugerties NY
22. ZIP: 12477
23. BUILDING NAME OR NUMBER: 2
24. FLOOR NAME OR NUMBER: 1
25. START UP DATE: 1 6 / 94 (MO / YR)
26. DRAWING NUMBERS OF PLANS SUBMITTED
27. PERMIT TO CONSTRUCT: A. ☒ NEW SOURCE B. ☐ MODIFICATION
28. CERTIFICATE TO OPERATE: A. ☐ NEW SOURCE B. ☐ MODIFICATION C. ☐ EXISTING SOURCE

SEC. B

29. EMISSION POINT ID.	30. GROUND ELEVATION (FT.)	31. HEIGHT ABOVE STRUCTURES (FT.)	32. STACK HEIGHT (FT.)	33. INSIDE DIMENSIONS (IN.)	34. EXIT TEMP.(°F)	35. EXIT VELOCITY (FT./SEC.)	36. EXIT FLOW RATE (ACFM)
00002	150	11	40	4	100	46	240

37. SOURCE CODE	38. HRS / DAY	39. DAYS / YR	40. % OPERATION BY SEASON Winter	Spring	Summer	Fall
	24	365	25	25	25	25

SEC. C — 41. DESCRIBE PROCESS OR UNIT

1. Process is soil vapor extraction
2. A Negative pressure is applied to
3. Vapor Extraction Wells to induce
4. Airflow through subsurface soils.
5. contamination violatilizes into
6. air stream, and is extracted.
7. The air is then discharged to the
8.

SEC. D

EMISSION CONTROL EQUIPMENT I.D.	CONTROL TYPE	MANUFACTURER'S NAME AND MODEL NUMBER	DISPOSAL METHOD	DATE INSTALLED MONTH / YEAR	USEFUL LIFE
42. NA	43. NA	44. NA	45. NA	46. N / A	47. NA
48.	49.	50.	51.	52. /	53.

SECTION E — CALCULATIONS

Emissions were calculated using New York State Departmetn of Environmental Conservation "AirGuide - 1" Calculations(attached) input concentrations were based upon contaminations presents in pilot testing Analytical Results, Proposed Operating conditions, and airguide-1 Guideline concentrations.

SECTION F

CONTAMINANT NAME	CAS NUMBER	INPUT OR PRODUCTION	UNIT	ENV. RATING	EMISSIONS ACTUAL	UNIT	HOW DET.	PERMISSIBLE	% CONTROL EFFIC'CY	HOURLY EMISSIONS (LBS/HR) ERP	ACTUAL	ANNUAL EMISSIONS (LBS/YR) ACTUAL	10^x	PERMISSIBLE
54. Vinyl Chloride	55. 75-01-4	56.	57.	58.	59. 0.013	60. 1	61. 3	62.	63.	64. 0.013	65. 0.013	66. 8.76	67. 1	68.
69. 1,1-Dichloroethene	70. 75-35-4	71.	72.	73.	74. 0.013	75. 1	76. 3	77.	78.	79. 0.013	80. 0.013	81. 8.76	82. 1	83.
84. c15-1,2 Dichloroethene	85. 540-59-0	86.	87.	88.	89. 0.016	90. 1	91. 3	92.	93.	94. 0.016	95. 0.016	96. 1.40	97. 2	98.
99. 1,1,1-Trichlorethane	100. 71-55-6	101.	102.	103.	104. 0.017	105. 1	106. 3	107.	108.	109.	110. 0.017	111. 1.49	112.	113.
114. 1,1 Dichloroethane	115. 75-34-3	116.	117.	118.	119. 0.006	120. 1	121. 3	122.	123.	124. 0.006	125. 0.006	126. 5.24	127. 1	128.
129. Tetrachloroethane	130. 127-18-4	131.	132.	133.	134. 0.05	135. 1	136. 3	137.	138.	139. 0.05	140. 0.05	141. 4.38	142. 2	143.

SEC. G

SOLID FUEL TYPE	SOLID FUEL TONS / YR	SOLID FUEL % S	LIQUID FUEL TYPE	LIQUID FUEL THOUSANDS OF GALLONS/YR	LIQUID FUEL % S	GAS TYPE	GAS THOUSANDS OF CF/YR	GAS BTU/CF	APPLICABLE RULE	APPLICABLE RULE
144. NA	145. NA	146. NA	147. NA	148. NA	149. NA	150. NA	151. NA	152. NA	153.	154.

Upon completion of construction sign the statement listed below and forward to the appropriate field representative

THE PROCESS, EXHAUST OR VENTILATION SYSTEM HAS BEEN CONSTRUCTED AND WILL BE OPERATED IN ACCORDANCE WITH STATED SPECIFICATIONS AND IN CONFORMANCE WITH ALL PROVISIONS OF EXISTING REGULATIONS.

155. SIGNATURE OF AUTHORIZED REPRESENTATIVE OR AGENT — DATE

156. LOCATION CODE	157. FACILITY ID. NO.	158. U.T.M. (E)	159. U.T.M. (N)	160. SIC NUMBER	161. DATE APPL. RECEIVED	162. DATE APPL. REVIEWED	163. REVIEWED BY:
					/ /	/ /	

AGENCY USE ONLY

PERMIT TO CONSTRUCT

164. DATE ISSUED	165. EXPIRATION DATE	166. SIGNATURE OF APPROVAL	167. FEE
/ /	/ /		

168.
1. DEVIATION FROM APPROVED APPLICATION SHALL VOID THIS PERMIT
2. THIS IS NOT A CERTIFICATE TO OPERATE
3. TESTS AND/OR ADDITIONAL EMISSION CONTROL EQUIPMENT MAY BE REQUIRED PRIOR TO THE ISSUANCE OF A CERTIFICATE TO OPERATE

CERTIFICATE TO OPERATE

169. DATE ISSUED	170. EXPIRATION DATE	171. SIGNATURE OF APPROVAL	172. FEE
/ /	/ /		

173.
1. ☐ INSPECTED BY _____ DATE _____
2. ☐ INSPECTION DISCLOSED DIFFERENCES AS BUILT VS. PERMIT. CHANGES INDICATED ON FORM
3. ☐ ISSUE CERTIFICATE TO OPERATE FOR SOURCE AS BUILT
4. ☐ APPLICATION FOR C.O. DENIED _____ (DATE) _____ (INITIALED)

AGENCY USE ONLY

174. SPECIAL CONDITIONS:

1.	2.
3.	4.
5.	6.
7.	8.

76-19-3 (9/81)

LOCATION | FACILITY | EMISSION POINT | I

A ADD
C CHANGE
D DELETE

READ INSTRUCTIONS CONTAINED IN FORM 76-11-12 BEFORE ANSWERING ANY QUESTION

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WHITE - ORIGINAL
GREEN - DIVISON OF AIR
WHITE - REGIONAL OFFICE
WHITE - FIELD REP.
YELLOW - APPLICANT

PROCESS, EXHAUST OR VENTILATION SYSTEM

APPLICATION FOR PERMIT TO CONSTRUCT OR CERTIFICATE TO OPERATE

SEC A

1. NAME OF OWNER / FIRM	9. NAME OF AUTHORIZED AGENT	10. TELEPHONE	19. FACILITY NAME (IF DIFFERENT FROM OWNER / FIRM)
Amperex Electronic Corp.	Groundwater Technology	(518) 370-5631	Ferroxcube
2. NUMBER AND STREET ADDRESS	**11. NUMBER AND STREET ADDRESS**		**20. FACILITY LOCATION (NUMBER AND STREET ADDRESS)**
Providence Pike	1245 Kings Road		5083 Kings Highway
3. TOWN - VILLAGE / **4. STATE** / **5. ZIP**	**12. CITY - TOWN - VILLAGE** / **13. STATE** / **14. ZIP**		**21. CITY - TOWN - VILLAGE** / **22. ZIP**
...ttersville / RI / 02876	Schenectady / NY / 12303		Saugerities NY 12477

6. OWNER CLASSIFICATON
A. ☐ COMMERCIAL C. ☐ UTILITY E. ☐ STATE F. ☐ MUNICIPAL H. ☐ HOSPITAL I. ☐ RESIDENTIAL
B. ☒ INDUSTRIAL D. ☐ FEDERAL G. ☐ EDUC. INST. J. ☐ OTHER

15. NAME OF P.E. OR ARCHITECT PREPARING APPLICATION	16. N.Y.S. P.E. OR ARCHITECT LICENSE NO.	17. TELEPHONE
Basilis Stephanatos	69175	(518) 370-5631

23. BUILDING NAME OR NUMBER	24. FLOOR NAME OR NUMBER
2	1

7. NAME & TITLE OF OWNERS REPRESENTATIVE	8. TELEPHONE	18. SIGNATURE OF OWNERS REPRESENTATIVE OR AGENT WHEN APPLYING FOR A PERMIT TO CONSTRUCT

25. START UP DATE	26. DRAWING NUMBERS OF PLANS SUBMITTED
MO 1 6 / YR 9 4	

27. PERMIT TO CONSTRUCT	28. CERTIFICATE TO OPERATE
A. ☒ NEW SOURCE	A. ☐ NEW SOURCE C. ☐ EXISTING SOURCE
B. ☐ MODIFICATION	B. ☐ MODIFICATION

SEC B

29. EMISSION POINT ID.	30. GROUND ELEVATION (FT.)	31. HEIGHT ABOVE STRUCTURES (FT.)	32. STACK HEIGHT (FT.)	33. INSIDE DIMENSIONS (IN.)	34. EXIT TEMP.(°F)	35. EXIT VELOCITY (FT./SEC.)	36. EXIT FLOW RATE (ACFM)	37. SOURCE CODE	38. HRS / DAY	39. DAYS / YR	40. % OPERATION BY SEASON (Winter Spring Summer Fall)

SEC C

41. DESCRIBE PROCESS OR UNIT	1.	2.
	3.	4.
	5.	6.
	7.	8.

SEC D

EMISSION CONTROL EQUIPMENT I.D.	CONTROL TYPE	MANUFACTURER'S NAME AND MODEL NUMBER	DISPOSAL METHOD	DATE INSTALLED MONTH / YEAR	USEFUL LIFE
42.	43.	44.	45.	46. /	47.
48.	49.	50.	51.	52. /	53.

SECTION E

CALCULATIONS

CONTAMINANT NAME	CAS NUMBER	INPUT OR PRODUCTION	UNIT	ENV. RATING	EMISSIONS ACTUAL	EMISSIONS UNIT	EMISSIONS HOW DET.	EMISSIONS PERMISSIBLE	% CONTROL EFFIC'CY	HOURLY EMISSIONS (LBS/HR) ERP	HOURLY EMISSIONS (LBS/HR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) 10^x	ANNUAL EMISSIONS (LBS/YR) PERMISSIBLE
54. Trichloroethene	55. 79-01-6	56.	57.	58.	59. 0.120	60. 1	61. 3	62.	63.	64. 0.120	65. 0.120	66. 1.05	67. 3	68.
69. 2-Butanone	70. 78-93-3	71.	72.	73.	74. 0.0001	75. 1	76. 3	77.	78.	79. 0.0001	80. 0.0001	81. 8.76	82. -1	83.
84. Carbon Disulfide	85. 75-15-0	86.	87.	88.	89. 0.0001	90. 1	91. 3	92.	93.	94. 0.0001	95. 0.0001	96. 8.76	97. -1	98.
99. Methylene Chloride	100. 75-09-2	101.	102.	103.	104. 0.0002	105. 1	106. 3	107.	108.	109. 0.0002	110. 0.0002	111. 1,75	112. 0	113.
114. Acetone	115. 67-64-1	116.	117.	118.	119. 0.0001	120. 1	121. 3	122.	123.	124. 0.0001	125. 0.0001	126. 8.76	127. -1	128.
129. Chloroethane	130. 75-00-3	131.	132.	133.	134. 0.0004	135. 1	136. 3	137.	138.	139. 0.0004	140. 0.0004	141. 3.50	142. 0	143.

SOLID FUEL TYPE	SOLID FUEL TONS / YR	SOLID FUEL % S	LIQUID FUEL TYPE	LIQUID FUEL THOUSANDS OF GALLONS/YR	LIQUID FUEL % S	GAS TYPE	GAS THOUSANDS OF CF/YR	GAS BTU/CF
144.	145.	146.	147.	148.	149.	150.	151.	152.

APPLICABLE RULE	APPLICABLE RULE
153.	154.

Upon completion of construction sign the statement listed below and forward to the appropriate field representative

THE PROCESS, EXHAUST OR VENTILATION SYSTEM HAS BEEN CONSTRUCTED AND WILL BE OPERATED IN ACCORDANCE WITH STATED SPECIFICATIONS AND IN CONFORMANCE WITH ALL PROVISIONS OF EXISTING REGULATIONS.

155. SIGNATURE OF AUTHORIZED REPRESENTATIVE OR AGENT	DATE

156. LOCATION CODE	157. FACILITY ID. NO.	158. U.T.M. (E)	159. U.T.M. (N)	160. SIC NUMBER	161. DATE APPL. RECEIVED	162. DATE APPL. REVIEWED	163. REVIEWED BY:
					/ /	/ /	

PERMIT TO CONSTRUCT

164. DATE ISSUED	165. EXPIRATION DATE	166. SIGNATURE OF APPROVAL	167. FEE
/ /	/ /		

168.
1. DEVIATION FROM APPROVED APPLICATION SHALL VOID THIS PERMIT
2. THIS IS NOT A CERTIFICATE TO OPERATE
3. TESTS AND/OR ADDITIONAL EMISSION CONTROL EQUIPMENT MAY BE REQUIRED PRIOR TO THE ISSUANCE OF A CERTIFICATE TO OPERATE

CERTIFICATE TO OPERATE

169. DATE ISSUED	170. EXPIRATION DATE	171. SIGNATURE OF APPROVAL	172. FEE
/ /	/ /		

173.
1. ☐ INSPECTED BY _____ DATE _____
2. ☐ INSPECTION DISCLOSED DIFFERENCES AS BUILT VS. PERMIT. CHANGES INDICATED ON FORM
3. ☐ ISSUE CERTIFICATE TO OPERATE FOR SOURCE AS BUILT
4. ☐ APPLICATION FOR C.O. DENIED _____ DATE _____ INITIALED

AGENCY ONLY

174. SPECIAL CONDITIONS:

1.	2.
3.	4.
5.	6.
7.	8.

OP | LOCATION | FACILITY | EMISSION POINT | I

A ADD
C CHANGE
D DELETE

READ INSTRUCTIONS CONTAINED IN FORM 76-11-12 BEFORE ANSWERING ANY QUESTION

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

COPIES
WHITE - ORIGINAL
GREEN - DIVISON OF AIR
WHITE - REGIONAL OFFICE
WHITE - FIELD REP.
YELLOW - APPLICANT

PROCESS, EXHAUST OR VENTILATION SYSTEM

APPLICATION FOR PERMIT TO CONSTRUCT OR CERTIFICATE TO OPERATE

SECTION A

1. NAME OF OWNER / FIRM	9. NAME OF AUTHORIZED AGENT	10. TELEPHONE	19. FACILITY NAME (IF DIFFERENT FROM OWNER / FIRM)
Amperex Electronic Corp.	Groundwater Technology	(518) 370 -5631	Ferroxcube
2. NUMBER AND STREET ADDRESS	**11. NUMBER AND STREET ADDRESS**		**20. FACILITY LOCATION (NUMBER AND STREET ADDRESS)**
Providence Pike	1245 Kings Road		5083 Kings Highway
3. CITY - TOWN - VILLAGE / 4. STATE / 5. ZIP	**12. CITY - TOWN - VILLAGE / 13. STATE / 14. ZIP**		**21. CITY - TOWN - VILLAGE / 22. ZIP**
Slatersville / RI / 02876	Schenectady / NY / 12303		Saugerties / NY / 12477
6. OWNER CLASSIFICATON	**15. NAME OF P.E. OR ARCHITECT PREPARING APPLICATION / 16. N.Y.S. P.E. OR ARCHITECT LICENSE NO. / 17. TELEPHONE**		**23. BUILDING NAME OR NUMBER / 24. FLOOR NAME OR NUMBER**
A. ☐ COMMERCIAL C. ☐ UTILITY E. ☐ STATE F. ☐ MUNICIPAL H. ☐ HOSPITAL I. ☐ RESIDENTIAL	Basilis Stephanatos / 69175 / (518) 370-5631		2 / 1
B. ☒ INDUSTRIAL D. ☐ FEDERAL G. ☐ EDUC. INST. J. ☐ OTHER			**25. START UP DATE (MO / YR) / 26. DRAWING NUMBERS OF PLANS SUBMITTED**
7. NAME & TITLE OF OWNERS REPRESENTATIVE / 8. TELEPHONE	**18. SIGNATURE OF OWNERS REPRESENTATIVE OR AGENT WHEN APPLYING FOR A PERMIT TO CONSTRUCT**		6 / 94
			27. PERMIT TO CONSTRUCT A. ☒ NEW SOURCE B. ☐ MODIFICATION / **28. CERTIFICATE TO OPERATE** A. ☐ NEW SOURCE C. ☐ EXISTING SOURCE B. ☐ MODIFICATION

SEC. B

29. EMISSION POINT ID.	30. GROUND ELEVATION (FT.)	31. HEIGHT ABOVE STRUCTURES (FT.)	32. STACK HEIGHT (FT.)	33. INSIDE DIMENSIONS (IN.)	34. EXIT TEMP.(°F)	35. EXIT VELOCITY (FT./SEC.)	36. EXIT FLOW RATE (ACFM)	37. SOURCE CODE	38. HRS / DAY	39. DAYS / YR	40. % OPERATION BY SEASON (Winter Spring Summer Fall)

SEC. C

41. DESCRIBE PROCESS OR UNIT		
	1.	2.
	3.	4.
	5.	6.
	7.	8.

SEC. D

EMISSION CONTROL EQUIPMENT I.D.	CONTROL TYPE	MANUFACTURER'S NAME AND MODEL NUMBER	DISPOSAL METHOD	DATE INSTALLED MONTH / YEAR	USEFUL LIFE
42.	43.	44.	45.	46. /	47.
48.	49.	50.	51.	52. /	53.

SECTION E

CALCULATIONS

SECTION F

CONTAMINANT NAME	CAS NUMBER	INPUT OR PRODUCTION	UNIT	ENV. RATING	EMISSIONS ACTUAL	EMISSIONS UNIT	EMISSIONS HOW DET	EMISSIONS PERMISSIBLE	% CONTROL EFFIC'CY	HOURLY EMISSIONS (LBS/HR) ERP	HOURLY EMISSIONS (LBS/HR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) 10³	ANNUAL EMISSIONS (LBS/YR) PERMISSIBLE
54. Trichlorotrifluoroethane	55. 76-13-1	56.	57.	58.	59. 0.013	60. 1	61. 3	62.	63.	64. 0.013	65. 0.013	66. 1.14	67. 2	68.
69. Benzene	70. 71-43-2	71.	72.	73.	74. 0.0001	75. 1	76. 3	77.	78.	79. 0.0001	80. 0.0001	81. 8.76	82. -1	83.
84. Toluene	85. 108-88-3	86.	87.	88.	89. 0.0005	90. 1	91. 3	92.	93.	94. 0.0005	95. 0.0005	96. 4.38	97. 0	98.
99. Ethylebenzene	100. 100-41-4	101.	102.	103.	104. 0.0006	105. 1	106. 3	107.	108.	109. 0.0006	110. 0.0006	111. 5.26	112. 0	113.
114. Xylenes	115. 1330-20-7	116.	117.	118.	119. 0.0002	120. 1	121. 3	122.	123.	124. 0.0002	125. 0.0002	126. 1.752	127. 1	128.
129.	130. - -	131.	132.	133.	134.	135.	136.	137.	138.	139.	140.	141.	142.	143.

SEC. G

SOLID FUEL TYPE	SOLID FUEL TONS / YR	SOLID FUEL % S	LIQUID FUEL TYPE	LIQUID FUEL THOUSANDS OF GALLONS/YR	LIQUID FUEL % S	GAS TYPE	GAS THOUSANDS OF CF/YR	GAS BTU/CF
144.	145.	146.	147.	148.	149.	150.	151.	152.

APPLICABLE RULE	APPLICABLE RULE
153.	154.

Upon completion of construction sign the statement listed below and forward to the appropriate field representative

THE PROCESS, EXHAUST OR VENTILATION SYSTEM HAS BEEN CONSTRUCTED AND WILL BE OPERATED IN ACCORDANCE WITH STATED SPECIFICATIONS AND IN CONFORMANCE WITH ALL PROVISIONS OF EXISTING REGULATIONS.

155. SIGNATURE OF AUTHORIZED REPRESENTATIVE OR AGENT | DATE

AGENCY USE ONLY

156. LOCATION CODE	157. FACILITY ID. NO.	158. U.T.M. (E)	159. U.T.M. (N)	160. SIC NUMBER	161. DATE APPL. RECEIVED	162. DATE APPL. REVIEWED	163. REVIEWED BY:
					/ /	/ /	

PERMIT TO CONSTRUCT

164. DATE ISSUED	165. EXPIRATION DATE	166. SIGNATURE OF APPROVAL	167. FEE
/ /	/ /		

168.
1. DEVIATION FROM APPROVED APPLICATION SHALL VOID THIS PERMIT
2. THIS IS NOT A CERTIFICATE TO OPERATE
3. TESTS AND/OR ADDITIONAL EMISSION CONTROL EQUIPMENT MAY BE REQUIRED PRIOR TO THE ISSUANCE OF A CERTIFICATE TO OPERATE

CERTIFICATE TO OPERATE

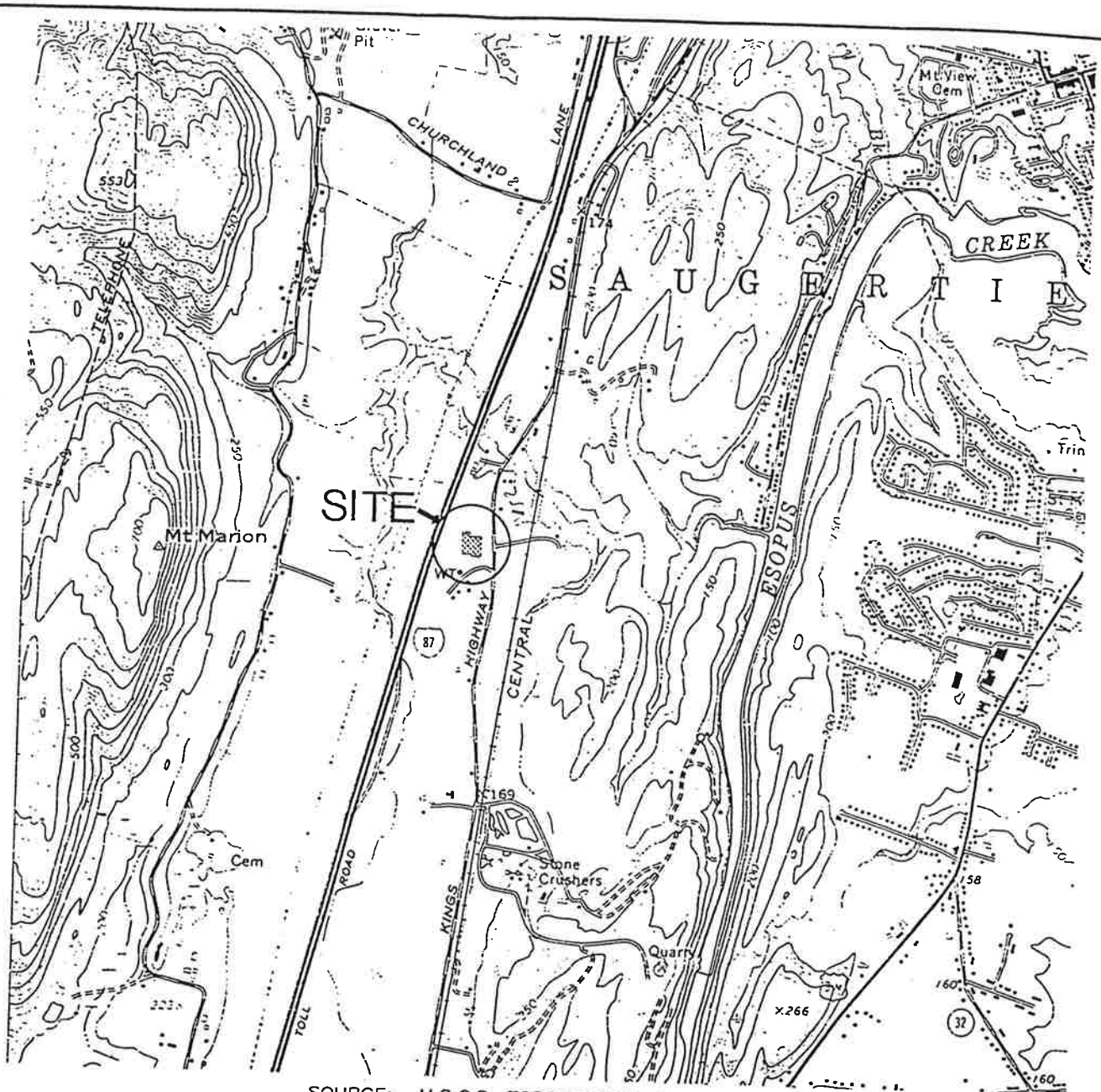
169. DATE ISSUED	170. EXPIRATION DATE	171. SIGNATURE OF APPROVAL	172. FEE
/ /	/ /		

173.
1. ☐ INSPECTED BY _____ DATE _____
2. ☐ INSPECTION DISCLOSED DIFFERENCES AS BUILT VS. PERMIT. CHANGES INDICATED ON FORM
3. ☐ ISSUE CERTIFICATE TO OPERATE FOR SOURCE AS BUILT
4. ☐ APPLICATION FOR C.O. DENIED _____ DATE _____ INITIALED

174. SPECIAL CONDITIONS:

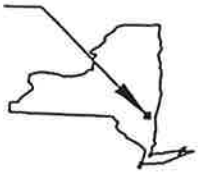
1.	2.
3.	4.
5.	6.
7.	8.

AGENCY USE ONLY



SOURCE: U.S.G.S. TOPOGRAPHIC QUADRANGLE
SAUGERTIES, N.Y. QUADRANGLE
7.5 MINUTE SERIES
DATE: 1963/REVISED 1978

QUAD LOCATION



SCALE 1:24,000

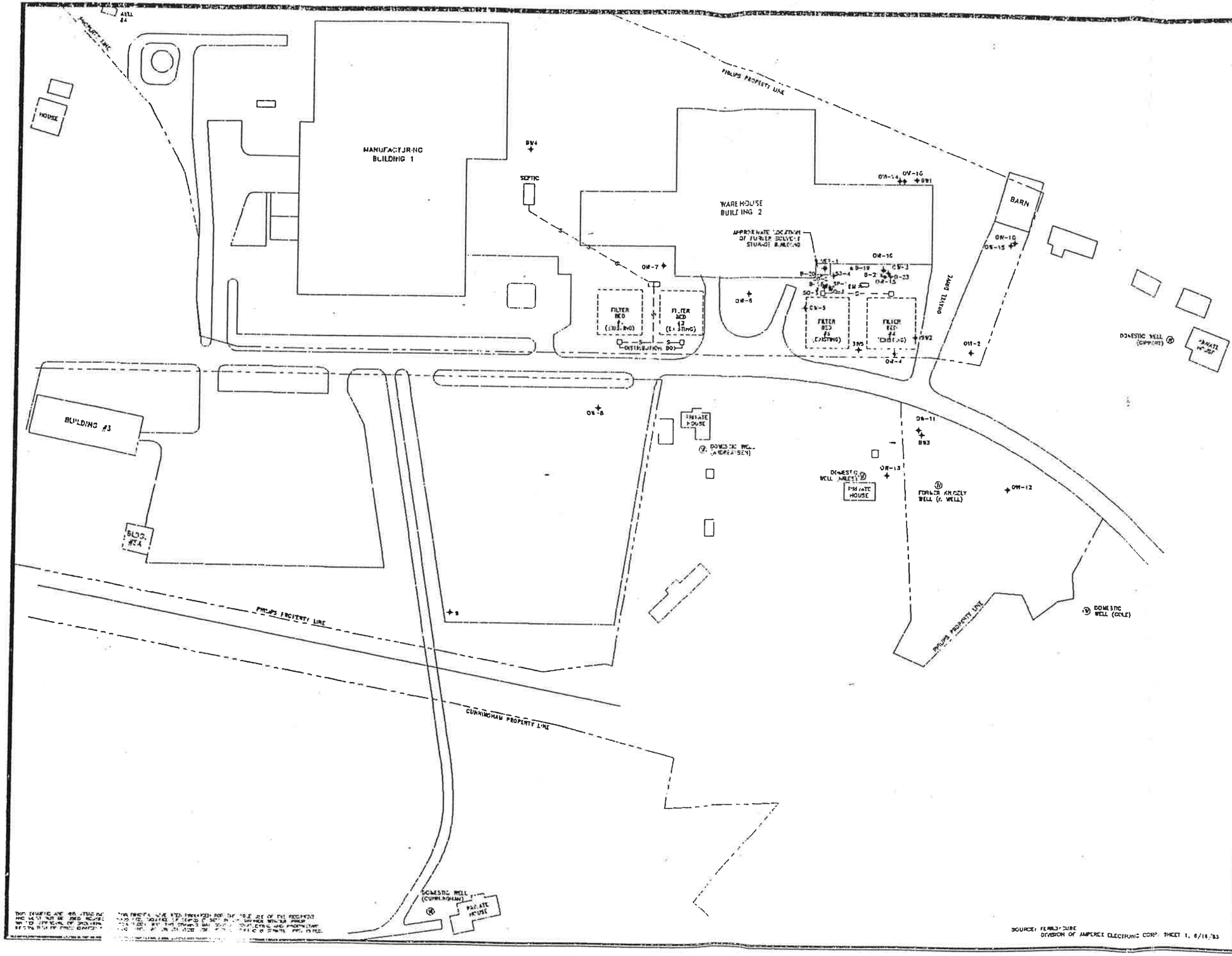
0 2,000 4,000
SCALE FEET

N

GROUNDWATER TECHNOLOGY

1245 KINGS ROAD
SCHENECTADY, NY 12303
(518) 370-5631

DESIGNED: RAH	**SITE LOCATION MAP**
DETAILED: DEO	CLIENT: PHILIPS COMPONENTS
CHECKED:	LOCATION: 5083 KINGS HIGHWAY SAUGERTIES, NEW YORK
	DRAWING DATE: 8/10/93
	FIGURE: 1-1



NO. | DATE | BY | REVISION

LEGEND

- MONITORING WELL
- SO-1 SPARGE OBSERVATION WELL
- SPARGE POINT
- VAPOR EXTRACTION WELL
- RECOVERY WELL
- —S— SEWER LINE

60 0 60 120
SCALE FEET

N

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY
1249 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-5831

PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

SITE PLAN

DESIGNED BY:	DETAILED BY	CHECKED BY:
RAH	DEO	
DRAWING DATE: 3/15/94		ACAD FILE: 5019-Y1
PROJECT NO.: 01110-5015		CONTRACT:
DRAWING: Y1		REVISION:

SPARGE AND PUMP AIR FROM COMPRESSOR (EXISTING)

COOLING TOWER (EXISTING)

GAC 1 AND 2 (EXISTING)

SUMP PUMP, P9 (EXISTING)

(EXISTING)

COMPRESSED AIR LINE (EXISTING)

WATER LINE (EXISTING)

APPROXIMATE LOCATION OF FORMER SOLVENT STORAGE BUILDING

APPROXIMATE LOCATION OF 4" SVE DISCHARGE STACK

DETAIL A1 T8

DETAIL A2 T8

WATER LINE (EXISTING)

EQUIPMENT SHED

ELECTRIC SWITCH GEAR

UTILITY TRENCH

CHLORINE HOUSE

LIMIT OF 10 mil POLYETHLENE COVER

COVER TO FOLLOW NATURAL GRADE (MIN 0.5% SLOPE)

LIMIT OF 10 mil POLYETHLENE COVER

4' HIGH SNOW FENCE

2' SILT FENCE

4' HIGH SNOW FENCE EXCLUSION SIGNS EVERY 40'

DISTRIBUTION BOX

WAREHOUSE BUILDING 2

GRAVEL

DRIVEWAY

FILTER BED (EXISTING) #4

NOTE: CONTRACTOR NEEDS TO CONFIRM LOCATION OF ALL UTILITY LINES

NO.	DATE	BY	REVISION

Legend

- MONITORING WELL
- SPARGE OBSERVATION WELL
- SPARGE WELL
- VAPOR EXTRACTION WELL
- RECOVERY WELL
- SOIL BORING
- PROPOSED RECOVERY WELL
- PROPOSED SPARGE WELL
- PROPOSED VENT WELL
- SEWER LINE
- WATER LINE
- COMPRESSED AIR LINE
- TRENCH LIMITS

N

SCALE 0 10 20 FEET

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY
1245 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-6831

PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

REMEDIAL SYSTEM AND TRENCHING LAYOUT

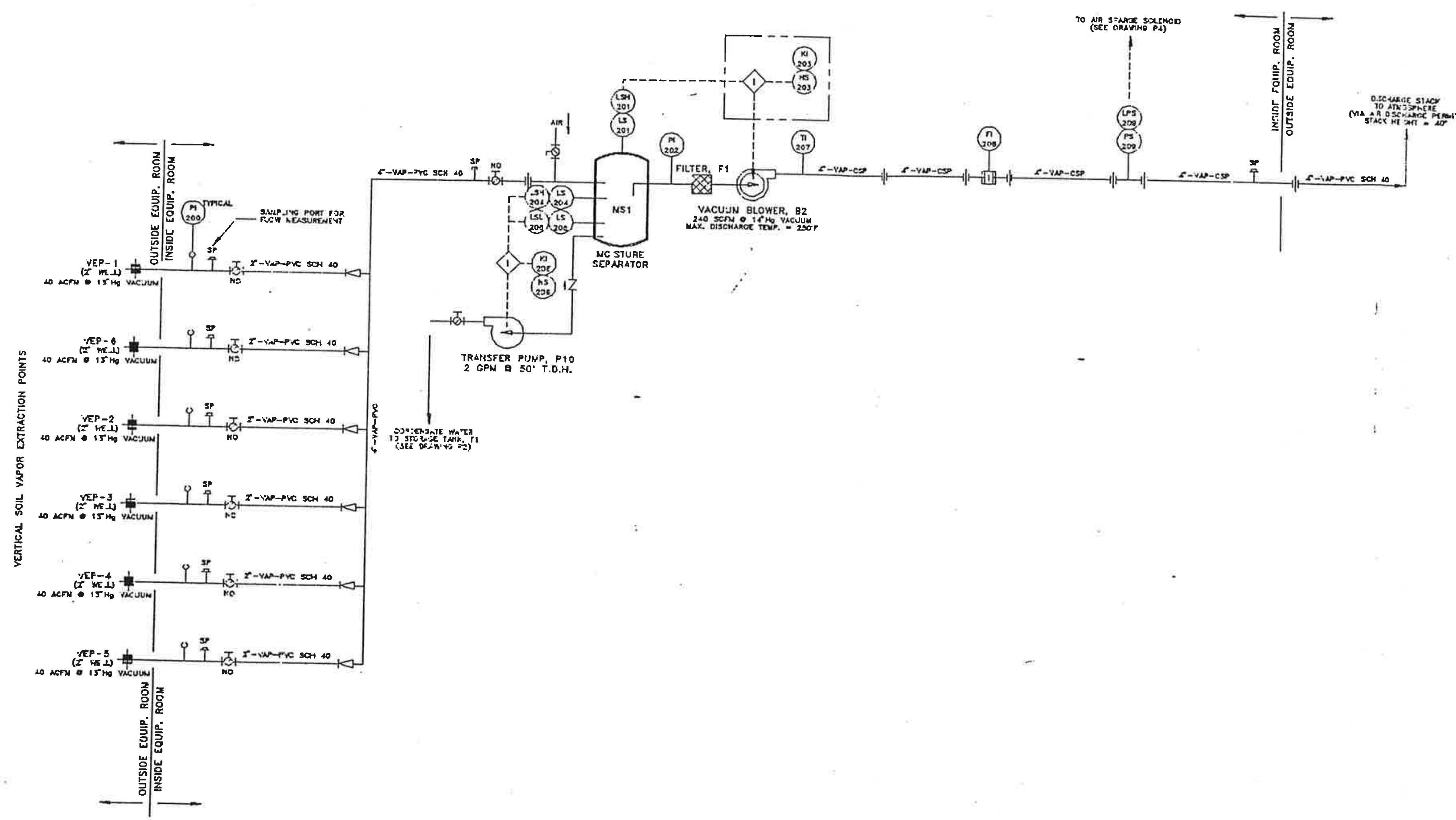
DESIGNED BY:	DETAILED BY:	CHECKED BY:
NPS	DEO	

DRAWING DATE:	ACAD FILE:
3/15/94	5019-Y2

PROJECT NO.:	CONTRACT:
01110-5019	

DRAWING: 2-1 REVISION:

SOIL VAPOR EXTRACTION SYSTEM



NO.	DATE	BY	REVISION

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY
1245 KINGS ROAD
SCHENECTADY, NY 12303 (518) 370-5631

PHILIPS COMPONENTS

1033 KINGS HIGHWAY
SAUGERTIES, NEW YORK

SOIL VAPOR EXTRACTION SYSTEM PIPING & INSTRUMENTATION DIAGRAM

DESIGNED BY: MPS	DETAILED BY: DEO	CHECKED BY:
DRAWING DATE: 3/15/94	ACAD FILE: 5019-P3	
PROJECT NO.: 01110-5019	CONTRACT:	
DRAWING: P3	REVISION:	

AIR GUIDE 1 – WORKSHEET #1

SOIL VAPOR EXTRACTION PERMIT WORKSHEET

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

NOTES:
THIS RUN WAS BASED UPON CONCENTRATIONS ACHIEVED DURING THE PILOT TEST. THE SAMPLE USED WAS LABELLED "INFLUENT 3", EXCEPT * WHICH WAS "INFLUENT 1", AND ** WHICH WAS "INFLUENT 2".

SOIL VAPOR EXTRACTION SYSTEM OPERATING DATA

AIR FLOW: 240 acfm

DISCHARGE TEMP.: 100 Degrees F

AMBIENT TEMP.: 50 Degrees F

STRUCTURE HEIGHT: 29

DIST. TO PROP. LINE: 200 feet
note: must be greater than 3 times building hight

STACK HEIGHT: 40 feet

STACK DIAMETER: 4 Inches

EXIT VELOCITY: 46 feet/sec

SOIL VAPOR EXTRACTION SYSTEM CHEMICAL DISCHARGE DATA

CONTAMINANT	MOL WEIGHT (g/mole)	CAS #	CONCENTRATION (ppmV)	CONCENTRATION (mg/m^3)	LOADING (lbs/hr)
VINYL CHLORIDE	62.5	75–01–4	5.90E+00	1.51E+01	0.0135
1,1–DICHLOROETHENE	96.94	75–35–4	3.80E+00	1.50E+01	0.0135
cis–1,2–DICHLOROETHENE	96.95	540–59–0	4.40E+00	1.74E+01	0.0156
1,1,1–TRICHLOROETHANE	133.405	71–55–6	3.40E+00	1.85E+01	0.0166
1,1–DICHLOROETHANE	98.96	75–34–3	1.80E+00	7.27E+00	0.0065
TETRACHLOROETHENE	165.8	127–18–4	8.40E+00	5.68E+01	0.0510
TRICHLOROETHENE	131.4	79–01–6	2.50E+01	1.34E+02	0.1204
2–BUTANONE*	72.1	78–93–3	2.80E–02	8.24E–02	0.0001
CARBON DISULFIDE	98.96	75–15–0	4.40E–03	1.78E–02	0.0000
METHYLENE CHLORIDE	84.9	75–09–2	8.00E–02	2.77E–01	0.0002
ACETONE*	58.1	67–64–1	2.20E–02	5.22E–02	0.0000
CHLOROETHANE**	64.5	75–00–3	1.90E–01	5.00E–01	0.0004
TRICHLOROTRIFLUOROETHANE	187.4	76–13–1	9.80E–01	7.50E+00	0.0067
				Total Emission (lb/Hr)	0.2447

POINT SOURCE DISCHARGE METHOD SUMMARRY

CONTAMINANT	AGC LIMIT (ug/m^3)	DISCHARGE (ug/m^3)	SGC LIMIT (ug/m^3)	DISCHARGE (ug/m^3)	WORKSHEET #
VINYL CHLORIDE	2.00E–02	1.98E–02	1.30E+03	8.29E+00	2
1,1–DICHLOROETHENE	2.00E–02	1.97E–02	2.00E+03	8.28E+00	3
cis–1,2–DICHLOROETHENE	1.90E+03	2.29E–02	1.90E+05	9.59E+00	4
1,1,1–TRICHLOROETHANE	1.00E+03	2.43E–02	4.50E+05	1.02E+01	5
1,1–DICHLOROETHANE	5.00E+02	9.54E–03	1.90E+05	4.00E+00	6
TETRACHLOROETHENE	7.50E–02	7.46E–02	8.10E+04	3.13E+01	7
TRICHLOROETHENE	4.50E–01	1.76E–01	3.30E+04	7.39E+01	8
2–BUTANONE*	3.00E+02	1.08E–04	1.40E+05	4.54E–02	9
CARBON DISULFIDE	7.00E+00	2.33E–05	7.10E+02	9.79E–03	10
METHYLENE CHLORIDE	2.70E+01	3.64E–04	4.10E+04	1.53E–01	11
ACETONE*	1.40E+04	6.85E–05	1.40E+05	2.87E–02	12
CHLOROETHANE**	6.30E+04	6.57E–04	6.30E+05	2.76E–01	13
TRICHLOROTRIFLUOROETHANE	9.00E+04	9.84E–03	1.80E+06	4.13E+00	14

AIR GUIDE 1 – WORKSHEET #2

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: VINYL CHLORIDE
CAS NUMBER: 75–01–4

Q Reported actual hourly emissions (lb/hr):	0.01
Qa Annual emission rate (lb/yr):	118.35
AGC Annual Guideline Concentration (ug/m3):	2.00E–02
SGC Short Term Guideline Concentration (ug/m3):	1.30E+03

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	1.98E–02 < AGC
maximum Potential Annual Impact Cp (ug/m3):	1.97E–02
maximum Short Term Impact Cst (ug/m3):	8.29E+00 < SGC

File Name: AG1SVE.WK3
Version: UPDATE January 21, 1994

AIR GUIDE 1 – WORKSHEET #3

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: 1,1–DICHLOROETHENE

CAS NUMBER:	75–35–4
Q Reported actual hourly emissions (lb/hr):	0.01
Qa Annual emission rate (lb/yr):	118.23
AGC Annual Guideline Concentration (ug/m3):	2.00E–02
SGC Short Term Guideline Concentration (ug/m3):	2.00E+03

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	1.97E–02 < AGC
maximum Potential Annual Impact Cp (ug/m3):	1.97E–02
maximum Short Term Impact Cst (ug/m3):	8.28E+00 < SGC

File Name: AG1SVE.WK3
Version: UPDATE January 21, 1994

AIR GUIDE 1 – WORKSHEET #4

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: cis–1,2–DICHLOROETHENE

CAS NUMBER:	540–59–0
Q Reported actual hourly emissions (lb/hr):	0.02
Qa Annual emission rate (lb/yr):	1.37E+02
AGC Annual Guideline Concentration (ug/m3):	1.90E+03
SGC Short Term Guideline Concentration (ug/m3):	1.90E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	2.29E–02 < AGC
maximum Potential Annual Impact Cp (ug/m3):	2.28E–02
maximum Short Term Impact Cst (ug/m3):	9.59E+00 < SGC

File Name: AG1SVE.WK3
Version: UP DATE January 21, 1994

AIR GUIDE 1 – WORKSHEET #5

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: 1,1,1–TRICHLOROETHANE

CAS NUMBER:	71–55–6
Q Reported actual hourly emissions (lb/hr):	0.02
Qa Annual emission rate (lb/yr):	1.46E+02
AGC Annual Guideline Concentration (ug/m3):	1.00E+03
SGC Short Term Guideline Concentration (ug/m3):	4.50E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	2.43E–02 < AGC
maximum Potential Annual Impact Cp (ug/m3):	2.43E–02
maximum Short Term Impact Cst (ug/m3):	1.02E+01 < SGC

File Name: AG1SVE.WK3
Version: UPDATE January 21, 1994

AIR GUIDE 1 – WORKSHEET #6

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: 1,1–DICHLOROETHANE

CAS NUMBER:	75–34–3
Q Reported actual hourly emissions (lb/hr):	0.01
Qa Annual emission rate (lb/yr):	57.17
AGC Annual Guideline Concentration (ug/m3):	5.00E+02
SGC Short Term Guideline Concentration (ug/m3):	1.90E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3) =	9.54E–03 < AGC
maximum Potential Annual Impact Cp (ug/m3):	9.53E–03
maximum Short Term Impact Cst (ug/m3):	4.00E+00 < SGC

File Name: AG1SVE.WK3
Version: UPDATE January 21, 1994

AIR GUIDE 1 – WORKSHEET #7

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: TETRACHLOROETHENE

CAS NUMBER:	127–18–4
Q Reported actual hourly emissions (lb/hr):	0.05
Qa Annual emission rate (lb/yr):	446.99
AGC Annual Guideline Concentration (ug/m3):	7.50E–02
SGC Short Term Guideline Concentration (ug/m3):	8.10E+04

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact	
Ca (ug/m3) =	7.46E–02 < AGC
maximum Potential Annual Impact	
Cp (ug/m3):	7.46E–02
maximum Short Term Impact	
Cst (ug/m3):	3.13E+01 < SGC

File Name: AG1SVE.WK3
Version: UPDATE January 21, 1994

AIR GUIDE 1 – WORKSHEET #8

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	
hs (physical stack height):	11
he (effective stack height):	40
	40
Inside dimension (ft.):	
R Stack outlet area (ft ^ 2):	0.3333
exit temperature (F):	0.09
T exit temperature (R):	100
V exit velocity (ft/min):	560
flowrate (ft ^ 3/min):	2752
ambient temperature (F):	240
	50
hb (building height):	
	29

CONTAMINANT: TRICHLOROETHENE

CAS NUMBER:	79–01–6
Q Reported actual hourly emissions (lb/hr):	0.12
Qa Annual emission rate (lb/yr):	1054.31
AGC Annual Guideline Concentration (ug/m3):	4.50E–01
SGC Short Term Guideline Concentration (ug/m3):	3.30E+04

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact	
Ca (ug/m3) =	1.76E–01 < AGC
maximum Potential Annual Impact	
Cp (ug/m3):	1.76E–01
maximum Short Term Impact	
Cst (ug/m3):	7.39E+01 < SGC

AIR GUIDE 1 – WORKSHEET #9

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: 2–BUTANONE*

CAS NUMBER:	78–93–3
Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	0.65
AGC Annual Guideline Concentration (ug/m3):	3.00E+02
SGC Short Term Guideline Concentration (ug/m3):	1.40E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact	
Ca (ug/m3) =	1.08E–04 < AGC
maximum Potential Annual Impact	
Cp (ug/m3):	1.08E–04
maximum Short Term Impact	
Cst (ug/m3):	4.54E–02 < SGC

AIR GUIDE 1 – WORKSHEET #10

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: CARBON DISULFIDE

CAS NUMBER:	75–15–0
Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	0.14
AGC Annual Guideline Concentration (ug/m3):	7.00E+00
SGC Short Term Guideline Concentration (ug/m3):	7.10E+02

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact
Ca (ug/m3)= 2.33E–05 < AGC

maximum Potential Annual Impact
Cp (ug/m3): 2.33E–05

maximum Short Term Impact
Cst (ug/m3): 9.79E–03 < SGC

AIR GUIDE 1 – WORKSHEET #11

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: METHYLENE CHLORIDE

CAS NUMBER:	75–09–2
Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	2.18
AGC Annual Guideline Concentration (ug/m3):	2.70E+01
SGC Short Term Guideline Concentration (ug/m3):	4.10E+04

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact	
Ca (ug/m3)=	3.64E–04 < AGC
maximum Potential Annual Impact	
Cp (ug/m3):	3.64E–04
maximum Short Term Impact	
Cst (ug/m3):	1.53E–01 < SGC

AIR GUIDE 1 – WORKSHEET #12

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: ACETONE*

CAS NUMBER:	67–64–1
Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	0.41
AGC Annual Guideline Concentration (ug/m3):	1.40E+04
SGC Short Term Guideline Concentration (ug/m3):	1.40E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact	
Ca (ug/m3) =	6.85E–05 < AGC
maximum Potential Annual Impact	
Cp (ug/m3):	6.84E–05
maximum Short Term Impact	
Cst (ug/m3):	2.87E–02 < SGC

AIR GUIDE 1 – WORKSHEET #13

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER 01110–5019

LOCATION: NY

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: CHLOROETHANE**

CAS NUMBER:	75–00–3
Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	3.93
AGC Annual Guideline Concentration (ug/m3):	6.30E+04
SGC Short Term Guideline Concentration (ug/m3):	6.30E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	6.57E–04 < AGC
maximum Potential Annual Impact Cp (ug/m3):	6.56E–04
maximum Short Term Impact Cst (ug/m3):	2.76E–01 < SGC

AIR GUIDE 1 – WORKSHEET #14

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: PHILIPS

JOB NUMBER: 01110–5019

LOCATION: NY

height above structure:	
hs (physical stack height):	11
he (effective stack height):	40
	40
Inside dimension (ft.):	
R Stack outlet area (ft^2):	0.3333
exit temperature (F):	0.09
T exit temperature (R):	100
V exit velocity (ft/min):	560
flowrate (ft^3/min):	2752
ambient temperature (F):	240
	50
hb (building height):	
	29

CONTAMINANT: TRICHLOROTRIFLUOROETHANE

CAS NUMBER:	76–13–1
Q Reported actual hourly emissions (lb/hr):	0.01
Qa Annual emission rate (lb/yr):	58.94
AGC Annual Guideline Concentration (ug/m3):	9.00E+04
SGC Short Term Guideline Concentration (ug/m3):	1.80E+06

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact	
Ca (ug/m3) =	9.84E–03 < AGC
maximum Potential Annual Impact	
Cp (ug/m3):	9.83E–03
maximum Short Term Impact	
Cst (ug/m3):	4.13E+00 < SGC

AIR GUIDE 1 – WORKSHEET #1

SOIL VAPOR EXTRACTION PERMIT WORKSHEET

DATE: 05/11/94

JOB NAME: ~~MOBIL CENTRAL~~ Philips Components

JOB NUMBER: 01110–5019

LOCATION: Saugerties, New York

SOIL VAPOR EXTRACTION SYSTEM OPERATING DATA

AIR FLOW:	240 acfm
DISCHARGE TEMP.:	100 Degrees F
AMBIENT TEMP.:	50 Degrees F
STRUCTURE HEIGHT:	29 feet
DIST. TO PROP. LINE:	200 feet
STACK HEIGHT:	40 feet
STACK DIAMETER:	4 inches
EXIT VELOCITY:	46 feet/sec

SOIL VAPOR EXTRACTION SYSTEM CHEMICAL DISCHARGE DATA

CONTAMINANT	MOL WEIGHT (g/mole)	CAS #	CONCENTRATION (ppmV)	CONCENTRATION (mg/m^3)	LOADING (lbs/hr)
BENZENE	78.11	71–43–2	0.040	0.128	0.000114
TOLUENE	92.13	108–88–3	0.150	0.564	0.000506
ETHYLBENZENE	106.16	100–41–4	0.160	0.693	0.000622
XYLENES	106.16	1330–20–7	0.530	2.297	0.002061
MtBE	98.15	1634–04–4	0.000	0.000	0.000000
				Total Emission (lb/Hr)	0.0033

POINT SOURCE DISCHARGE METHOD SUMMARRY

CONTAMINANT	AGC LIMIT (ug/m^3)	DISCHARGE (ug/m^3)	SGC LIMIT (ug/m^3)	DISCHARGE (ug/m^3)	WORKSHEET #
BENZENE	1.20E–01	1.67E–04	3.00E+01	7.02E–02	2
TOLUENE	2.00E+03	7.40E–04	8.90E+04	3.11E–01	3
ETHYLBENZENE	1.00E+03	9.10E–04	1.00E+05	3.82E–01	4
XYLENES	6.00E+00	3.01E–03	6.00E+02	1.26E+00	5
MtBE	4.00E+00	0.00E+00	––	0.00E+00	6

AIR GUIDE 1 – WORKSHEET #2

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: MOBIL CENTRAL

JOB NUMBER: 01110–5019

LOCATION: Saugerties, New York

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: BENZENE

CAS NUMBER: 71–43–2

Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	1.00
AGC Annual Guideline Concentration (ug/m3):	1.20E–01
SGC Short Term Guideline Concentration (ug/m3):	3.00E+01

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	1.67E–04 < AGC=1.20–01
maximum Potential Annual Impact Cp (ug/m3):	1.67E–04
maximum Short Term Impact Cst (ug/m3):	7.02E–02 < SGC=3.00+01

File Name: AG1SVE.WK3

AIR GUIDE 1 – WORKSHEET #3

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: MOBIL CENTRAL

JOB NUMBER: 01110–5019

LOCATION: Saugerties, New York

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	
R Stack outlet area (ft^2):	0.3333
exit temperature (F):	0.09
T exit temperature (R):	100
V exit velocity (ft/min):	560
flowrate (ft^3/min):	2752
ambient temperature (F):	240
	50
hb (building height):	29

CONTAMINANT: TOLUENE

CAS NUMBER: 108–88–3

Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	4.44
AGC Annual Guideline Concentration (ug/m3):	2.00E+03
SGC Short Term Guideline Concentration (ug/m3):	8.90E+04

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	7.40E–04 < AGC=2.00+03
maximum Potential Annual Impact Cp (ug/m3):	7.40E–04
maximum Short Term Impact Cst (ug/m3):	3.11E–01 < SGC=8.90+04

File Name: AG1SVE.WK3

AIR GUIDE 1 – WORKSHEET #4

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: MOBIL CENTRAL

JOB NUMBER: 01110–5019

LOCATION: Saugerties, New York

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: ETHYLBENZENE

CAS NUMBER: 100–41–4

Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	5.45
AGC Annual Guideline Concentration (ug/m3):	1.00E+03
SGC Short Term Guideline Concentration (ug/m3):	1.00E+05

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	**9.10E–04** < AGC=1.00+03
maximum Potential Annual Impact Cp (ug/m3):	**9.09E–04**
maximum Short Term Impact Cst (ug/m3):	**3.82E–01** < SGC=1.00+05

File Name: AG1SVE.WK3

AIR GUIDE 1 – WORKSHEET #5

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: MOBIL CENTRAL

JOB NUMBER: 01110–5019

LOCATION: Saugerties, New York

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: XYLENES

CAS NUMBER: 1330–20–7

Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	18.06
AGC Annual Guideline Concentration (ug/m3):	6.00E+00
SGC Short Term Guideline Concentration (ug/m3):	6.00E+02

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact Ca (ug/m3)=	3.01E–03 < AGC=6.00+00
maximum Potential Annual Impact Cp (ug/m3):	3.01E–03
maximum Short Term Impact Cst (ug/m3):	1.26E+00 < SGC=6.00+02

File Name: AG1SVE.WK3

AIR GUIDE 1 – WORKSHEET #6

STANDARD POINT SOURCE DISCHARGE EVALUATION 1991 EDITION

DATE: 05/11/94

JOB NAME: MOBIL CENTRAL

JOB NUMBER: 01110–5019

LOCATION: Saugerties, New York

height above structure:	11
hs (physical stack height):	40
he (effective stack height):	40
Inside dimension (ft.):	0.3333
R Stack outlet area (ft^2):	0.09
exit temperature (F):	100
T exit temperature (R):	560
V exit velocity (ft/min):	2752
flowrate (ft^3/min):	240
ambient temperature (F):	50
hb (building height):	29

CONTAMINANT: MtBE

CAS NUMBER: 1634–04–4

Q Reported actual hourly emissions (lb/hr):	0.00
Qa Annual emission rate (lb/yr):	0.00
AGC Annual Guideline Concentration (ug/m3):	4.00E+00
SGC Short Term Guideline Concentration (ug/m3):	--

STANDARD POINT SOURCE METHOD

maximum Actual Annual Impact
Ca (ug/m3)= 0.00E+00 < AGC=4.00+00

maximum Potential Annual Impact
Cp (ug/m3): 0.00E+00

maximum Short Term Impact
Cst (ug/m3): 0.00E+00 SGC=--

File Name: AG1SVE.WK3

Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Groundwater Technology Inc.

Client Sample ID: Influent 3 (02/24/92) (4:00)

PAI Sample ID: 9200834

Test Code: GC/MS EPA TO-14
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Tuday

Matrix: Summa Canister
Date Received: 02/25/92
Date Analyzed: 03/03-04/92
Volume Analyzed: 1.00 Liter & 0.020 L
P_i = +0.6 P_f = +2.0 DF= 1.09
P_i = -0.2 P_f = +1.6 DF= 1.12

CAS #	COMPOUND	RESULT (UG/M^3)	DETECTION LIMIT (UG/M^3)	RESULT (PPB)	DETECTION LIMIT (PPB)
74-87-3	CHLOROMETHANE	ND	5.0	ND	2.4
75-01-4	VINYL CHLORIDE	6500	5.0	2500	2.0
75-00-3	CHLOROETHANE	450	5.0	170	1.9
74-83-9	BROMOMETHANE	ND	5.0	ND	1.3
67-64-1	ACETONE	26	10	11	4.2
75-69-4	TRICHLOROFLUOROMETHANE	ND	5.0	ND	0.90
75-35-4	1,1-DICHLOROETHENE	6200	5.0	1600	1.3
75-09-2	METHYLENE CHLORIDE	270	5.0	80	1.5
75-15-0	CARBON DISULFIDE	14	5.0	4.4	1.6
76-13-1	TRICHLOROTRIFLUOROETHANE	7500	5.0	980	0.66
156-60-5	TRANS-1,2-DICHLOROETHENE	ND	5.0	ND	1.3
156-59-2	CIS-1,2-DICHLOROETHENE	17000	5.0	4400	1.3
75-34-3	1,1-DICHLOROETHANE	7400	5.0	1800	1.2
108-05-4	VINYL ACETATE	ND	10	ND	2.8
78-93-3	2-BUTANONE	32	10	11	3.4
67-66-3	CHLOROFORM	ND	5.0	ND	1.0
107-06-2	1,2-DICHLOROETHANE	ND	5.0	ND	1.2
71-55-6	1,1,1-TRICHLOROETHANE	19000	5.0	3400	0.93
71-43-2	BENZENE	13	5.0	4.1	1.6
56-23-5	CARBON TETRACHLORIDE	ND	5.0	ND	0.80
78-87-5	1,2-DICHLOROPROPANE	ND	5.0	ND	1.1
75-27-4	BROMODICHLOROMETHANE	ND	5.0	ND	0.75
79-01-6	TRICHLOROETHENE	3800	5.0	710	0.94
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	5.0	ND	1.1

ND = Not Detected TR = Trace Level < = Below Indicated Detection Limit

2095 Osborne Street Canoga Park CA 91304 Phone 818-709-1539 Fax 818-709-7915

Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS (Continued)

Client: Groundwater Technology Inc.

Client Sample ID: Influent 3 (02/24/92) (4:00)

PAI Sample ID: 9200834

Test Code: GC/MS EPA TO-14
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Tuday

Matrix: Summa Canister
Date Received: 02/25/92
Date Analyzed: 03/03-04/92
Volume Analyzed: 1.00 Liter & 0.020 L
P_i = +0.6 P_f = -2.0 DF= 1.09
P_i = -0.2 P_f = -1.6 DF= 1.12

CAS #	COMPOUND	RESULT (UG/M^3)	DETECTION LIMIT (UG/M^3)	RESULT (PPB)	DETECTION LIMIT (PPB)
108-10-1	4-METHYL-2-PENTANONE	ND	10	ND	2.4
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ND	5.0	ND	1.1
79-00-5	1,1,2-TRICHLOROETHANE	ND	5.0	ND	0.93
108-88-3	TOLUENE	56	5.0	15	1.3
124-48-1	DIBROMOCHLOROMETHANE	ND	5.0	ND	0.59
119-78-6	2-HEXANONE	ND	10	ND	2.4
106-93-4	1,2-DIBROMOETHANE	ND	5.0	ND	0.65
127-18-4	TETRACHLOROETHENE	1200	5.0	180	0.75
108-90-7	CHLOROBENZENE	ND	5.0	ND	1.1
100-41-4	ETHYLBENZENE	71	5.0	16	1.2
75-25-2	BROMOFORM	ND	5.0	ND	0.49
100-42-5	STYRENE	ND	5.0	ND	1.2
1330-20-7	m- & p-XYLENES	130	5.0	29	1.2
95-47-6	o-XYLENE	100	5.0	24	1.2
79-34-5	1,1,2,2-TETRACHLOROETHANE	ND	5.0	ND	0.74
541-73-1	1,3-DICHLOROBENZENE	ND	5.0	ND	0.84
106-46-7	1,4-DICHLOROBENZENE	ND	5.0	ND	0.84
95-50-1	1,2-DICHLOROBENZENE	ND	5.0	ND	0.84

ND = Not Detected TR = Trace Level — Below Indicated Detection Limit

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Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Groundwater Technology Inc.

Client Sample ID: Influent I (02/24/92) (11:50)

PAI Sample ID: 9200831

Test Code: GC/MS EPA TO-14
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Tuday

Matrix: Summa Canister
Date Received: 02/25/92
Date Analyzed: 03/03-04/92
Volume Analyzed: 1.00 Liter & 0.10 L
P_i = +0.9 P_f = +2.0 DF= 1.07
P_i = 0.0 P_f = +1.5 DF= 1.10

CAS #	COMPOUND	RESULT (UG/M^3)	DETECTION LIMIT (UG/M^3)	RESULT (PPB)	DETECTION LIMIT (PPB)
74-87-3	CHLOROMETHANE	ND	5.0	ND	2.4
75-01-4	VINYL CHLORIDE	1600	5.0	630	2.0
75-00-3	CHLOROETHANE	120	5.0	46	1.9
74-83-9	BROMOMETHANE	ND	5.0	ND	1.3
67-64-1	ACETONE	53	10	22	4.2
75-69-4	TRICHLOROFLUOROMETHANE	ND	5.0	ND	0.90
75-35-4	1,1-DICHLOROETHENE	1000	5.0	250	1.3
75-09-2	METHYLENE CHLORIDE	64	5.0	19	1.5
75-15-0	CARBON DISULFIDE	ND	5.0	ND	1.6
76-13-1	TRICHLOROTRIFLUOROETHANE	1100	5.0	140	0.66
156-60-5	TRANS-1,2-DICHLOROETHENE	ND	5.0	ND	1.3
156-59-2	CIS-1,2-DICHLOROETHENE	2300	5.0	590	1.3
75-34-3	1,1-DICHLOROETHANE	1400	5.0	360	1.2
108-05-4	VINYL ACETATE	ND	10	ND	2.8
78-93-3	2-BUTANONE	81	10	28	3.4
67-66-3	CHLOROFORM	ND	5.0	ND	1.0
107-06-2	1,2-DICHLOROETHANE	ND	5.0	ND	1.2
71-55-6	1,1,1-TRICHLOROETHANE	1900	5.0	360	0.93
71-43-2	BENZENE	9.2	5.0	2.9	1.6
56-23-5	CARBON TETRACHLORIDE	ND	5.0	ND	0.80
78-87-5	1,2-DICHLOROPROPANE	ND	5.0	ND	1.1
75-27-4	BROMODICHLOROMETHANE	ND	5.0	ND	0.75
79-01-6	TRICHLOROETHENE	210	5.0	40	0.94
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	5.0	ND	1.1

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit

20954 Osborne Street, Canoga Park, CA 91304 Phone 818-709-1539 Fax 818-709-1915

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS (Continued)

Client: Groundwater Technology Inc.

Client Sample ID: Influent 1 (02/24/92) (11:50)

PAI Sample ID: 9200831

Test Code: GC/MS EPA TO-14
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Tuday

Matrix: Summa Canister
Date Received: 02/25/92
Date Analyzed: 03/03-04/92
Volume Analyzed: 1.00 Liter & 0.10 L
P_i = +0.9 P_f = +2.0 DF= 1.07
P_i = 0.0 P_f = +1.5 DF= 1.10

CAS #	COMPOUND	RESULT (UG/M3)	DETECTION LIMIT (UG/M3)	RESULT (PPB)	DETECTION LIMIT (PPB)
108-10-1	4-METHYL-2-PENTANONE	ND	10	ND	2.4
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ND	5.0	ND	1.1
79-00-5	1,1,2-TRICHLOROETHANE	ND	5.0	ND	0.93
108-88-3	TOLUENE	14	5.0	3.7	1.3
124-48-1	DIBROMOCHLOROMETHANE	ND	5.0	ND	0.59
119-78-6	2-HEXANONE	ND	10	ND	2.4
106-93-4	1,2-DIBROMOETHANE	ND	5.0	ND	0.65
127-18-4	TETRACHLOROETHENE	90	5.0	13	0.75
108-90-7	CHLOROBENZENE	ND	5.0	ND	1.1
100-41-4	ETHYLBENZENE	5.6	5.0	1.3	1.2
75-25-2	BROMOFORM	ND	5.0	ND	0.49
100-42-5	STYRENE	ND	5.0	ND	1.2
1330-20-7	m- & p-XYLENES	19	5.0	4.3	1.2
95-47-6	o-XYLENE	15	5.0	3.5	1.2
79-34-5	1,1,2,2-TETRACHLOROETHANE	ND	5.0	ND	0.74
541-73-1	1,3-DICHLOROBENZENE	ND	5.0	ND	0.84
106-46-7	1,4-DICHLOROBENZENE	ND	5.0	ND	0.84
95-50-1	1,2-DICHLOROBENZENE	ND	5.0	ND	0.84

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Groundwater Technology Inc.

Client Sample ID: Influent 2 (02/24/92) (2:30)

PAI Sample ID: 9200833

Test Code: GC/MS EPA TO-14
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael.Tuday

Matrix: Summa Canister
Date Received: 02/25/92
Date Analyzed: 03/03-04/92
Volume Analyzed: 1.00 Liter & 0.050 L
P_i = +1.2 P_f = +2.1 DF= 1.06
P_i = +0.1 P_f = +1.6 DF= 1.10

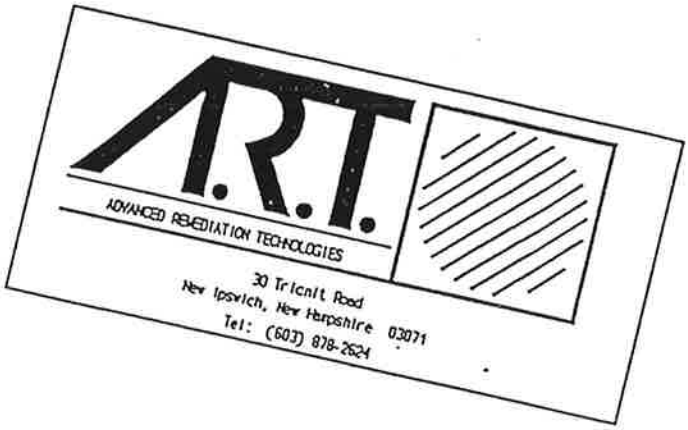
CAS #	COMPOUND	RESULT (UG/M^3)	DETECTION LIMIT (UG/M^3)	RESULT (PPB)	DETECTION LIMIT (PPB)
74-87-3	CHLOROMETHANE	ND	5.0	ND	2.4
75-01-4	VINYL CHLORIDE	5400	5.0	2100	2.0
75-00-3	CHLOROETHANE	490	5.0	190	1.9
74-83-9	BROMOMETHANE	ND	5.0	ND	1.3
67-64-1	ACETONE	12	10	4.9	4.2
75-69-4	TRICHLOROFLUOROMETHANE	ND	5.0	ND	0.90
75-35-4	1,1-DICHLOROETHENE	4400	5.0	1100	1.3
75-09-2	METHYLENE CHLORIDE	270	5.0	78	1.5
75-15-0	CARBON DISULFIDE	ND	5.0	ND	1.6
76-13-1	TRICHLOROTRIFLUOROETHANE	4900	5.0	640	0.66
156-60-5	TRANS-1,2-DICHLOROETHENE	57	5.0	14	1.3
156-59-2	CIS-1,2-DICHLOROETHENE	11000	5.0	2900	1.3
75-34-3	1,1-DICHLOROETHANE	5700	5.0	1400	1.2
108-05-4	VINYL ACETATE	ND	10	ND	2.8
78-93-3	2-BUTANONE	13	10	4.3	3.4
67-66-3	CHLOROFORM	ND	5.0	ND	1.0
107-06-2	1,2-DICHLOROETHANE	ND	5.0	ND	1.2
71-55-6	1,1,1-TRICHLOROETHANE	11000	5.0	2000	0.93
71-43-2	BENZENE	10	5.0	3.3	1.6
56-23-5	CARBON TETRACHLORIDE	ND	5.0	ND	0.80
78-87-5	1,2-DICHLOROPROPANE	ND	5.0	ND	1.1
75-27-4	BROMODICHLOROMETHANE	ND	5.0	ND	0.75
79-01-6	TRICHLOROETHENE	1600	5.0	310	0.94
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	5.0	ND	1.1

ND = Not Detected TR = Trace Level — Below Indicated Detection Limit

10954 Osborne Street Canoga Park, CA 91304 Phone 818-709-1539 Fax 818-709-3045

APPENDIX C

Equipment Manufacturers' Catalogs


A.R.T.
ADVANCED REMEDIATION TECHNOLOGIES
30 Tricnit Road
New Ipswich, New Hampshire 03071
Tel: (603) 878-2624

Sales Order #
94 - 3137

A.R.T.
ADVANCED REMEDIATION TECHNOLOGIES
30 Tricnit Road
New Ipswich, New Hampshire 03071
Tel: (603) 878-2624

15 HP, 460V, 3 PHASE, ROTARY LOBE, VAPOR EXTRACTION SYSTEM WITH MOISTURE SEPARATOR AND PUMPOUT OPTION

NOTICE

If assistance is required from the manufacturer of this equipment, please have the following information when calling;

A) Supplied manual
B) A.R.T. Sales Order Number
C) Serial Number

All information can be located on the SPECIFICATION SHEET located within this manual.

1-800-338-1837

REV: 0	DOC: 1000324	PG: CVR
Writer:	Engineer:	Date: 8/9/04

TABLE OF CONTENTS

Specification Sheet .....

1.0 Inspection .....

2.0 Storage .....

3.0 Description .....

3.1 Controller .....
3.1.1 Controls .....
3.1.1.1 HAND-OFF-AUTO Selector Switch .....
3.1.1.2 ON-OFF Selector Switch .....
3.1.2 Control Circuit Fuse .....
3.1.3 Transformer Primary Fuses .....
3.1.4 Jet Pump Fuses .....
3.1.5 Indicators .....
3.1.5.1 VES RUN Indicator .....
3.1.5.2 OVERRIDE Push Button RESET .....
3.1.6 Local Disconnect Switch .....
3.1.7 Seven Day Timer .....
3.1.8 Hour Meters .....
3.1.9 Level Sensors .....
3.1.9.1 HIGH OVERRIDE Liquid Level Sensor .....
3.1.9.2 LOW Liquid Level Sensor .....
3.1.9.3 HIGH Liquid Level Sensor .....
3.2 Vacuum Gauges .....
3.3 Pressure Gauge .....
3.4 Filter Element .....
3.5 Bleed Port .....
3.6 Moisture Separator .....
3.7 Jet Pump .....

4.0 Deployment .....

5.0 Pre-Operation Tests .....

TABLE OF CONTENTS CONTINUED

6.0 Operation .....
6.1 Thermal Overload of Motor 8
7.0 Maintenance 8
8.0 Troubleshooting 8-9
DIAGRAMS (In Order)
Sight Tube Level Sensor 9
Layout: 15 HP, Rotary Lobe VES, 460V, 3 Phase, ...1250849
SCHEMATICS (In Order)
Schematic:15 HP, 460V, 3 Phase, Rotary Lobe 1250841
Appendix-A: Blower Information 1300308
Appendix B: Seven Day Timer Information
Appendix C: Jet Pump Information
Appendix D: Warranty

SPECIFICATION SHEET

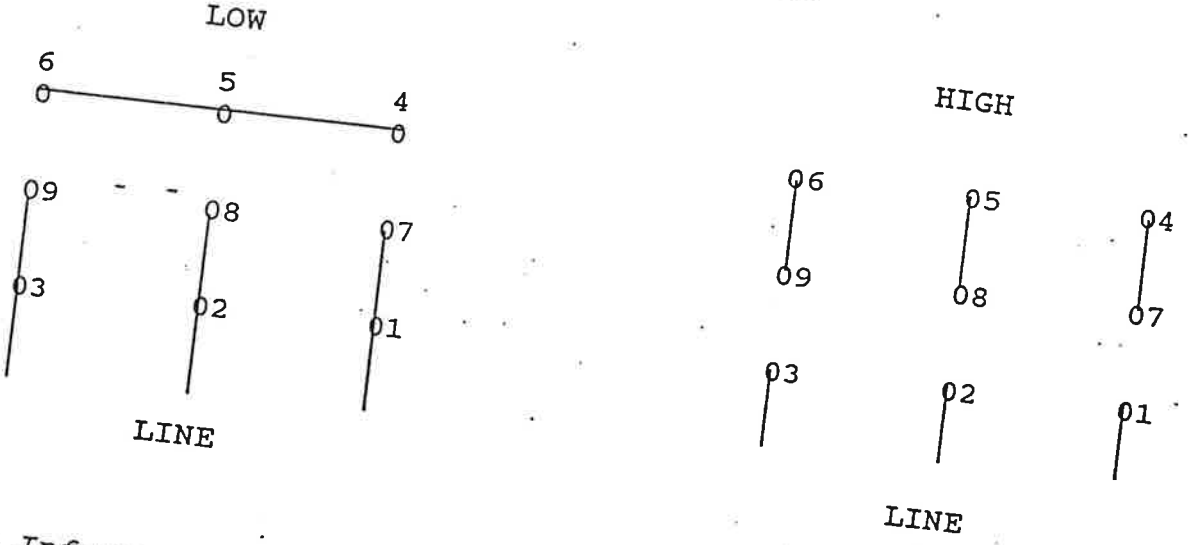
Description: 15 HP Vapor Extraction System, Rotary Lobe Blower, 36 URAI

Capabilities: 240 SCFM @ 14.0 HG

Blower: Designation: 36 URAI

Motor: Baldor; CAT #: EM2513T SER.: 6940-522 PH: 3
HP: 15 VOLTS: 230/460 Hz: 60 RPM: 1765 AMPS: 36/18
CLASS: B FRAME: 254T CODE: H SPEC: 39K57W317 DES: B
PU. END BRG: 6309 FR END BRG: 6208 SER.F.: 1.15

ELECTRICAL CONNECTIONS



Other Information: Bleed valve installed on influent of moisture separator. 2" Relief Valve set at 6.75" Hg.

Model Number: VS15-230M Serial Number: 94-3137-01

Sales Order #" 94-3137 Manual #: 1000324 REV: 0

1.0 *INSPECTION:*

Inspect all equipment upon arrival. If any items are missing or damaged, make note of this on the shipping papers. Also, notify Advanced Remediation Technologies, Inc. immediately at (603) 878-2624.

As soon as the equipment is received, it should be inspected carefully to insure that the unit was not damaged in shipping and all items on the packing list are received. Even though Advanced Remediation Technologies, Inc. takes all precautions to insure that the equipment is packaged securely, it is possible for it to be damaged in shipment. All damages or shortages should be noted on the Bill of Lading. The purchaser should take steps immediately to file reports and damage claims with the carrier. Damage incurred in shipping is the responsibility of the common carrier since it is the manufacturer's policy to make shipment FOB New Ipswich, New Hampshire. This means that ownership passes to the purchaser when the unit is loaded and accepted by the carrier. Any claims for in-transit damage or shortage must be brought against the carrier by the purchaser.

2.0 *STORAGE:*

If the equipment is not installed at time of delivery, it should be stored indoors.

3.0 *DESCRIPTION:*

This unit is designed to be used in vapor extraction applications. Refer to the supplied manufacturer's information for more in depth operating characteristics and limitations.

The blower is a rotary lobe, positive displacement type unit. It is powered by a 15 HP, 230V AC, 3 phase, totally enclosed, fan cooled (T.E.F.C.) electric motor.

3.1 *CONTROLLER:*

A control enclosure has been located on the skid. The control circuit and controls for the VES are located in this enclosure. The controller is NOT RATED, and is intended for use within a building or shelter.

3.1.1 *Controls:*

The enclosure provides short circuit and overload protection for the system. The exterior of the enclosure contains a HAND-OFF-AUTO selector switch, ON-OFF selector switch, and an override RESET push button.

3.1.1.1 *"HAND-OFF-AUTO" Selector Switch (Jet Pump):*

"HAND" With the selector switch in this position, the jet pump will operate regardless of sensor conditions.

"OFF" With the selector switch in this position, the jet pump will not operate.

"AUTO" With the selector switch in this position, the jet pump will operate and is controlled by the level sensors within the moisture separator.

3.1.1.2 *"ON-OFF" Selector Switch (VES):*

"ON" With the selector switch in this position, the VES blower will operate.

"OFF" With the selector switch in this position, the VES blower will not operate.

NOTE: THE VES BLOWER WILL NOT OPERATE WITH THE LOCAL DISCONNECT (LOCATED ON THE BLOWER MOTOR) IN THE **"OFF"** POSITION. THE LOCAL DISCONNECT MUST BE IN THE **"ON"** POSITION FOR THE **"ON-OFF"** SELECTOR SWITCH TO FUNCTION PROPERLY.

NOTE: THE VES WILL NOT OPERATE IN THE "ON" POSITION IF A HIGH OVERRIDE CONDITION HAS OCCURED AND NOT BEEN CLEARED.

NOTE: THE VES BLOWER WILL NOT OPERATE IN THE **"ON"** POSITION IF THE 7 DAY TIMER IS IN AN **"OFF"** CYCLE.

3.1.2 *Control Circuit Fuse (F1):*

The control circuit fuse **(F1)** is located in the controller next to the motor starter. The fuse provides overload and control circuit protection for the VES system.

To test the fuse; disconnect and lock out power, open the controller cover, remove and test the fuse using an ammeter. Replace if necessary with a 2 amp, 5 x 20 mm, slo-blo type fuse.

3.1.3 *Transformer Primary Fuses (F2 & F3):*

The transformer primary fuses **(F2 & F3)** are located in the controller next to the control circuit fuse.

To test the fuses; disconnect and lock out power, open the controller cover, remove and test the fuses using an ammeter. Replace if necessary with a 2 amp, 5 x 20 mm, slo-blo type fuse.

3.1.4 *Jet Pump Fuses (F4 & F5):*

The jet pump (transfer pump)fuses **(F2 & F3)** are located in the controller next to the transformer primary fuses.

To test the fuses; disconnect and lock out power, open the controller cover, remove and test the fuses using an ammeter. Replace if necessary with a 15 amp, 1/4" x 1 1/4", slo-blo type fuse.

3.1.5 *Indicators:*

3.1.5.1 *VES "RUN" Indicator:* This indicator will illuminate when the VES blower is operating.

3.1.5.2 **"OVERRIDE"** push button **"RESET"** indicator: In the event of an override condition (HIGH liquid level in the moisture separator) this indicator will illuminate. To reset the system, the condition must be cleared and this **"RESET"** push button pressed.

3.1.6 *Local Disconnect Switch:*

The local disconnect switch is located on the VES blower motor. This disconnect switch must be in the **"ON"** position for the VES to operate.

3.1.7 *Seven Day Timer:*

This timer, located on the face of the controller, enables the vapor extraction system to energize at preset intervals. Once this timer has timed out (set by the user) the VES blower will disconnect until the next programmed interval. Refer to Appendix B for programming instructions.

3.1.8 *Hour Meters:*

Two hour meters have been located in the controller, under the clear hinged window. One is labeled **"TRANSFER PUMP"** and the second is labeled **"VES"**. The meters display the time (in hours) that the motor is energized.

3.1.9 *Level Sensors:*

A three float, sight tube level sensor assembly is located within the moisture separator sight tube. The float funtions are as follows;

3.1.9.1 *HIGH OVERRIDE Liquid Level Sensor:* The HIGH OVERRIDE level sensor will disconnect power to the VES blower in the event that the HIGH liquid level fails to start the transfer pump.

3.1.9.2 *LOW Liquid Level Sensor:* The LOW liquid level sensor acts as the **"OFF"** switch for the transfer pump. Once the liquid has been evacuated from the moisture separator, lowering this float, power will be disconnected from the transfer pump. The **"HAND-OFF-AUTO"** selector switch must be in the **"AUTO"** position for this operation.

3.1.9.3 *HIGH Liquid Level Sensor:* This sensor acts as an **"ON"** switch for the transfer pump. Once the liquid level has surpassed the LOW liquid level sensor and reached this sensor, the transfer pump will start, evacuating the moisture separator. The **"HAND-OFF-AUTO"** selector switch must be in the **"AUTO"** position for this operation.

3.2 *VACUUM GAUGES:*

There are two (2) vacuum gauges installed on the influent line of the VES. They are mounted pre and post filter which can indicate a clogged filter element.

3.3 *PRESSURE GAUGE:*

There is a pressure gauge installed on the effluent line of the VES.

3.4 *FILTER ELEMENT:*

The filter element is located within the moisture separator on the influent line. Remove the cover of the moisture separator to expose the filter element.

3.5 *BLEED PORT:*

The air bleed port is used to introduce fresh air into the influent line to dilute the vapor stream. A gate valve/muffler assembly is located on the influent port of the moisture separator. The valve is adjusted to attain the desired setting.

3.6 *MOISTURE SEPARATOR:*

The moisture separator is used to separate water entrained in the air stream prior to it entering the VES. There is a high liquid level shutoff mounted in the side of the separator. A liquid level sight tube and manual drain are also located on the separator.

3.7 *JET (TRANSFER) PUMP:*

A 3/4, 230V, single phase, TEFC jet pump has been mounted on the skid to evacuate the moisture separator. HIGH and LOW liquid level sensors control the operation of the transfer pump.

4.0 *DEPLOYMENT:*

NOTE: MAKE SURE TO DISCONNECT AND LOCK OUT POWER DURING ENTIRE DEPLOYMENT PROCEDURE.

NOTE: INSTALLATION OF THIS SYSTEM REQUIRES CONNECTION TO A HIGH VOLTAGE POWER SOURCE. IT IS RECOMMENDED THAT THE INSTALLATION BE PERFORMED BY A LICENSED ELECTRICIAN.

NOTE: THE SYSTEM IS NOT SUITABLE FOR USE IN HAZARDOUS LOCATIONS AND THEREFORE MUST BE LOCATED IN AN AREA FREE OF FLAMMABLE VAPORS. THE DETERMINATION AS TO WHETHER OR NOT A LOCATION IS HAZARDOUS MAY REQUIRE THE SKILL AND JUDGEMENT OF SOMEONE TRAINED TO MAKE SUCH AN EVALUATION AND IS BEYOND THE SCOPE OF THIS MANUAL. SHOULD QUESTIONS ARISE AS TO THE SUITABILITY OF A LOCATION, PLEASE CONTACT YOUR STATE FIRE MARSHAL OR OTHER LOCAL AUTHORITY.

NOTE: ALLOW SEALING COMPOUND TO DRY PRIOR TO ENERGIZING SYSTEM.

NOTE: TEMPERATURES IN EXCESS OF 200 DEGREES FAHRENHEIT CAN BE GENERATED ON THE DISCHARGE OF THE BLOWER. WHEN CHOOSING THE DISCHARGE PIPING FOR THIS SYSTEM A MATERIAL THAT CAN WITHSTAND THE ELEVATED TEMPERATURES MUST BE USED.

* Position the vacuum system where needed.

NOTE: THE SKID MOUNTED VES MUST HAVE A SUITABLE EARTH GROUND.

* Run conduit from a 460V, three phase power source to the controller.
* Pull three appropriately sized power conductors, a dedicated neutral, and a ground between the two. An electrician can size the conductors which is dependent upon length of run.
* Connect the power conductors to the terminals labeled **L1, L2** and **L3**. Connect the ground to grounding terminal provided.
* Connect the neutral to the terminal labeled **"N"**.
* Verify the integrity of all connections.

NOTE: THIS CONTROLLER DOES NOT HAVE A POWER DISCONNECT OR CIRCUIT BREAKER. PER THE N.E.C., UPON INSTALLATION, A LABEL MUST BE AFFIXED TO THE CONTROLLER COVER STATING THE LOCATION AND DESIGNATION OF THE MAIN POWER CIRCUIT BREAKER.

The system is now ready for pre-operation testing.

5.0 *PRE-OPERATION TEST:*

* Apply power to the vacuum system.
* Verify proper rotation of the motor.
* Turn the VES disconnect switch to the **"ON"** position.
* Jog the VES **"ON-OFF"** selector switch to the **"ON"** position and "OFF" again. Verify proper rotation of the VES blower.

* If motor is turning in reverse direction, turn the disconnect switch to the **"OFF"** position. Disconnect and lock out power to the VES.

* Open cover of the enclosure and swap any two of the three wires on the terminals labeled **L1, L2 or L3.**

* Verify the integrity of the connections, close and secure cover of the enclosure.

* Again, check for proper rotation.

> **NOTE:** TEMPERATURES IN EXCESS OF 200 DEGREES FAHRENHEIT CAN BE GENERATED ON THE DISCHARGE OF THE BLOWER. WHEN CHOOSING THE DISCHARGE PIPING FOR THIS SYSTEM A MATERIAL THAT CAN WITHSTAND THE ELEVATED TEMPERATURES MUST BE USED.

* Connect the influent piping to the filter canister/moisture separator. Male threads enter the moisture separator (4" NPT) for connection.

* Connect the effluent piping to an appropriate treatment system.

* Make the proper plumbing connections from the transfer pump to an appropriate discharge point.

* Program the 7 day timer. Refer to Appendix B for assistance.

* The system is now ready for operation.

6.0 *OPERATION:*

Operation of the vapor extraction system is automatic. The system will operate as long as power is supplied to the system and the **"ON-OFF"** switch is in the **"ON"** position. If power is interrupted due to an override condition (HIGH OVERRIDE LIQUID LEVEL), the VES will stop and will not restart until the condition is cleared and the override **"RESET"** push button is pressed.

This system also incorporates a integral moisture separator and debris filter combination. As moisture laden air enters the system, the moisture separator drops out any entrained liquid. The liquid will accumulate in the drum. The moisture separator contains LOW AND HIGH liquid level sensors within the moisture separator's sight tube. If enough moisture accumulates in the separator to lift the HIGH level float sensor, and the transfer pump selector switch is in the **"AUTO"** position, the transfer pump will evacuate the moisture separator until the liquid lowers below the LOW liquid level sensor.

A 0 - 240 degree F., temperature gauge has been installed on the discharge silencer.

Liquid level in the moisture separator can be monitored via a sight tube located on the side of the separator.

A manually operated fresh air bleed valve is supplied on the influent of the moisture separator. Adjustments can be made at this valve to match the desired performance required.

The seven day timer allows the VES blower to operate for the preset amount of time (0 - 999 Minutes). Once this time has expired, the timer will disconnect the blower until the next preset time.

6.1 *THERMAL OVERLOAD OF MOTOR:*

The motor of this system has internal thermals. If the motor should become overheated due to excessive amperage draw, the thermals will disconnect power to the motor.

Should the unit thermal overload, the motor must be allowed to cool and the **"RESET"** push button pressed prior to restarting the system.

7.0 *MAINTENANCE:*

Monthly: Check all level sensors for accumulation of solids which could interfere with the travel of the floats. Clean if necessary. This procedure may need to be performed more often depending upon site characteristics.

The sight tube sensor assembly can easily be removed from the sight tube by means of the quick disconnect fittings provided. Rotate the levers on the sight tube fittings, then gently remove the level sensor. The sensor can then be inspected and/or cleaned.

To replace, carefully insert the sensor in the top of the sight tube until the fitting on the sensor cable mates with the sight tube fitting. Once in position, rotate the levers downward, locking the sensor in place.

Monthly: Check the transfer pump intake for accumulation of solids which could interfere with water flow. Clean if necessary. This procedure may need to be performed more or less often depending upon site characteristics.

Monthly: Check that the debris filter is clean. Disconnect power to the vacuum system. Remove the top of the moisture separator by removing the wing nut securing the cover. The filter element is exposed for removal. Replace cover of moisture separator when finished, making sure the gasket is in place prior to reassembly.

8.0 *TROUBLE SHOOTING:*

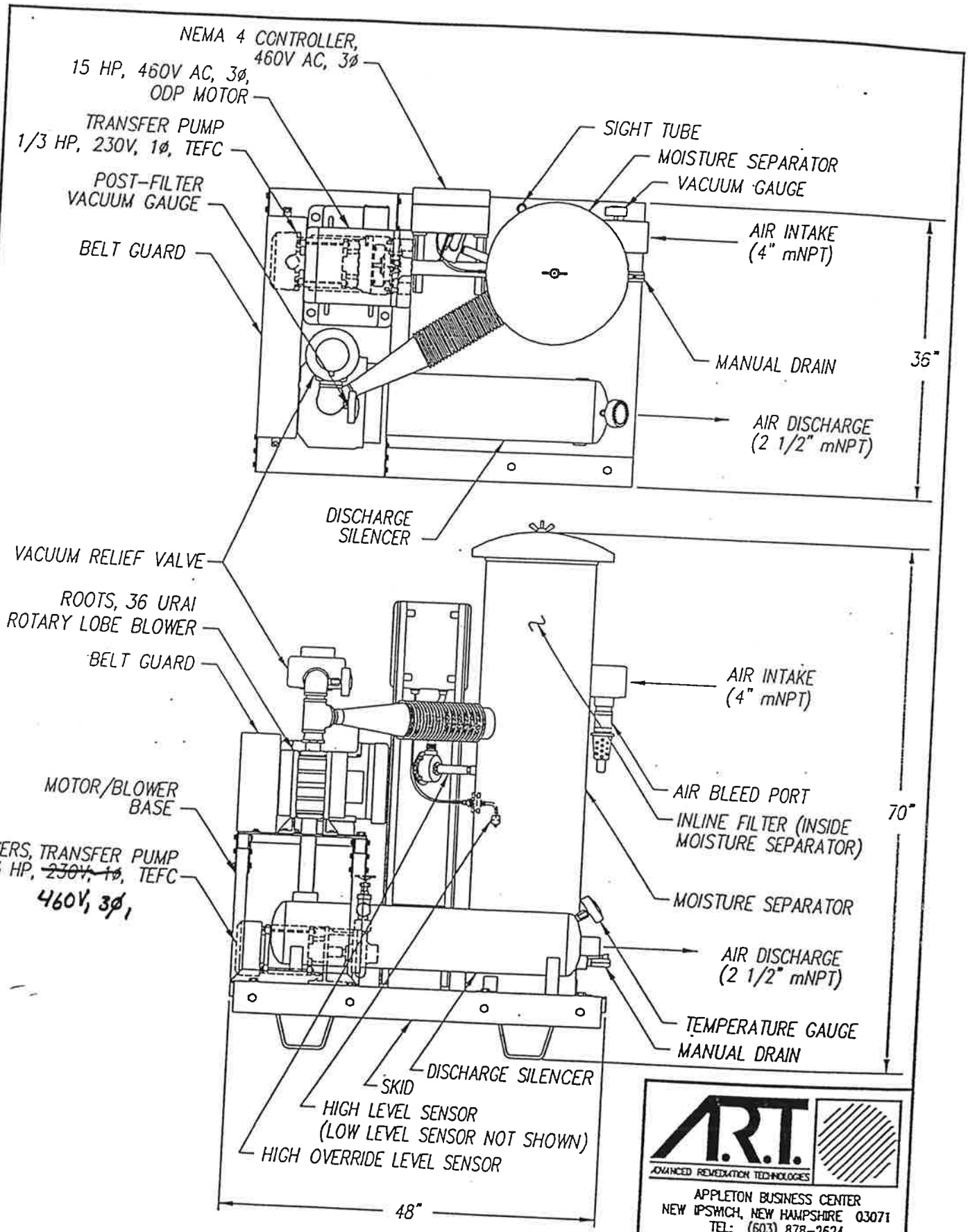
SYMPTOM: 15 HP vapor extraction system will not start.

POSSIBLE CAUSE	*REMEDY*
No power to the contactor	Check power source.
High liquid level in moisture separator.	Drain moisture separator.
Thermal overload exists.	Allow motor to cool. Adjust to operating specs. Check power to the site.

SYMPTOM: VES not creating a vacuum:

POSSIBLE CAUSE	*REMEDY*
Air bleed valve opened completely.	Adjust valve to suggested operating parameters.
Break in influent line.	Locate break and repair.

If there are any question regarding this system please call Advanced Remediation Technologies, Inc. at (603) 878-2624.



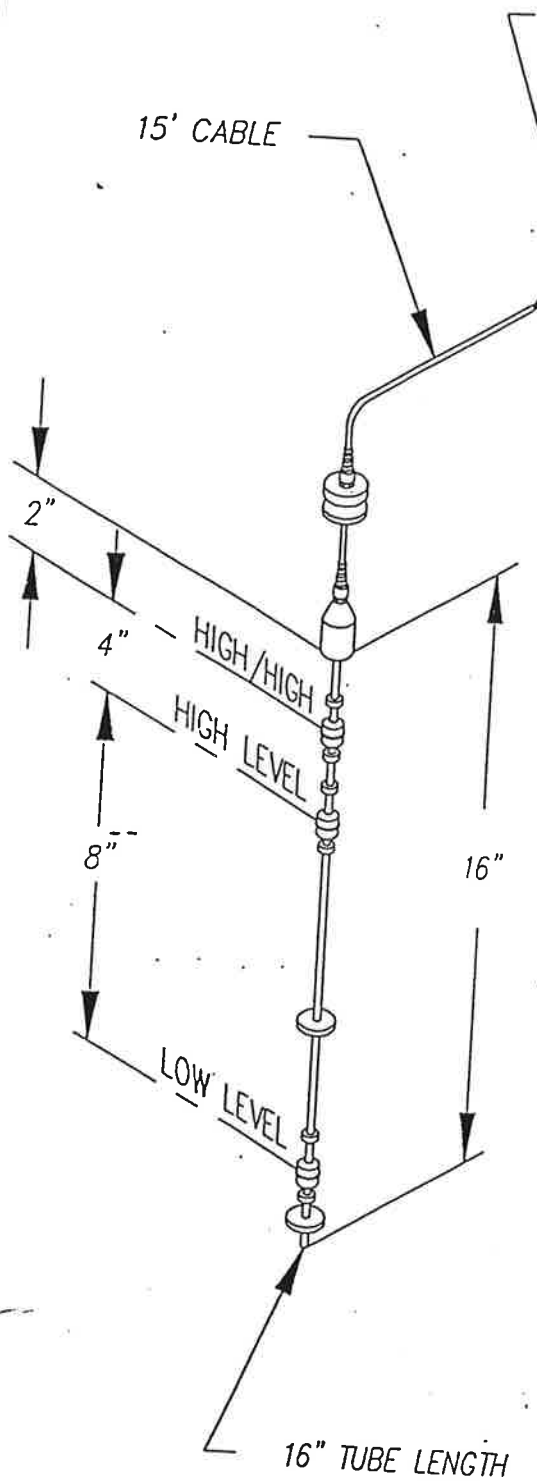
A.R.T.
ADVANCED REMEDIATION TECHNOLOGIES

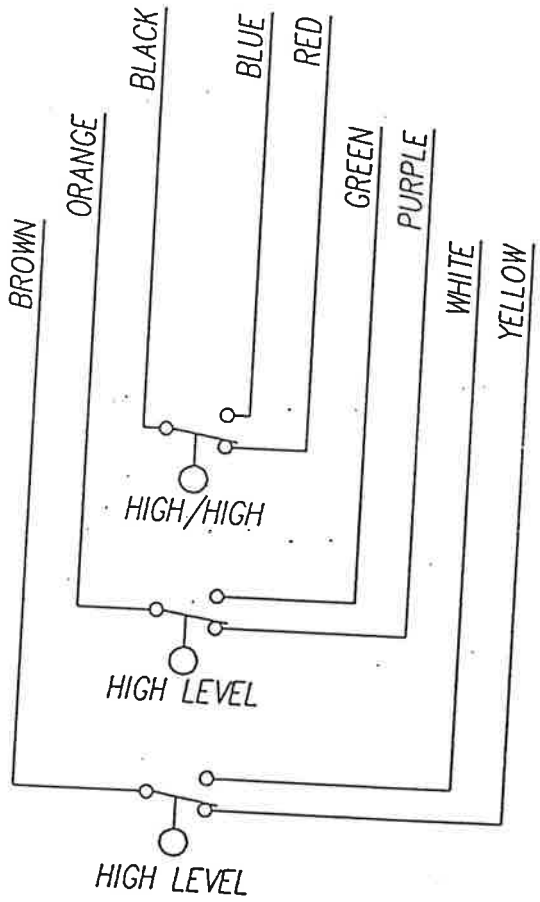
APPLETON BUSINESS CENTER
NEW IPSWICH, NEW HAMPSHIRE 03071
TEL: (603) 878-2624

LAYOUT: VES, RL, 15 HP, 460V, 3ø,
SKID MOUNTED WITH MOISTURE SEPARATOR
SALES ORDER #: 94-3137

DWG. NO.: 1250841 | REV. 1

DATE 7/18/94 | CHECK





REF: 2990636

A.R.T.
ADVANCED REMEDIATION TECHNOLOGIES

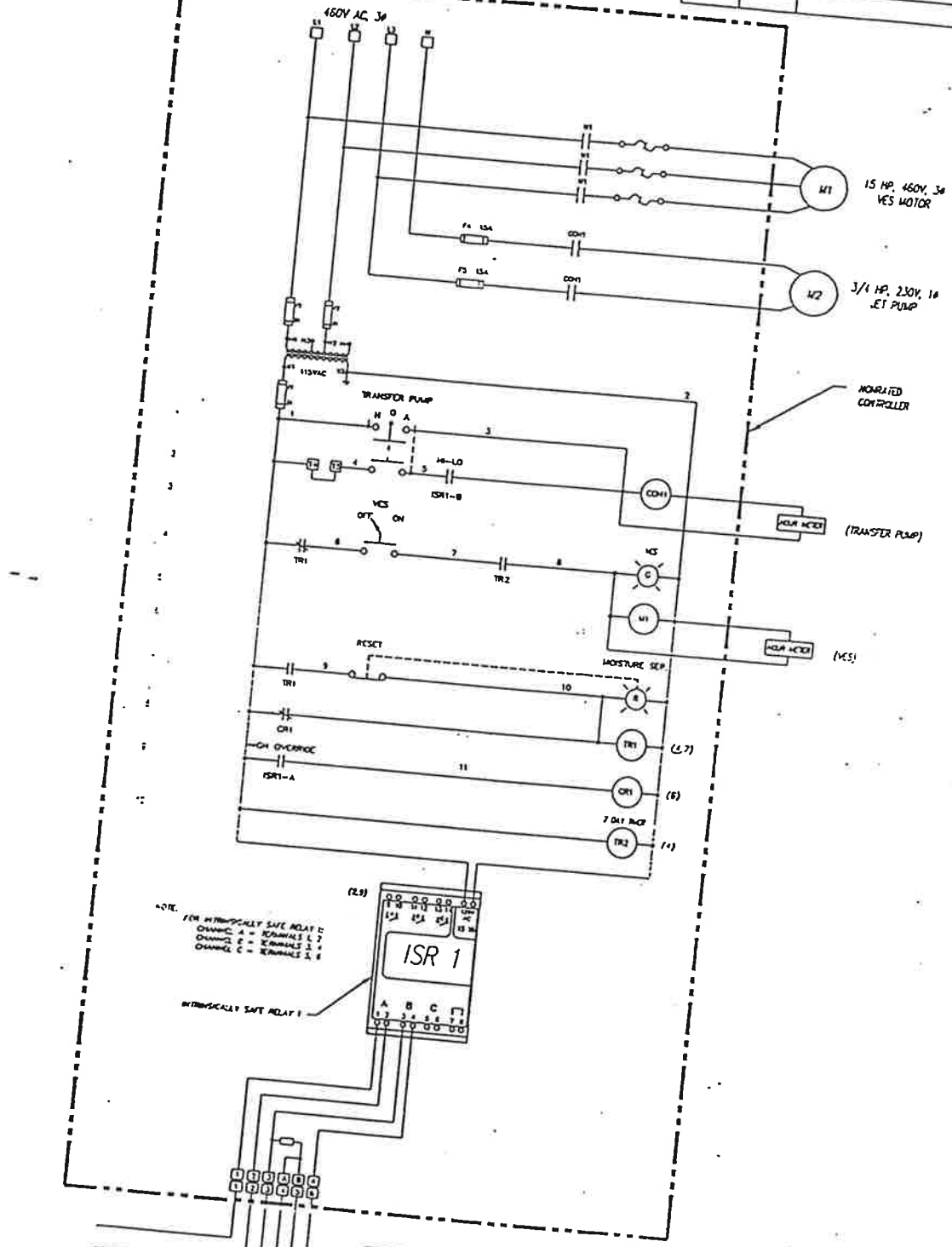
APPLETON BUSINESS CENTER
NEW IPSWICH, NEW HAMPSHIRE 03071
TEL: (603) 878-2624

SENSOR: SIGHT TUBE,
3FLOAT FOR DISCHARGE M/S,
SALES ORDER #: 94-3137

DWG. NO.: 1250849 REV. 0

DATE 7/27/94 CHECK TOM

DATE	SYM	REVISION RECORD	DR
7/29/94	1	ADDED HOUR METERS	



CONTRACT NO.	94-3137
DRAWN	R.H. WALLACE III
DATE	7/15/94
CHECK	[illegible]
DATE	8/3/94
DESIGN	
DESIGN ACTIVITY	
CUSTOMER	

ADVANCED REMEDIATION TECHNOLOGIES, INC.
APPLETON BUSINESS CENTER NEW IPSWICH, NEW HAMPSHIRE
TEL: (603) 878-2624

SCHEMATIC: 15 HP, ROTARY LOBE, VES, 3ø, 460V AC
SALES ORDER #: 94-3137

SIZE	DWG. NO.	REV
A	1300308	1

SCALE: RELEASE DATE:

APPENDIX: A

ROOTS DRESSER

$2.00

Universal RAI® BLOWER

INSTRUCTIONS

ROTARY LOBE BLOWERS

CONTENTS

NUMBERS IN ( ) ARE METRIC EQUIVALENTS

INFORMATION SUMMARY.....This page
Receiving. . .Installing. . .Operating

OPERATING CHARACTERISTICS.....2
Description. . .Control. . .Protection

OPERATING LIMITATIONS.....2
Pressure. . .Temperature. . .Speed

BLOWER ORIENTATION.....3

INSTALLATION.....5
Mounting. . .Aligning. . .Piping

LUBRICATION.....7
Oil Fill. . .Servicing. . .Greasing

OPERATION.....8
Starting. . .Checking. . .Running

TROUBLE SHOOTING.....9
Capacity. . .Power. . .Heating

SAFETY PRECAUTIONS.....10
Physical. . .Operating. . .General

MAINTENANCE/REPLACEMENTS.....10
Servicing. . .Repairs. . .Clearances

PARTS DRAWINGS.....14

DISTRIBUTORS.....24

DO THESE THINGS To Get The Most From Your Roots Blower

1 Check shipment for damage. If found, file claim with carrier and notify Sales Office.

2 Unpack shipment carefully, and check contents against Packing List. Notify Sales Office if a shortage appears.

3 Store in a clean, dry location until ready for installation, if possible. Lift by methods discussed under INSTALLATION to avoid straining or distorting the equipment. Keep covers on all openings. Protect against weather and corrosion if outdoor storage is necessary.

4 Read LIMITATIONS and INSTALLATION sections in this manual and plan the complete installation.

5 Provide for adequate safeguards against accidents to persons working on or near the equipment during both installation and operation. See SAFETY PRECAUTIONS.

6 Install all equipment correctly. Foundation design must be adequate and piping carefully done. Use recommended accessories for operating protection.

7 Make sure both driving and driven equipment is correctly lubricated before start-up. See LUBRICATION.

8 Read starting check points under OPERATION. Run equipment briefly to check for installation errors and make corrections. Follow with a trial run under normal operating conditions.

9 In event of trouble during installation or operation, do not attempt repairs of Roots furnished equipment. Notify Sales Office or factory, giving all nameplate information plus an outline of operating conditions and a description of the trouble.

10 Unauthorized attempts at equipment repair may void Manufacturer's warranty. Units out of warranty may be repaired or adjusted by the owner. It is recommended that such work be limited to the operation described in this manual, using Factory Parts. Good inspection and maintenance practices should reduce the need for repairs. See Distributor List on last page for parts and service after warranty period.

Bulletin IRB-103-792

OPERATING CHARACTERISTICS

Roots UNIVERSAL RAI® blowers, as covered in this manual, are designated as air blowers, and may be used for handling air in either pressure or vacuum service. They are unsuitable for handling gases because shaft seals are not designed to prevent leakage to atmosphere.

The Roots rotary lobe blower is a positive displacement type unit, whose pumping capacity is determined by size, operating speed and pressure conditions. It employes two double-lobe impellers mounted on parallel shafts and rotating in opposite directions within a cylinder closed at the ends by headplates. As the impellers rotate, air is drawn into one side of the cylinder and forced out the opposite side against the existing pressures. The differential pressure developed, therefore, depends on the resistance of the connected systems.

Effective sealing of the blower inlet area from the discharge area is accomplished by use of very small operating clearances. Resulting absence of moving contacts eliminates the need for any internal lubrication. Clearances between the impellers during rotation are maintained by a pair of accurately machined timing gears, mounted on the two shafts extending outside the air chamber.

Operation of the familiar basic rotary lobe blower is illustrated in FIGURE 1, where air flow is right to left from inlet to discharge with the bottom impeller rotating clockwise. In Position 1 it is delivering a known volume (A) to the discharge, while space (B) between the upper impeller and cylinder wall is being filled. Counterclockwise rotation of this impeller then traps equal volume (B) in Position 2, and further rotation delivers it to the discharge in Position 3. At the same time, another similar volume is forming under the lower impeller, and will be discharged when rotation reaches Position 1 again.

One complete revolution of the driving shaft alternately traps four equal and known volumes of air (two by each impeller) and pushes them through to the discharge. The pumping capacity of a lobe blower operating at a constant speed therefore remains relatively independent of reasonable inlet or discharge pressure variations. To change capacity, it is necessary either to change speed of rotation or vent some of the air.

No attempt should ever be made to control capacity by means of a throttle valve in the intake or discharge piping. This increases the power load on the driver, and may seriously damage the blower. Likewise, if a possibility exists that flow to the blower inlet may be cut off during normal operation of a process, then an adequate vacuum relief valve must be installed near the blower. A pressure type relief valve in the discharge line near the blower is also strongly recommended for protection against cut-off or blocking in this line.

When a belt drive is employed, blower speed can usually be adjusted to obtain desired capacity by changing the diameter of one or both sheaves. See pages 18 and 20 for minimum sheave diameter. In a direct coupled arrangement, a variable speed motor or transmission is required, or air may be vented through a manually controlled unloading valve and silencer. If discharge air is returned to the blower inlet, it must be cooled to 100° F (38° C) through a cooling by-pass arrangement.

Before making any change in blower capacity or operating conditions, contact the nearest Distributor for specific information applying to your particular blower. In all cases, operating conditions must be maintained within the approved range of pressures, temperatures and speeds as stated under LIMITATIONS. Also, the blower must not be used to handle air containing liquids or solids, or serious damage to the rotating parts will result.

OPERATING LIMITATIONS

To permit continued satisfactory performance, a Roots UNIVERSAL RAI® blower must be operated within certain approved limiting conditions. The Manufacturer's warranty is, of course, also contingent on such operation.

Maximum limits for pressure, temperature and speed are specified in Table 1 for various sizes of UNIVERSAL RAI® blowers. These limits apply to all blowers of normal construction, having operating clearances as listed in Table 5 when operated under standard atmospheric conditions. **Do not exceed any of these limits.**

Example: The listed maximum allowable temperature rise (increase in air temperature between inlet and discharge) for any particular blower may occur well before its maximum pressure or vacuum rating is reached. This can easily occur at high altitude or at very low speed.

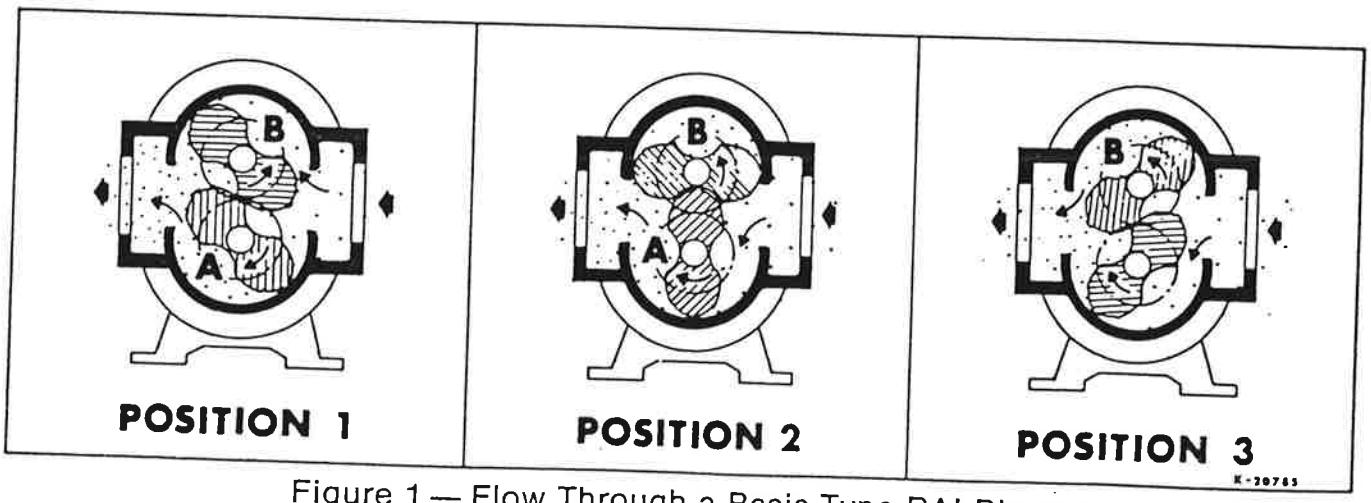


Figure 1 — Flow Through a Basic Type RAI Blower

Temperature rise then is the limiting condition. In other words, the operating limit is always determined by the maximum rating reached first. It can be any one of the three: pressure, temperature or speed.

Be sure to arrange connections or taps for thermometers and mercury type pressure or vacuum gauges at or near the inlet and discharge connections of the blowers. These, along with a good tachometer, will enable periodic checks of operating conditions to be made easily.

PRESSURE — On pressure service, the pressure rise in pounds per square inch (kPa) (between blower inlet and discharge) must not exceed the figure listed for the specific blower frame size concerned. Also, in any system where the blower inlet is at a positive pressure above atmosphere, the discharge pressure must never exceed 25 PSI (172 kPa) gauge regardless of blower size.

On vacuum service, with the discharge going to atmospheric pressure, the inlet suction or vacuum in inches of mercury (Hg.) (kPa) must not be greater than the values listed for the specific frame size.

TEMPERATURE — Various blower frame sizes are approved only for installations where the following temperature limitations can be maintained in service.

A. Measured temperature rise in Fahrenheit degrees (C°) must not exceed listed values when the inlet is at ambient temperature. Ambient is considered as the general temperature of the space around the blower. This is not outdoor temperature unless the blower is installed outdoors.

B. If inlet temperature is higher than ambient, the listed allowable temperature rise values must be reduced by ⅔ of the difference between the actual measured inlet temperature and the ambient temperature.

C. Average of inlet plus discharge temperature must not exceed 220°F (104°C)

SPEED RANGE — UNIVERSAL RAI® blowers may be operated at speeds up to the maximums listed for various frame sizes. They may be direct coupled to suitable constant speed drivers if pressure/temperature conditions are also within limits. At low speeds, excessive temperature rise may be the limiting factor as noted in the preceding example.

Table 1 — Maximum Allowable Operating Conditions

Frame Size	Speed RPM	Inlet Vac. Inches Hg. (kPa)	Temp. Rise Fahr. Deg. (C°)	Press. Rise PSI (kPa)
22	5275	14 (47)	225 (125)	12 (82)
24	5275	14 (47)	185 (102)	7 (47)
32	3600	14 (47)	225 (125)	15 (101)
33	3600	14 (47)	170 (94)	12 (82)
36	3600	14 (47)	115 (64)	7 (47)
42	3600	14 (47)	240 (133)	15 (101)
45	3600	14 (47)	170 (94)	10 (68)
47	3600	14 (40)	130 (72)	7 (47)
53	2850	14 (47)	195 (108)	15 (101)
56	2850	14 (47)	180 (100)	10 (68)
59	2850	14 (40)	115 (64)	7 (47)
65	2350	16 (53)	250 (139)	15 (101)
68	2350	16 (53)	240 (133)	12 (82)
615	2350	12 (40)	130 (72)	6 (40)
76	2050	16 (53)	250 (139)	15 (101)
711	2050	16 (53)	210 (117)	10 (68)
718	2050	12 (14)	130 (72)	6 (40)

BLOWER ORIENTATION

The unique removable feet feature of Roots UNIVERSAL RAI® blowers permit field modification of blower mounting by repositioning blower feet and gear box breather as shown in Fig. 3.

Four blower mounting positions are possible:

1. Horizontal mounting, vertical air flow, drive shaft on left.
2. Same as (1) except drive shaft on right.
3. Vertical mounting, horizontal air flow, drive shaft on bottom.
4. Same as (3) except drive shaft on top.

To change blower mounting:

1. Place blower on its feet.
2. Loosen feet capscrews (32).
3. Place blower on a solid base resting on the gear box end with drive shaft on top.
4. Remove feet. (Note - Feet capscrews (32) are longer than cylinder capscrews (26), only capscrews (32) are to be used for feet.)
5. Remove cylinder capscrews (32) where feet are to be re-installed. Install capscrews (26) in the location previously occupied by feet capscrews (32).
6. Install feet using capscrews (32).
7. Place blower on its feet on flat surface.
8. Loosen feet capscrews (32) and square up blower and re-tighten capscrews (32).
9. Gear box has four threaded holes, one with breather and three with pipe plugs. Remove pipe plug (21) from the top most hole. Remove breather (25) and install it in the top most hole. Install pipe plug that was removed from the top hole into the hole previously occupied by the breather. The breather and the pipe plug should be sealed with a thread sealer.

For convenience, the position of the grease fitting (37) and the relief fitting (38) could be interchanged, however each bearing must have one grease fitting (37) and one relief fitting (38).

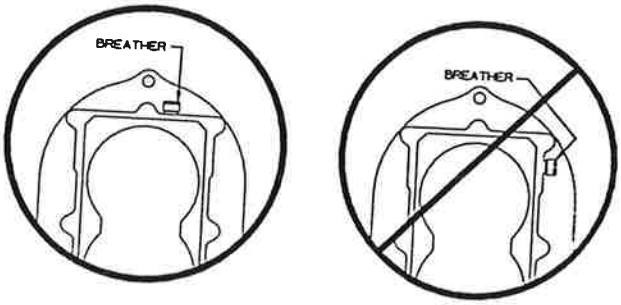


Figure 2 — Breather Installation

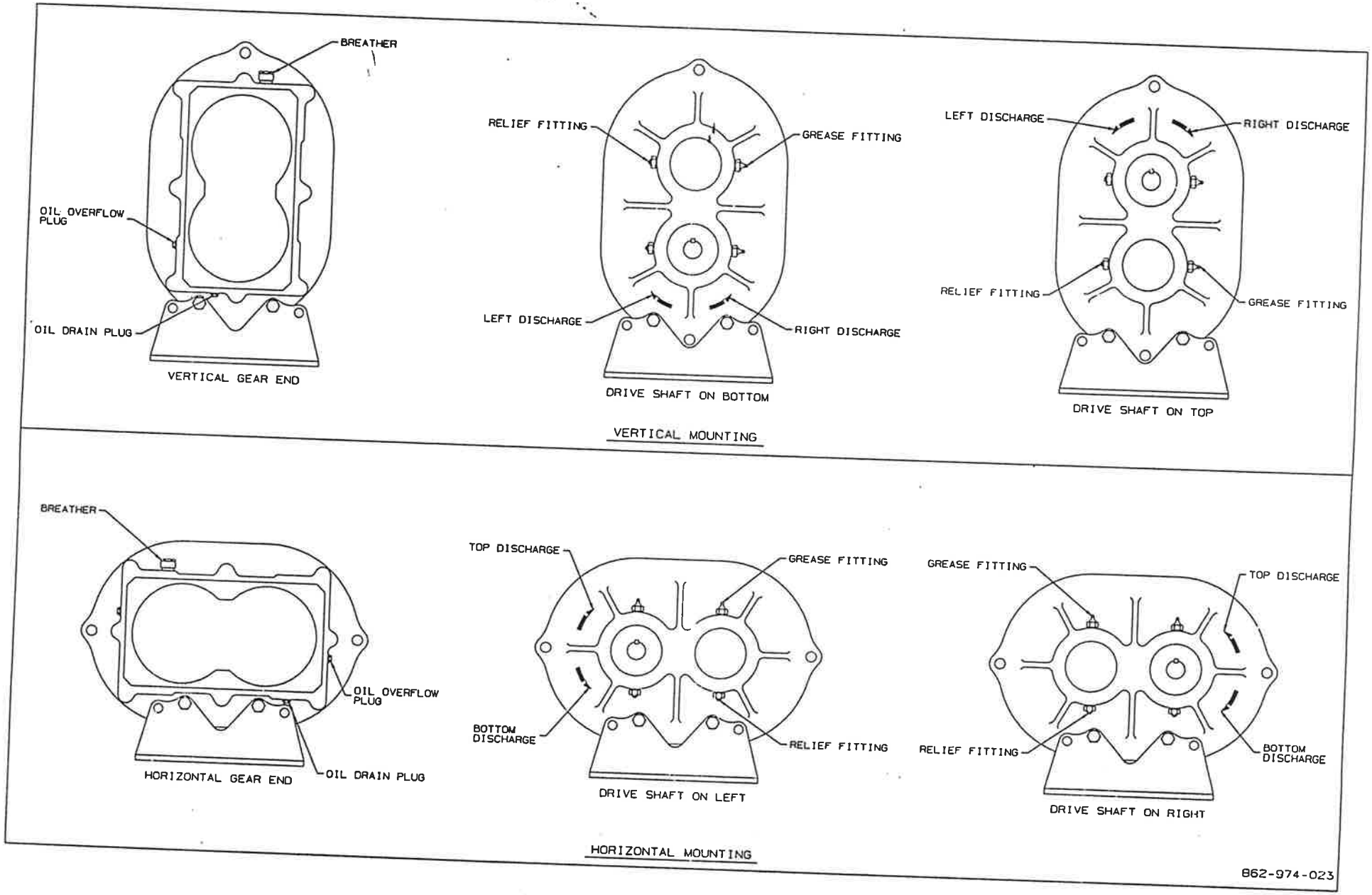


Figure 3 — Blower Orientation and Lubrication Points

INSTALLATION

Roots UNIVERSAL RAI® blowers are internally and externally treated after factory assembly to protect against normal atmospheric corrosion before installation. Maximum period of internal protection is considered to be one year under average conditions, if closing plugs or seals are not removed. **Protection against chemical or salt water atmosphere is not provided.** Avoid opening the blower until ready to start installation, as protection will be lost quickly by evaporation.

NOTE — If there is to be an extended period between delivery (and/or installation) and startup, the following steps should be taken to insure corrosion protection:

1. Coat internals of cylinder and gearbox with Nox-Rust No. VCI10 or equivalent. Repeat once a year or as conditions may require. Motorstor is oil soluble and does not have to be removed before lubricating. If desired, No. VCI10 may be removed from within the cylinder shortly before startup by spraying a fine mist of petroleum solvent through the blower while it is running at a slow speed with open inlet and discharge, or it can remain in the blower if it is not harmful to the operation of the connected system.
2. Fill drive end bearing cavities with grease as specified in Lubrication section.
3. Paint shaft extension, inlet and discharge flanges, and all other exposed surfaces with Nox-Rust X-110 or equivalent.
4. Seal inlet, discharge, and all vent openings with tape. It is not recommended that the unit be set in place, piped to the system, and allowed to remain idle for extended periods. If any part is left open to the atmosphere, the Motorstor vapor will escape and lose its effectiveness.
5. Units are not to be subjected to excessive vibration during storage. If stored outdoors, provide coverage such as a tarpaulin or lean-to.
6. Rotate drive shaft three or four revolutions every two weeks.
7. Prior to startup, remove flange covers on both inlet and discharge and inspect internals to insure absence of rust. Check all internal clearances. Also, at this time, remove gearbox and inspect gear teeth for rust.

Because of the completely enclosed blower design, location of the installation is generally not a critical matter. A clean, dry and protected indoor location is to be preferred. However, an outdoor or wet location will normally give satisfactory service. Important requirements are that the correct grade of lubricating oil be provided for expected temperatures, and that the blower be located so that routine checking and servicing can be handled conveniently after installation. Effect of the location on driver and accessory equipment must also be considered.

Supervision of the installation by a Factory Service Engineer is not usually required for these blowers. Workmen with experience in installing light-medium weight machinery should be able to produce satisfactory results. Handling of the equipment needs to be accomplished with care, and in compliance with safe practices. Blower mounting must be solid, without strain or twist, and air piping must be clean, accurately aligned and properly connected.

A bare blower without base should be lifted by a rope sling, with one loop passing under the gearhouse and the other loop under the cylinder.

When a blower is furnished mounted on a baseplate, with or without a driver, use of lifting slings passing under the base flanges is required. Arrange these slings so that no strains are placed on the blower casing or mounting feet, or on any mounted accessory equipment.

Before starting the installation, remove plugs, covers or seals from blower inlet and discharge connections and inspect the interior completely for dirt or foreign material. If cleaning is required, finish by washing the cylinder, headplates and impeller thoroughly with a petroleum solvent such as DuPont Triclene D. After this, turn the drive shaft by hand to make sure that the impellers turn freely at all points. Anti-rust compound on the drive shaft extension may also be removed at this time with the same solvent. Then plug the inlet and discharge connections to keep out dirt until ready to connect the air piping. Washing out is not required if the interior is found to be clean. The corrosion inhibitor used will vaporize and disappear during operation.

Care, plus consideration of all possible problems, will pay dividends when arranging the blower mounting. This is especially true when the blower is a "bare" unit furnished without a baseplate. The convenient procedure may be to mount such a unit directly on a floor or small concrete pad, but this generally produces least satisfactory results. It definitely causes the most problems in leveling and alignment.

Direct use of structural framing members is also not a recommended mounting. If unavoidable, the members must be rigidly reinforced when part of a building, and spring type mountings should not be used. Noise transmission can usually be reduced by use of a cork insulating pad 1 to 2 inches (25 to 50 mm) thickness. The pad should be supported by a full steel plate attached to the structure, with a rigid concrete slab laid on top of the cork to carry the blower and driver.

For a blower without base, it is recommended that a well anchored and carefully leveled steel or cast iron mounting plate be provided at the installation point. The plate should be ¾ to 1¼ inches (19 to 32 mm) thick, with its top surface machined flat, and needs to be large enough to provide leveling areas at one side and one end after the blower is mounted. It should have properly sized studs or tapped holes located to match the blower foot drilling. As an alternative, smaller plates at each end of the blower may be used. This is more complicated, usually makes leveling more difficult, and can produce twist or strains in the blower. Use of a high quality machinist's level is important. With the mounting plate in place and leveled, set the blower on it without bolting and check for rocking. If it is not solid, determine the total thickness of shims required under one foot to stop the rocking. Place half of this under each of the two short feet, and tighten the mounting studs or screws. Rotate the drive shaft to make sure the impellers still turn freely. If the blower is to

be direct coupled to a driving motor, consider the height of the motor shaft and the necessity for it to be aligned very accurately with the blower shaft. Best arrangement is for the blower to be bolted directly to the mounting plate while the driver is on shims of at least ⅛ inch (3 mm) thickness. This allows adjustment of motor position in final shaft alignment by varying the shim thickness.

Satisfactory installation can be obtained by setting the baseplate on a concrete slab that is rigid and free of vibration, and leveling the top of the base carefully in two directions so that it is free of twist. The slab must be provided with suitable anchor bolts. The use of grouting under and inside the base, after it has been carefully leveled by shimming, is recommended.

When blower and driver have been factory mounted on a common baseplate, the assembly will have been properly aligned and is to be treated as a unit for leveling purposes. It is possible for a base mounted assembly to become twisted during shipment thus disturbing the original alignment. For this reason, make the following checks after the base has been leveled and bolted down. Disconnect the drive and rotate the blower shaft by hand. It should turn freely at all points. Loosen the blower foot hold-down screws and determine whether all feet are evenly in contact with the base. If not, insert shims as required and again check for free impeller rotation. Finally, if blower is direct coupled to the driver, check shaft and coupling alignment carefully and make any necessary corrections prior to grouting.

In planning the installation, and before setting the blower, consider how piping arrangements are dictated by the blower design and assembly.

When a blower is DIRECT COUPLED to its driver, the driver RPM must be selected or governed so as not to exceed the maximum speed rating of the blower. Refer to LIMITATIONS for allowable speeds for various blower sizes. A flexible type coupling should always be used to connect the driver and blower shafts.

For engine drives, couplings with proper stiffness must be selected to avoid resonant torisonal vibrations. Also, safe operating speed must be limited to avoid critical speeds.

Coupling halves must be accurately aligned, and a sufficient gap between shaft ends provided, so that side strains and end thrust on either shaft are avoided or minimized. This will require considerable care in the mounting of the driver. The two shafts must be in as near perfect alignment in all directions as possible, and the gap must be established with the motor armature on its electrical center if end play exists. Coupling halves must be fitted to the two shafts such that they can be worked into place by hand. Maximum deviation in offset alignment of the shafts should not exceed .005" (.13 mm) total indicator reading, taken on the two coupling hubs. Maximum deviation from parallel of the inside coupling faces should not exceed .001" (.03 mm) when checked at six points around the coupling.

CAUTION

Couplings as well as sheave bushings must have a slight slide fit with the blower shaft such that they can be installed in place by hand. Any force used to install them will change blower end clearances resulting in blower damage. If an interference fit is desired for the coupling, the coupling hub should be heated and shrunk on the shaft. For engine drives, use "Locktite" between the coupling hubs and the blower/engine shafts and on the threads of the coupling set screws.

When a blower is BELT DRIVEN, a proper selection of sheave diameters can usually be made to adapt any standard driver speed to the required blower speed. This flexibility can sometimes lead to operating temperature problems caused by blower speed being too low. Make sure the drive speed selected is within the allowable range for the specific blower size, as specified under LIMITATIONS.

Belted drive arrangements usually employ two or more V-belts running in grooved sheaves, and a variety of positions are available for the driver. Installation of the driver is less critical than for direct coupling, but its shaft must be level and parallel with the blower shaft. The driver must also be mounted on an adjustable base to permit installing, adjusting and removing the V-belts. To position the driver correctly, both sheaves need to be mounted on their shafts and the nominal shaft center distance known for the belt lengths to be used.

Install the blower sheave (usually the larger one) so that its inner hub face is not more than ¼ inch (7 mm) from the bearing end cover. The shaft fit should be such that the sheave can be worked into place by hand. A tight or driving fit can damage a bearing, and may cause internal blower damage by forcing the impeller out of its normal operating position. A loose fit or wobbly sheave will cause vibration, and may result in shaft breakage.

The driver sheave should also be mounted as close to its bearing as possible, and again should fit the shaft correctly. Position the driver on its adjustable base so that ⅔ of the total movement is available in the direction away from the blower, and mount the assembly so that the face of the sheave is accurately in line with the blower sheave. This position minimizes belt wear, and allows sufficient adjustment for both installing and tightening the belts. After belts are installed, adjust their tension in accordance with the manufacturer's instructions. However, only enough tension should be applied to prevent slippage when the blower is operating under load. *Excessive tightening* can lead to early bearing failures.

Failure to properly align the blower and drive sheaves will result in the impeller being forced against one of the headplates during operation causing serious damage to the blower.

In the absence of belt manufacturer's instructions for tensioning, the following procedures may be used.

1. With the belts loose, pull the slack on all of them to the bottom side of the drive.
2. Adjust motor position to tighten belt until they appear to be seating in the sheave grooves.
3. Thump the belts with your fist. If they feel dead, tighten them more until they vibrate and feel springy when struck.
4. Run-in the drive for a short period, after preparing the blower as instructed in a following paragraph. While running, adjust until only a very slight bow appears in the slack side of the belts.
5. Stop the motor and compare the tensions of the individual belts by pressing down firmly with one hand on the top surface. It should be possible to deflect each

belt only to the point where its top surface is even with the bottoms of the other undeflected belts.

6. A new set of belts should be first tensioned about ⅓ greater than normal to allow for stretch and wear-in. Before putting the drive into normal operation, increase the tension as obtained above by a small amount. Recheck after each 8 hour operating period during the first 50 hours, and adjust as necessary.

Before operating the drive under power to check initial belt tension, first remove covers from the blower connections. Make sure the interior is still clean, then rotate the shaft by hand. Place a screen over the inlet connection to prevent anything being sucked into the blower while it is operating, and avoid standing in line with the discharge opening. Put oil in the gearhouse per instructions under LUBRICATION.

Before cnnecting piping, remove any remaining antirust compound from blower connections. Piping must be clean and should be sized so that the air velocity will not exceed 75 feet per second (23 m per second). Pipe used should be no smaller than blower connections. In addition, make sure it is free of dirt, scale, cuttings, weld beads, or foreign materials of any kind.

To further guard against damage to the blower, especially when an inlet filter is not used, install a substantial screen of 16 mesh backed with hardware cloth at or near the inlet connections. Make provisions to clean this screen of collected debris after a few hours operation. It should be removed when its usefulness has ended, as the wire will eventually deteriorate and small pieces going into the blower may cause serious damage.

Pipe threads or flanges must meet the blower connections accurately and squarely. Do not attempt to correct misalignment by springing or cramping the pipe. In most cases this will distort the blower casing and cause impeller rubbing. In severe cases it can prevent operation or result in a broken drive shaft. For similar reasons, piping should be supported near the blower to eliminate dead weight strains. Also, installation of flexible connectors or expansion joints is recommended.

Figure 4 represents in diagram form a blower installation with all accessory items that might be required under various operating conditions. Inlet piping should be completely free of valves or restrictions. When a shut-off valve (not shown) cannot be avoided, make sure a full size vacuum relief is installed near the blower inlet. This will protect against blower overload caused by accidental closing.

Need for an inlet silencer will depend on blower speed and pressure, as well as sound-level requirements in the general surroundings. An inlet filter is normally recommended, especially in dusty or sandy locations, for blower protection. A discharge silencer is also normally suggested. Specific recommendations on silencing can be obtained from the nearest Distributor. Silencers should be mounted as close to blower as possible.

Discharge piping requires a pressure relief valve, and should include a manual unloading valve to permit starting the blower under no-load conditions. Reliable pressure/vacuum gauges and good thermometers at both inlet and discharge are recommended to allow making the important checks on blower operating conditions. If the demand is constant, but somewhat lower than the blower output, excess may be blown off through the manual unloading valve.

In multiple blower installations when two or more units discharge into a common header, use of check valves is recommended. These should be of a direct acting or free swinging type, with one valve located in each blower

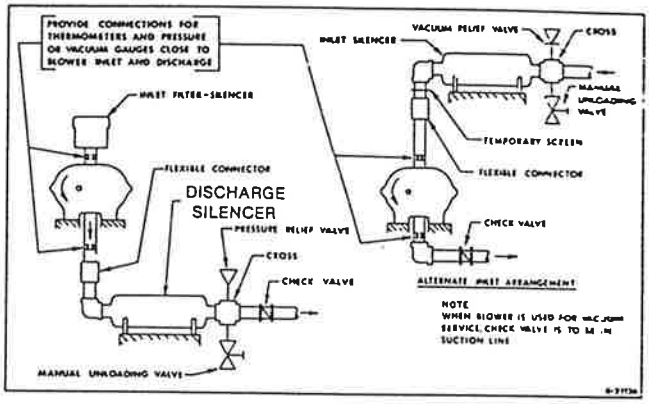


Figure 4 — Installation with Accessories

discharge line. Properly installed, they will protect against damage from reverse rotation caused by air backflow through an idle blower.

After piping is completed, and before applying power, rotate the drive shaft by hand again. If it does not move with uniform freedom, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment. Do not operate the blower more than briefly at this time because of possible inadequate oil supply in the gearhouse. Read LUBRICATION section.

LUBRICATION

A simple but very effective lubrication system is employed on UNIVERSAL RAI® blowers. At the drive shaft end the bearings are grease lubricated using hydraulic pressure relief fittings. These relief fittings vent any excess grease, preventing pressure build-up on the seals. A restriction plug and metering orifice prevent loss of lubricant from initial surges in lubricant pressure but permit venting excess lubricant under steadily rising pressures.

The blind end bearings and timing gears are enclosed by a gearhouse located opposite the drive end of the blower. In a side outlet blower, the lower timing gear functions as an oil slinger, carrying lubricant to the upper timing gear and providing splash lubrication for the bearings. Pressure within the gearbox is vented through the breather vent plug (25).

The above description also applies in general to the top or bottom outlet style blower, the principal difference being that both gears dip into the oil sump.

Before starting blower, be sure oil has been put in gearhouse, as ALL OIL WAS DRAINED FOLLOWING SHOP TESTS. For recommended lubricating oil see Table 2. Use a good grade industrial type rust, oxidation, and foam inhibited, non-detergent oil.

Table 2 — Recommended Oil Grades

Ambient Temperature ° F (°C)	Viscosity Range SSU at 100° F. (38°C)	Approx. SAE No.	Approx. ISO No.
Above 90° (32°)	1000 - 1200	50	320
32° to 90° (0° to 32°)	700 - 1000	40	220
0° to 32° (– 18° to 0°)	500 - 700	30	150
Below 0° (– 18°)	300 - 500	20	100

To fill the gearbox, remove the breather plug and the oil overflow plug (Fig. 3). Fill the reservoir up to the overflow hole. Place the breather and the overflow plug back into their respective holes.

Table 3 — Oil Sump Capacities

Frame Size	Capacity, Fl. Oz. (Liters) Vertical	Horizontal
22	3.4 (.1)	6.1 (.18)
24	3.4 (.1)	6.1 (.18)
32	8.5 (.25)	16.0 (.47)
33	8.5 (.25)	16.0 (.47)
36	8.5 (.25)	16.0 (.47)
42	12.7 (.37)	22.8 (.67)
45	12.7 (.37)	22.8 (.67)
47	12.7 (.37)	22.8 (.67)
53	16.0 (.47)	27.6 (.82)
56	16.0 (.47)	27.6 (.82)
59	16.0 (.47)	27.6 (.82)
65	28.3 (.84)	52.1 (1.54)
68	28.3 (.84)	52.1 (1.54)
615	28.3 (.84)	52.1 (1.54)
76	32.3 (.96)	59.5 (1.76)
711	32.3 (.96)	59.5 (1.76)
718	32.3 (.96)	59.5 (1.76)

Proper lubrication is usually the most important single consideration in obtaining maximum service life and the most satisfactory operation from the unit. Unless operating conditions are quite severe, a weekly check of gearhouse oil level and necessary addition of lubricant should be sufficient. However, oil should be changed after initial 100 hours of operation. Thereafter, a complete oil change normally is made after 1000 operating hours, or less, depending on the type of oil and oil operating temperature.

Shaft bearings at the drive end of the blower are grease lubricated and each bearing housing is equipped with pressure type grease fittings and pressure type relief fittings. When servicing drive end bearings, use a NLGI #2 premium grade, petroleum base grease with high temperature (300° service temperature) and moisture resistance and good mechanical stability. Using a pressure gun, force new lubricant into each drive end bearing housing until traces of clean grease comes out of the relief fitting.

After a long shutdown, it is recommended that the grease relief fittings be removed, the old grease flushed out with kerosene or #10 lubricating oil, drained thoroughly, and bearings refilled with new grease. Be sure grease relief fittings are reinstalled. Grease should be added using hand operated grease gun to the drive end bearings at varying time intervals depending on duty cycle and RPM. Table 4 has been prepared as a general greasing schedule guide based on average operating conditions. More frequent intervals may be necessary depending on the grease operating temperature and under unusual circumstances.

Table 4 — Suggested Bearing Lubrication Intervals

Speed in RPM	Operating Hours Per Day		
	8	16	24
	Greasing Intervals in Weeks		
750 - 1000	7	4	2
1000 - 1500	5	2	1
1500 - 2000	4	2	1
2000 - 2500	3	1	1
2500 - 3000	2	1	1
3000 and up	1	1	1

OPERATION

Before operating a blower under power for the first time, check the unit and the installation thoroughly to reduce the likelihood of avoidable troubles. Use the following procedure list as a guide, but consider any other special conditions in the installation.

1. **Be certain** that no bolts, tools, rags or dirt have been left in the blower air chamber.
2. **Be certain** that inlet piping is free of debris. If an outdoor intake without filter is used, be sure the opening is located so it cannot pick up dirt and is protected by a strong screen or grille. Use of the temporary protective screen at the blower as described under INSTALLATION is strongly recommended.
3. **Recheck** blower leveling, drive alignment and tightness of all mounting bolts if installation is not recent. If belt drive is used, adjust belt tension correctly.
4. Turn drive shaft by hand to make sure impellers still rotate without bumping or rubbing at any point.
5. **Make sure** oil level in blower gearbox is correct.
6. Check lubrication of driver. If it is an electric motor, be sure that power is available and that electrical overload devices are installed and workable.
7. Open the manual unloading valve in the discharge air line. If a valve is in the inlet piping, be sure it is open.
8. Bump blower a few revolutions with driver to check that direction of rotation is correct, and that both units coast freely to a stop.

After the preceding points are cleared, blower is ready for trial operation under "no-load" conditions as set up under Item 7. The following procedure is suggested to cover this initial operating test period.

a. Start blower, let it accelerate to full speed, then shut off. Listen for knocking sounds, both with power on and as speed slows down.
b. Repeat above, but let blower run 2 or 3 minutes. Check for noises, and vibrations of 5 mils or greater.
c. Operate blower for about 10 minutes unloaded. Check oil levels. Feel cylinder and headplate surfaces for development of spots too hot to touch, indicating impeller rubs. Be aware of any noticeable increase in vibration.

Assuming that all trials have been satisfactory, or that necessary corrections have been made, the blower should now have a final check run of at least one hour under normal operating conditions. After blower is re-

started, gradually close the discharge unloading valve to apply working pressure. At this point it is recommended that a good pressure gauge or manometer be connected into the discharge line if not already provided, and that thermometers be in both inlet and discharge lines. Readings from these instruments will show whether pressure or temperature ratings of the blower are being exceeded.

During the final run, check operating conditions frequently and observe the oil levels at reasonable intervals. If excessive noise or local heating develops, shut down immediately and determine the cause. If either pressure rise or temperature rise across the blower exceeds the limit specified in this manual shut down and investigate conditions in the piping system or in the process to which air is being supplied. Refer to the **TROUBLE SHOOTING CHECKLIST** for suggestions on various problems that may appear.

The blower should now be [illegible] operation at full speed. During [illegible] periodic checks to determine [illegible] main steady, or at least acce[illegible] ticularly important if the blow[illegible] cess system where conditions [illegible] tunity, stop the blower and cle[illegible] tective screen. If no appreciable [illegible] lected, the screen may be re[illegible] **INSTALLATION.** At this [illegible] coupling alignment or belt [illegible] tightness.

Should operating expe[illegible] capacity is a little too high for [illegible] a small excess may be blown [illegible] manual unloading vent valve. [illegible] **relief valve as an automatic** [illegible] discharge pressure to beco[illegible]

TROUBLE SHOOTING CHECKLIST

TROUBLE	ITEM	POSSIBLE CAUSE	REM[illegible]
No Air Flow	1	Speed too low	Check by tachometer [illegible] shown on Roots Order [illegible]
	2	Wrong rotation	Compare actual rotati[illegible] Change driver if wrong
	3	Obstruction in piping	Check piping, screen, v[illegible] an open flow path.
Low capacity	4	Speed too low	See item 1. If belt driv[illegible] readjust tension.
	5	Excessive pressure	Check inlet vacuum [illegible] and compare these [illegible] operating conditions c[illegible]
	6	Obstruction in piping	See item 3.
	7	Excessive slip	Check inside of casing [illegible] faces causing excessive [illegible]
Excessive Power	8	Speed too high	Check speed and co[illegible] Acknowledgement.
	9	Pressure too high	See item 5.
	10	Impellers rubbing	Inspect outside of cy[illegible] high temperatures are[illegible] peller contacts at thes[illegible] mounting, drive alignm[illegible]
Overheating of Bearings, or Gears	11	Inadequate lubrication	Restore correct oil [illegible] lubricate.
	12	Excessive lubrication	Check gear oil level. If [illegible] with clean oil of reco[illegible]
	13	Excessive pressure rise	See item 5.
	14	Coupling misalignment	Check carefully. Realig[illegible]
	15	Excessive belt tension	Readjust for correct [illegible]
	16	Speed too low	Speeds lower than the [illegible] will overheat the entire [illegible]
Vibration	17	Misalignment	See item 14.
	18	Impellers rubbing	See item 10.
	19	Worn bearings/gears	Check gear backlash [illegible]
	20	Unbalanced or rubbing impellers	Scale or process mate[illegible] ing and impellers, or [illegible] build-up to retore o[illegible] peller balance.
	21	Driver or blower loose	Tighten mounting bo[illegible]
	22	Piping resonances	Determine whether [illegible] pulsations are prese[illegible] Distributors.

result in failure of the valve itself. If blower capacity appears to be too low, refer to the TROUBLE SHOOTING CHECKLIST first. If no help is found there it may be possible to increase the blower speed. Before attempting this change, contact the nearest Distributor for recommendations. Be prepared to furnish data on actual air requirements and operating pressure/temperature conditions.

SAFETY PRECAUTIONS

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Cover external moving parts with adequate guards.
- Disconnect power before doing any work and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong coarse screen over the inlet and avoid standing in the discharge air stream.
- Stay clear of open inlet piping (suction area) of pressure blowers, and the open discharge blast from vacuum blowers.
- Stay clear of the blast from pressure relief valves and the suction area of vacuum relief valves.
- Avoid extended exposure in close proximity to machinery which exceeds safe noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating and maintaining the equipment.
- Casing pressure must not exceed 25 PSI (172 kPa) gauge. Do not pressurize vented cavities from an external source, nor restrict the vents.
- Do not use air blowers on explosive or hazardous gases.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be warned by signs and trained to exercise adequate general safety precautions.

MAINTENANCE & REPLACEMENTS

A good program of inspection and maintenance servicing, followed consistently, is the most reliable method of minimizing repairs to a blower. A simple record of services and dates will help keep this work on a regular schedule. Basic service needs are lubrication, checking for hot spots or increase in vibration and noise and the recording of operating pressures and temperatures. Above all, a **blower must be operated within its specified rating limits,** to obtain satisfactory service life.

A newly installed blower should be checked frequently during the first month of full-time operation. Attention thereafter may be less frequent, depending on what the early checks have shown. Lubrication is normally the most important consideration. Unless operating conditions are unusually severe, a weekly check of oil levels in the gearbox, with addition of oil as required, should be sufficient. Complete oil changes should be made at intervals of 1000 operating hours, or more frequently if oil condition becomes poor.

Driver lubrication practices should be in accordance with the manufacturer's instructions. If direct connected to the blower through a lubricated type coupling, the coupling should be checked and greased each time blower oil is changed. This will help reduce wear and prevent it from causing vibration. In a belted drive system, check belt tension periodically and inspect for frayed or cracked belts. Refer to tensioning instructions under INSTALLATION.

In a new and properly installed blower there are no moving contacts between the two impellers, or between the impeller and cylinder or headplates. Wear is then confined to the bearing which support and locate the shafts, the shaft seals, and the timing gears. All are lubricated, and wear should be nominal if clean oil of the correct grade is always supplied. Seals are subject to deterioration as well as wear, and may require replacement at varying periods.

Shaft bearings have been selected to have optimum life under average conditions with proper lubrication. They are critical in the service life of the blower. Gradual bearing wear may allow a shaft position to change slightly, until rubbing develops between impeller and cylinder headplate. This will cause spot heating, which can be detected by feeling these surfaces. Sudden bearing failure is usually more serious. Since the shaft and impeller are no longer supported and properly located, extensive general damage to the blower casing and gears is likely to occur.

Shaft seals should be considered expendible items, to be replaced whenever drainage from the headplate vent cavity becomes excessive or when the blower is disassembled for any reason. Sealing effectiveness can vary considerably from seal to seal and is also affected by shaft smoothness under the seal lip. Because of these normal variables, minor seal leakage should not be considered an indicator for seal replacement.

Timing gear wear, when correct lubrication is maintained should be negligible over a period of years. Gear teeth are cut to provide the correct amount of backlash, and gears correctly mounted on the shafts will accom-

modate a normal amount of tooth wear without permitting contact between lobes of the two impellers.

However, a high oil level will cause churning and excessive heating, indicated by an unusually high temperature at the bottom of the gear housing. Consequent heating of the gears will result in loss of tooth-clearance or backlash, and rapid wear of the gear teeth usually will develop. Continuation of this tooth wear will eventually produce impeller contacts (knocking), and from this point serious damage will be unavoidable if blower operation is continued. A similar situation can be produced suddenly by gear tooth fracture, which is usually brought on by sustained overloading or momentary shock loads.

Operating problems may also develop from causes other than internal parts failure. Operating clearances within a blower are only a few thousandths of an inch (hundredths of a mm). This makes it possible for impeller interferences or casing rubs to result from shifts in the blower mounting or from changes in piping support. Foreign materials sucked into the blower will also cause trouble, which can only be cured by disconnecting the piping and thoroughly cleaning the blower interior.

If this type of trouble is experienced, and the blower is found to be clean, try removing mounting strains. Loosen blower mounting bolts and reset the leveling and drive alignment. Then tighten mounting again, and make sure that all piping meets blower connections accurately and squarely before reconnecting it.

A wide range of causes for operating troubles are covered in the TROUBLE SHOOTING CHECKLIST. The remedies suggested there in some cases need to be performed by qualified mechanics with a good background of general experience, using procedures detailed in this manual. Major repairs generally are to be considered beyond the scope of maintenance, and should be referred to the nearest Distributor listed on the last page.

Warranty failures should not be repaired at all, unless specific approval has been obtained through a Distributor or a factory before starting work. Unauthorized disassembly within the warranty period may void the warranty.

When a blower is taken out of service it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgment based on existing conditions as well as length of downtime. Under favorable conditions, protection will probably not be needed if shut-down is not longer than a month. Under atmospheric conditions producing rapid corrosion, the blower should be protected immediately. If blower is to be shut down for an extended period of time, see suggestions for corrosion protection under installation.

It is recommended that major repairs, if needed, be performed at a Dresser authorized service facility. However, it is recognized that this may not always be practical, especially when a spare blower is not available. If a blower is out of the warranty period, mechanical adjustments and parts replacement may be undertaken locally at the owner's option and risk. It is recommended that Factory Parts be used to insure fit and suitability. The maintenance of a small stock of on-hand spare parts can eliminate possible delays. When ordering parts give Item Numbers and their word descriptions from Figures 5 & 6. Also specify quantities wanted and the blower size and serial number from the nameplate.

Repairs or adjustments are best performed by personnel with good mechanical experience and the ability to follow the instructions in this manual. Some operations involve extra care and patience, and a degree of precision work. This is especially true in timing impellers and in handling bearings. Experience indicates that a high percentage of bearing failure is caused by dirt contamination before or during assembly. Therefore, the work area should be cleaned before starting disassembly, and new or re-usable parts protected during progress of the work.

In the following outlines of repair procedures, numbers shown in brackets ( ) correspond to the Item Numbers used in assembly drawing, Figures 11 & 13. It is recommended that the procedure be studied carefully and completely, with frequent reference to the drawings, before starting work. This will produce better efficiency through an understanding of what work is to be done, and the order of doing it. Before disassembly, mark all parts so that they may be returned to original locations or relative positions.

A — Replacing Timing Gears

1. Drain all oil from the gearhouse by removing drain plug (21) in the bottom. Remove gearhouse by taking out all cap screws (23) in its flange. It may be necessary to bump the sides with a wood block or mallet to break the flange joint.
2. Reach through one of the blower pipe connections and place a chalk mark on the strip of one impeller and the mating waist of the other, so that they may easily be returned to their original relative positions.

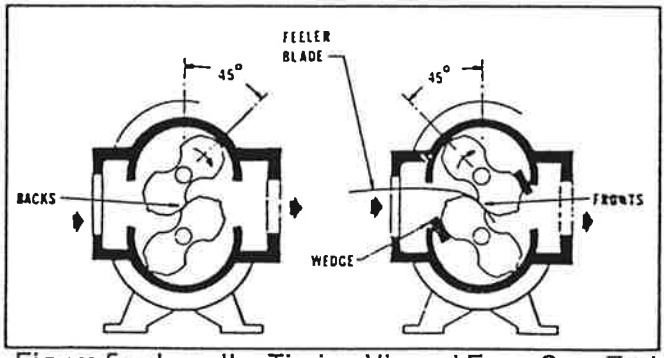


Figure 5 — Impeller Timing Viewed From Gear End

3. GEAR REMOVAL: For this operation, the impellers should be wedged as shown in Figure 5. Back off gear clamping nuts (17) about ¼". Use a puller of the type shown in Figure 10. Position it around the gear per Figure 9. As the puller set screw is torqued, the puller will have a tendency to turn and contact teeth of the other gear. To prevent this contact, hold the puller corner nut with a wrench while torquing the set screw. Once the gear is unseated, remove the puller. Remove gear nuts (17) and the gear. Repeat same procedure for the other gear. NOTE: Do not remove gear nuts (17) completely before the gears are unseated from the taper fits or damage/injury may result.

4. GEAR INSTALLATION: Place impellers in correct position as previously marked. Be sure shafts and gear bores are clean and free of scratches. Clean the shaft tapered fits. Place hardwood wedges as shown in Figure 5. Install drive gear (4) and gear nut (17) so match mark at tooth is at the line of engagement. Tighten the drive gear nut to the torque given in Table 5. Blower assembly must be fastened down for torquing operation.

TABLE 5 — GEAR NUT TORQUE

Gear Size (in.)	Torque	
	lb.-ft.	(kg-m)
2.5	60	(8.3)
3.5	110	(15.2)
4.0	190	(26.3)
5.0	250	(34.6)
6.0	400	(55.3)
7.0	550	(76.1)

5. Installing driven gear (4) - Insert a long, metal feeler gauge between the impellers' lobes at the fronts or backs as shown in Figure 5. Feeler gauge thickness to be a middle value from Table 6 for fronts and backs. Align the gear so the tooth match marks agree with the drive gear, then install nut (17). Tighten lightly with a small wrench, then check front and back clearances against Table 6 for each 45° position. Both fronts and backs should be about the same and within the specified range in Table 6. Adjust gear position, if necessary, then insert the corrected feeler gauge and wedges and use a torque wrench to tighten the gear nut to the torque specified in Table 5. Remove wedges and rotate the drive shaft by hand to make sure there are no gear tight spots or impeller contacts.

   Caution! Keep fingers away from impellers and gears.

6. Check the end clearances between impellers and headplates. Adjust clearances per B-15 below.

7. When clearances are correct, clean and re-install the gearhouse. Check condition of flange gasket (7) and replace if questionable. Fill gearhouse to correct level with proper grade of oil.

B — Replacing Shaft Bearings, and Impellers

Remove coupling or sheave from the drive shaft. Drain and remove gearhouse, and pull the timing gears. If gears are to be re-used, mark them so they may be returned to the same shafts.

1. Break corners and deburr the keyway. Remove bearing end cover at the drive end. Remove bearing clamp plates (34).

2. Make single and double identifying punch marks on the mating edges of headplate and cylinder flanges at the two ends of the blower.

3. At the drive end, drive out the two dowel pins and remove all capscrews holding headplate to cylinder. By inserting jacking screws into the two threaded flange holes, and turning them in evenly, the headplate will be separated from the cylinder. As the headplate comes off the shafts it will bring bearings with it. 2½" and 3½" gear diameter units do not have tapped holes for jack screws in the drive end headplates. Remove dowel pins and all capscrews holding headplate to cylinder and foot on the drive end. Support unit under gear end cylinder flange with the shafts vertical. Using soft metal block against gear end shafts, push them out of gear end headplate.

4. For 2½" and 3½" gear diameter units, support the drive end headplate on the underside, and using soft metal block against drive end, shafts, push them out of drive end headplate.

   For 4", 6" & 7" gear diameter units, from the gear end , using a wood or soft metal block against the ends of the shafts, drive them out of the headplate. If they are to be reused, protect them from damage in this operation.

5. If blower interior surfaces need cleaning, it may be advisable to separate the gear end headplate from the cylinder. Use the same general procedure as employed at the drive end.

6. Working from the back (flat) face of each headplate, push or tap out the bearings and seals. Use a round bar or tube that will pass through the shaft clearance holes in the headplates. All lip seals will be damaged during removal and must be replaced.

7. Clean bearing and seal pockets in headplates and remove burrs or rough edges. (Apply a thin coating of sealant on seal O.D.) Press new seals (27) into gear end headplate using a round tube or bar with recessed end that will bear on the outer metal edge of seal enclosure. Seal lip should point toward the driving tool. Seals to be flush with outboard bore face. Apply a light coat of oil or grease to the seal lips. In a similar fashion, install lip seals into the drive end headplate.

8. Place cylinder on a flat surface. Assemble gear end headplate to cylinder after checking flange punch marks. Drive in the two locating dowel pins before tightening flange screws. Also install gear end foot using the same longer cap screws (32) and washers (41). (on 6" & 7" UNIVERSAL RAI® install both gear and feet.)
9. Place the assembly horizontally on steel blocks with gear end headplate on bottom. The height of the blocks should be sufficient to clear gear end shaft extensions. Assemble impellers into the cylinder with the drive shaft (longer shaft) in same

location as in original assembly. Before starting the shafts through the headplate holes, make sure shaft ends have no sharp or rough edges to damage seal lips. Position impellers at 90° to each other in the cylinder, using lobe-and-waist match marks if original impellers are being re-installed. Install drive end headplate and feet in same manner as gear end.

10. It is recommended that new bearings be used for rebuild. Apply thin film of machine oil on the shaft bearing fit, bearing I.D., and headplate bearing bore. Install drive end bearings into headplate. Use a tube with flanged end that will contact both bearing faces simultaneously. Refer to Fig. 11 for proper bearing depths.

    NOTE: Cylindrical drive bearing should be installed with inner race large shoulder facing outboard.

11. Place blower on its feet on a flat surface. Loosen feet capscrews (32) and square up unit. Re-tighten capscrews (32). Clamp unit down to a solid base for further assembly.

12. Oil the gear end bearing fits as described previously. Install 2½-5" UNIVERSAL RAI® gear end bearings flush with the headplate bearing shoulders using proper drivers. On 6" & 7" UNIVERSAL RAI®, install thrust washer (29) in bearing bores then install gear end bearings so that they protrude 1/16" (1.6mm) above headplate surface.

13. Install bearing clamp plates (34). On 6" & 7" UNIVERSAL RAI®, impeller end clearances are also to be set during this step. Install clamp plates (34) with capscrews (31) making sure that the gap between the clamp plates and the headplate is even all around, at the same time, set end clearances per Table 5.

14. Install gears and time impellers as in (A).

15. For setting end clearances on 2½-5" gear diameter units, special tools, thrust adjuster fork Fig. 7 and thrust adjuster saddle Figure 8 are required. Refer to Fig. 6 for installation of tools. The flat side of the saddle rests against the bearing inner race and the flat side of the fork rests against the back side of the gear. Install a shim, with thickness equal to gear end clearance (Table 6), between the impeller and the gear end headplates. Tap on top of the fork until the shim becomes snug. Remove the shim and check end clearances. To increase gear end clearance, tap on the end of the gear end shaft with a soft metal [illegible] set end clear[illegible] (31) evenly i[illegible]

16. Install drive [illegible] cavities with [illegible] seal. Lip mus[illegible] th[illegible] cise care not [illegible] shaft keyway

17. Install gaske[illegible] cleaning out [illegible] screws (23) ev[illegible] til oil flows ou[illegible] and bearings.

18. Reinstall cou[illegible] they have a s[illegible] be installed b[illegible]

Where repairs in[illegible] mended that Facto[illegible] suitability. Delay in[illegible] by having spare par[illegible]

When ordering [illegible] from the blower nam[illegible]

Repairs or adjustm[illegible] by personnel with a g[illegible] experience and the ab[illegible] in this manual. No sp[illegible] tions involve extra ca[illegible] is especially true [illegible] ings. Experience [illegible] ing failures is caus[illegible] ing assembly. Ther[illegible] ing disassembly, [illegible] ing progress of [illegible] Information.)

INTERCHANGE

References to [illegible] clude only one [illegible] to be used or ex[illegible] formation is no[illegible] may arise, howev[illegible] clearances with [illegible] establish clearan[illegible]

Listed in Tab[illegible] used in factory [illegible] blowers. It shou[illegible] change slightly [illegible] the minimum va[illegible] should attempt [illegible] with this data.

Table 6 — Normal Clearances for UNIVERSAL RAI® Blowers — Inches (MM)

SIZE	IMPELLER ENDS			CYLINDER		IMPELLER
	TOTAL	DRIVE END MINIMUM	GEAR END MINIMUM	INLET & DISCHARGE	CENTER	FRONTS BACKS
22	.006/.100 (.15-.25)	.003 (.08)	.003 (.08)	.004/.0055 (.1-.14)	.002/.003 (.05-.08)	.007/.01 (.18-.25)
24	.006/.100 (.15-.25)	.003 (.08)	.003 (.08)	.004/.0055 (.1-.14)	.002/.003 (.05-.08)	.007/.01 (.18-.25)
32	.006/.011 (.15-.28)	.003 (.08)	.003 (.08)	.0045/.0065 (.11-.17)	.002/.003 (.05-.08)	.01/.012 (.25-.30)
33	.006/.011 (.15-.28)	.003 (.08)	.003 (.08)	.0045/.0065 (.11-.17)	.002/.003 (.05-.08)	.01/.012 (.25-.30)
36	.006/.011 (.15-.28)	.003 (.08)	.003 (.08)	.0045/.0065 (.11-.17)	.002/.003 (.05-.08)	.01/.012 (.25-.30)
42	.008/.011 (.20-.28)	.004 (.10)	.004 (.10)	.005/.007 (.13-.18)	.003/.004 (.08-.10)	.009/.012 (.23-.30)
45	.008/.013 (.20-.33)	.004 (.10)	.004 (.10)	.005/.007 (.13-.18)	.003/.004 (.08-.10)	.012/.015 (.3-.38)
47	.008/.013 (.20-.33)	.004 (.10)	.004 (.10)	.005/.007 (.13-.18)	.003/.004 (.08-.10)	.012/.015 (.3-.38)
53	.008/.011 (.20-.28)	.004 (.10)	.004 (.10)	.0055/.0075 (.14-.19)	.003/.004 (.08-.10)	.011/.013 (.28-.33)
56	.008/.013 (.20-.33)	.004 (.10)	.004 (.10)	.0055/.0075 (.14-.19)	.003/.004 (.08-.10)	.015/.017 (.38-.43)
59	.008/.013 (.20-.33)	.004 (.10)	.004 (.10)	.0055/.0075 (.14-.19)	.003/.004 (.08-.10)	.015/.017 (.38-.43)
65	.012/.016 (.30-.40)	.008 (.20)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.010/.014 (.25-.36)
68	.014/.018 (.36-.46)	.008 (.20)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.010/.014 (.25-.36)
615	.014/.018 (.36-.46)	.008 (.20)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.010/.014 (.25-.36)
76	.012/.016 (.30-.40)	.008 (.13)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.013/.015 (.33-.38)
711	.014/.018 (.36-.46)	.010 (.25)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.013/.015 (.33-.38)
718	.014/.018 (.36-.46)	.010 (.25)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.013/.015 (.33-.38)

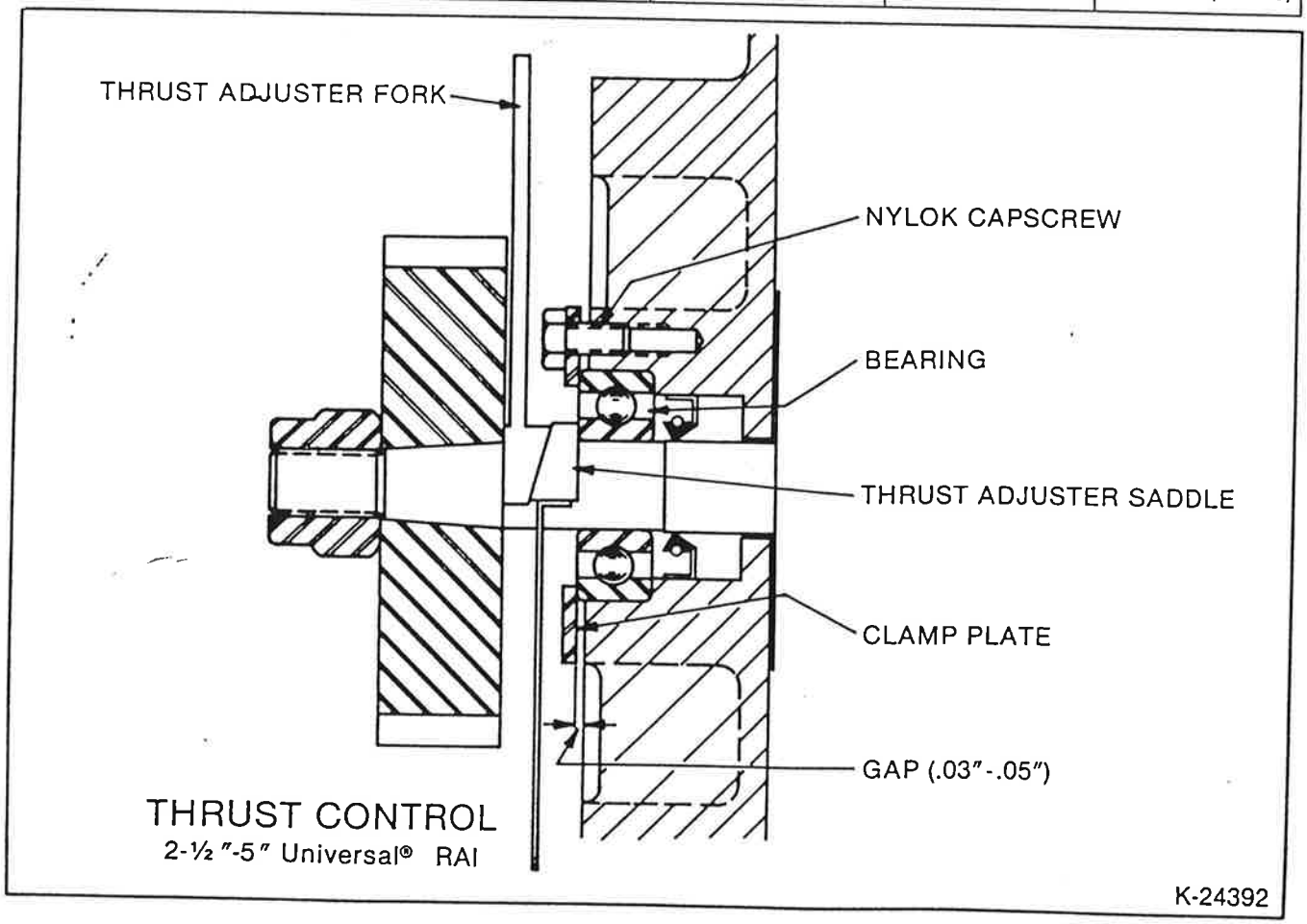
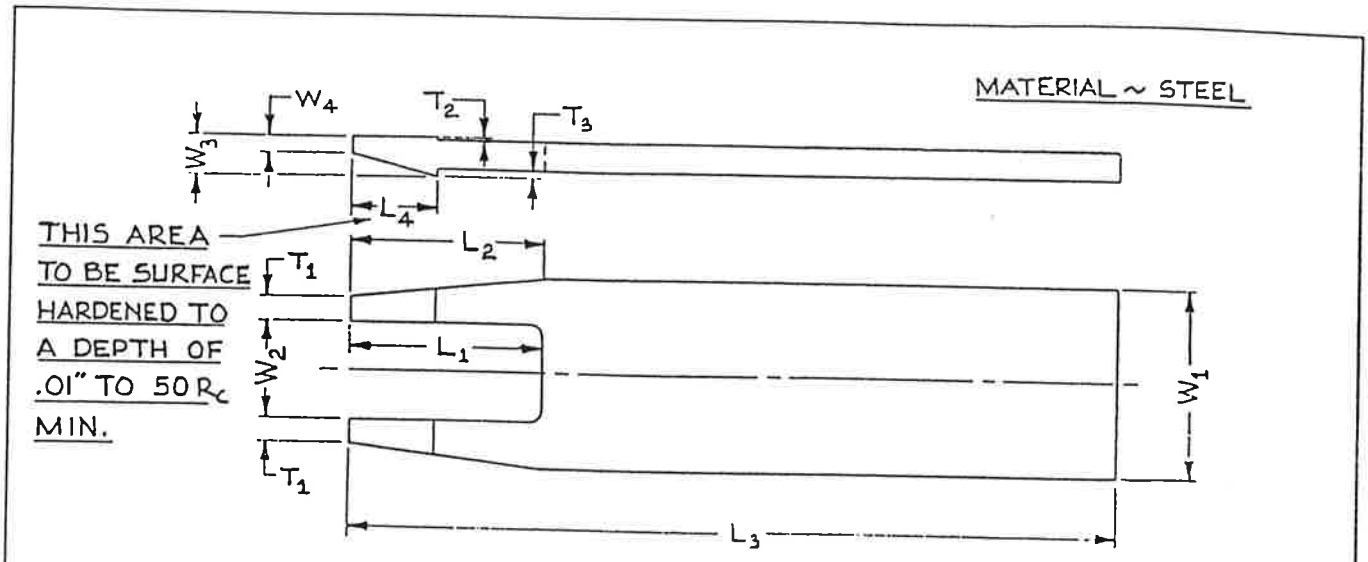


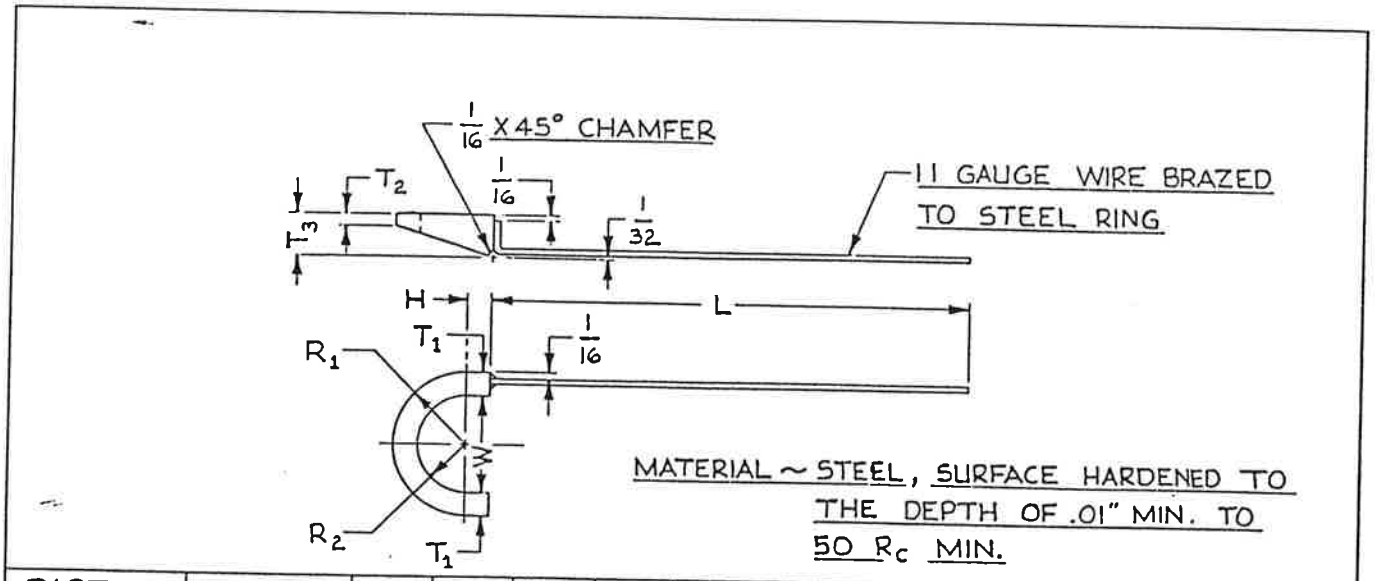
Figure 6 — Thrust Setting, 2½"-5" UNIVERSAL RAI®



PART Nº	BLW. SIZE	L_1	L_2	L_3	L_4	W_1	W_2	W_3	W_4	T_1	T_2	T_3	NOTES
812-973-001	2 1/2"	1 3/4	1 3/4	6 1/2	9/16	1 3/8	11/16	1/4	1/8	7/32	1/32	1/32	
812-973-002	3 1/2"	2	2	7	7/8	1 1/2	13/16	5/16	1/16	7/32	1/32	1/16	
812-973-003	4"	2	2	7 1/2	1	1 3/4	1 1/32	3/8	1/16	1/4	1/32	1/32	
812-973-004	5"	2 1/4	2 1/4	8	7/8	2	1 1/4	13/32	3/16	1/4	1/32	1/16	

Figure 7 — Thrust Adjuster Fork

812-973



PART Nº	BLW. SIZE	R_1	R_2	W	T_1	T_2	T_3	H	L	NOTES
812-974-001	2 1/2"	15/32	11/32	11/16	1/8	1/16	1/4	3/16	3	
812-974-002	3 1/2"	5/8	13/32	13/16	7/32	1/16	5/16	3/16	3 1/2	
812-974-003	4"	49/64	33/64	1 1/32	1/4	1/8	7/16	1/4	4	
812-974-004	5"	7/8	5/8	1 1/4	1/4	1/8	7/16	1/4	5	

Figure 8 — Thrust Adjuster Saddle

812-974

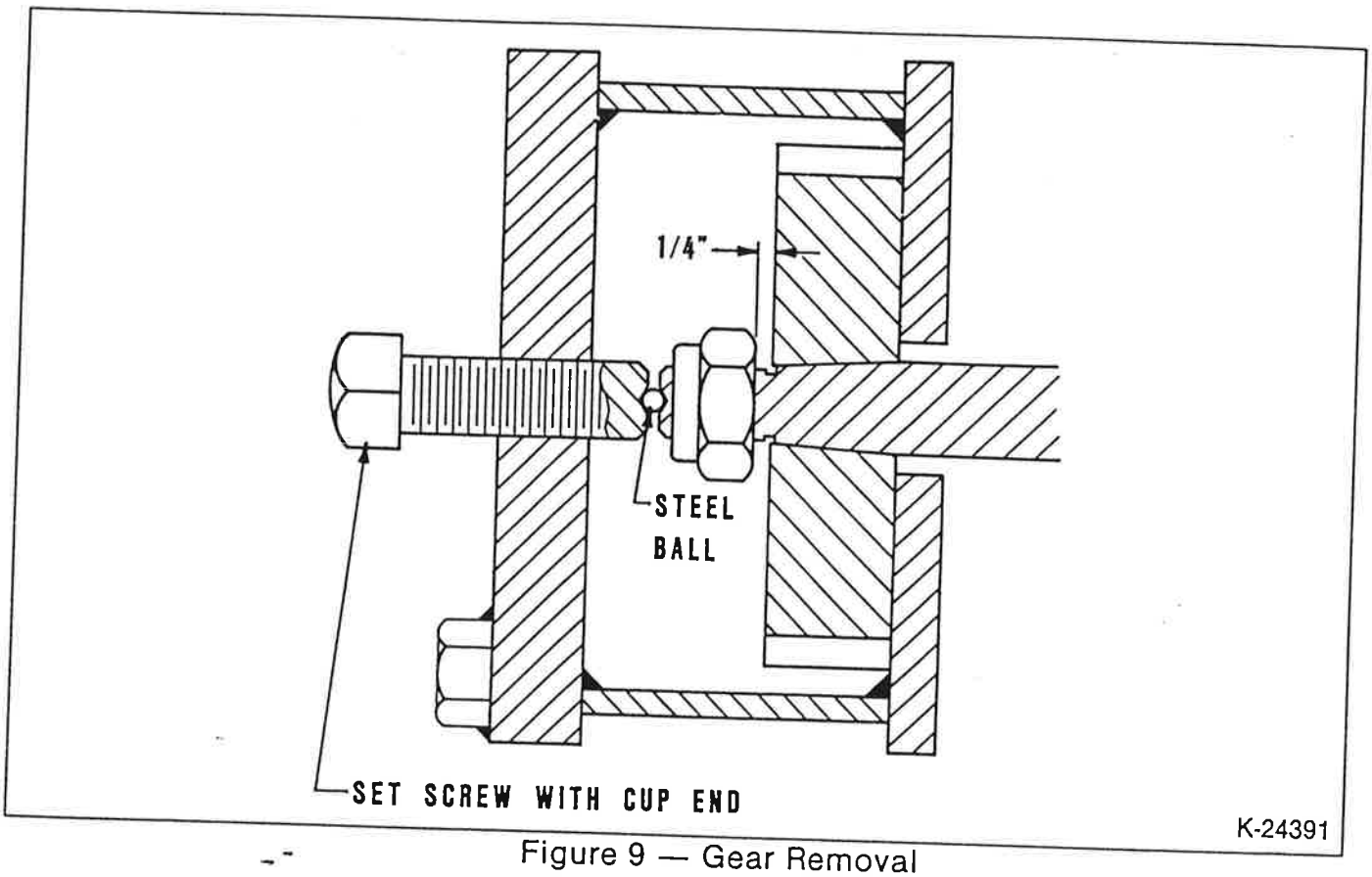
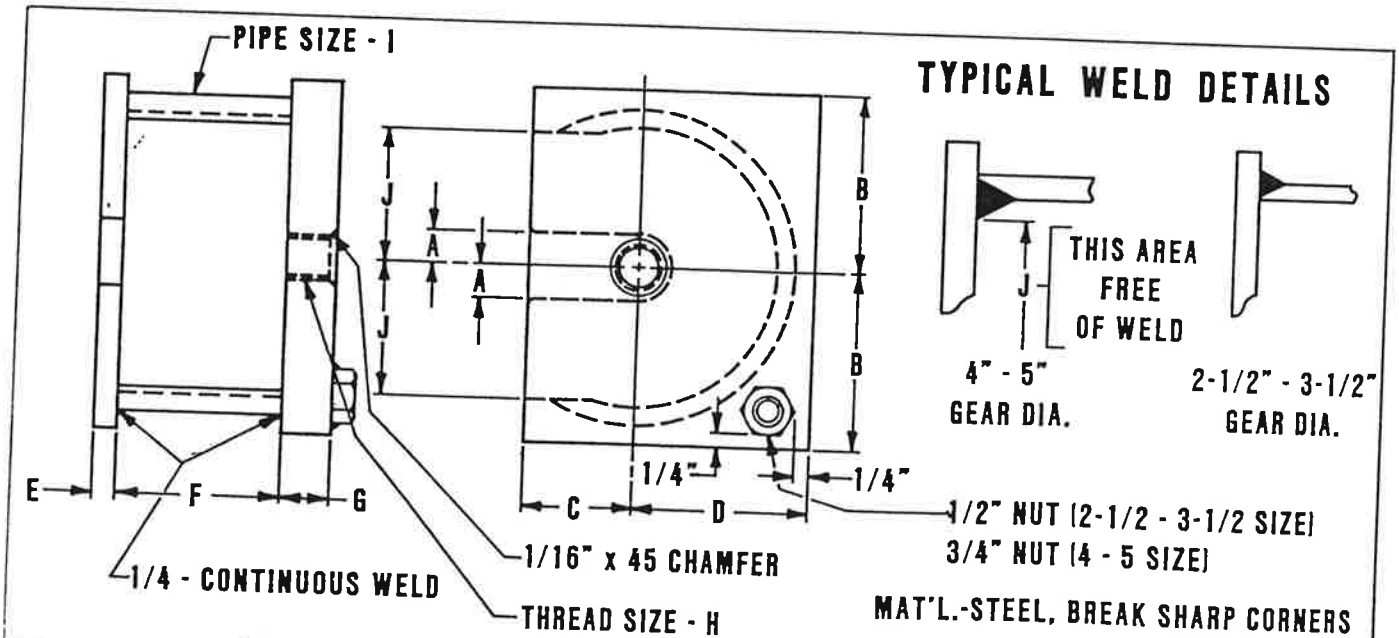


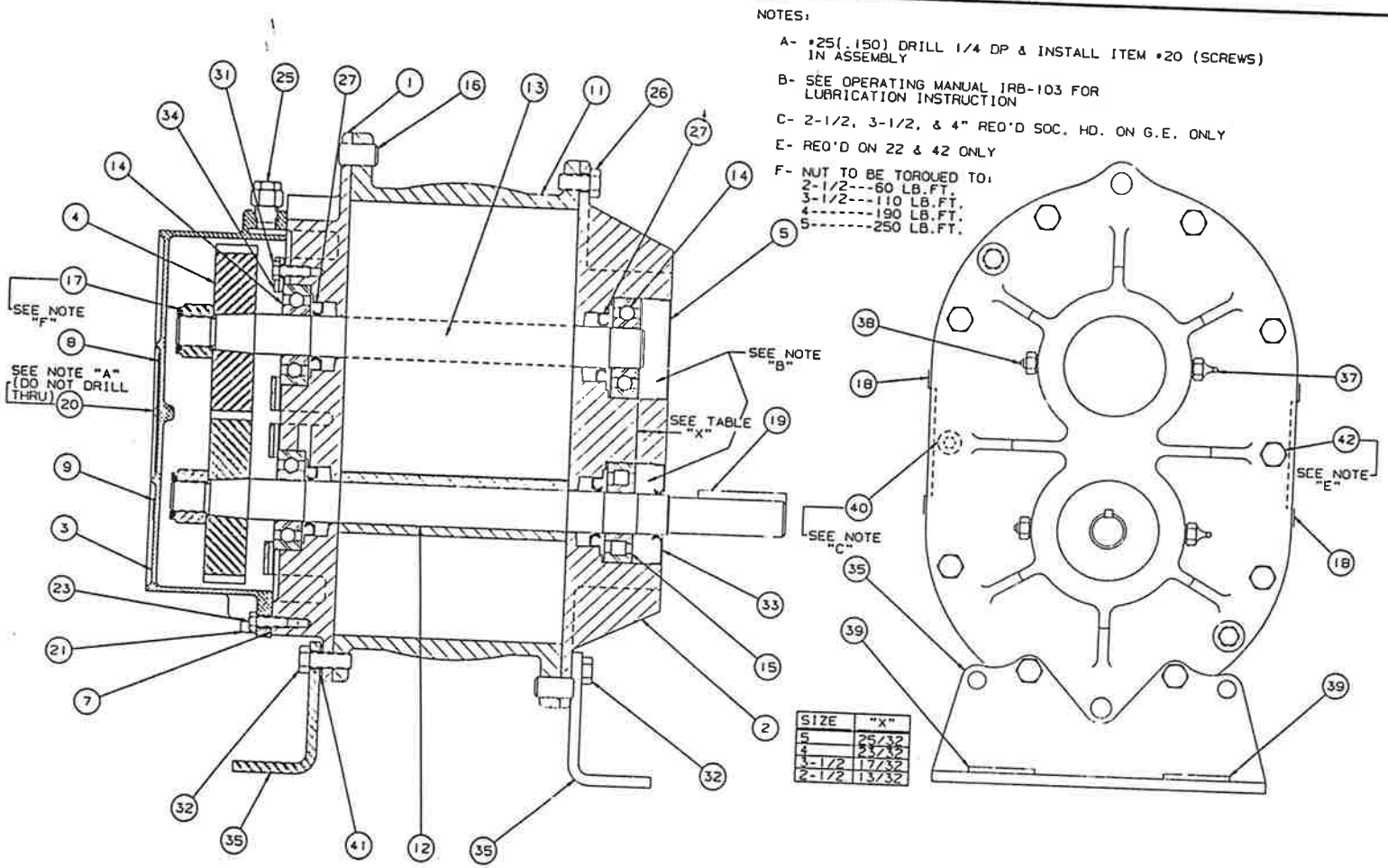
Figure 9 — Gear Removal



BLOWER SIZE	PART NO.	A	B	C	D	E	F	G	H	I	J
2-1/2	812-977-001	3/8	2	1-1/16	2	1/4	2	5/8	7/16-14	3" SCH. - 40	1-3/8
3-1/2	812-977-002	7/16	2-1/2	1-1/4	2-1/2	5/16	2-3/8	3/4	1/2-13	4" SCH. - 40	1-7/8
4	812-977-003	17/32	2-13/16	1-3/4	2-13/16	3/8	2-1/2	3/4	5/8-11	5" SCH. - 40	2-1/8
5	812-977-004	5/8	3-3/8	2	3-3/8	7/16	3	1	3/4-10	6" SCH. - 40	2-11/16

Figure 10 — Gear Pullers for UNIVERSAL RAI® with Tapered Gear Bores

812-977-

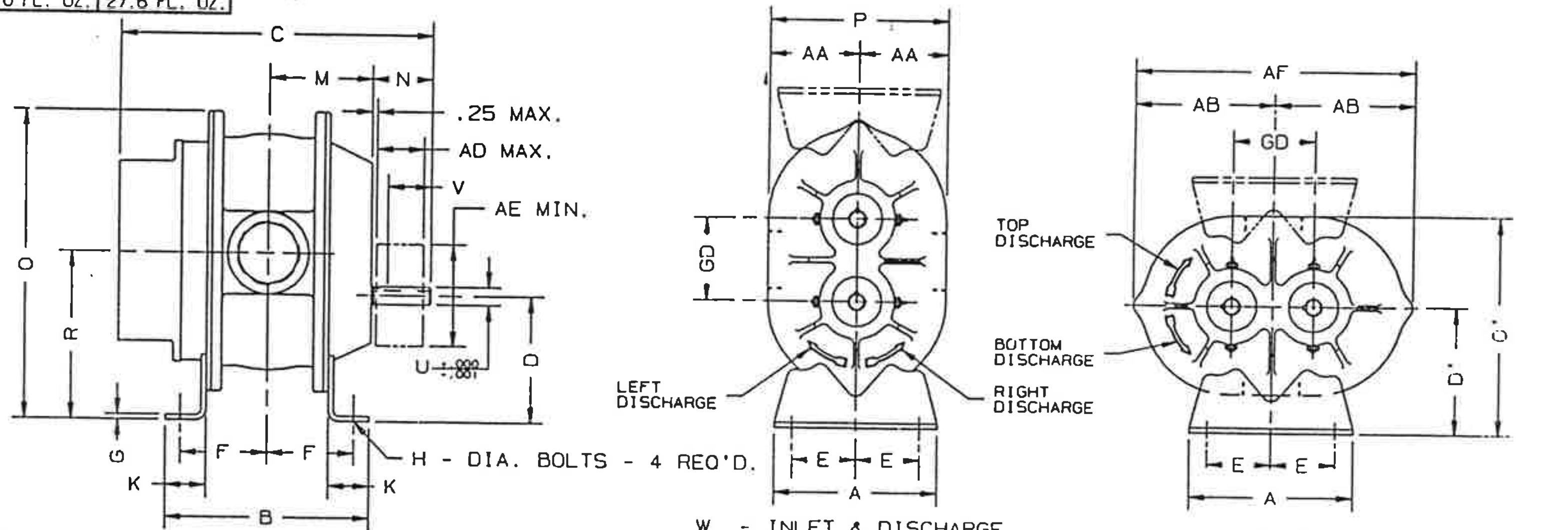


ITEM	PART NAME	ITEM	PART NAME	ITEM	PART NAME	ITEM	PART NAME
1	Headplate Gear End	12	Impeller & Shaft-Drive	21	Plug, Pipe	35	Foot
2	Headplate Drive End	13	Impeller & Shaft-Driven	23	Screw, Hex	37	Fitting, Grease
3	Gearbox	14	Bearing G.E.,-Driven	25	Breather	38	Fitting, Relief
4	Gears	15	Bearing D.E.-Drive	26	Screw, Hex	7	Gasket
5	Cover-Blind	16	Pin, Dowel	27	Seal, Lip	39	Washer Flat
8	Nameplate-Serial Number	17	Gear Nut	31	Screw, Hex	40	Screw Socket
9	Nameplate-Lub	18	Plug Tin	32	Screw, Hex	41	Washer
		19	Key	33	Seal Lip-Drive	42	Screw Hex
11	Cylinder	20	Screw, Self Tap	34	Clamp Plate		

864-720-023

Figure 11 — Assembly of UNIVERSAL RAI® Blowers, 2½"-5" Gear Diameter

FRAME	APPROX. OIL CAPACITY VERTICAL	APPROX. OIL CAPACITY HORIZONTAL
2-1/2	3.4 FL. OZ.	6.1 FL. OZ.
3-1/2	8.5 FL. OZ.	16 FL. OZ.
4	12.7 FL. OZ.	22.8 FL. OZ.
5	16.0 FL. OZ.	27.6 FL. OZ.



W - INLET & DISCHARGE
AD - SHEAVE WIDTH
AE - SHEAVE DIAMETER

ALL DIMENSIONS IN INCHES

UNIVERSAL RAI BLOWER

FRAME SIZE	GD	A	B	C	D	D'	E MIN.	E MAX.	F MIN.	F MAX.	G	H	K	M	N	O	O'	P	R	U	KEYWAY	W NPT.	V	AA	AB	AD	AE	AF	APPROX. WT. LBS
22	2.5	5.13	5.00	9.75	3.75	3.75	1.50	2.00	2.00	2.00	.25	.38	1.25	2.63	2.50	9.63	6.88	6.25	5.00	.625	.188x.094	1"	1.81	3.13	4.63	1.75	4.00	9.25	32
24	"	"	7.00	11.75	"	"	"	"	3.00	3.00	"	"	"	3.63	"	"	"	"	"	"	"	2"	"	"	"	"	"	"	43
32	3.50	7.25	6.75	11.25	5.00	5.00	2.50	2.88	2.56	2.81	.25	.44	1.75	3.38	2.44	12.81	8.88	7.75	6.75	.750	.188x.094	1-1/4"	1.63	3.88	6.06	1.91	5.00	12.13	69
33	"	"	7.63	12.13	"	"	"	"	3.00	3.25	"	"	"	3.81	"	"	"	"	"	"		2"	"	"	"	"	"	"	74
36	"	"	10.00	14.63	"	"	"	"	4.18	4.44	"	"	"	5.00	2.56	"	"	"	"	"		2-1/2"	1.75	"	"	"	"	"	102
42	4.00	8.00	7.25	13.00	6.25	6.25	3.00	3.13	2.50	3.13	.31	.44	2.00	3.68	3.18	15.06	10.63	8.75	8.25	.875	.188x.094	1-1/2"	2.31	4.38	6.81	2.31	5.00	13.63	88
45	"	"	10.00	15.50	"	"	"	"	3.56	4.25	"	"	"	5.06	2.94	"	"	"	"	"		2-1/2"	2.13	"	"	"	"	"	100
47	"	"	11.75	17.63	"	"	"	"	4.63	5.38	"	"	"	5.94	3.31	"	10.50	8.50	"	"		3"	2.50	4.25	"	"	"	"	120
53	5.00	10.50	8.38	15.38	6.25	6.75	3.50	3.50	3.18	3.68	.25	.50	1.88	4.50	3.68	17.38	11.88	10.25	8.75	1.125	.25 x .125	2-1/2"	2.75	5.13	8.63	3.06	6.00	17.25	145
56	"	"	11.00	18.00	"	"	"	"	4.25	5.00	"	"	"	5.81	3.38	"	12.25	11.00	"	"	"	4"	2.50	5.50	"	"	"	"	170
59	"	"	14.00	21.00	"	"	"	"	6.00	6.50	"	"	"	7.31	3.88	"	"	"	"	"	"	4"	3.00	"	"	"	"	"	204

CERTIFIED CORRECT FOR
CUSTOMER ORDER No.______
ROOTS ORDER No.______
DATE______

V-BELT DRIVE DATA	
BELTS	
DRIVE SHEAVE	
DRIVEN SHEAVE	
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DRESSER INDUSTRIES, INC.
ROOTS DIVISION
900 WEST MOUNT STREET
CONNERSVILLE, INDIANA 47331

DB 8/29 84
FCH

862-795-021

PRINTED IN U.S.A. /PARTS/XXAD REV DIM A 22621/10-11-84 ADDED WEIGHTS/10-23-84 REV DIM F/3-6-85 REV DIM U/5-85 REV AD DIM/KEM/10-7-86 REV FRAME 59/KEM/6-9-88 ADDED FRAME 57/RVL/6-22-90 CORRECTED FRAME 36 REV 8/14/91

Figure 12 — Dimensional Assembly of UNIVERSAL RAI® Blower (2½"-5")

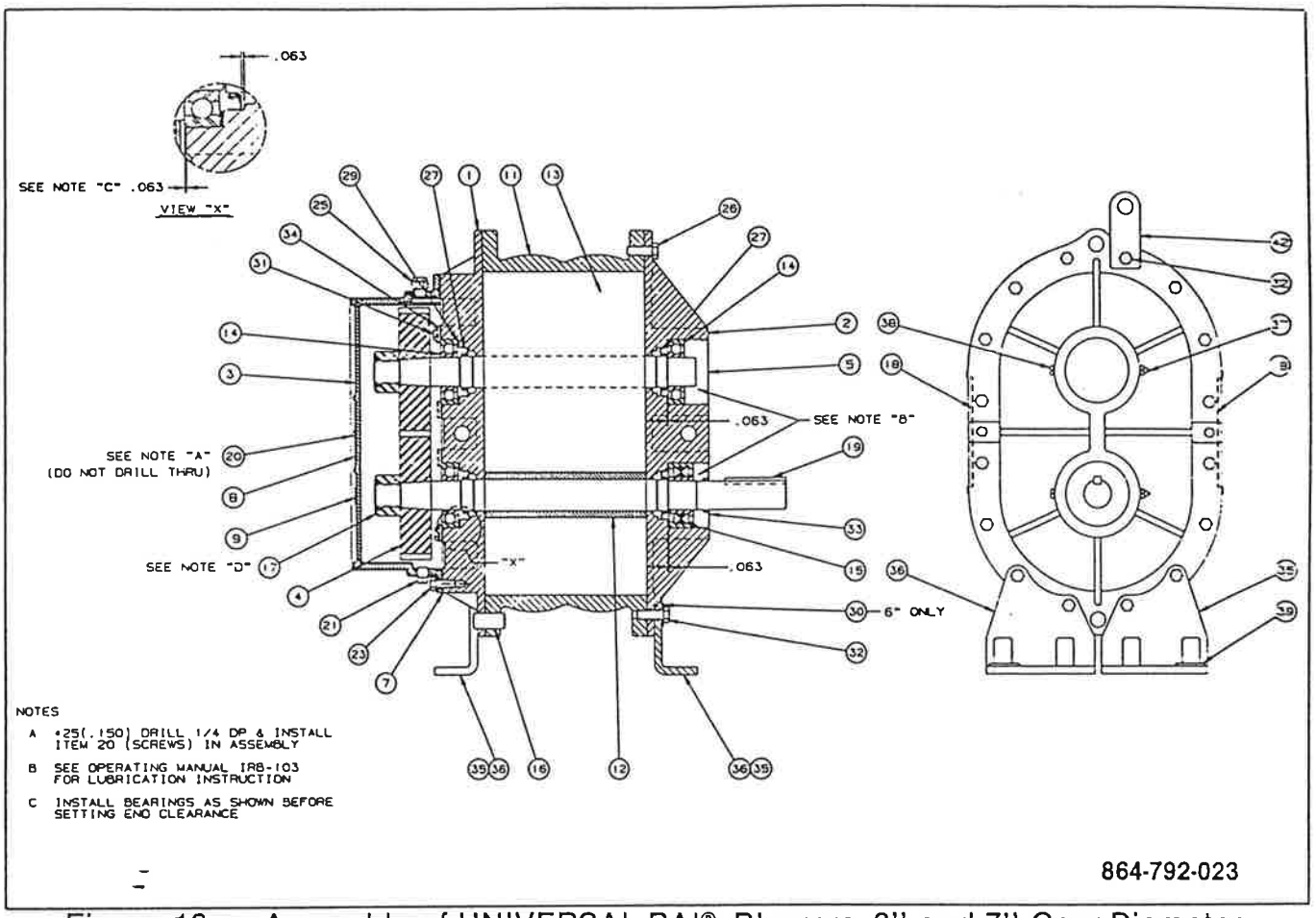
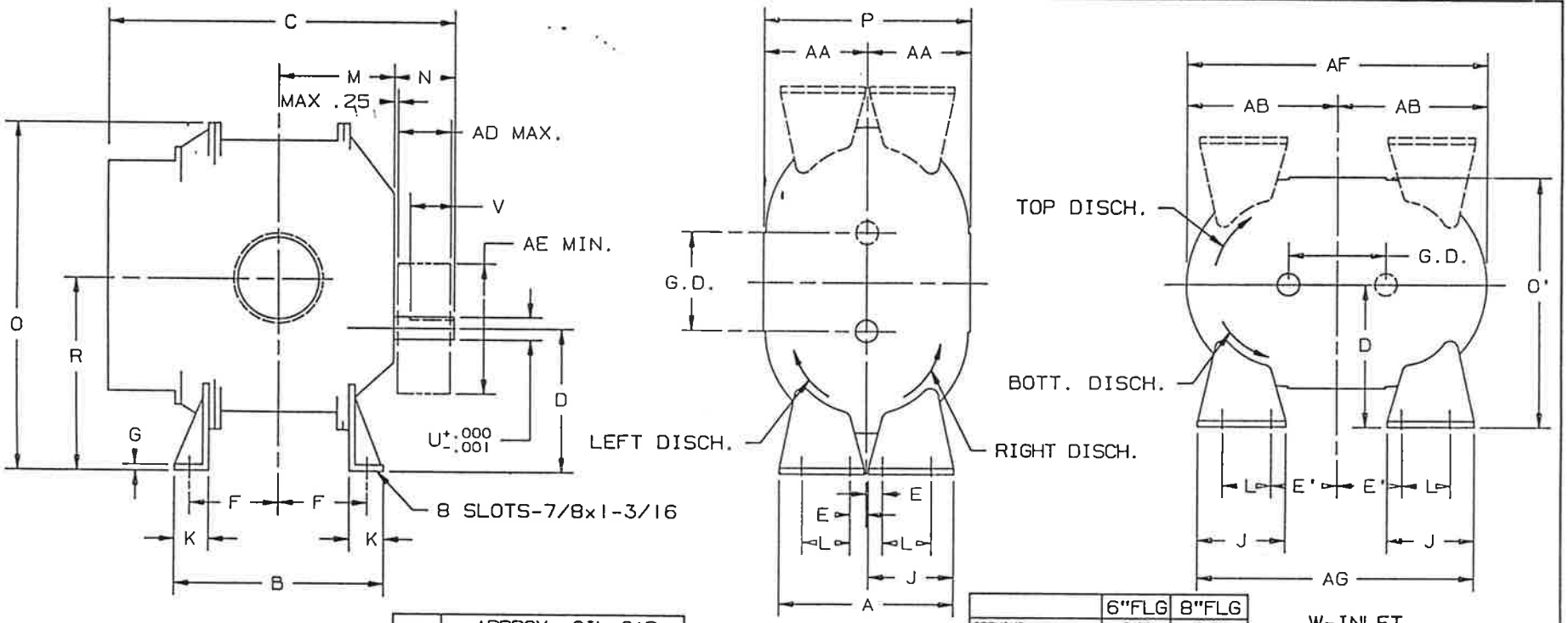


Figure 13 — Assembly of UNIVERSAL RAI® Blowers, 6" and 7" Gear Diameter

PARTS LIST FOR 6"-7" UNIVERSAL RAI®

ITEM	PART NAME	ITEM	PART NAME	ITEM	PART NAME	ITEM	PART NAME
1	Headplate - G.E.	13	Imp & Shaft - Drvn	25	Plug - Vent	36	Foot - Lt. Hand
2	Headplate - D.E.	14	Bearing, Ball	26	Screw, Cap - Hex	37	Fitting, Grease
3	Gearbox	15	Bearing, Roller	27	Seal, Lip	38	Plug - Vent
4	Gear Assembly	16	Pin, Dowel	29	Washer - Wavy Spr.	39	Washer - Oblong
5	Plug - Opening	17	Nut, Stop - Hex	30	Washer	40	Pipe - Tbe. (Close)
7	Gasket, Gearbox	18	Plug - Opening	31	Screw, Cap Hex	41	Coupling - Pipe
8	Nameplate - S/N	19	Key, Square	32	Screw, Cap Hex	42	Lifting Lug
9	Nameplate - Lube	20	Screw, Rd. Hd.	33	Seal, Lip		
11	Cylinder	21	Plug, Pipe - Sq. Hd.	34	Brg. Clamp Plate		
12	Imp & Shaft — Drive	23	Screw, Cap - Hex	35	Foot - Rt. Hand		



UNIVERSAL RAI® BLOWER

UNIT SIZE	APPROX. OIL CAP. VERT.	APPROX. OIL CAP. HORIZ.	G.D.
6"	28.3 FL OZ	52.1 FL OZ	6.00
7"	32.3 FL OZ	59.5 FL OZ	7.00

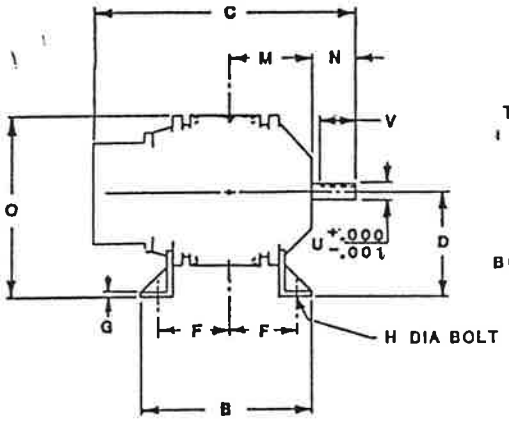
	6"FLG	8"FLG
OPENING	6.00	8.00
BOLT CIRCLE	9.50	11.75
FLANGE O.D.	11.00	13.50
NO. TAPPED HOLES	8	8
SIZE HOLES	3/4-10	3/4-10
TAP DEPTH	1.13	1.13

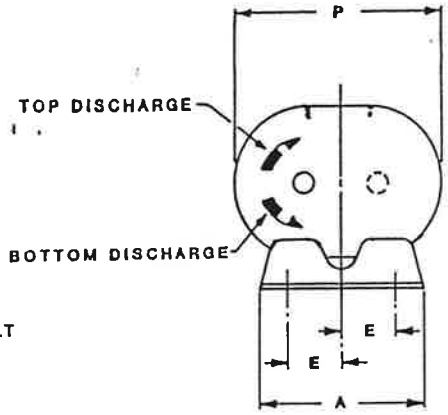
W-INLET
W'-DISCHARGE
AD-SHEAVE WIDTH
AE-SHEAVE DIA.
ALL DIM. IN INCHES

FRAME SIZE	A	B	C	D	E	E'	F	G	J	K	L	M	N	O	O'	P	R	U	V	KEYWAY	W	W'	AA	AB	AD	AE	AF	AG	APPROX WEIGHT
65	11.00	10.00	18.38	8.75	1.00	4.00	3.81	.38	5.38	2.13	3.00	5.63	3.56	21.63	15.13	12.75	11.75	1.375	2.75	.312x.156	3"NPT	3"NPT	6.38	9.88	3.44	8.00	19.75	17.00	245 LBS
68	"	13.00	21.38	"	"	"	5.31	"	"	"	"	7.13	3.69	"	"	"	"	"	"	"	5"NPT	5"NPT	"	"	"	"	"	"	"	285 LBS
615	"	20.00	28.38	"	"	"	8.81	"	"	"	"	10.63	"	"	16.25	15.00	"	"	"	"	6"FLG	6"FLG	7.50	"	"	"	"	"	"	425 LBS
76	14.00	11.75	19.94	11.00	2.00	5.50	4.88	.50	6.75	2.38	3.50	5.94	4.06	26.13	20.69	19.38	14.5	1.562	3.00	.375x.188	4"NPT	4"NPT	9.69	11.63	3.75	9.50	23.25	21.00	400 LBS
711	"	16.75	25.19	"	"	"	7.38	"	"	"	"	8.44	4.31	"	19.50	17.00	"	"	"	"	6"FLG	6"FLG	8.50	"	"	"	"	"	"	530 LBS
718	"	23.75	32.19	"	"	"	10.88	"	"	"	"	11.94	"	"	"	"	"	"	"	"	8"FLG	8"FLG	"	"	"	"	"	"	"	650 LBS

862-753-021

Figure 14 — Dimensional Assembly of UNIVERSAL RAI® Blower (6" & 7")





W-INLET & DISCHARGE

ALL DIMENSIONS IN INCHES

DIMENSIONS NOT CERTIFIED FOR CONSTRUCTION

NOTE:
UNIVERSAL RAI

1. 45 & 56 U-RAI WILL HAVE TO RUN AT REDUCED SPEED TO DUPLICATE AF PERFORMANCE.
2. LARGER STANDARD SHAFT THAN AF. SEE DIMENSION "U".
3. U-RAI INLET & OUTLET CONNECTIONS ARE LARGER THAN AF ON THE FOLLOWING SIZES: 24, 45, 47, 56 & 59. SEE DIMENSION "W".
4. 45 U-RAI REPLACES 44 AF. 56 U-RAI REPLACES 55 AF.
5. FOR ADDITIONAL INFORMATION CONTACT YOUR SALES REPRESENTATIVE OR THE FACTORY.

FRAME SIZE	A	B	C	D	E	F	H	M	N	O	P	U	V	KEYWAY	W
22 U-RAI	5.13	5.00	9.75	3.75	2.00	2.00	3/8	2.63	2.50	6.88	9.25	.625	1.81	3/16 x 3/32	1" NPT
22 AF	5.50	5.06	9.13	3.75	2.00	2.00	3/8	2.63	1.94	6.86	9.25	.5875	1.31	3/16 x 3/32	1" NPT
24 U-RAI	5.13	7.00	11.75	3.75	2.00	3.00	3/8	3.63	2.50	6.88	9.25	.625	1.81	3/16 x 3/32	2" NPT
24 AF	5.50	7.06	11.13	3.75	2.00	3.00	3/8	3.63	1.94	6.88	9.25	.5875	1.31	3/16 x 3/32	1-1/2" NPT
33 U-RAI	7.25	7.63	12.13	5.00	2.88	3.00	3/8	3.81	2.44	8.88	12.13	.750	1.63	3/16 x 3/32	2" NPT
33 AF	7.25	7.44	12.56	5.00	2.88	3.00	3/8	3.81	2.63	8.88	12.13	.6562	1.66	3/16 x 3/32	2" NPT
36 U-RAI	7.25	10.00	14.63	5.00	2.88	4.18	3/8	5.00	2.56	8.88	12.13	.750	1.75	3/16 x 3/32	2-1/2" NPT
36 AF	7.25	9.81	14.94	5.00	2.88	4.18	3/8	5.00	2.63	8.88	12.13	.6562	1.88	3/16 x 3/32	2-1/2" NPT
42 U-RAI	8.00	7.25	13.00	6.25	3.13	2.94	3/8	3.68	3.18	10.63	13.63	.875	2.31	3/16 x 3/32	1-1/2" NPT
42 AF	8.25	7.13	12.88	6.25	3.13	2.94	3/8	3.68	3.00	10.63	13.63	.7812	2.38	3/16 x 3/32	1-1/2" NPT
45 U-RAI	8.00	10.00	15.50	6.25	3.13	3.56	3/8	5.06	2.94	10.63	13.63	.875	2.13	3/16 x 3/32	2-1/2" NPT
44 AF	8.25	8.83	14.13	6.25	3.13	3.56	3/8	4.31	3.00	10.63	13.63	.7812	2.38	3/16 x 3/32	2" NPT
47 U-RAI	8.00	11.75	17.63	6.25	3.13	5.18	3/8	5.94	3.31	10.50	13.63	.875	2.50	3/16 x 3/32	3" NPT
47 AF	8.25	11.63	17.38	6.25	3.13	5.18	3/8	5.94	3.00	10.63	13.63	.7812	2.30	3/16 x 3/32	2-1/2" NPT
53 U-RAI	10.50	8.38	15.38	6.75	4.25	3.69	3/8	4.50	3.66	11.88	17.25	1.125	2.75	1/4 x 1/8	2-1/2" NPT
53 AF	10.75	8.81	15.44	6.75	4.25	3.69	3/8	4.50	3.63	12.00	17.25	.9687	2.86	1/4 x 1/8	2-1/2" NPT
56 U-RAI	10.50	11.00	18.00	6.75	4.25	4.25	3/8	5.81	3.38	12.25	17.25	1.125	2.50	1/4 x 1/8	4" NPT
55 AF	10.75	9.81	16.56	6.75	4.25	4.25	3/8	5.06	3.63	12.00	17.25	.9687	2.88	1/4 x 1/8	2-1/2" NPT
59 U-RAI	10.50	14.00	21.18	6.75	4.25	6.50	3/8	7.31	3.38	12.25	17.25	1.125	3.00	1/4 x 1/8	4" NPT
59 AF	10.75	14.31	21.06	6.75	4.25	6.50	3/8	7.31	3.63	12.00	17.25	.9687	2.88	1/4 x 1/8	3" NPT

ROOTS DRESSER

DRESSER INDUSTRIES, INC.
ROOTS OPERATIONS
900 WEST MOUNT STREET,
CONNERSVILLE, INDIANA 47331

PRINTED IN U.S.A.

COMPARING ROOTS UNIVERSAL RAI® TO ROOTS AF

DB 1-7-86
FLR
863-813-021

Figure 15

Major Changes when Replacing AF with UNIVERSAL RAI® Blower

Size & Type	Sheave Bushing Dia.	Inlet Size	Disch. Size	Mounting Feet
22 UNIVERSAL RAI®	.625"	1"	1"	Interchangeable
22 AF	.5875"	1"	1"	
24 UNIVERSAL RAI®	.625"	2"	2"	Interchangeable
24 AF	.5875"	1½"	1½"	
32 UNIVERSAL RAI®	.750"	1¼"	1¼"	Special Feet
315 AF	.6562"	¾"	¾"	
33 UNIVERSAL RAI®	.750"	2"	2"	Interchangeable
33 AF	.6562"	2"	2"	
36 UNIVERSAL RAI®	.750"	2½"	2½"	Interchangeable
36 AF	.6562"	2½"	2½"	
42 UNIVERSAL RAI®	.875"	1½"	1½"	Interchangeable
42 AF	.7812"	1½"	1½"	
45 UNIVERSAL RAI®	.875"	2½"	2½"	Reverse Feet
44 AF	.7812"	2"	2"	
47 UNIVERSAL RAI®	.875"	3"	3"	Interchangeable
47 AF	.7812"	2½"	2½"	
53 UNIVERSAL RAI®	1.250"	2½"	2½"	Special Feet
53 AF	.9687"	2½"	2½"	
56 UNIVERSAL RAI®	1.250"	4"	4"	Special Feet
55 AF	.9687"	2½"	2½"	
59 UNIVERSAL RAI®	1.250"	4"	4"	Special Feet
59 AF	.9687"	3"	3"	

*To maintain AF performance with UNIVERSAL RAI®, the blower speed will have to be reduced by sheave change. See Fig. 15 drawing for your specific blower size.

CAUTION CAUTION CAUTION

MAKE CERTAIN THAT THE BREATHER IS LOCATED ON TOP AND THE DRAIN PLUG IN THE BOTTOM OF THE GEAR BOX.

GENERAL TERMS

CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE

A. Unless Seller specifically assumes installation, construction or start-up responsibility, all products shall be finally inspected and accepted within thirty (30) days after receipt at point of delivery. Products not covered by the foregoing and all work shall be finally inspected and accepted within thirty (30) days after completion of the applicable work by Seller. All claims whatsoever by Buyer (including claims for shortages) excepting only those provided for under the WARRANTY AND LIMITATION OF LIABILITY and PATENTS Clause hereof must be asserted in writing by Buyer within said thirty (30) day period or they are waived. If this contract involves partial performance, all such claims must be asserted within said thirty (30) day period for each partial performance. There shall be no revocation of acceptance.

Rejection may be only for defects substantially impairing the value of products or work and Buyer's remedy for lesser defects shall be those provided for under the WARRANTY AND LIMITATION OF LIABILITY Clause.

B. Seller shall not be responsible for nonperformance or delays in performance occasioned by any causes beyond Seller's reasonable control, including, but not limited to, labor difficulties, delays of vendors or carriers, fires, governmental actions and material shortages. Any so occasioned shall effect a corresponding extension of Seller's performance dates which are, in any event, understood to be approximate. In no event shall Buyer be entitled to incidental or consequential damages for late performance or a failure to perform.

TITLE AND RISK OF LOSS

Full risk of loss (including transportation delays and losses) shall pass to the Buyer upon delivery of products to the f.o.b. point or if Seller consents to a delay in shipment beyond the contract date at the request of the Buyer, upon notification by the Seller that the products are manufactured.

WARRANTY AND LIMITATION OF LIABILITY

A. Seller warrants that its products and parts, when shipped, and its work (including installation, construction and start-up), when performed will meet all applicable specifications and other specific product and work requirements (including those of performance), if any, of this agreement, will be of good quality and will be free from defects in material and workmanship. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and, in any event, within eighteen (18) months after installation (not to exceed twenty-four [24] months after shipment) of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within eighteen (18) months after installation (not to exceed twenty-four [24] months after shipment) of completion thereof by Seller. Defective items must be held for Seller's inspection and returned to the original f.o.b. point upon request. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.

B. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair or replace the unit claimed defective within the warranty period defined above, regardless of cause of failure EXCEPT shipping damage, vandalism or mishandling, i.e. dropping or other external impact damage, at the original f.o.b. point of delivery, or (ii) refund an equitable portion of the purchase price.

Seller reserves the right to withdraw the Uncontested Warranty where evidence indicates repeated failures are due to misapplication, abuse, or operation not in accordance with Roots operating instruction bulletin.

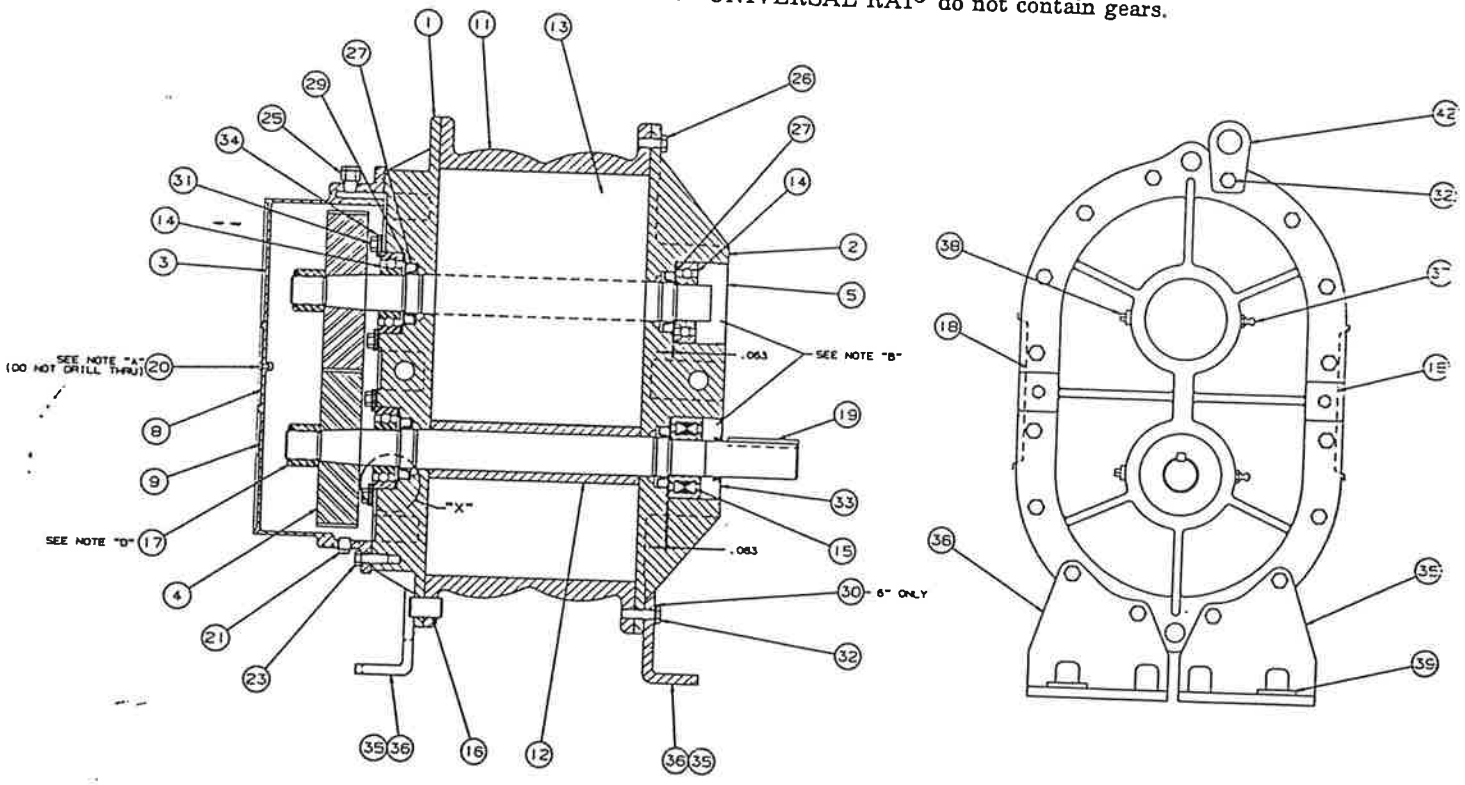
C. The warranty specified herein shall apply to this contract, but it is specifically understood that products sold hereunder are not warranted for operation with erosive or corrosive fluids or those which may tend to build-up within the product quoted. No product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action of any fluid and Buyer shall have no claim whatsoever against Seller therefore, nor for problems resulting from build-up of material within the unit.

D. The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is Buyer's only remedy hereunder by way of breach of contract, tort or otherwise. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within two (2) years after the cause of action has accrued.

REPAIR KIT INFORMATION

UNIVERSAL RAI®				
REF. NO.	QTY.	PART DESCRIPTION	REPAIR KIT PART NOS.	
			FRAME SIZE	REPAIR KIT NO.
4	1 Pr.	Timing Gear	2″	65-101-ORK
5	1	Plug — Opening	3″	65-104-ORK
7	1	Gasket	4″	65-107-ORK
14	1	Bearing, D.E. — DRVN	5″	65-111-ORK
14	2	Bearing, G.E.	*6″	65-115-ORK
15	1	Bearing, Dr. Shaft	*7″	65-119-ORK
17	1	Gear Nut		
27	2	Seals, D.E.		
27	2	Seals, G.E.		
31	4	Capscrew — Selflock		
33	1	Seal — Dr. Shaft		

*Repair kits for the 6" and 7" UNIVERSAL RAI® do not contain gears.



SEE BACK COVER FOR NEAREST DISTRIBUTOR.

ROOTS AUTHORIZED DISTRIBUTOR LIST

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*Arkansas Industrial Machy.
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Little Rock, AR 72115
501/758-2745
Fax: 501/758-3223

CALIFORNIA

*American Compressor Co.
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Santa Fe Springs, CA 90670
310/944-6188
Fax: 310/946-8365

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Walnut Creek, CA 94596
3000 Citrus Circle
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510/944-0494
Fax: 510/947-3978

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303/233-7400
Fax: 303-233-0093

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East Hartford, CT 06108
203/528-9454
Fax: 203/528-7392

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P.O. Box 3529
Lakeland, FL 33802-3529
813/665-8500
Fax: 813/666-3858

Barney's Pumps, Inc.
5601 Powerline Rd.
Suite 408
Ft. Lauderdale, FL 33309
305/771-8411 (Broward)
305/945-0279 (Dade)
Fax: 305/771-8440

Barney's Pumps of Jacksonville
11306 Business Prk. Blvd.
P.O. Box 56170
Jacksonville, FL 32241-6170
904/260-0669
Fax: 904/260-4913

GEORGIA

*Pye Barker Supply Co.
21 Royal Drive
P.O. Drawer M
Forest Park, GA 30050
404/363-6000
Fax: 404/361-8579

Pye Barker Supply Co.
2805 Palmyra Rd.
Albany, GA 31707
912/436-2479
Fax: 912/883-6222

Pye Barker Supply Co.
11 Magazine Avenue
Savannah, GA 31042
912/238-0303
Fax: 912/238-5214

HAWAII

*Foster Equipment Co.
719 Ahua Street
Honolulu, HI 96820-0188
808/839-7731
Fax:

ILLINOIS

*AMCO Industries
Compressor Engrg. Co.
625 District Drive
Itasca, IL 60143
708/773-1100
Fax: 708/773-1063

*Cochrane Comp. Serv & Sup Co.
4533 West North Ave.
Melrose Park, IL 60160
708/345-0225
Fax: 708/345-1339

*Cochrane Compressor Co.
505 North Madison
Rockford, IL 61107
815/965-1860
Fax: 815/965-1874

Cochrane Compressor
819 S.W. Adams
Peoria, IL 61602
309/674-9104
Fax: 309/674-5242

*Cochrane Compressor Co.
2209 3rd Avenue
Rock Island, IL 61201
309/786-7739

INDIANA

*Powered Equip. & Repair
600 Voorhees
Terre Haute, IN 47802
812/232-0241
Fax: 812/232-0055

AMCO Industries (No. IN only)
Compressor Engineering Co.
1944 Griffith Blvd., Unit "E"
Griffith, IN 46319
219/923-8300
Fax: 219/923-8324

KANSAS

*Pump & Power Equip., Inc.
9010 Rosehill Road
Lenexa, KS 66215
913/492-7991
Fax: 913/492-7994

KENTUCKY

*Air Systems, Inc.
4512 Bishop Lane
Louisville, KY 40218
502/452-6312
Fax: 502/458-0791

LOUISIANA

*Delta Process Equip.
9929 Florida Blvd.
P.O. Box 969 (77027)
Denham Springs, LA 70726
504/665-1666
Fax: 504/665-1855

*Gulf States Engrg.
252 Harbor Circle
P.O. Box 26156
New Orleans, LA 70126
504/241-8510
Fax: 504/242-0844

MARYLAND

*Cole Compressor
1201A Ridgely Street
Baltimore, MD 21230
410/539-3883
Fax: 410/539-3905

*Tate Eastern Shore
R.D. 3, Box 858
Delmar, MD 21875
301/546-3293
Fax: 301/546-3461

MASSACHUSETTS

*PEECO, Inc.
10 Brent Drive
P.O. Box 497
Hudson, MA 01749
508/562-9112
Toll Free: 800/762-9720 (MA only)
800/225-9242 (CT, ME, NH, RI & VT)
Fax: 508/562-6915

MICHIGAN

*Detroit Air Compressor & Pump Co.
3205 Bermuda
Ferndale, MI 48220
313/544-2982
Fax: 313/544-2027

*Air Components & Engrg., Inc.
939 Ken-O-Sha Industrial Dr.
P.O. Box 9385
Grand Rapids, MI 49509
616/452-3188
Fax: 616/452-0393

MINNESOTA

*Grubb Equip. - GES SCA
1754 Washington Avenue
Stillwater, MN 55082
612/430-1055
Fax: 612/430-3947

MISSISSIPPI

*Gulf States Engrg.
117 Richardson Dr.
Jackson, MS 39209
601/922-8725
Fax: 601/922-8728

MISSOURI

Cochrane Compressor Service & Supply Company
2207 S. 12th Street
St. Louis, MO 63104
314/772-2888
Fax: 314/772-3087

*St. Louis Compressor Serv. Co.
3863 Laclede Avenue
St. Louis, MO 63108
314/652-3400
Fax: 314/652-3405

NEW JERSEY

Argo Industrial
33 Terminal Avenue
Clark, NJ 07066
908/574-2400

*Argo Compressor & Pump Div.
326 Freylinghuysen Avenue
Newark, NJ 07114
201/242-2305

*Argo Industrial
1707 Imperial Way
Thorofare, NJ 08086
609/848-4200
Fax: 609/848-9077

NEW YORK

*Argo Compressor Serv. Corp.
19-35 Hazen Street
Jackson Hgts., LI, NY 11370
718/726-7800
Fax: 718/274-5041

Hayes Distributors, Inc.
1103-43rd Road
Long Island City, NY 11101
718/784-7965

*Siewert Equipment Co., Inc.
175 Akron Street
Rochester, NY 14609
716/482-9640
Fax: 716/482-4513

NORTH CAROLINA

*Edmac Compressor Co.
P.O. Box 227, 1551 M.L. King Dr.
Winston-Salem, NC 27102
919/725-2395
Fax: 919/725-2161

OHIO

Craun-Liebing Co.
1214 California Avenue
Akron, OH 44314
216/745-6544

SYTEK, IEM Div.
1089 Claycraft Road
Blacklick, OH 43004
614/864-9205
Fax: 614/864-0326

*SYTEK, IEM Div.
5100 Duff Drive
Cincinnati, OH 45246
513/874-5840
Fax: 513/874-5508

Craun-Liebing Co.
11801 Clifton Blvd.
Cleveland, OH 44107
216/228-7900

*SYTEK, IEM Div.
5131 Webster Street
Dayton, OH 45414
513/278-7355
Fax: 513/278-0270

*Tomlin Equipment Co.
242 Poplar Street
Toledo, OH 43605
419/691-3571
Fax: 419/691-1928

*Tomlin Equipment Co.
121 Keep Court
Elyria, OH 44035
216/228-0433
Fax: 216/324-2871

Argo Marine & Industrial
9001 Dutton Drive
P.O. Box 407
Twinsburg, OH 44087
216/425-3121
Fax: 216/425-4612

OKLAHOMA

Duncan Equipment Co.*
1005 South Second
Duncan, OK 73533
405/255-1216
800/375-5216 (in OK)
Fax: 405/255-0409

Duncan Equipmennt Co.*
3709 West Reno
Oklahoma City, OK 73107
405/947-0931
800/375-9470 (in OK)
Fax: 405/942-3735

Duncan Equipment Co.
9751 East 55th Place
Tulsa, OK 74146
918/663-3252
800/375-5678 (in OK)
Fax: 918/664-5720

OREGON

*Rogers Machinery Co., Inc.
14600 S.W. 72nd Avenue
Portland, OR 97223
503/639-6151
Fax: 503/639-1844

PENNSYLVANIA

*Airtek, Inc.
R.D. #3 Arona Road
P.O. Box 466
Irwin, PA 15642
412/351-3837
Fax: 412/864-7853

*Harris Pump & Supply Co.
5501 Campbells Run Road
Pittsburgh, PA 15205
412/787-7867
Fax: 412/787-7696

*R & M Associates
915 Madison Avenue
P.O. Box 920
Valley Forge, PA 19481
215/666-9080
Fax: 215/666-1766

SOUTH CAROLINA

*Edmac Compressor Co.
306 Catawba Street
Columbia, SC 29201
803/252-8000
Fax: 803/254-4898

TENNESSEE

*Wascon, Inc.
Route 4, Box 118
Livingston, TN 38570
615/823-1388
Fax: 615/823-4924

*Arkansas Industrial Machy.
2884 Sanderwood Drive
Memphis, TN 38118
901/363-2200
Fax: 901/363-6804

TEXAS

Air & Pump Co.
585 South Padre Island Dr.
Corpus Christi, TX 78405
512/289-7000
Fax: 512/289-9071

*Dallas Compressor
13717 Neutron Road
Dallas, TX 75234
214/233-9870
Fax: 214/233-1878

*McKenzie Equipment Co.
9260 Bryant Street
P.O. Box 34427
Houston, TX 77234
713/946-1413
Fax: 713/946-0559

*McKenzie Equipment Co.
18523 I.H. 35 North
Schertz, TX 78154-9504
512/651-9314
Fax: 512/651-9620

Duncan Equipment Co.
3511 North Central Freeway
Wichita Falls, TX 76306
817/855-6110
Fax: 817/855-0849

*AAS/UNIMAC
13773 Omega Road
Dallas, TX 75244
214/701-0400
Fax:

UTAH

Compressor Pump & Service
3323 West 2400 South
Salt Lake City, UT 84119
801/973-0154
Fax: 801/973-9546

VIRGINIA

*Engineered Sys. & Prods.
County Route 1, Box 19A
Concord, VA 24538
804/993-2500
Fax: 804/993-3752

*Engineered Sys. & Prods. Co.
8130 Virginia Pine Court
Richmond, VA 23237
804/271-7200
Fax: 804/271-8317

*Clinch River Corp.
Route 6, Box 60
Tazewell, VA 24651
703/988-2548
Fax: 703/988-9325

WASHINGTON

*Rogers Machinery Co., Inc.
1705 Harrison Avenue
P.O. Box 548
Centralia, WA 98531
206/736-9356

*Rogers Machinery Co., Inc.
7800 Fifth Avenue South
Seattle, WA 98108
206/763-2530
Fax: 206/763-1187

*Rogers Machinery Co., Inc.
Spokane Industrial Park
East 16615 Euclid Avenue
Spokane, WA 99216
509/922-0556
Fax: 509/922-0910

WEST VIRGINIA

Guyan Machinery Co.
P.O. Box 150
Chapmanville, WV 25508
304/855-4501
Fax: 304/855-8601

West Virginia Pump & Supply Co.
20 East 24th Street
Huntington, WV 25721
304/529-4161
Fax: 304/522-9361

WYOMING

*Compression & Components Co., Inc.
1907 Salt Creek Hwy.
P.O. Box 879
Mills, WY 82644
307/235-4700
Fax:

CANADA

*Beckland Equipment Ltd.
3250 Beta Avenue
Burnaby, B.C. V5G 4K4
604/299-8808
Fax: 604/299-6162

*A. G. Dunbar Co., Ltd.
10 Morris Drive, Unit 9
Burnside Industrial Park
Dartmouth, N.S. B3B 1K8
902/469-0981
Fax: 901/468-3157

*Canadian Air Compressor Ltd.
1875 Industrial Blvd.
Laval, Quebec H7S 1P5
514/334-5810

*Canadian Air Compressor, Ltd.
57 Atomic Avenue
Toronto, Ontario M8Z 5K8
416/252-9505
Fax: 416/252-9228

*Scott Industrial, Inc.
1515 Matheson Blvd., Unit C-1
Mississauga, Ontario L4W 2P5
416/624-6330

*Scott Industrial Prods. Ltd.
5859 CH St. Francois
Montreal, Quebec H4S 1B6
514/336-5661
Fax: 514/336-1158

AUSTRALIA

Godfrey Howden Engrg. Pty Ltd.
P.O. Box 84, Niddrie
Victoria 3042, Australia
338-3666, Ext. 39

Connersville Printing 3M

Revised 9/1/92

APPENDIX: B

NT TIMERS & ROCKER SWITCHES

Panel-Mount Digital Electronic Timers

exible programming, choose these timers. ve two separate SPST circuits, LCD display, backup in case of power loss, and manual e. Timers operate on 100 to 240 VAC, 50/60 Hz. Long-term error is ±15 seconds/month.

Timers have screw terminal connections. Hardware for panel mounting is included. UL recognized and CSA certified.

on	Cycle Length	Contact Rating @ 250 VAC	Max. Daily On/Off Cycles	Size Ht. × Wd. × Lg.	No.	NET EACH
Days	1 Min. to 23 Hr. 59 Min.	10A	8	3.78″ × 3.78″ × 2.22″	70395K71	$136.27
	1 Min. to 1 Week	15A	12	2.83″ × 2.83″ × 2.30″	70395K81	150.27

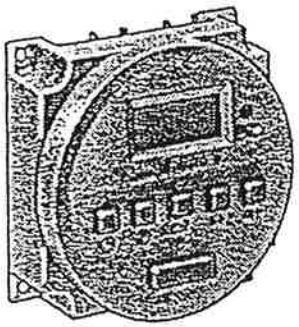
iterval Timers

cam-controlled, snap- that actuates at end of knob and pointer allow be set quickly.

models activate timer for just a push of a button. itch capacity of 15 amps ous motor operates Connections are .250″ units are 3½″H × 2⅞″W. ted and CSA certified.

d	Pushbutton Reset No.	NET EACH
6	7366K71	$85.77
6	7366K72	85.77
6	7366K73	85.77
6	7366K74	85.77
6	7366K75	85.77

Panel-Mount Digital 7-Day Timers



These single-circuit timers are a less sophisticated, less expensive alternative to the electronic panel-mount timers sold above. Timers have a minimum programming interval of one minute and NiCad battery backup with one-year memory retention. They can be used as a 24-hour timer (with weekend skipper) and as a 7-day timer with independent daily programs.

Timers are capable of up to six on/off cycles per day and have manual override. Both units are 2.36″H × 2.36″W × 1.34″D (.83″ behind panel depth). Fit into a 2.4″ circular cutout.

UL listed and CSA certified.

Switch	Volts	Amps	No.	NET EACH
SPST	100-240	10	71075K71	$33.22
SPDT	100-240	7	71075K72	37.38

l-Mount Digital Programmable Timers

mers are surface, mountable.

programmed to re- ess skipped). It can ed for momentary 7-day timer fea- 7-day programers have independming with override tomatic correction 2SPDT model also co ct capability. se and sunset prouth.

th a 9V battery AC, 50/60 Hz, and have contacts rated 15 amps @ 120 VAC. Size is 4⅛″H × 4⅛″W × 3″D. UL recognized and CSA certified.

Switch	No. of Independent Programs	On/Off Cycles Day	Week	No.	NET EACH
24-HOUR TIMER WITH SKIP-A-DAY					
SPDT	1	144	—	70425K81	$179.22
7-DAY TIMER					
SPDT	1	15	105	70425K82	146.57
365-DAY TIMERS					
SPDT	1	9	63	70425K83	185.73
2SPDT	2	8•	56•	70425K84	233.14
ASTRONOMIC 365-DAY TIMERS					
2SPDT	1	2	14	70425K85	195.18
2SPDT	2	2•	14•	70425K86	314.67

•Per pole.

71075 K71

FUNCTI[illegible]
- Weekday
- [illegible]e-of-day
- [illegible]t program for following switching times:
  - [illegible]/TUE/WED/THU/FRI/SAT/SUN (daily)
  - [illegible]N + TUE + WED + THU + FRI + SAT + SUN (weekly)
  - MON + TUE + WED + THU + FRI (Monday through Friday)
  - SAT + SUN (weekend)
- Re[illegible] clearing the whole switching program and [illegible]tting
- Overr[illegible] or Operation ON, Operation [illegible]tomatic ru[illegible]ng programs & Operation OFF

Approvals:
TH-817 TUV Approved 1991. UL & CSA ~~Pending 1992.~~
TH-827 TUV, UL & CSA ~~pending 1992.~~

Patents:
U.K. No. 20110265
France No. 913623
Germany No. M9006894.7
Taiwan No. 90995, 79200961
P.R.C. Pending
Italy Pending
U.S.A. Pending

[illegible]CATION

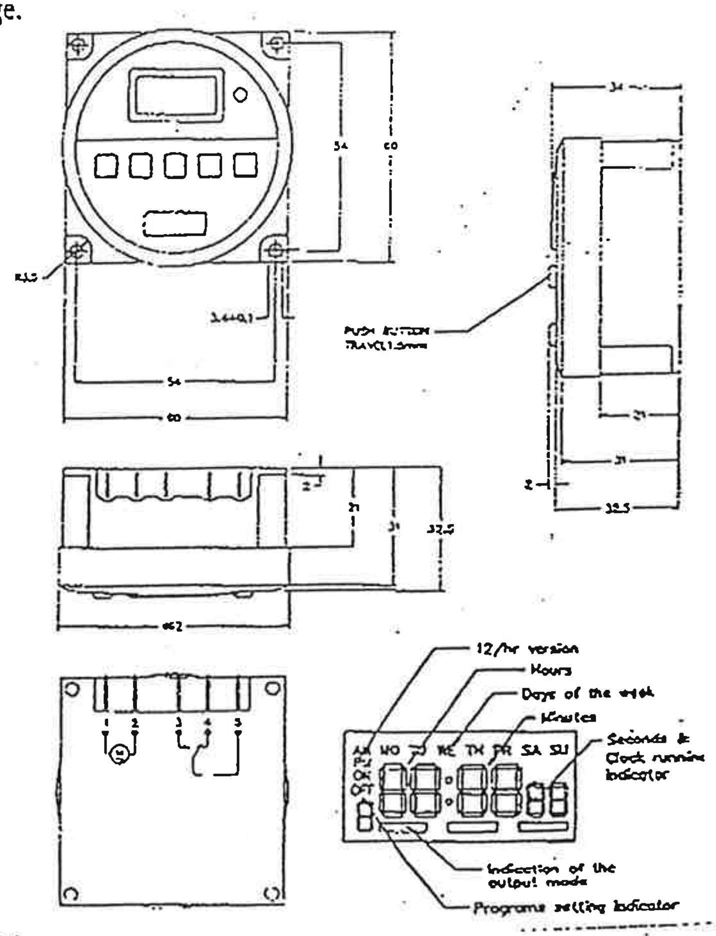
	RATED VOLTAGE RANGE	RATED FREQUENCY	RATED CURRENT @250VAC		SWITCHING
			RESISTIVE LOAD	INDUCTIVE LOAD	
[illegible]	100-240 VAC	50-60 Hz	10 Amps.	5 Amps.	Switch on
[illegible]	200-240 VAC	50-60 Hz	10 Amps.	5 Amps.	Switch on
[illegible]	100-240 VAC	50-60 Hz	7 Amps.	3.5 Amps.	Changeover
TH-81[illegible]	200-240 VAC	50-60 Hz	7 Amps.	3.5 Amps.	Changeover
TH-827[illegible]	200-240 VAC	50-60 Hz	16 Amps.	3 Amps.	Changeover

- Back[illegible] NiCd rechareable button battery 1.2 VDC. Life [illegible] more than 1,000 times from empty to fully charge.
- Programming interval minimum 1 minute On and Off.
- Operation temperature range: 0 to 55°C
- Storage temperature range: -10 to 75°C

APPLICATIONS:

Electric appliances and installations with highly accurate and periodically recurring working cycles, such as heating systems, furnaces, annealing and drying ovens, automatic, feeders, laboratory equipm[illegible], security and alarm system etc.

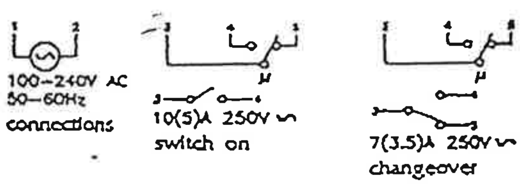
DIMENSIONS:



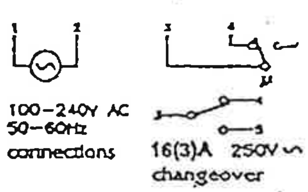
MODEL TH-817 & TH-827

Electronic Timeswitch daily and w[illegible]ekly program 1 channel

MODEL TH-817



MODEL TH-827



TIME, REPEAT STEP 2.1 TO 2.7 TO SET PROGRAM 2 TO 6.

3. TO RESET TIMER:

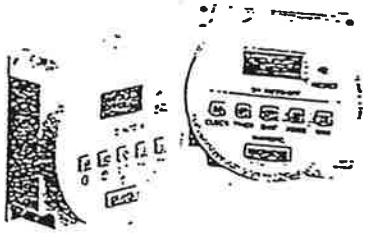
3.1 PRESS RESET / KEY TO RESET THE TIMER UNIT.
NOTICE: ONCE THE RESET KEY IS PRESSED. THE PREVIOUS TIME AND PROGRAM WILL BE CLEAR TO INITIAL STATE

4. TO SELECT ON/AUTO/OFF OR ON / AUTO/ MODE:

4.1 PRESS MANUAL / KEY TO SELECT ON/AUTO/OFF MODES:

4.2 ON / MODE IS TO TURN ON THE TIMER.
AUTO MODE IS TO SET THE TIMER TO PROGRAM MODE. IT WILL TURN ON/OFF ACCORDING THE PROGRAM TIME. (FROM ON TO AUTO. IT WILL TURN ON TIMER ACCORDING TO PROGRAM ON TIME. FROM OFF TO AUTO. IT WILL TURN OFF TIMER ACCORDING TO PROGRAM OFF TIME.) OFF / MODE IS TO TURN OFF THE TIMER.

5. WIRE CONNECTION:
PLEASE SEE THE WIRING DIAGRAM ON THE BACK OF THE UNIT.
THE VOLTAGE RANGE IS FROM 100-250 VAC.
THE MAX. POWER IS 2,500 VA.



TH-817 PROGRAMMABLE TIMER MODULE INSTRUCTION MANUAL

1. TO SET TIME AND DAY OF THE WEEK:

1.1 SET DAY OF WEEK:

1.1.1 PRESS CLOCK / KEY AND DAY / 1...7 KEY. THE DAY OF WEEK WILL BE CHANGED.
1.1.2 RELEASE BOTH KEYS. THE DAY OF THE WEEK WILL BE SET.

1.2 SET HOUR:
1.2.1 PRESS CLOCK / KEY AND HOUR / h+ KEY. THE HOUR WILL BE CHANGED.
1.2.2 HOLD CLOCK / AND HOUR / h+ KEYS MORE THAN 3 SECONDS. THE HOUR WILL SHIFT FASTER
1.2.3 RELEASE BOTH KEYS. THE HOUR WILL BE SET.
1.3 SET MINUTE:
1.3.1 PRESS CLOCK / KEY AND MINUTE / m+ KEY. THE MINUTES WILL BE CHANGED.
1.3.2 HOLD CLOCK / AND MINUTE / m+ KEYS MORE THAN 3 SECONDS. THE MINUTE WILL SHIFT FASTER.
1.3.3 RELEASE BOTH KEYS. THE MINUTE WILL BE SET.

NOTICE: WHEN SETTING TIME AND DAY OF THE WEEK. IT WILL RESET THE SECONDS.

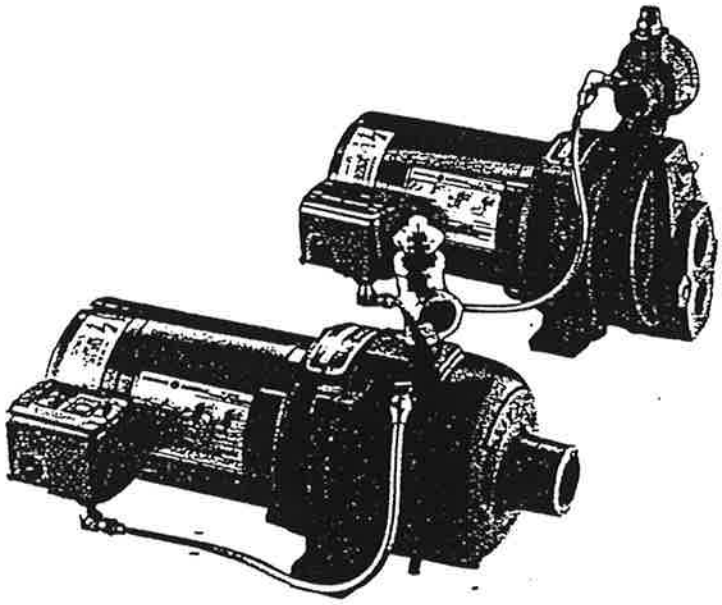
2. TO SET PROGRAMS:

2.1 PRESS TIMER / KEY TO ENTER INTO PROGRAM MODE.
2.2 PROGRAM 1 TURN ON TIME IS READY FOR SET.
2.3 PRESS DAY / 1...7 KEY TO SELECT THE DAY OF WEEK. THERE ARE 10 SETTING FOR DAY OF WEEK TO BE CHOSE FROM: (1). MO. (2). TU. (3). WE. (4). TH. (5). FR. (6). SA. (7). SU. (8). MO+TU+WE+TH+FR. (9). SA+SU. (10). MO TO SU.
2.4 PRESS HOUR / h+ TO SET HOUR.
2.5 PRESS MINUTE / m+ TO SET MINUTE.
2.6 AFTER SETTING THE PROGRAM 1 ON TIME. PRESS TIMER / KEY TO SET PROGRAM 1 OFF TIME.
2.7 REPEAT STEP 2.3 TO 2.5 TO SET THE PROGRAM 1 OFF TIME.
2.8 AFTER SETTING PROGRAM 1 ON/OFF

APPENDIX: C

HJ Series

1/3, 1/2, 3/4 & 1 Horsepower
Shallow and Deep Well
Jet Pumps



MYERS HJ SERIES JET PUMPS OFFER THE PREMIUM, QUALITY FEATURES REQUESTED BY TODAY'S PUMP INSTALLERS. Myers advanced engineering design and manufacturing know-how are combined to give you a complete line of jets built to perform with dependability for home and farm water systems as well as many commercial and industrial applications.

ADVANTAGES BY DESIGN

FULL FEATURED DESIGN WHICH PROVIDES OPTIMUM PERFORMANCE

- Dual compartment 115/230 volt GE motor.
- Square D pressure switch.
- Copper pressure tubing with brass fittings.
- Comes complete with priming tee on shallow well models and pressure regulator on deep well models.
- Cast iron pump housing and motor bracket.
- Engineered reinforced thermoplastic impeller (optional brass impeller available).

WHERE INNOVATION MEETS TRADITION

Shallow Well Specifications

Pump Cat. No.	Motor HP	Suction	Discharge	Motor Specifications (Built-In Overload Protection)	Shipping Wt — Lbs.
HJ33S*	1/3	1 1/4"	3/4"	115/230 volt—capacitor	42
HJ50S*	1/2	1 1/4"	3/4"	115/230 volt—capacitor	44
HJ75S*	3/4	1 1/4"	1"	115/230 volt—capacitor	58
HJ100S*	1	1 1/4"	1"	115/230 volt—capacitor	62

See Section 250 for Size and Catalog Numbers of Pressure Tanks.
* For Brass Impeller add "-1" to Catalog Number. Example: HJ50S-1

Deep Well Specifications

Pump Cat. No.	Dischg.	Pressure Switch Setting	Packer Type Inner Pipe Size For 2" Well	Twin Type Drop Pipe Size For		Foot Valve Size—Twin Type Only	Motor Specifications (Built-In Overload Protector)	Shipping Wt.—Lbs.	Shipping Weight of Jet Packages For			
				4" Min. Well	3" Min. Well				Twin Type			Packer Type
									4" Min. Well		3" Min. Well	2" Well
									C.I.	Brass		
HJ33D*	3/4"	20-40	1"	1 1/4" x 1"	1" x 1"	1"	115/230 volt—capacitor	42	4	—	5	4
HJ50D*	3/4"	20-40	1"	1 1/4" x 1"	1" x 1"	1"	115/230 volt—capacitor	44	4	5	5	4
HJ75D*	1"	20-40	1"	1 1/4" x 1 1/4"	—	1 1/4"	115/230 volt—capacitor	58	4	5	—	4
HJ100D*	1"	20-40	1"	1 1/4" x 1 1/4"	—	1 1/4"	115/230 volt—capacitor	60	4	5	—	4

See Section 250 for Size and Catalog Numbers of Pressure Tanks.
NOTE: For Complete Water System — Order Basic Pump Unit, Proper Ejector Package, Well Adapter and Pressure Tank Separately.
* For Brass Impeller add "-1" to Catalog Number. Example: HJ75D-1

Myers®

HJ Series

1/3, 1/2, 3/4 & 1 Horsepower
Shallow and Deep Well
Jet Pumps

Shallow Well Selection Table

Pump Cat. No.	Motor HP	Pressure Switch Setting	** Capacity in U.S. Gallons Per Minute			
			Discharge Pressure, Lbs.	5 Ft. Suction Lift	15 Ft. Suction Lift	25 Ft. Suction Lift
HJ33S*	1/3	20-40	20	8.5	6.5	4
			30	8.5	6.5	4
			40	6	5	3.5
			50	3.5	2.5	—
HJ50S*	1/2	20-40	20	14.5	11.5	7
			30	14.5	11.5	7
			40	10	8	6
			50	5.5	3.5	2
HJ75S*	3/4	20-40	20	23.5	17.5	10.5
			30	23.5	17.5	10.5
			40	19.5	16.5	10.5
			50	12.5	9	5
HJ100S*	1	20-40	20	27.5	21	13
			30	27.5	21	13
			40	25.5	21	13
			50	19	15.5	12
			60	11	7	2

Deep Well Selection Table 20/40 PSI Pressure Switch Setting

Pump Catalog Number	Motor HP	Average Regulator Setting	Jet Package Catalog Number			Vertical Distance in Feet from Pump to Low Water Level									
			Twin Type 4" Min. Well		Packer 2" Well	30	40	50	60	70	80	90	100	110	120
			Cast Iron	Bronze		**Capacity in U.S. Gallons Per Minute									
HJ33D*	1/3	20 PSI	DW33-I	DW33	P33	9	7.5	6	5	4	3	—	—	—	—
HJ50D*	1/2	22 PSI	DW50-I	DW50	P50	10.5	9.5	8	6	5	4	2.5	—	—	—
HJ75D*	3/4	26 PSI	DW75-I	DW75	P75	16.5	13.5	10	8	7	6	4	3	1	—
HJ100D*	1	34 PSI	DW100-I	DW100	P100	18	15.5	12.5	10	9	8	5.5	4.5	2.5	1

Deep Well Selection Table 30/50 PSI Pressure Switch Setting

Pump Catalog Number	Motor HP	Average Regulator Setting	Jet Package Catalog Number			Vertical Distance in Feet from Pump to Low Water Level									
			Twin Type 4" Min. Well		Packer 2" Well	30	40	50	60	70	80	90	100	110	120
			Cast Iron	Bronze		**Capacity in U.S. Gallons Per Minute									
HJ50D*	1/2	22 PSI	DW50-I	DW50	P50	9	8	7	5.5	4.5	3.5	2	—	—	—
HJ75D*	3/4	26 PSI	DW75-I	DW75	P75	15.5	12	10.5	7.5	6	5	3	2	—	—
HJ100D*	1	34 PSI	DW100-I	DW100	P100	18	15	12	10	9	7.5	5	4	2	1

NOTE: For Complete Water System — Order Basic Pump Unit, Proper Ejector Package, Well Adapter and Pressure Tank Separately.
* For Brass Impeller add "-1" to Catalog Number. Example: HJ50D-1
** Capacity given to nearest half gallon.

JET PUMP TANK MOUNTING KITS

For Horizontal Tanks

Jet Pump Mounting Kit	Pump Number	Tank No.	Tank Capacity	Approx. Dimension Inches		
				Width	Height	Length
. 14446A24	HJ33S, HJ33D, HJ50S, HJ50D	T12	12 gal.	12	25	24
		T30	30 gal.	16	29	36

For Well-X-Trol Tanks

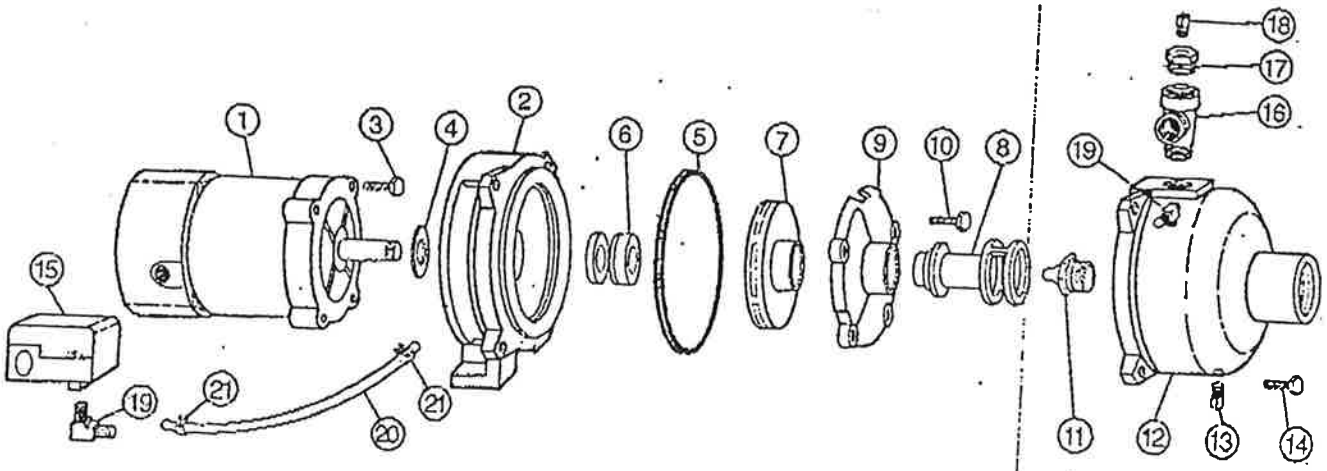
Jet Pump Tank Mounting Kit No. 14446A25	Pump Number	Tank No.	Tank Capacity	Approx. Dimension Inches	
				Width	Height
	HJ33S, HJ33D, HJ50S, HJ50D	WX-104-OC	10 gal.	15¾	27¾
		WX-201-OC	14 gal.	15¾	32¾
		WX-202-OC	20 gal.	15¾	40

K3248 3/92
Printed in U.S.A.

Myers®
F. E. Myers, A Pentair Company
1101 Myers Parkway
Ashland, Ohio 44805-1923

APPENDIX: D

HJA Series Ejecto Pumps Parts List
1/3, 1/2, 3/4 & 1 HP
Shallow Well



Ref. No.	Description	Part No. for 1/3 HP units	Part No. for 1/2 HP units	Part No. for 3/4 HP units	Part No. for 1 HP units
1	Motor - 115/230 V. - HJA	20923A000	20924A000	20934A000	20935A000
2	Bracket - HJA	20936D001	20936D001	20936D004	20936D004
3	Screw, Cap, 3/8" -16 UNC x 7/8" - 4 Req'd.	19101A008	19101A008	19101A008	19101A008
4	Slinger	05059A318	05059A318	05059A318	05059A318
5	Gasket	05014A157	05014A157	05014A157	05014A157
6	Seal, Shaft	14525A000	14525A000	14525A000	14525A000
7	Impeller - Lexan	16821B010	26188B010	19196B004	19196B004
	Impeller - Brass	17681B003	17682B004	19196B000	19196B000
8	Venturi	25886A406	26232B000	26232B001	26232B002
9	Diffuser	12370B000	12371B000	14379B001	14379B001
10	Screw, Cap, 1/4" -20 UNC x 1" - 3 Req'd.	19099A023	19099A023	19099A023	19099A023
11	Nozzle	12366A000	12367A000	26224A002	26224A001
12	Case, Pump	18622D001	18622D001	18622D001	18622D001
13	Plug, Pipe, 1/4" NPT - 2 Req'd.	05022A009	05022A009	05022A09	05022A09
14	Screw, Cap, 3/8" -16 UNC x 1-1/4" - 4 Req'd.	19101A020	19101A020	19101A020	19101A020
15	Switch, Pressure	15760A000	15760A000	15760A000	15760A000
	Nut, Conduit Nipple	08715A000	08715A000	08715A000	08715A000
	Nipple, Conduit - For units w/separate nipple	15021A001	15021A001	15021A001	15021A001
16	Tee	05002A001	05002A001	05002A001	05002A001
17	Bushing	05004A016	05004A016	05004A016	05004A016
18	Plug, Pipe	05022A009	05022A009	05022A009	05022A009
19	Fitting, 1/4" NPT - 2 Req'd.	23168A004	23188A004	23189A004	23188A004
20	Tube	10649A127	10649A127	10649A127	10649A127
—	Package - Consists of ref. nos. 17 thru 20	15285A025	15285A025	15285A026	15285A026
21	Hose Clamp (2 Req'd.)	26280A000	26280A000	26280A000	26280A000

LIMITED ONE (1) YEAR WARRANTY

Advanced Remediation Technologies, Inc., provides the following one (1) year limited warranty to the original purchaser of Advanced Remediation Technologies, Inc.'s soil and groundwater remediation equipment.

Advanced Remediation Technologies, Inc. will, at its option, repair or replace free-of-charge any part or parts found to be defective in material or workmanship under normal use for the period of one (1) year from the original purchase date or, if that date cannot be established, the date of manufacture. This warranty is void if the product is not installed and used in accordance with the operating instructions, has been subject to alteration or damage, or is defective due to unauthorized service or repair.

Repair or replacement is the purchaser's sole remedy under this or any other warranty on the product, whether expressed or implied. ADVANCED REMEDIATION TECHNOLOGIES, INC., SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND. ADVANCED REMEDIATION TECHNOLOGIES, INC. EXPRESSLY DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE AFTER THE ONE (1) YEAR PERIOD. Some states do not allow the exclusion of incidental or consequential damages or limitation of an implied warranty so the above exclusion and limitation may not apply to you.

To make a claim, contact Advanced Remediation Technologies, Inc., Appleton Business Center, New Ipswich, NH 03071, identify the product, and follow the instructions for return, which will be provided.

This warranty gives you specific legal rights, and you may have other rights which may vary from state-to-state.

BRAINARD•KILMAN™

EVACUATOR II

All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. We reserve the right to make changes at any time without notice and without incurring any obligation.

Longyear
U.S. Products Group

2175 W. Park Ct • P.O. Box 1959
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FAX (404)498-2841

INTRODUCTION

The Brainard-Kilman™ EVACUATOR II pneumatic pump is available in two versions: a top and bottom loading version or a top loading only version to pump fluids to the surface for treatment. The pump is designed to fit in groundwater wells as small as 4 inches (102 mm) in diameter. The EVACUATOR II uses a down-well pneumatic logic system to automatically determine the optimal pumping rate needed to maintain a constant groundwater depression level. The pneumatic valve, located on the pump, eliminates the need for any controls at the surface.

This concise manual introduces the EVACUATOR II and provides step-by-step guidelines for successful installation and operation. Please read this information carefully before using the pump and keep the manual handy for field reference.

SYSTEM COMPONENTS

This section introduces the EVACUATOR II pump system which consists of an EVACUATOR II pump, a 4-inch diameter Well Clincher, and a 5-micron filter with auto drain, all standard with the purchase of each pump. It also details the hoses required for the pump and the air compressor required to power the pump.

EVACUATOR II

The EVACUATOR II, shown in Figure 1, consists of a stainless steel assembly with intake ports at the top and bottom or top only and connections for air, exhaust, and product discharge tubing. The intake port on the top of the EVACUATOR II is a stainless steel, poppet check valve with a Viton® o-ring seal. The bottom water intake port consists of a Buna-N check ball in a stainless steel seat. An epoxy coated, Buna-N float rides on a stainless steel rod providing the mechanism to cycle the pump (Figure 2).

WELL CLINCHER

The EVACUATOR II pump system comes complete with a 4-inch (102 mm) diameter Well Clincher which is used at the well head for pump support, air and water connections, and to provide a watertight seal. The Well Clincher is made of PVC, precision machined so that its inner diameter matches the outer diameter of 4-inch PVC well monitor pipe. The Well Clincher features an o-ring seal for vacuum applications. It comes complete with brass fittings required to connect to the EVACUATOR II pump system and a stainless steel eye hook to attach a pump support cable.

HOSES

The following is a brief description of the hoses required to operate the EVACUATOR II pump system.

1. Air Supply Line (down hole): 1/2-inch I.D. (13 mm) Buna-N lined hose with twin tubing attached. The main air supply line enables the pump to quickly and efficiently evacuate the fluid from the EVACUATOR II pump. The attached polypropylene twin tubing supplies a continuous flow of air exhaust to the level logic. It is recommended to use this specific tubing for the air supply line to the pump. This tubing is custom made for the EVACUATOR II.

2. Air Exhaust Line (down hole): 1/2-inch I.D. (13 mm) Buna-N lined hose. The exhaust line allows the EVACUATOR II to quickly exhaust the air and allows the pump to begin filling with fluid. The exhaust line does not have to be run to the surface, but it cannot be submerged. Submersion of the exhaust line will not allow the EVACUATOR II to cycle properly.

3. Fluid Discharge Line (down hole): 3/4-inch I.D. (19 mm) Buna-N lined hose to transfer fluids to surface.

AIR SOURCE

The EVACUATOR II pump system uses compressed air to displace the water in the pump and force it to the surface. An air source is not included with the EVACUATOR II pump system due to the wide variation in compressor requirements for each site. We recommend clean, dry air to prolong the life of the EVACUATOR II and prevent the introduction of further contamination in the groundwater. In freezing temperatures, the addition of an air dryer may be required to avoid freeze damage to the system.

AIR FILTRATION

A coalescing filter and air regulator assembly is included with each EVACUATOR II pump system. It must be installed at the well head to assure that clean air is supplied to the EVACUATOR II, within its working pressure range of 40 psi to 100 psi (275 kPa to 690 kPa). CAUTION: air pressures greater than 100 psi (690 kPa) applied to the EVACUATOR II may damage the pneumatic logic system.

The air consumption rate of the EVACUATOR II pump system will depend on several site-specific variables including operating air pressure and total fluid recovery rate. A worksheet in Appendix A shows the air consumption for the pump system. Once the air consumption rate has been determined, a local air compressor dealer will be able to specify the appropriate size compressor (and air dryer if applicable).

PRINCIPLES OF OPERATION

The EVACUATOR II pumps fluids by air displacement: compressed air forces the fluids out of the annular space of the pump to the surface.

The EVACUATOR II operates in two stages: the ON, or discharge stage, and the OFF, or filling stage. The stages are controlled by a float inside the annular space of the pump which rides on the top of the fluid. When the pump is in the OFF stage, the bottom and top inlet valves are open and fluid is entering the annular space of the pump. As the annular space fills, the float reaches its maximum height which triggers a valve to initiate the ON stage. During the ON stage, high pressure air closes the top and bottom inlet valves, forcing the fluid to evacuate the annular space of the pump through the discharge pipe. When all of the fluid has been removed from the annular space, the float, which has now reached its lower limit, triggers the three-way valve to stop pressurizing and exhaust the annular space which closes the valve and begins the OFF stage again. This cycle is repeated as rapidly as the pump fills up with fluid; therefore, the EVACUATOR II automatically determines its own pumping rate. The pumping rate can be decreased by regulating the flow at the surface using a gate valve.

The EVACUATOR II is designed to maintain a maximum fluid level in the well which is even with the top of the pump. This level is 36 inches from the bottom of the pump and is located approximately at the white teflon o-ring that separates the pump top from the annular tube. If the EVACUATOR II is being used in the optional "top loading only" configuration, the fluid level will be maintained 39 inches from the bottom of the pump, flush with the top of the top cap.

The standard EVACUATOR II pump system, configured for top and bottom loading, is designed to pump a maximum of 10.8 gpm (40 L/min). The optional top-loading-only EVACUATOR II will pump at a maximum of 4.8 gpm (18 L/min).

INSTALLATION AND OPERATION

The EVACUATOR II may be used to remove fluids from wells that are 4 inches (102 mm) in diameter or larger. The relative location of the pump to the air supply and the recovery system on the surface may differ from site to site. Similarly, the length of discharge and air hoses required to connect the pump may vary; otherwise, the installation and operation of the EVACUATOR II is essentially the same for any application.

WARNING: Any electrical components used in an explosive atmosphere must be located in compliance with Chapter 5 of the National Electric Code and any other local codes. This would apply to electrically-powered air compressors.

INSTALLATION PROCEDURE

The following steps outline the connection of the air, exhaust, and fluid discharge hoses, lowering the EVACUATOR II into the well, and attaching the hoses to the Well Clincher.

1. Measure the distance (Hw) from the top of the well to the existing ground water level (Figure 3).

2. Add to that distance the height of the water depression (Hwd) you are trying to create (Figure 3).

3. Cut the down-hole hoses to the following lengths - (Figure 3):

   - Main air supply line (with attached twin tubing): Hwd - 21" (Hwd -533 mm)
   - Air exhaust tubing: Hwd - 21" (Hwd - 533 mm)
   - Fluid discharge tubing: Hwd - 6" (Hwd - 152 mm)

   This will bring all hoses flush with the well casing at the surface. Final cuts can be made to attach hoses to the Well Clincher.

4. NOTICE: We recommend that a teflon coated, steel safety cable be attached to the EVACUATOR II in order to minimize the tension on the down hole hoses. Stainless steel eye hooks can be found on the top of the pump and inside the top cap of the Well Clincher.

5. The 1/4" (6 mm) air logic exhaust and 1/16" (1.6 mm) logic supply hoses are connected to the Well Clincher using a Prestolok fitting. Simply cut the tubing square and insert it into the Prestolok fitting until the tube bottoms out. To release, push the locking shoulder of the fitting down and pull tubing out.

6. Place the bottom half of the Well Clincher on the top of the recovery well pipe. Make sure that the top of the recovery well is smooth and straight. The Well Clincher should fit snugly.

7. Connect the down-hole hoses and the safety cable to the top of the EVACUATOR II, see Figure 3.

8. Connect the down-hole hoses and safety cable to the under side of the Well Clincher top (Figure 4).

9. Lower the EVACUATOR II down the well and secure the top cap of the Well Clincher to the bottom half which was previously attached to the well.

10. Connect the fluid discharge line to the appropriate fitting on the top of the Well Clincher, see Figure 4.

11. Attach the air regulator/coalescing filter assembly to the side of the well vault.

12. Connect the main air supply line to the inlet of the regulator/filter assembly.

13. Connect the outlet of the regulator/filter assembly to the air supply line on the top of the Well Clincher, see Figure 4.

14. Adjust the supply air at the regulator/filter assembly to the appropriate pressure. **REMEMBER: DO NOT EXCEED 100 psi (690 kPa).**

15. Open the air supply valve to begin pump operation.

APPENDIX A

AIR CONSUMPTION

The EVACUATOR II pump uses compressed air to transport fluid from a recovery well to the surface. The volume of compressed air required will be dependent on three factors:

1. Number of EVACUATOR II pumps
2. Operating air pressure of the pumps
3. Pumping rates (gallons or liters per minute)

As the number of EVACUATOR II pumps increases, the compressed air consumption rate will also increase.

As the operating air pressure of the EVACUATOR II pump is increased, the volume of air consumed during each pump cycle increases. The following table outlines the air consumption rate per cycle of the EVACUATOR II at different operating air pressures.

TABLE A-1

Operating Air Pressure psi	kPa	Compressed Air Consumption Rate (ft^3/cycle)	cm^3/cycle
60	414	0.83	14
70	483	0.94	15
80	552	1.05	17
90	620	1.15	19
100	690	1.26	21

Very few sites will require an operating air pressure of 100 psi (690 kPa), but it is recommended that the highest air consumption rate, 1.26 ft^3/cycle (21 cm^3/cycle) be used when determining the total compressed air consumption for the site.

The pumping rate required to achieve the desired water table depression will directly influence the compressed air consumption rate. The EVACUATOR II pump draws 1.2 US gallons (4.5 L) of fluid/cycle and can pump a maximum of 10.8 gpm (41 L/min) with the top and bottom loading version.. The pumping rate of each recovery well should be determined so that the total pumping rate of the site can be calculated.

The following questions will help determine the compressed air consumption rate:

1. How many recovery wells will be used on this site?
2. What is the pumping rate for each recovery well?
3. What is the total pumping rate for the site? (Add pumping rates from question 2)
4. Use the total pumping rate calculated in question 3 in the following formula to determine the air consumption rate.

$$\text{AIR CONSUMPTION } [ft^3/min] = \frac{\text{Total Pumping Rate [gal/min]}}{10.8} \times \text{Air consumption per cycle } (ft^3) \text{ at operating pressure}^*$$

$$\text{AIR CONSUMPTION } [cm^3/min] = \frac{\text{Total Pumping Rate [L/min]}}{40} \times \text{Air consumption per cycle } (cm^3) \text{at operating pressure}^*$$

The operating air pressure will depend on the amount of force the EVACUATOR II will need to push the water from the pump to the remediation equipment on the surface (total dynamic head). As the operating air pressure is set higher, more air will be consumed with each cycle of the pump due to the physical characteristics of compressed air. For example, at an operating pressure of 60 psi (414 kPa), the EVACUATOR II will consume 0.8 ft^3 (14 cm^3) of air/cycle. At an operating pressure of 100 psi (690 kPa), the EVACUATOR II will consume 1.26 ft^3 (21 cm^3) of air/cycle. The total water recovery rate will dictate how often the pump cycles.

* see table A-1, page 6

LIST OF FIGURES

Figure 1: EVACUATOR II pump - Exterior view

Figure 2: EVACUATOR II pump - Interior view

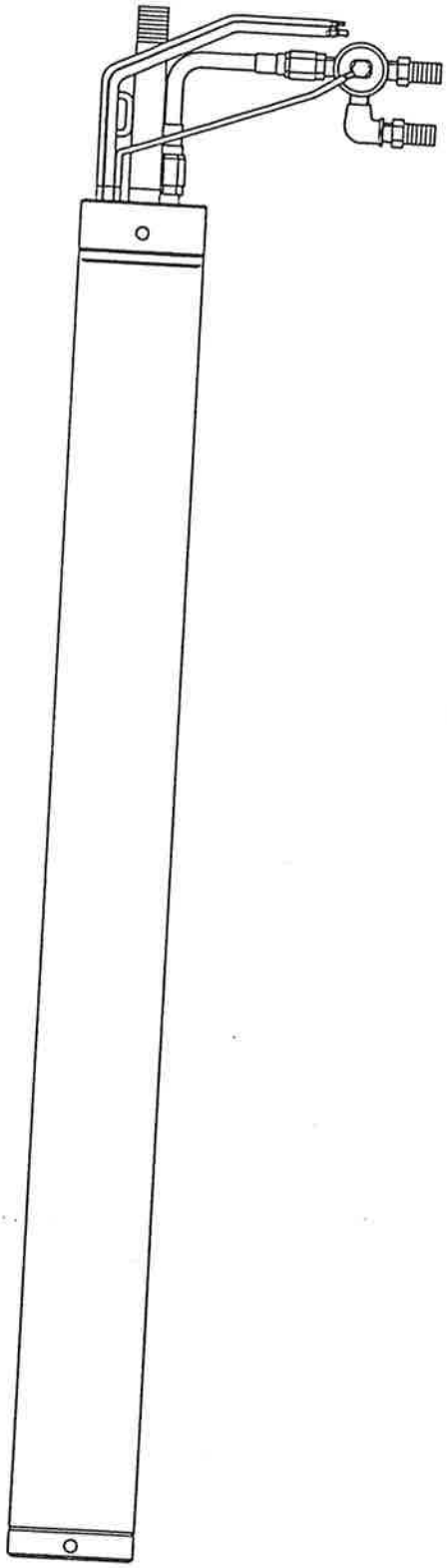
Figure 3: EVACUATOR II pump schematic down a well, showing hose connections and relative lengths of hoses compared to water draw down level.

Figure 4: Well Clincher hose connections (down hole and top)

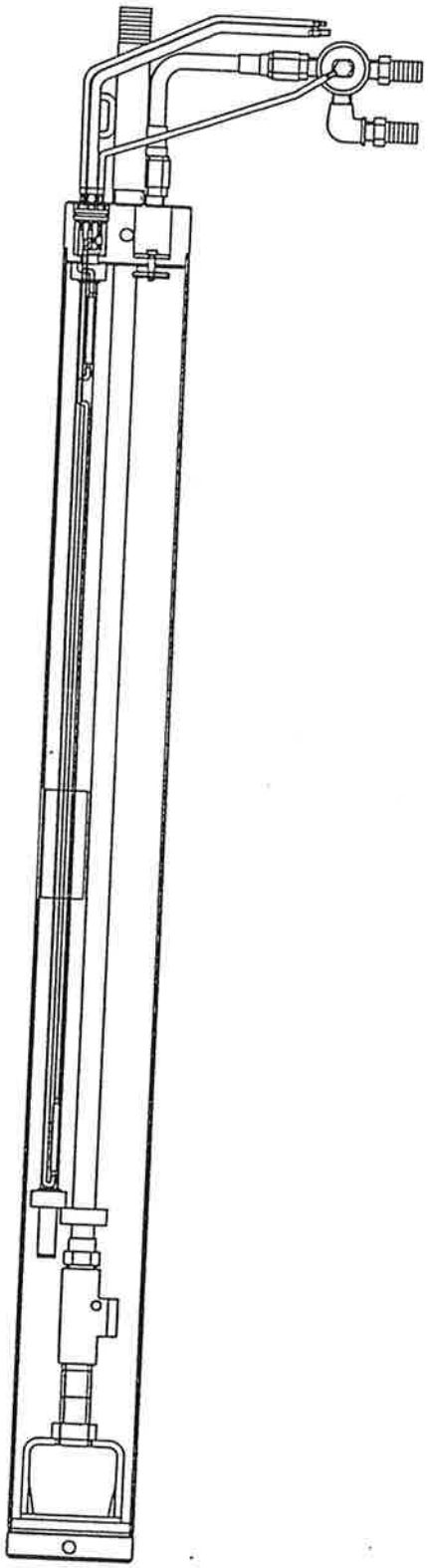
Figure 5: Top loading system showing product

Figure 6: Top and bottom loading system showing dissolved phase

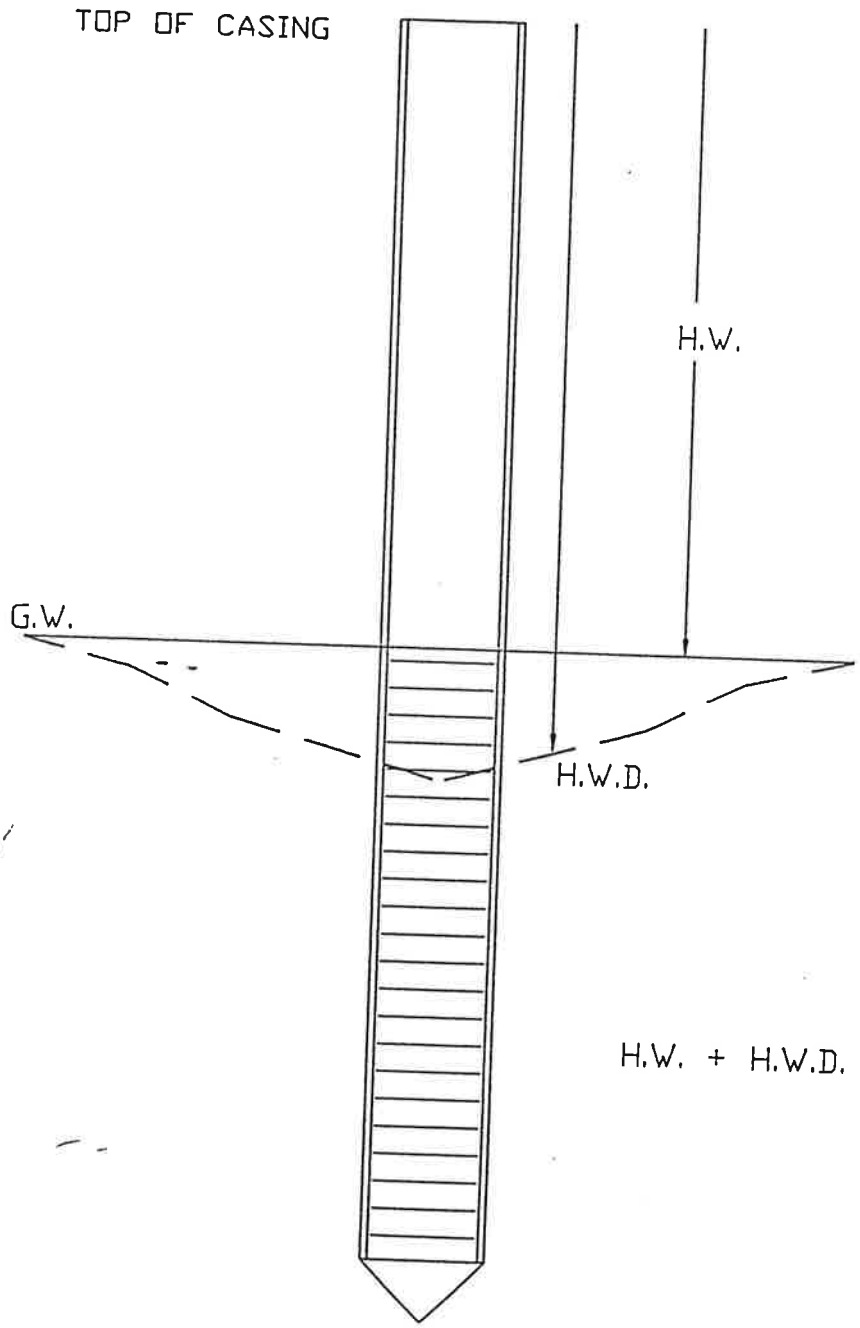
(FIG. 1)



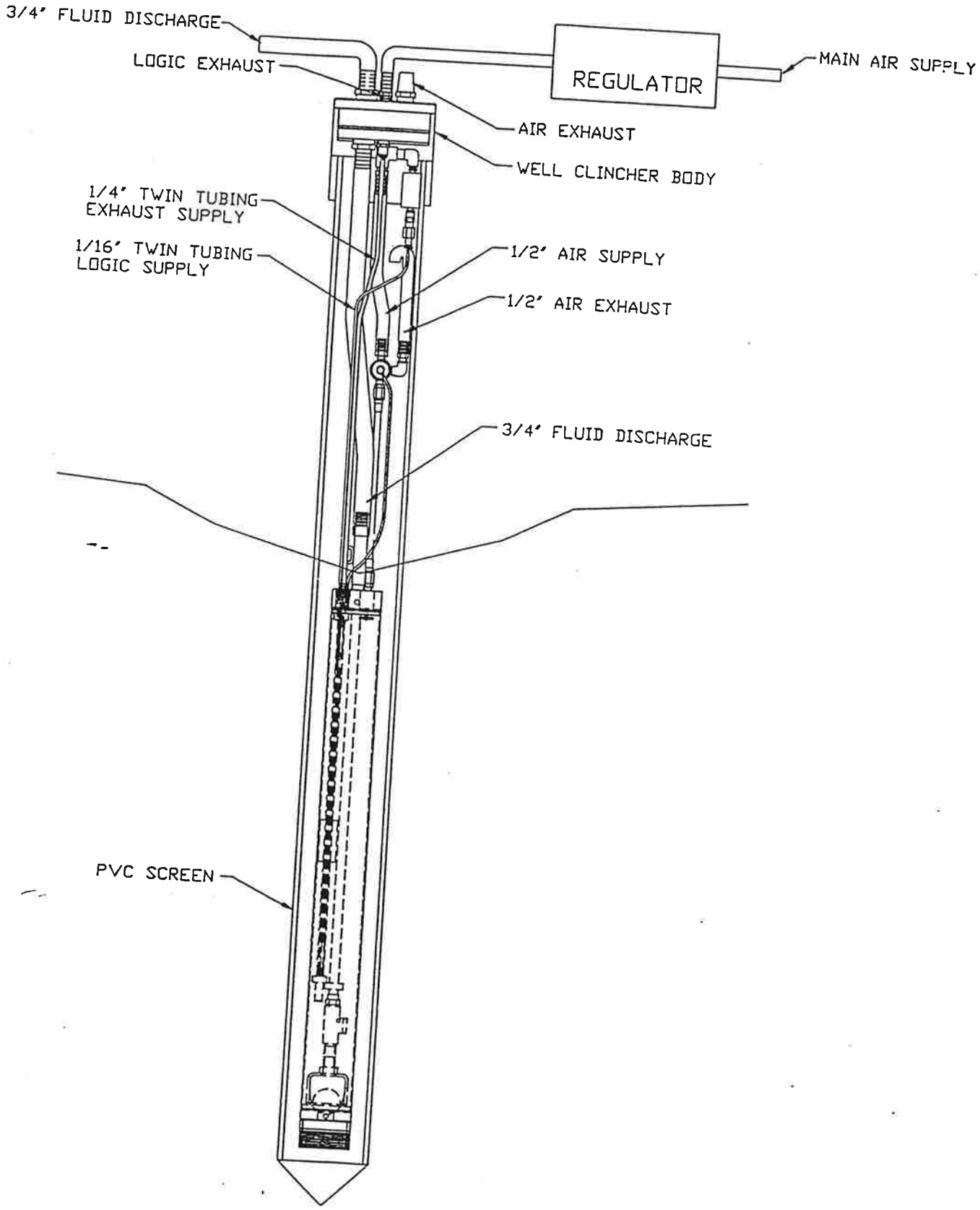
(FIG. 2)



(FIG. 3)

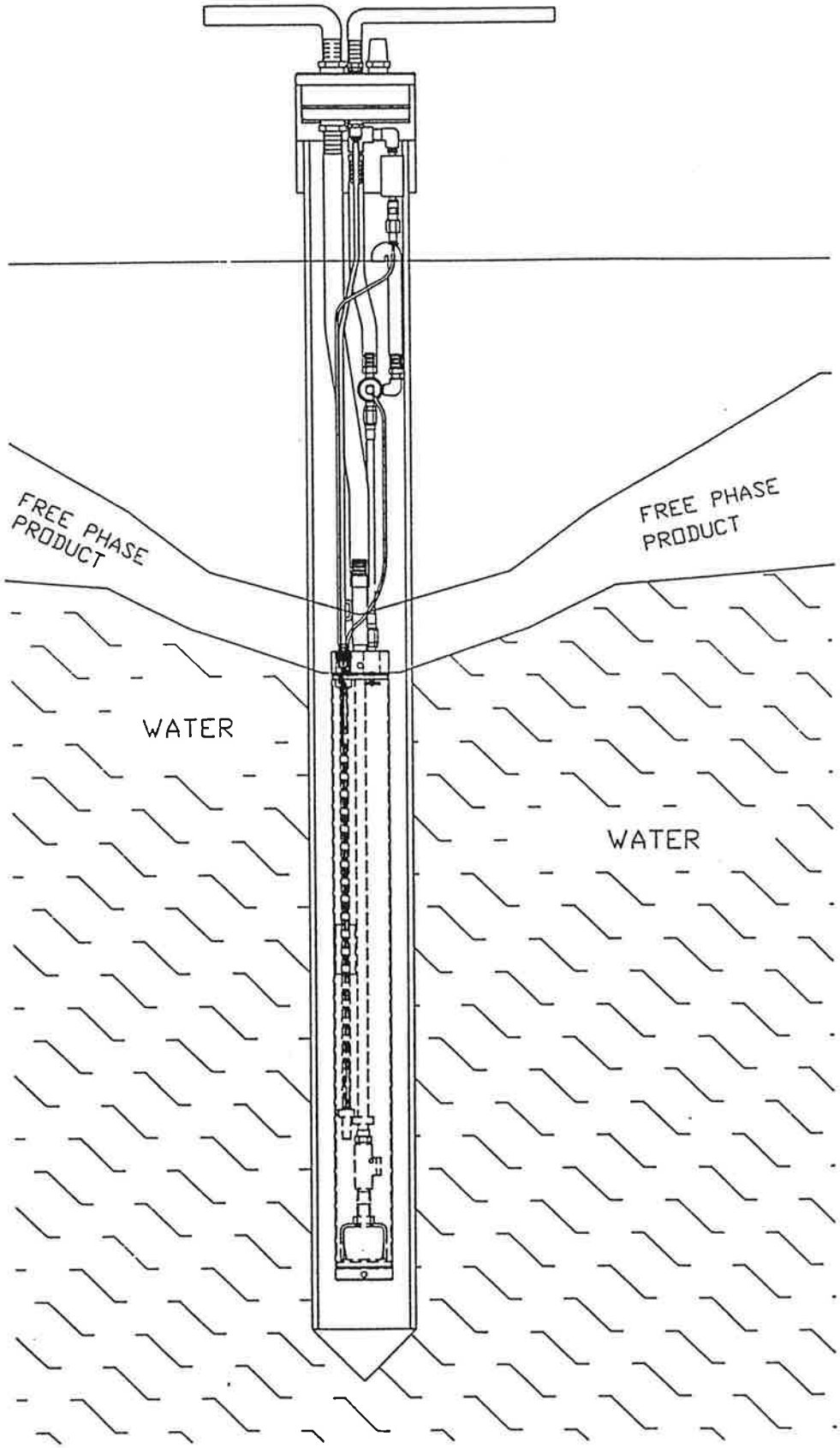


EVACUATOR II
TOP/BOTTOM LOADING
(FIG. 4)

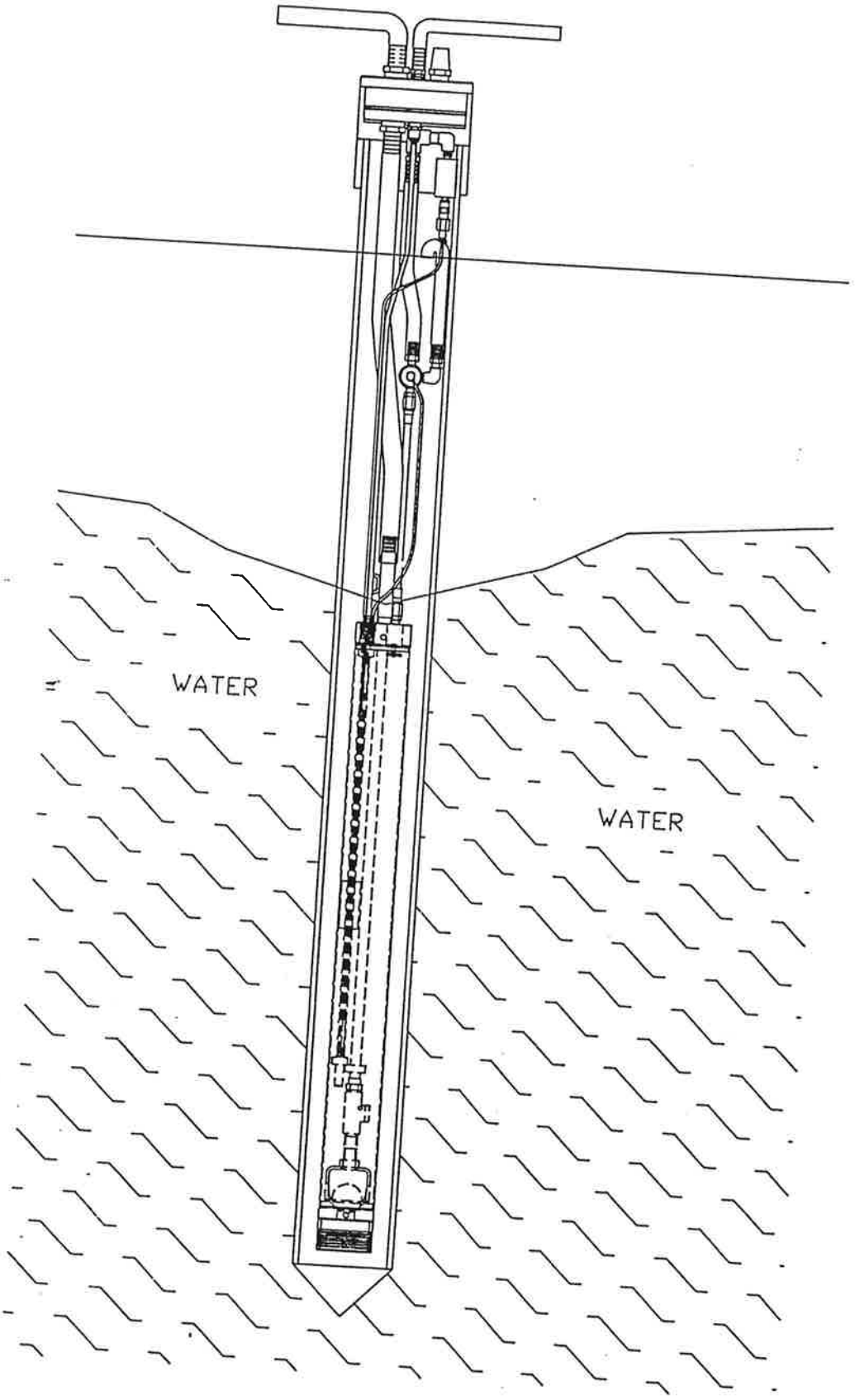


(FIG. 5)

TOP LOADING

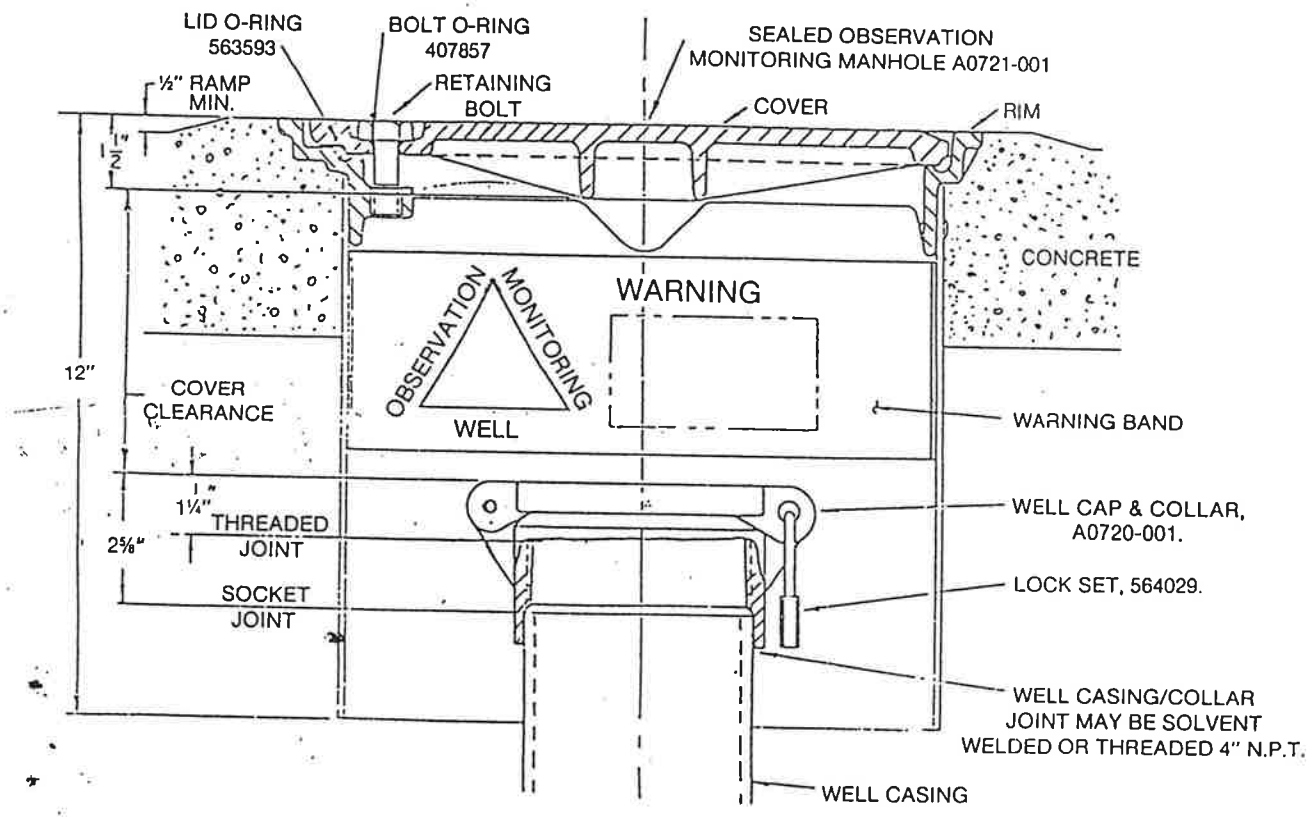


(FIG. 6)
TOP/BOTTOM LOADING



INSTALLATION/MAINTENANCE INSTRUCTIONS FOR A720, A721 & A722

OBSERVATION/MONITORING WELL MANHOLE



EMCO® WHEATON

2300 Industrial Park Drive
Wilson, NC 27893
(919) 243-0150

FIELD INSTALLATION INSTRUCTIONS

1. Set monitoring well casing as desired, allowing proper clearance between the cap and collar assembly and manhole rim, to prevent damage to the cap and collar from the manhole cover.

2. Attach Cap and Collar Assembly A720-001. The collar to casing joint may be made in two ways; one collar accommodates both methods.

   2a. The collar is equipped with standard 4" NPT pipe threads. For a threaded joint allow 1¼" above casing for cap and collar plus cover clearance.

   2b. A 4" pipe socket is provided for the use of an adhesive or solvent welding agent. Allow 2⅜" above casing for cap and collar plus cover clearance.

   IMPORTANT NOTE: The compatibility of the adhesive or solvent welding agent and the type of detector to be used on the particular site should be checked out prior to use. Petroleum based solvents or adhesives may produce vapors which falsely trigger the detection system and, therefore, should not be used.

3. Set the Observation Monitoring Manhole A721-001 over the capped casing, adjust the height of the manhole rim to allow for ½" minimum of mounding above the finished grade. This will allow proper drainage of surface fluids.

4. Carefully backfill around manhole and proceed with concrete.

MAINTENANCE INSTRUCTIONS

1. Lubricate retaining bolt threads periodically with a silicone based lubricant such as General Electric Silicone Oil. Do not use petroleum based lubricants.

2. Examine the retaining bolt O-ring 407857 for damage or deterioration; replace if necessary.

3. Examine the lid O-ring 563593 for damage or deterioration; replace if necessary.

IMPORTANT NOTE: Seal is retained in groove with an adhesive from the factory. When replacing the original be sure to use an adhesive that is compatible with your detection system. Do not use petroleum based or other adhesive types which may produce vapors that can trigger the detection system.

EMCO WHEATON RECOMMENDS: A non-solvent base contact adhesive such as Weldwood Non-flammable Contact Cement.

Part No. 563987

APPENDIX D

Health and Safety Plan

GROUNDWATER TECHNOLOGY ®

Groundwater Technology, Inc.
1245 Kings Road, Schenectady, NY 12303 USA
Tel: (518) 370-5631 Fax: (518) 370-5864

APPENDIX D
SITE SAFETY PLAN

Prepared for:

Philips Saugerties
1033 Kings Highway
Saugerties, New York 12477

May 10, 1994

Project Manager: Richard A. Hixon

Health and Safety Representative: Barry Bedaw

SSP11.3

#68Reports\Philips\5019-SSP.394

SITE EMERGENCY FORM

Contaminants of Concern: Solvents and Freon
Minimum Level of Protection: Modified Level D

Do not endanger your life. Survey the situation before taking any action.

GTI Office Telephone:	(518) 370-5631
Site Location Address:	1033 Kings Highway Saugerties, New York 12477
Telephone Located at:	Site Office 914-246-2811

EMERGENCY PHONE NUMBERS

IN THE EVENT OF ANY EMERGENCY, CONTACT PROJECT MANAGER OR HEALTH AND SAFETY REPRESENTATIVE

Ambulance:	246-5660	Project Manager:	Rich Hixon
Fire:	338-1600	Health and Safety Rep:	Barry Bedaw
Police:	246-9800	Client Contact:	John Bedell
Poison Control:	1-800-682-9211	State Agency:	NYSDEC 914-255-5453
Hospital Name:	Kingston Hospital	Hospital Phone:	914-331-3131

FIRST AID FOR PETROLEUM HYDROCARBON EMERGENCIES

Ingestion: DO NOT INDUCE VOMITING. Call Poison Control; follow instructions. Administer CPR, if necessary. Seek medical attention.

Inhalation: Remove person from contaminated environment. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND A STANDBY PERSON IS PRESENT. Administer CPR if necessary. Seek medical attention.

Skin Contact: Brush off dry material, remove wet or contaminated clothing. Flush skin thoroughly with water. Seek medical attention if irritation persists.

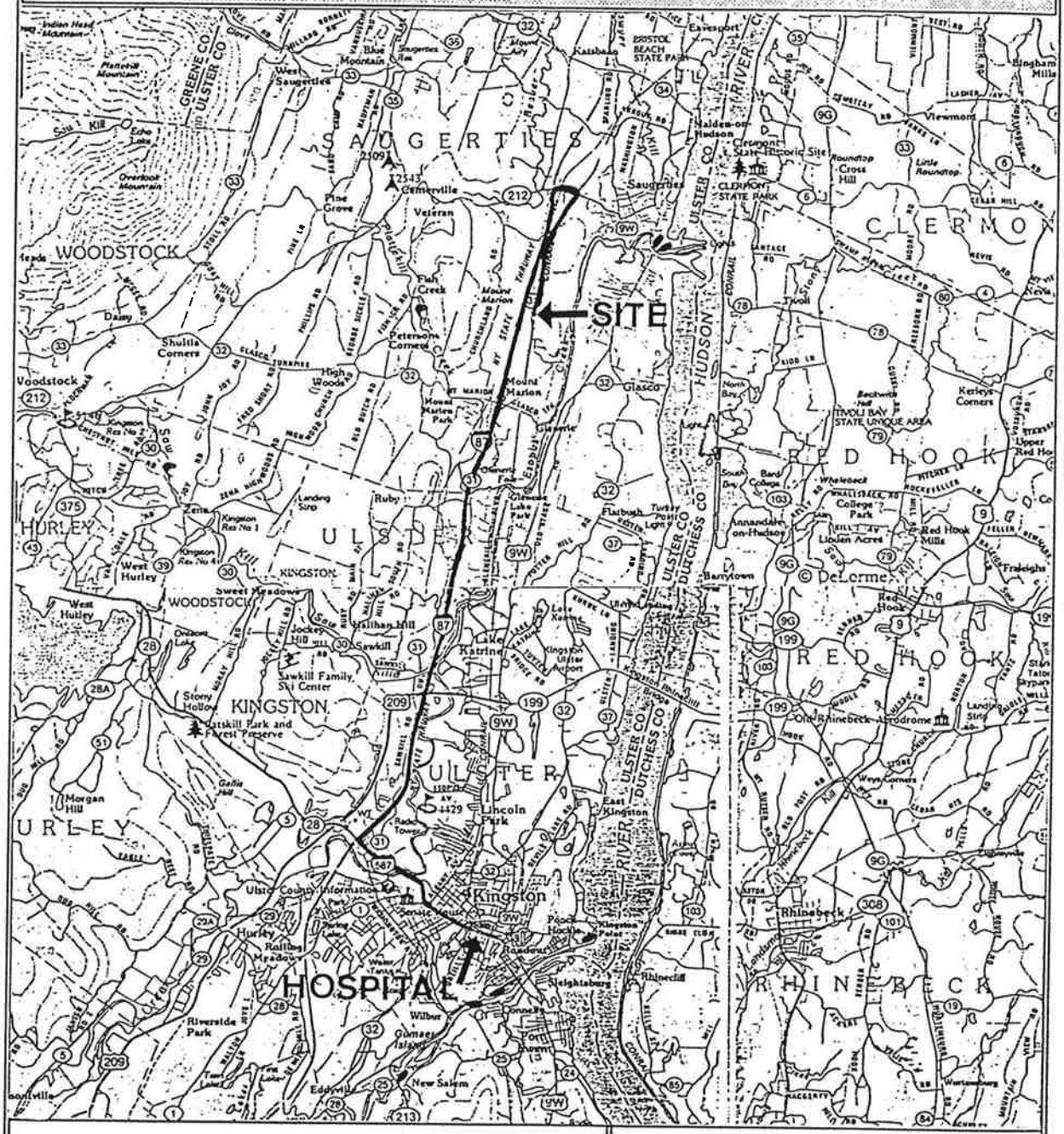
Eye Contact: Flush eyes with water for 15 minutes. Seek medical attention.

Exposure Symptoms: Headache, dizziness, nausea, drowsiness, irritation of eyes, nose, throat, breathing difficulties.

Contingency Plan: Report incident to Project Manager and Regional Health and Safety Manager after emergency procedures have been implemented.

GROUNDWATER TECHNOLOGY

HOSPITAL LOCATION MAP



Hospital Directions

Exit site and turn north (left). Take Route 31 to Route 212 west. Take interstate 87 south to Exit 19. After the toll booth, enter the rotary and exit at Route 587 east. At the light, take Broadway east to the hospital on the left.

Hospital Information:

Name	Kingston Hospital
Address	396 Broadway
City, State	Kingston, New York 12401
Phone	914-331-3131

GROUNDWATER TECHNOLOGY

EMERGENCY FIRST AID

1. Survey the situation. Do not endanger your own life. **DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND A STANDBY PERSON IS PRESENT.**

2. Call 911 (if available) or the fire department **IMMEDIATELY.** Explain the physical injury, chemical exposure, fire, or release.

3. Decontaminate the victim without delaying life-saving procedures.

4. If the victim's condition appears to be noncritical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by trained Emergency Medical Services (EMS) personnel: Let the doctor assume the responsibility for determining the severity of the injury. If the condition is obviously serious, EMS must transport the victim.

5. Notify the Project Manager and the Regional Health and Safety Manager. Complete the Groundwater Technology Accident/Incident (near miss) Form within 24 hours.

EMERGENCY FIRST AID PROCEDURES	
To Stop Bleeding	**Cardiopulmonary Resuscitation (CPR)**
1. Give medical statement.	1. Give medical statement.
2. Assure airway, breathing, circulation	2. Arousal: Check for consciousness.
3. Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use nonpermeable gloves). Direct pressure will control most bleeding.	3. Open airway with chin-lift.
4. Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT.** Use pressure points for 30-60 seconds to help control severe bleeding.	4. Look, listen, and feel for breathing.
5. Continue primary care and seek medical aid as needed.	5. If breathing is absent, give 2 slow, full rescue breaths.
	6. Check the pulse for 5 to 10 seconds.
	7. If pulse is present, continue rescue breathing: **1 breath every 5 seconds**

TABLE OF CONTENTS

SITE EMERGENCY FORM i

HOSPITAL LOCATION MAP ii

EMERGENCY FIRST AID iii

1.0 EMERGENCY RESPONSE 1
- 1.1 Site Specifics 1
  - 1.1.1. Emergency/Medical Resources 2
- 1.2 Contingency/Evacuation Plan 3
- 1.3 Usual Procedures for Injury 3
- 1.4 Emergency Treatment 3
  - 1.4.1 Ingestion 3
  - 1.4.2 Inhalation/Confined Space 4
  - 1.4.3 Inhalation/Other 4
  - 1.4.4 Skin Contact/Non-Caustic Contaminant (Petroleum, Gasoline, etc) 4
  - 1.4.5 Skin Contact/Corrosive Contaminant (Acids, Hydrogen Peroxide) 4
  - 1.4.6 Eyes 4

2.0 INFORMATIONAL SUMMARY 5
- 2.1 Health and Safety Summary 5
- 2.2 Other Site Specific Considerations 6

3.0 INTRODUCTION 7
- 3.1 Background 7
- 3.2 Purpose 7
- 3.3 Objective 7
- 3.4 Authorization 7
- 3.5 Amendments 8

4.0 HAZARD EVALUATION 9
- 4.1 Site Tasks 9
- 4.2 Job Task Hazards 9
  - 4.2.1 All Field Tasks 9
  - 4.2.2 Well Installation; Well Development; Well Gauging; Well Bailing; Soil Excavations & Groundwater Sampling 10
  - 4.2.3 Sample Preservation 10
  - 4.2.4 Cleaning Equipment 10
  - 4.2.6 Confined Space Entry 10
  - 4.2.7 Occupational Noise 11
  - 4.2.8 Heat Stress 12
  - 4.2.9 Exposure: Cold Stress 14

5.0 PERSONAL PROTECTIVE EQUIPMENT 15

6.0 DECONTAMINATION PROCEDURES 17

TABLE OF CONTENTS (continued)

7.0 HEALTH AND SAFETY REQUIREMENTS 19
- 7.1 Medical Monitoring Program 19
- 7.2 Training 19
- 7.3 Visitor Policy 19
- 7.4 Work Zones Area 19
- 7.5 First Aid Equipment 20
- 7.6 Drilling Procedures 20
- 7.7 Fire Prevention 20

8.0 PROJECT PERSONNEL 22
- 8.1 Medical/Technical Advisors 22

APPENDICES

A: Agreement and Acknowledgement Statement
B: Visitor Policy
C: Site Safety Plan Amendment Sheet
D: MSDS/Contaminant Profiles
E: Accident Investigation Form
F: Vapor Monitoring Forms
G: Confined Space Entry Permit
H: Excavation and Trenching
I: OSHA
J: Electrical Safety
K: Contingency Plans
L: Maps

1.0 EMERGENCY RESPONSE

1.1 Site Specifics

In the event of an accident or emergency situation, immediate action must be taken by the first person to recognize the event. First aid equipment is located on site inside the Groundwater Technology, Inc. vehicle. Notify: I) the Site Safety Officer and, 2) the Project Manager and Regional Safety Director about the situation immediately after emergency procedures are implemented.

	Title	Name	Telephone
1.	Regional Manager	Frank Aceto	215-558-1730
2.	Health & Safety Specialist	Barry Bedaw	518 370-5631
3.	Project Manager	Rich Hixon	518-370-5631
4.	Site Supervisor	Mike Sykes	518-370-5631
5.	Site Safety Officer	Carl Aldrich	518-370-5631
6.	Site Contact	John Bedell	914-246-2811
7.	State Agency Contact	NYSDEC	914-255-5453

For the purpose of this document, "site" refers to only the portion of the facility adjacent to Building 2A/2B where and when remedial action construction work is being performed, as delineated or marked off with flagging tape, cones, fencing, or other barricades.

1.1.1. Emergency/Medical Rescurces

Ambulance	914-246-5660
Local Fire	914-338-1600
Local Police	914-246-9800
Poison Center	1-800-682-9211
Hospital	Kingston Hospital 396 Broadway Kingston, New York 12401
National Response Center	1-800-424-8802
EPA (Information Line)	1-800-424-9346
Chemtrec	1-800-424-9300
Dig Safe	_____

1.2 Contingency/Evacuation Plan

It is possible that a site emergency could necessitate evacuating all personnel from the site. If such a situation develops, appropriate signals will be given for site evacuation. Personnel shall evacuate the site in a calm and controlled fashion and regroup a predetermined location. The route of evacuation will be dependent on wind direction, severity and type of incident, etc. Refer to **Appendix K.**

The site must not be re-entered until back-up help, monitoring equipment and/or personal protective equipment is on hand.

1.3 Usual Procedures for Injury

1. Telephone for ambulance/medical assistance if necessary. Whenever possible, notify the receiving hospital of the nature of physical injury or chemical overexposure. If no phone is available, transport the person to the nearest hospital. Refer to **Appendix K** for additional information.
2. Send/take this SSP with the attached MSDS's to medical facility with injured person.
3. If the injury is minor, proceed to administer first aid.
4. Notify the Site Safety Officer, Project Manager, and the Regional Safety Director of all accidents, incidents and near miss situations.
5. Complete Preliminary Incident Form found in **Appendix E.**

1.4 Emergency Treatment

When transporting an injured person to a hospital, bring this site safety plan to assist medical personnel with diagnosis and treatment. In all cases of chemical overexposure, follow standard procedures as outlined below for poison management, first aid, and, if applicable, cardiopulmonary resuscitation. Four different routes of exposure and their respective first aid/poison management procedures are outlined below: Refer to **Appendix K.**

1.4.1 Ingestion:

DO NOT INDUCE VOMITING. Transport person to nearest hospital immediately.

1.4.2 Inhalation/Confined Space:

DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND A STANDBY PERSON IS PRESENT.

1.4.3 Inhalation/Other:

Move the person from the contaminated environment. Initiate CPR if necessary. Call or have someone call for medical assistance. Refer to MSDS for additional specific information. If necessary, transport the victim to the nearest hospital as soon as possible.

1.4.4 Skin Contact/Non-Caustic Contaminant:

Wash off skin with a large amount of water immediately. Remove any affected clothing and rewash skin using soap, if available. Transport person to a medical facility if necessary.

1.4.5 Skin Contact/Corrosive Contaminant (Acids, Hydrogen Peroxide):

Wash off skin with a large amount of water immediately. Remove any affected clothing and rewash skin with water. Transport person to a medical facility if necessary.

1.4.6 Eyes:

Hold eyelids open and rinse the eyes immediately with large amounts of water for 15 minutes. If possible, have the person remove his/her contact lenses (if worn). Never permit the eyes to be rubbed. Transport person to a medical facility as soon as possible.

2.0 INFORMATIONAL SUMMARY

2.1 Health and Safety Summary

CONTAMINANTS OF CONCERN

1,1-DICHLOROETHANE, FREON, METHYLENE CHLORIDE, TETRACHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, TRICHLOROETHYLENE, VINYL CHLORIDE

ACTION LEVELS

Action levels have been developed by Groundwater Technology, Inc. health and safety professionals. Action levels are those concentrations at which an upgrade in personal protective equipment (PPE) is required. Organic vapor concentrations are to be monitored in the field by the use of flame ionization or photoionization detectors (FID or PID) with readings being taken in the breathing zone occupied by Groundwater Technology field personnel to determine whether an action level has been exceeded. Log all air monitoring results on the Vapor Monitoring Sheet found in the appendix section.

Ionization Detector Response

Photoionization or Flame Ionization Detector

11.0	to	25.0	: Level C
<25.0		"	: Level B to be worn
Above 500.00			: Immediately withdraw from area:

Combustible Gas Response

0.0	to	10.0% LEL	: Continue with normal activity
Above 10.0% LEL			: Immediately withdraw from area

Oxygen Detector Response

0.0	to	19.5% Oxygen	: Level B is mandatory
19.5%	to	22.0% Oxygen	: Continue with normal activity
Above 22.0% Oxygen			: Immediately withdraw from area

Colormetric Detector Tube (CDT) (Vinyl Chloride)

>0.5 ppm : Level B to be worn

HAZARD SUMMARY

Job Task	Level PPE	Air Monitoring Instrument	Frequency
Drilling/Excavation	Modified Level D	FID, CDT & O2-LEL	Start-up of work at each new task location

Well Installation	Modified Level D	FID, CDT & O2-LEL	Start-up of work at each new task location
Well Survey, Gauging	Modified Level D	FID, CDT & O2-LEL	Start-up of work at each new task location
Well Developement	Modified Level D	FID, CDT & O2-LEL	Start-up of work at each new task location
Groundwater and soil sampling	Modified Level D	FID, CDT & O2-LEL	Start-up of work at each new task location

Note: "Start up of work at each new task location" means to monitor the air quality at each new operation on the site. The breathing zone is the area inside a 1 foot radius around the head.

3.0 INTRODUCTION

3.1 Background

Groundwater Technology, Inc. has been retained to perform environmental services at the location on the cover page of this document. This Site Safety Plan is prepared in accordance with OSHA 29 CFR 1910.120.

3.2 Purpose

The purpose of the site safety plan (SSP) is to provide Groundwater Technology field personnel subcontractors and other visitors with an understanding of the potential chemical and physical hazards that exist or may arise while the tasks of this project are being performed.

This SSP describes the procedures to be followed in order to reduce employee exposure to potential health hazards which may be present at the project site. The project site is defined as the portion of the facility adjacent to Building 2A/2B when and where remedial action construction work is being performed. The emergency response procedures necessary to respond to such hazards are also described within this SSP.

3.3 Objective

The primary objective is to ensure the well-being of all field personnel and the community surrounding this site. In order to accomplish this, project staff and approved subcontractors shall acknowledge and adhere to the policies and procedures established herein. Accordingly, all personnel assigned to this project shall read this site safety plan and sign the Agreement and Acknowledgement Statement (**Appendix A**) to certify that they have read, understood and agreed to abide by its provisions.

3.4 Authorization

Groundwater Technology personnel have the authority to stop work performed by our sub-contractors at this site if work is not performed in accordance with the requirements of this Site Safety Plan.

3.5 Amendments

Any changes in the scope of work of this project and/or site conditions must be amended in writing on the Site Safety Plan Amendment Sheet (**Appendix B**) and approved by Regional Health and Safety Manager.

4.0 HAZARD EVALUATION

4.1 Site Tasks

The field tasks covered by this Site Safety Plan includes soil boring samples, drilling, monitoring well installation, monitoring well maintenance, monitoring well survey, groundwater well gauging, monitoring well development, vapor screening, groundwater and soil sampling.

4.2 Job Task Hazards

4.2.1 All Field Tasks

The following hazards may be encountered.

- Organic Vapors: The inhalation of volatile organic vapors during all operations can pose a potential health hazard. Hazard reduction procedures include monitoring the ambient air with a PID and/or FID and use of Personal Protective Equipment. Workers should stand upwind of the source of contamination whenever possible.

- Flammable Vapors: Presence of flammable vapors can pose a potential fire hazard and health hazard. Hazard reduction procedures include monitoring the ambient air with an O_2/LEL meter. If the LEL reading exceeds 10%, leave the site immediately and contact the fire department.

- Oxygen: Atmospheres that contain a level of oxygen greater than 22% pose an extreme fire hazard (the usual ambient oxygen level is approximately 20.5%). This hazard can be compounded by the fact that vapors associated with this site are highly flammable. All personnel encountering atmospheres that contain a level of Oxygen greater than 22% must evacuate the site immediately and must notify the Fire Department. If Oxygen Level is less than 19.5%, do not enter the space.

- Vehicular traffic: All employees will be required to wear a fluorescent safety vest at all times while on site. In addition, supplemental traffic safety equipment use can be exercised when warranted by specific task (ie., drilling or excavation). Supplemental equipment can be items such as cones, cone flags, barricades and/or caution tape.

4.2.2 Well Installation; Well Development; Well Gauging; Well Bailing; Soil Excavations & Groundwater Sampling

Skin and eye contact with contaminated groundwater and/or soil may occur during these tasks. Nitrile gloves and approved safety glasses must be worn. When splash potential exists, safety goggles must be worn for additional protection.

4.2.3 Sample Preservation

When hydrochloric acid is used, skin and eye contact can occur. This hazard can be reduced with the use of Nitrile gloves and the use of safety glasses, safety goggles should be worn additional if there is a potential splash hazard present.

4.2.4 Cleaning Equipment

Skin and eye contact with methanol, alconox, or other cleaning substances can occur while cleaning equipment. This hazard can be reduced with use of Nitrile gloves and the use of goggles or safety glasses.

4.2.6 Confined Space Entry

Excavation pits, storage tanks, subsurface vaults, basements and sheds are examples of confined spaces. Confined spaces can be identified as an area having any one of the following characteristics:

- limited access and egress
- unfavorable for natural ventilation, and
- not designed for continuous human occupancy

Organic and/or combustible vapors may be trapped resulting in lack of oxygen (anoxia) and/or overexposure to vapors. When site work takes place in a confined space, the air must be monitored for:

a. oxygen level
b. flammable vapors
c. toxic vapors, dust, mist

The following air monitoring procedures must be followed before entering a confined space.

a. Oxygen Level: Monitor for % Oxygen with a O_2/LEL Meter to ensure a oxygen level between 19.5 and 22%. Because of the high vapor density of the contaminants associated with this site there is a high probability that vapors in the enclosed spaces or vaults will replace any oxygen that is present, even if the space is open to the air. Therefore, oxygen level monitoring will be done at the top, middle and bottom of the enclosed space to determine if there is a minimum acceptable oxygen level of 19.5% prior to entry. The oxygen/LEL meter is factory set to sound an alarm at levels less than 19.5% oxygen.

   If oxygen is less than 19.5% or greater than 22%, do not enter the space.

b. Explosive Vapors: Monitor for % of Lower Explosive Limit (LEL) with a O_2/LEL meter to determine whether vapor concentrations within the confined space are within the flammable range. If LEL readings exceed 10% **personnel MUST leave the site immediately and contact the project manager.**

c. Toxic Vapors: Monitor for toxic vapors with a FID to determine whether toxic vapors within the confined space exceed the action levels. FID readings will be taken at the top, middle and bottom of a vault, shed, or other confined space to determine vapor levels.

d. Summary: Do not enter the confined space unless:

   - the oxygen concentration is between 19.5 and 22%
   - the LEL is less than 10%
   - Miniram readings are less than 5.0 mg/m^3 (SCBAs must be worn if the readings exceed 5.0 mg/m^3)
   - PID readings are less than 5.0 ppm (SCBAs must be worn if the readings exceed 5.0 ppm)

ALL MONITORING EQUIPMENT MUST BE CALIBRATED AND MAINTAINED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS

4.2.7 Occupational Noise

Requirements set forth in the OSHA Hearing Conservation Regulation (OSHA 1910.95) shall be adhered to during work on-site. Hearing protection shall be provided to the employee where sound pressure levels exceeds 85 dB. Hearing protection shall be worn where sound pressure levels in areas and/or on equipment exceeds 90 dB. Typical Groundwater Technology drilling operations have been monitored with a sound level meter and indicate that hearing protection is required for all personnel while engaged in this action.

4.2.8 Heat Stress

Since climatic changes cannot be avoided, work schedules will be adjusted to provide time intervals for intake of juices, juice products and water in an area free from contamination and in quantity appropriate for fluid replacement.

Heat stress may occur even in moderate temperature areas and may present any or all of the following:

A. Heat Rash: result of continuous exposure to heat, humid air, and chafing clothes. Heat rash is uncomfortable and decreases the ability to tolerate heat.

B. Heat Cramps: result of the inadequate replacement of body electrolytes lost through perspiration. Signs include severe spasms and pain in the extremities and abdomen.

C. Heat Exhaustion: result of increase stress on the vital organs of the body in the effort to meet the body's cooling demands. Signs include shallow breathing; pale, cool, moist skin; profuse sweating; dizziness.

D. Heat Stroke: result of overworked cooling system. Heat stroke is the most serious form of heat stress. Body surfaces must be cooled and medical help must be obtained immediately to prevent severe injury and/or death. Signs include red, hot, dry skin; absence of perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma; and death.

HEAT STRESS PREVENTION

A. Replace body fluids (water and electrolytes) lost through perspiration. Solutions may include a 0.1% salt and water solution or commercial mixes such as Gatorade or Squench. Employees must be encouraged to drink more than the amount required to satisfy thirst.

B. Cooling devices to aid the natural body ventilation. Cooling occurs through evaporation of perspiration and limited body contact with heat-absorbing protective clothing. Utilize fans and air conditioners to assist in evaporation. Long, cotton underwear is suggested to absorb perspiration and limit any contact with heat-absorbing protective clothing (i.e., coated tyvek suits).

C. Provide hose-down mobile shower facilities to cool protective clothing and reduce body temperature.

D. Conduct non-emergency response activities in the early morning or evening during very hot weather.

E. Provide shelter against heat and direct sunlight to protect personnel, take breaks in shaded areas.

F. Rotate workers utilizing protective clothing during hot weather.

G. Establish a work regime that will provide adequate rest periods, with personnel working in shifts.

*** HEAT STRESS MONITORING ***

Heat stress may occur even in moderate temperatures and may present heat rash, heat cramps, heat exhaustion, and/or heat stroke.

Monitoring procedures should be implemented to prevent heat stress arising from any of the following: environmental conditions, use of personal protective equipment, intensity of workload. Such procedures may include the following.

For temperature above 70F, the following regime shall be followed for workers wearing permeable coveralls:

Adjusted Temperature	Normal Work Uniform	Impermeable Tyvek Suit
90 F or above	After @ 45 min work	After @ 15 min work
87.5-90 F	After @ 60 min work	After @ 30 min work
82.5-87.5 F	After @ 90 min work	After @ 60 min work
77.5-82.5 F	After @ 120 min work	After @ 90 min work
72.5-77.5 F	After @ 150 min work	After @ 120 min work

Workers wearing semipermeable or impermeable encapsulating protective clothing should be monitored for heart rate and temperature when the temperature in the work area is above 70 degrees fahrenheit. To monitor the worker, measure:

a. Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third.

b. Oral temperature. Use a clinical thermometer or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6F shorten the next work cycle by one-third.

Do not permit a worker to wear a semipermeable or impermeable garment if the core body temperature exceeds 100.6F.

Workers shall not be required to continue working if they feel any of the symptoms of heat stress. Rest periods should be a minimum of 15 minutes. Length of rest period should be extended as appropriate or as recommended by the Site Safety Officer or alternate.

4.2.9 Exposure: Cold Stress

Work schedules will be adjusted to provide sufficient rest periods in a heated area for warming up during operations conducted in cold weather. Also thermal protective clothing such as wind and/or moisture resistant outerwear is recommended to be worn.

If work is performed continuously in the cold at or below -7°C (20°F), including wind chill temperature, heated warming shelters (tents, cabins, company vehicles, rest rooms, etc.) shall be made available nearby and the worker should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria, are indications for immediate return to the shelter. When entering the heated shelter the outerlayer of clothing shall be removed and the remainder of the clothing loosened to permit sweat evaporation. A change of dry work clothing shall be provided as necessary to prevent worker from returning to their work with wet clothing.

Dehydration, or the loss of body fluids, occurs in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of a diuretic and circulatory effect. (Adapted from TLV's and Biological Exposure Indices 1988-1989; ACGIH).

5.0 PERSONAL PROTECTIVE EQUIPMENT

Modified Level D is the minimum acceptable level of PPE for this site.

Modified Level D includes:

- hard hat
- safety glasses
- steel toe and shank boots
- fluorescent vest
- latex or vinyl gloves
- coveralls/work uniform
- outer Nitrile butyl-rubber (NBR) gloves (as appropriate)
- outer boots (as appropriate)
- splash goggles (as appropriate)
- hearing protection (as appropriate)

Level C includes:

- buddy system required at all times
- full face respirator with NIOSH approved chemical cartridges (organic)
- Saranex coated Tyvek suit with hood
- inner latex or vinyl gloves
- outer Nitrile butyl-rubber gloves
- steel toe and shank boots
- outer boots - chemical resistant
- hard hat
- hearing protection (as appropriate)

NOTE: Respirator cartridges will be changed once per day at a minimum. This can be accomplished at the end of the work day during respirator decontamination. If odor breakthrough is detected while wearing the respirator or if breathing becomes difficult, change cartridges immediately.

Level B includes:

- Regional Health and Safety representatives must be on site upon start up of any project requiring level B protection, this should be understood to include subcontractors conducting level B activity.
- buddy system required at all times
- supplied air respirator or SCBA
- Saranex Tyvek suit
- inner Latex gloves
- outer Nitrile butyl-rubber gloves
- steel toe and shank boots
- chemical resistant boot covers
- hard hat
- hearing protection (as appropriate)

Contact with contaminated surfaces, or surfaces suspected of being contaminated should be avoided. This includes walking through, kneeling or placing equipment in puddles, mud, discolored surfaces, or on drums and other containers. Eating, smoking, drinking and/or the application of cosmetics in the immediate work area is prohibited.

When utilizing protective garments such as tyvek suit, gloves and booties, all seams between protective items will be sealed with duct tape.

6.0 DECONTAMINATION PROCEDURES

All operations conducted at this site have the potential to contaminate monitoring equipment and personal protection equipment. To prevent the transfer of any contamination to vehicles, administrative areas and personnel, the following procedures must be followed.

Whenever possible, monitoring equipment should be decontaminated with a solution of Alconox and thoroughly rinsed with water prior to leaving the site. This must be done outside a 5-foot radius of any work area.

Personal Decontamination

LEVEL D
- segregated equipment drop
- wash/rinse outer boot, then remove (as appropriate)
- wash/rinse chemical resistant outer glove, then remove (as appropriate)
- remove hard hat, goggles/safety glasses/faceshield
- remove and throw out inner disposable gloves in designated receptacles (as appropriate)

LEVEL C
- segregated equipment drop
- wash/rinse outer boots
- wash/rinse chemical resistant outer gloves, then remove
- remove chemical resistant suit (remove by rolling down the suit)
- remove outer boots and place to dry
- remove first pair(s) of disposable gloves
- remove respirator/hard hat, dispose of cartridges and wash respirator
- remove last pair of disposable gloves

LEVEL B
- segregated equipment drop
- wash/rinse outer boots
- wash/rinse chemical resistant outer gloves, then remove
- cross hotline (into decon area) and change air tanks, then redress or
- cross hotline (into clean area)
- remove boots and gloves
- remove SCBA, if worn over chemical resistant suit
- if SCBA is worn under the suit, remove the chemical resistant suit, then the SCBA
- remove hard hat

All water used in decontamination procedures should be stored in portable storage tanks, until sufficient amounts are stockpiled to facilitate disposal treatment.

All decontamination solution shall be disposed at the work station where it was generated.

Disposable sampling and personal protective equipment will be placed in plastic bags and temporarily stored in designated drums. These drums shall be disposed of according to regulatory guidelines, if necessary.

7.0 HEALTH AND SAFETY REQUIREMENTS

7.1 Medical Monitoring Program

A baseline physical examination must be conducted on all employees before they are permitted to engage in cleanup and remedial action work. A complete medical survey should be completed on each employee upon start of employment. Yearly re-examinations should be performed to update information on employee health status. Additional re-evaluation will be considered in the event of a chemical over-exposure. These medical surveillance requirements shall comply with OSHA regulations as defined in 29 CFR 1910.120.

7.2 Training

All personnel working at this site should have received a minimum of 40 hours of initial hazardous waste activity instruction, and a minimum of three days of field experience under the direct supervision of a trained, experienced person. Personnel assigned to the site will also receive 8 hours refresher training per year. On-site managers and supervisors directly responsible for employees engaged in hazardous waste operations have received an additional 8 hours of supervisory training. These training requirements comply with the OSHA Hazardous Waste Operations and Emergency Response regulation, 29 CFR 1910.120.

7.3 Visitor Policy

All visitors and/or trainees on site must submit to the limitations described in **Appendix B.**

7.4 Work Zones Area

Work and support areas shall be established based on ambient air data and proposed work sites. They shall be established in order to contain contamination within the smallest areas possible and shall ensure that each employee has the proper personal protective equipment for the area or zone in which work is to be performed.

7.5 First Aid Equipment

Vehicles used for site work will be equipped with a first aid kit and safety equipment including:

- fluorescent vests,
- cones (and flags as needed),
- hazard tape (barricades as needed),
- mounted fire extinguisher (10 pound A/B/C type),
- working flashlight, (as needed)
- water, suitable for drinking,
- portable eye wash,
- first aid kit with appropriate bandage material,
- full body harness with lifeline for confined space entry (as appropriate)

7.6 Drilling Procedures

A Digsafe authorization number must be obtained prior to drilling.

During the drilling operation, two persons (one designated as "driller" and the other as "helper") must be present at all times. The helper (whether Groundwater Technology, Inc. personnel or subcontractors) must be instructed as to the location of the emergency shut-off switch. Every attempt must be made to keep unauthorized personnel from entering the work area. If this is not possible, the operation should be shut down until the area is cleared. The area where the operation is taking place shall be cordoned off with a barricade. The Site Safety Officer or the Field Team Leader has the authority and the responsibility to shut down the drilling operations whenever a hazardous situation is deemed present.

The mast of the drilling rig must maintain a minimum clearance of 20 feet from any overhead electrical cables. All drilling operations will cease immediately during hazardous weather conditions such as high winds, heavy rain, lightening and heavy snow.

7.7 Fire Prevention

During equipment operation, periodic vapor concentration measurements should be taken with an explosimeter or combustimeter. If at any time the vapor concentrations exceed 10% of LEL, then the Site Safety Officer or designated field worker should immediately shut down all operations.

Only approved safety cans will be used to transport and store flammable liquids.

All gasoline and diesel-driven engines requiring refueling must be shut down and allowed to cool before filling.

Smoking is not allowed during any operations within the work area in which petroleum products or solvents in free-floating, dissolved or vapor forms, or other flammable liquids may be present.

No open flame or spark is allowed in any area containing petroleum products, or other flammable liquids.

8.0 PROJECT PERSONNEL

Groundwater Technology, Inc. will oversee and act accordingly during all phases of the project. The following management structure will be instituted for the purpose of successfully and safely completing this project.

8.1 Medical/Technical Advisors

David T. Crowley, CSP, SET, CHMM
GROUNDWATER TECHNOLOGY, INC., Norwood MA ..... (617) 769-7602

Katy Perkowski
GROUNDWATER TECHNOLOGY, INC., Norwood, MA ..... (617) 769-7600

The specific duties of the Medical/Technical Advisors include:

- providing technical input into the design of the site safety plan,
- advising worker exposure potential along with appropriate hazard reduction methods, and
- recommending a suitable medical monitoring program for the site workers.

APPENDIX C

Site Safety Plan Amendment Sheet

Project Name:

Project Number:

Location:

Changes in field activities or hazards:

Approved by:

_____ _____

District Health and Safety Specialist Date

DEFINITIONS

(TLV-TWA)	Threshold Limit Value - Time Weighted Average. The time-weighted average concentration for a normal [illegible] day and a 40-hour work week, to which nearly all work[illegible] repeatedly exposed without adverse effect.
(PEL)	Time-weighted average concentrations similar to (and [illegible] derived from) the Threshold Limit Values.
(REL)	Recommended Exposure Limit as defined by NIOSH s[illegible] Threshold Limit Values.
(IDLH)	"Immediately dangerous to life or health" means any at[illegible] condition that poses an immediate threat to life, or whic[illegible] result in acute or immediate severe health effects. This [illegible] oxygen deficiency conditions.
(LEL)	Lower Explosive Limit The minimum concentration of vapor in air below whic[illegible] of a flame will not occur in the presence of an ignition [illegible]
(UEL)	Upper Explosive Limit The maximum concentration of vapor in air above whic[illegible] propagation of a flame will not occur in the presence [illegible] source.
Flash Point (F.P.)	The lowest temperature at which the vapor of a com[illegible] can be made to ignite momentarily in air.
Vapor Pressure (V.P.)	The pressure characteristic at any given temperature [illegible] equilibrium with its liquid or solid form, often expressed [illegible] millimeters of mercury (mm Hg).
Odor Threshold	A property displayed by a particular compound, low [illegible] indicates a physiological sensation due to molecular [illegible] the olfactory nervous system (Based on 50% of the [illegible]
Ionization Potential (I.P.)	The amount of ionization characteristic a particular c[illegible] compound displays.

EXCAVATION/TRENCHING

Purpose

The intent of these requirements is to help reduce the risk of injury to all person's working in or around trenching and excavation operations. These requirements are in accordance with OSHA Subpart P 29 CFR 1926.65 - .653.

Definitions

According to the OSHA construction safety and health standards, 29 CFR 1926, the following is defined:

Trench: A narrow excavation in which the depth is greater than the width, although the width is not greater than 15 feet.

Excavation: Any mechanically made cavity or depression in the earth's surface. This can include excavations for anything from cellars to highways.

General Requirements

OSHA requires that, in all excavations, employees exposed to danger from moving ground shall be protected by a shoring system, sloping of the ground, or some other equivalent means.

In addition, OSHA requires that all trenches over 5 feet deep in either hard and compact or soft and unstable soil be sloped, shored, sheeted, braces or otherwise supported and that trenches less than 5 feet in depth also be effectively protected when hazardous ground movement may be expected.

One method of ensuring the safety and health or workers in a trench or excavation is to slope the sides of the cut to the "angle of repose," the greatest angle above the horizontal plane at which a material will lie without sliding. The angle of repose varies with different kinds of soil, and must be determined on each individual project. When an excavation has water conditions, silty material or loose boulders, or when it is being dug in areas where erosion, deep frost, or slide planes are apparent, the angle of repose must be flattened.

Specific Requirements

a. Prior to excavation, all utility companies should be contacted and underground utilities located to reduce accidental damage to gas, sewer, electric, telephone lines, etc. In areas where available, the utility "DIG-SAFE" hot line, located in front of the local telephone book, should be contacted.

b. To reduce the risk of collapse, all trenches more than 5 feet deep, and those less than 5 feet deep in unstable soil, should be provided with adequate shoring or the trench should be sloped back to the angle of repose.

c. To reduce the risk of injury from materials falling into excavations, all excavated soils or other materials should be stored 2 feet or more from the edge of the excavation.

d. To reduce the risk of trips/falls, trenches more than 4 feet deep should have ladders or steps located so as to require no more than 25 feet of lateral base and extend a minimum of 36 inches above the landing and secured against movement.

e. To reduce the risk of collapse from adverse weather conditions, diversion ditches, dikes, or other suitable means should be used to prevent surface water from entering an excavation or trench.

f. To help prevent unauthorized traffic and personnel from entering trenching and excavation sites, cones with 6 foot flags, barricades and flagging tape should be used to cordon off the immediate area.

CONTINGENCY PLANS

I. CONTINGENCY PLAN FOR EVACUATION

Although very unlikely, it is possible that a site emergency could necessitate evacuating all personnel from the site. If such a situation develops, the Site Safety Officer, or designated representative will notify the Project Supervisor, or vice versa, of the event and appropriate signal will be given for site evacuation. The above officers shall ensure that the evacuation is carried out in a calm, controlled fashion.

All personnel shall exit the site and shall congregate in an area designated by the Project Supervisor and/or Site Safety Officer. The route of evacuation will be dependent on wind direction, severity and type of incident, etc.

The Project supervisor and/or Site Safety Officer shall ensure that all personnel are accounted for. If someone is missing the Site Safety Officer will alert emergency personnel. This may be done by contacting the local Police Department. Advise them of the situation and request and expedient response by Emergency Services personnel.

Contact the Project Manager, Health & Safety Manager and/or District Manager as soon as possible after attending to the evacuation.

II. CONTINGENCY PLAN FOR MEDICAL EMERGENCY

The following procedures should be instituted immediately in the event of a medical emergency involving illness or injury to one of Groundwater Technoloyg's employees while on-site.

The site should be shut-down and immediately secured. The area in which the injury or illness occurred should be considered off-limited until the cause of the illness or injury is known.

In the event of a non-trauma related illness or injury, instantaneous real-time air monitoring with flame or photoionization detectors should be acquired to ascertain if the illness or injury was caused by potential exposure to hazardous materials. Monitoring should be done both upwind and downwind of the incident site.

Assess the victim's condition for the nature of injury or illness. Pay close attention to the level of consciousness and any cardiac or respiratory involvement.

If the victim appears to be critically injured (i.e. unconsciousness, cardiac or respiratory abnormalities, stroke, seizures, etc.), support the victim's vital functions. Administer CPR if needed. Notify Police, Fire Department and EMS Units immediately.

The victim should be decontaminated as soon as possible after removal from the contaminated environment. This should be done in non-contaminated area well away from the source of the problem.

If the victim appears to be critically injured, they should be transported to the nearest Emergency Room by an EMS Unit staffed with qualified personnel.

If the victim's condition appear to be non-critical, and is anything more severe than minor cuts or bruises, they should be transported to the nearest hospital. Under no circumstances should the victim be transported to the hospital in anything other than an EMS Unit staffed by qualified personnel.

If the victim has sustained extremely minor injuries or a minor illness, it will be up to the discretion of the Site Safety Officer whether or not the victim should be treated on-site, and, may continue to work. If the Site Safety Officer determines that the victim may not continue to work, the victim should be decontaminated, relieved of duty for the day and returned to the office, if during normal working hours. An occupational physician from the current medical surveillance contractor, or the victim's family physician should be contacted.

Contact the Project Manager, Health & Safety Manager or District Manager as soon as possible after attending the needs of the victim. The incident should be documented both in the project file and on the Groundwater Technology Accident/Incident/Near-Miss.

III. CONTINGENCY PLAN FOR CONTAMINATION EMERGENCY

The following procedures should be instituted immediately in the event of contamination to one of the Groundwater Technology's employees by Hazardous Materials.

If Emergency Rescue is needed to remove the victim from the contaminated area, notify, Police, Fire Department and EMS Units immediately. Advise them of the situation and request an expedient response by Emergency Services Personnel.

Absolutely no Emergency Rescue is to be attempted without having a trained back-up present.

If the victim is able to move under their own power, escort them to a non-contaminated area as soon as possible.

The site should be shut-down immediately secured. The area in which the contamination occurred should be considered off-limits until the arrival of trained personnel who are properly equipped with the appropriate personal protective equipment and monitoring instrumentation.

Assess the victim's condition for the nature of injury or contamination. The victim should be considered symptomatic if they exhibit any evidence of abnormal symptoms. Pay close attention to the level of consciousness and any cardiac or respiratory involvement. Use special care to insure that you do not become contaminated as well. If any abnormal symptoms are present, notify Police, Fire Department and EMS units immediately.

Attempted to identify the exact type of material involved. Use extreme caution if the danger of being contaminated exists.

The victim should be decontaminated as soon as possible after removal from the contaminated environment. This should be done in non-contaminated area well away from the source of the problem. Extreme care should be used to avoid cross-contamination. The victim should be washed by water spray or safety shower. Contaminated protective clothing should be removed after washing.

The victim should not be transported until decontamination is performed to the degree that medical personnel will not be subjected to cross-contamination.

If the victim appears to be critically injured (i.e. unconsciousness, cardiac or respiratory abnormalities, seizures, etc.), support the victim's vital functions. Administer CPR if needed.

If the victim appears to be symptomatic, they should be transported to the nearest Emergency Room by an EMS unit staffed with qualified personnel.

If the victim appears to be asymptomatic, the victim should be decontaminated, relieved of duty the day and returned to the office, if during normal working hours. An occupational physician fr the current medical surveillance contractor should be contacted.

Contact the Project Manager, Health & Safety Manger and/or District Manager as soon as possi after attending to the needs of the victim. The incidents should be documented both in the pro file and on the Groundwater Technology Accident/Incident/Near-Miss Report Form.

IV. CONTINGENCY PLAN FOR FIRE EMERGENCY

The following procedures should be instituted immediately in the event of a fire on-site.

The site should be shut-down and immediately secured. The area in which the fire occurred sh be considered off-limits until the cause can be determined. All non-essential site personnel sho be evacuated from the site to a safe, secure area. Notify the Fire Department immediately.

This may be done by contacting the local Fire Department. Advise them of the situation and th identify of any hazardous material involved.

The four classes of fire along with their constituents are as follows:

Class A:	Wood, cloth, paper, rubber, many plastics, ordinary combustible mater
Class B:	Flammable liquids, gases and greases.
Class C:	Energized electrical equipment.
Class D:	Combustible metals such as magnesium, titanium, sodium, potassiu

Small fires on-site may be actively attached for control and extinguishment. Extreme care sho taken while in this operation.

The designated Site Fire Safety Officer, or his representative, will be responsible for all fire fi activities on the site.

All approaches to the fire should be done from the upwind side if possible. Distance from th employee to the fire should be close enough to ensure proper attach of the extinguishing m but far enough away to ensure that the employee is safe. The proper extinguisher should be us for the Class(s) of fire present on the site.

If possible, the fuel source should be cut off or separated from the fire. Care must be taken performing operations involving the shut-off values and manifolds, if present.

Examples of proper extinguishing agents are as follows:

Class A -	Water
	Water with 1% AFFF Foam (Wet W
	Water with 6% AFFF or Fluoroprote
	ABC Dry Chemical
	Halon 1211
Class B -	ABC Dry Chemical
	Purple K
	Halon 1211
	Carbon Dioxide
	Water with 6% AFFF Foam
Class C -	ABC Dry Chemical
	Halon 1211
	Carbon Dioxide
Class D -	Metal-X Dry Powder

No attempt should be made against large fires. These sho

Contact the Project Manager, Health & Safety Manager an
The incident should be documented both in the project file
Accident/Incident/Near-Miss Report Form.

V. CONTINGENCY PLAN FOR SPILL OR AIR RELEA

The following procedures should ne instituted IMMEDIATEL
greater than the reportable quantity of a hazardous materia

The site should be shut-down and immediately secured. Tr
occurred should be considered off-limits until the cause ca
evaluated. All non-essential site personnel should be evacu

The spilled or released product should be immediately iden
dikes or birms, should be instituted to halt and contain the
the National Response Center should be notified immediate
an attempt to prevent downstream contamination.

Real-time air monitoring with ionization and combustible ha
Monitoring should be done both upwind and downwind of
evaluation of upgrades in personnel protective equipment s
the air monitoring.

If the material is unknown, Level B protection is mandator
acquired to facilitate identification of the material.

If the results of the monitoring show that the levels of conta
should be immediately evacuated and the appropriate Fede
authorities and emergency response personnel should be

Notify the Police and Fire Departments IMMEDIATELY if contaminants are found to have migrated off-site into populated areas, a large spill or flammable products is involved, or, the material is considered acutely toxic or exceeding published IDLH values.

The procedures as listed above should be instituted if there is a discovery of an acutely toxic material in must larger quantities than expected. In this case, all employees on the site should be cleared to a safe area and briefed.

The spill or release should be reported to the appropriate Federal, State, County and local regulatory authorities per the reporting standards of those regulatory agencies.

Contact the Project Manager, Safety Director, and/or District Manager as soon as possible. The incident should be documented both in the project file and on the Groundwater Technology Accident/Incident/Near-Miss Report Form.

APPENDIX A

Agreement and Acknowledgement Statement

APPENDIX A-2: AGREEMENT AND ACKNOWLEDGEMENT SHEET

Groundwater Technology personnel have the authority to stop field activities at this site if any activity is not performed in accordance with the requirements of the Site Safety Plan. All Groundwater Technology project personnel, subcontractor personnel and visitors are required to sign the Agreement and Acknowledgement Sheet **prior** to conducting field activities at this site.

APPENDIX A-2
GROUNDWATER TECHNOLOGY, INC.
AGREEMENT AND ACKNOWLEDGEMENT SHEET

1. I have read and fully understand the SSP and my responsibilities.
2. I agree to abide by the provisions of the SSP.

Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date

APPENDIX B

Visitor Policy

APPENDIX A-3: VISITOR/TRAINEE GUIDELINES

Groundwater Technology, Inc. is committed to providing a safe environment on all work sites for visitors, trainees, employees and/or passersby. In order to accomplish this, the following guidelines must be followed.

1. VISITORS

Any person not actively participating in the work at the site is regarded as a "visitor" and must follow Groundwater Technology's visitor/trainee guidelines. Visitors must be accompanied by a representative while on site.

Sites must be marked with signs, placards, and/or barricades to designate hazardous boundaries. Visitors will not be allowed on any site that is not adequately marked.

2. TRAINEES

Trainees are employees of Groundwater Technology who have not yet completed Groundwater Technology's required safety training program. New hires and in-house company transfers will be considered trainees until safety training requirements are met.

Trainees will be informed of restrictions by their supervisor and must abide by them before visiting active sites.

Trainees will be permitted to visit Groundwater Technology sites as observers as long as the following conditions are met:

- Trainees are supervised at all times while observing on site.
- Trainees do not perform work functions of any type while on site.
- Trainees do not handle any equipment, tools and/or supplies while on site.
- Trainees do not enter any hazardous or hot zone or confined space areas while on site.

Supervisors will be responsible for informing trainees of the above conditions and for ensuring that the conditions are met. Supervisors will also ensure that trainees will not be asked to violate the conditions listed above.

A Trainee/Observer Agreement Form must be signed by both the trainee and the supervisor and placed on file in the Regional Human Resources department.

Infractions of the above agreement will be viewed as extremely serious and will be subject to discipline up to and including termination for either the trainee and/or supervisor.

TRAINEE/OBSERVER AGREEMENT FORM

Groundwater Technology is committed to providing a safe working environment for all employees. In addition, Groundwater Technology will comply with OSHA requirements for employee safety training prior to working on any hazardous site.

The following section is to be filled out by trainee.

Agreement between:

_____ _____ and Groundwater Technology.
Name (print/type) SS#

Because we have your safety in mind, you will be considered a trainee until all training criteria are met. This means you must complete all training requirements prior to performing work activities on site. As a requirement of the training program, you will be asked to visit Groundwater Technology sites as an observer. You must be supervised on all of these site visits.

As an on-site observer trainee, your signature below indicates your agreement to these restrictions.

You may not:

1. Perform work functions of any type.
2. Handle any equipment/tools and/or supplies of any type.
3. Enter any hazardous or hot zone areas.

I agree to adhere to the above conditions in all instances while on site as a trainee/observer.

_____ _____
Signature Date

This section is to be filled out by supervisor.

As supervisor to the above trainee, I agree to the above restrictions and agree not to request him/her to perform activities contrary to those restrictions.

_____ _____
Signature Date

APPENDIX C

Site Safety Plan Amendment Sheet

APPENDIX C

Site Safety Plan Amendment Sheet

Project Name:

Project Number:

Location:

Changes in field activities or hazards:

Approved by:

District Health and Safety Specialist

Date

GROUNDWATER TECHNOLOGY

APPENDIX D

MSDS

DEFINITIONS

(TLV-TWA)	Threshold Limit Value - Time Weighte The time-weighted average concentra day and a 40-hour work week, to wh repeatedly exposed without adverse
(PEL)	Time-weighted average concentration derived from) the Threshold Limit Valu
(REL)	Recommended Exposure Limit as de Threshold Limit Values.
(IDLH)	"Immediately dangerous to life or he condition that poses an immediate th result in acute or immediate severe h oxygen deficiency conditions.
(LEL)	Lower Explosive Limit The minimum concentration of vapo of a flame will not occur in the prese
(UEL)	Upper Explosive Limit The maximum concentration of vapo propagation of a flame will not occu source.
Flash Point (F.P.)	The lowest temperature at which th can be made to ignite momentarily in
Vapor Pressure (V.P.)	The pressure characteristic at any gi equilibrium with its liquid or solid fo millimeters of mercury (mm Hg).
Odor Threshold	A property displayed by a particula indicates a physiological sensation the olfactory nervous system (Base
Ionization Potential (I.P.)	The amount of ionization characte compound displays.

CHEMICALS OF CONCERN

ontaminant	Standard (TLV/PEL)	Ionization Potential	Vapor Pressure	Flash Point
,1,1-Trichloroethane	350	11.00	100 mm	N/A
richloroethylene	25	9.45	58 mm	90° F
,1-Dichloroethane	100	11.06	230 mm	22° F
Methylene Chloride	50	11.32	350 mm	N/A
Tetrachloroethylene	25	9.32	14 mm	N/A
Freon	1000	11.99	285 mm	N/A

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 311

METHYL CHLOROFORM
(Revision E)
Issued: November 1975
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: METHYL CHLOROFORM

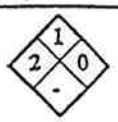
Description (Origin/Uses): Used in cold-type metal cleaning; also in cleaning plastic molds.

Other Designations: 1,1,1-Trichloroethane; CH_3CCl_3; CAS No. 0071-55-6

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS
H 2
F 0
R 1
PPG*
*See sect. 8

R 1
I –
S 2
K 1



NFPA

SECTION 2. INGREDIENTS AND HAZARDS/EXPOSURE LIMITS

Methyl Chloroform, CAS No. 0071-55-6

OSHA PELs
8-Hr TWA: 350 ppm, 1900 mg/m³
STEL: 450 ppm, 2450 mg/m³

ACGIH TLVs, 1988-89
TLV-TWA: 350 ppm, 1900 mg/m³
TLV-STEL: 450 ppm, 2450 mg/m³

Toxicity Data**
Man, Inhalation, LC_{Lo}: 27 g/m³ (10 Mins)
Man, Inhalation, TC_{Lo}: 350 ppm
Human, Oral, TD_{Lo}: 670 mg/kg
Rat, Oral, LD_{50}: 10300 mg/kg

*Contact your supplier for specifications, including details about inhibitors that can be added to the methyl chloroform product.
**See NIOSH, *RTECS* (KJ2975000), for additional data with references to irritative, reproductive, and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 165°F (74.1°C)
Melting Point: -26.5°F (-32.5°C)
Vapor Density (Air = 1): 4.55
Vapor Pressure: 100 Torrs at 68°F (20°C)

Molecular Weight: 133 Grams/Mole
Solubility in Water (%): Insoluble
Specific Gravity (H_2O = 1): 1.3376 at 68°F (20°C)
% Volatile by Volume: Ca 100

Appearance and Odor: A colorless liquid; mild, sweetish, pleasant, etherlike odor that may be just perceptible (if unfatigued) at about 100 ppm in the air.

Comments: Small variations in the above-noted physical properties are expected because of the various inhibitors that may be included in the methyl chloroform product.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point: None Found	Autoignition Temperature: 998°F (537°C)	LEL: 8.0% v/v	UEL: 10.5% v/v

Extinguishing Media: Methyl chloroform does not burn at ordinary temperatures. High-energy sources such as an electric arc or an elevated temperature are required for ignition of this material. When the source of ignition is removed, methyl chloroform tends to stop burning. Use water spray to cool fire-exposed containers. Use water fog, carbon dioxide, dry chemical, or foam to fight fires involving this material or nearby fires. Unusual Fire or Explosion Hazards: Methyl chloroform vapor is heavier than air and may travel a considerable distance to a low-lying high-energy source of ignition and flash back to its origin. Use care in selecting equipment (see sect. 5, Comments). Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Methyl chloroform is stable in closed containers during routine operations. Hazardous polymerization cannot occur. Chemical Incompatibilities: Methyl chloroform can react dangerously with acetone, nitrogen tetroxide, oxygen (gas or liquid), sodium, sodium hydroxide, and sodium-potassium alloys. Conditions to Avoid: Avoid exposure to any high-energy source of ignition or to incompatible chemicals. Hazardous Products of Decomposition: Toxic and corrosive gases such as hydrogen chloride, dichloracetylene, chlorine, and phosgene can be produced by decomposition of methyl chloroform at high temperatures, contact with hot metals, or exposure to ultraviolet radiation. Phosgene is usually produced in very small quantities; however, the significant irritating properties of hydrogen chloride (the dominant product of decomposition) prevent significant exposure to the phosgene. Comments: This material can be hydrolyzed by water to form hydrochloric acid and acetic acid. It will react with strong caustics to form flammable or explosive materials. It attacks natural rubber. Methyl chloroform requires an inhibitor content to prevent corrosion of metals. When the inhibitor is depleted, this material can decompose rapidly by reaction with finely divided white metals such as aluminum, magnesium, or zinc. Do not use these metals in pressurized spraying equipment where methyl chloroform is involved.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Methyl chloroform is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Methyl chloroform exhibits low oral toxicity. It can defat the exposed skin of workers and cause redness and scaling. Although methyl chloroform is low in systemic toxicity, it is an anesthetic that is capable of causing death if it is inhaled at concentrations of 14000 to 15000 ppm. Fatalities that have occurred in poorly ventilated areas such as pits or tanks are attributed to anesthesia and/or sensitization of the myocardium to epinephrine. Quick and complete recovery is reported upon prompt removal of unconscious exposed persons from the area of exposure. The TLV-TWA cited in section 2 is set to prevent initial anesthetic effects and/or objections to the

Material Safety Data Sheet

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Genium Publishing Corporation
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Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 312
TRICHLOROETHYLENE
(Revision E)

Issued: July 1979
Revised: August 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: TRICHLOROETHYLENE

DESCRIPTION (Origin/Uses): Prepared from *sym*-tetrachloroethane by way of eliminating HCl by boiling with lime. Used to manufacture organic chemicals, pharmaceuticals; in degreasing and dry cleaning; and as a solvent for fats, waxes, rubbers, oils, paints, varnishes, ethers, and cellulose esters.

OTHER DESIGNATIONS: Ethylene Trichloride; TCE; Trichloroethene; 1,1,2-Trichloroethylene; C_2HCl_3; NIOSH *RTECS* #KX4550000; CAS #0079-01-6

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Dow Chemical USA, 2020 Dow Center, Midland, MI 48640;
Telephone: (517) 636-1000; (800) 258-CHEM

COMMENTS: Trichloroethylene is a toxic solvent and a suspected occupational carcinogen.

HMIS

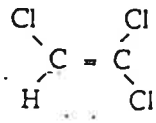
H	2
F	1
R	1
PPE*	

R	1
I	3
S	1
K	0

* See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

Ingredients	%	HAZARD DATA
Trichloroethylene, CAS #0079-01-6; NIOSH *RTECS* #KX4550000	100	ACGIH Values 1987-88 TLV-TWA*: 50 ppm, 270 mg/m^3 TLV-STEL**: 200 ppm, 1080 mg/m^3 OSHA PEL 1986*** 8-Hr TWA: 100 ppm Ceiling: 200 ppm NIOSH REL 1986 10-Hr TWA: 25 ppm TOXICITY DATA Human, Oral, LD_{Lo}: 7 g/kg Human, Inhalation, TC_{Lo}: 6900 mg/m^3 (10 Min) Human, Inhalation, TC_{Lo}: 160 ppm/83 Min Human, Inhalation, TD_{Lo}: 812 mg/kg



* The TLV-TWA is set to control subjective complaints such as headache, fatigue, and irritability.

** The TLV-STEL is set to prevent incoordination and other beginning anesthetic effects from TCE. These levels should provide a wide margin of safety in preventing liver injury.

*** The OSHA PEL is 300 ppm for 5 minutes in any 2 hours.

SECTION 3. PHYSICAL DATA

Boiling Point ... 188.6°F (87°C)
Vapor Pressure ... 58 Torr at 68°F (20°C)
Water Solubility ... Insoluble
Vapor Density (Air = 1) ... 4.53
Evaporation Rate ... Not Listed
Specific Gravity ... 1.4649 at 68°F (20°C)
Melting Point ... -120.64°F (-84.8°C)
Molecular Weight ... 131.40 Grams/Mole

Appearance and odor: Colorless, nonflammable mobile liquid; sweetish odor like chloroform.

COMMENTS: TCE is highly soluble in lipids. A high vapor pressure at room temperature provides the potential for TCE vapors to contaminate use areas.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Listed	770°F (410°C)	% by Volume	8%	10.5%

EXTINGUISHING MEDIA: TCE has no flash point in a conventional closed tester at room temperature, but it is moderately flammable at higher temperatures. Use dry chemical, carbon dioxide, alcohol foam, or other extinguishing agents suitable for the surrounding fire.

OSHA Flammability Class (29 CFR 1910.106): Not Regulated

UNUSUAL FIRE/EXPLOSION HAZARDS: During fire conditions TCE emits highly toxic and irritating fumes, including hydrochloric acid and phosgene. SPECIAL FIRE-FIGHTING PROCEDURES: Wear a self-contained breathing apparatus with a full facepiece operated in a pressure-demand or another positive-pressure mode. At TCE vapor levels of 300-1000 ppm, fire fighters who lack the proper respiratory equipment may experience incoordination and impaired judgment.

DOT Flammability Class (49 CFR 173.115): Not Regulated

SECTION 5. REACTIVITY DATA

Trichloroethylene is stable. Hazardous polymerization can occur under certain circumstances (see Conditions to Avoid and Comments, below).

CHEMICAL INCOMPATIBILITIES include magnesium or aluminum powder, NaOH, KOH, or other strong alkaline materials. Reactions with alkaline materials may lead to the formation of dangerous explosive mixtures of chloroacetylenes.

CONDITIONS TO AVOID: When TCE is heated (as in the case with vapor degreasers) or exposed to sunlight, it requires extra stabilization against oxidation, degradation, and polymerization. It is slowly decomposed by light when moist.

PRODUCTS OF HAZARDOUS DECOMPOSITION include hydrochloric acid and phosgene under certain conditions at elevated temperatures.

COMMENTS: TCE is stable under normal handling and storage conditions, and hazardous polymerization is not expected to occur. However, failure of the stabilizer at elevated temperatures or other extreme conditions may allow polymerization to take place.

SECTION 6. HEALTH HAZARD INFORMATION

Trichloroethylene is listed as a carcinogen by the NTP, IARC, and OSHA. NIOSH recommends that trichloroethylene be treated as an occupational carcinogen. IARC carcinogenic results are animal suspect, animal positive, and human indefinite. SUMMARY OF RISKS: Moderate exposures to TCE cause symptoms similar to those of alcohol inebriation. Higher concentrations cause narcotic effects. Ventricular fibrillation has been cited as the cause of death following heavy exposures. TCE-induced hepato cellular carcinomas have been detected in mice during tests conducted by the National Cancer Institute (*Chem & Eng News* 54 [April 5, 1976]:4). Organ systems affected by overexposure to TCE are the central nervous system (euphoria, analgesia, anesthesia), degeneration of the liver and kidneys, the lungs (tachypnea), heart (arrhythmia) and skin (irritation, vesication, and paralysis of fingers when immersed in liquid TCE). Contact with the liquid defats the skin, causing topical dermatitis. Certain people appear to experience synergistic effects from TCE exposure concomitant with exposure to caffeine, alcohol, and other drugs. When combined with alcohol intake, toxic effects are increased and may cause a red, blotchy facial and upper body rash commonly called "degreaser's flush." Other reported symptoms of TCE exposure include abnormal fatigue, headache, irritability, gastric disturbances, and intolerance to alcohol. Toxic effects from testing of TCE on humans include hallucination, distorted perception, somnolence (general depressed activity), and jaundice. TARGET ORGANS: Respiratory system, central nervous system, heart, liver, kidneys, and skin. PRIMARY ENTRY: Ingestion, inhalation, skin contact. ACUTE EFFECTS: Headache, vertigo, visual disturbance, tremors, nausea, vomiting, dermatitis, dizziness, drowsiness, and irritation to the eyes, nose, and throat. CHRONIC EFFECTS: None Reported. MEDICAL CONDITIONS AGGRAVATED BY LONG-TERM EXPOSURE: Diseases of the liver, kidneys, lungs, and central nervous system. FIRST AID: EYE CONTACT: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Get medical help.* SKIN CONTACT: Wash thoroughly with soap and water. Remove and launder contaminated clothing before wearing it again; clean material from shoes and equipment. Get medical help.* INHALATION: Remove victim to fresh air; restore and/or support his breathing as needed. Do not give adrenalin to the victim. Get medical help.* INGESTION: Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. A professional decision regarding whether or not to induce vomiting is required. Do not give adrenalin to the victim. Get medical help.*

*GET MEDICAL ASSISTANCE = IN PLANT, PARAMEDIC, COMMUNITY. Get prompt medical assistance for further treatment, observation, and support after first aid.

COMMENTS: Workers' responses to TCE vary significantly because of many factors, including age, health status, nutrition, and intake of alcohol, caffeine, and medicines. Do not use these substances before, during, or after exposure to TCE. If a worker displays any of the symptoms of exposure to TCE, thoroughly investigate all the possible contributing factors to determine, if possible, how much the work environment levels of TCE are responsible.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Inform safety personnel of any trichloroethylene spill or leak and evacuate the area for large spills. Cleanup personnel must use respiratory and liquid contact protection. Adequate ventilation must be provided. Confine the spilled TCE to as small an area as possible. Do not allow it to run off to sewers or open waterways. Pick up spilled TCE with a vacuum cleaner or an absorbent such as vermiculite.

DISPOSAL: Consider reclamation, recycling, or destruction rather than disposal in a landfill.

Trichloroethylene is designated as a hazardous substance by the EPA (40 CFR 116.4).

Trichloroethylene is reported in the 1983 EPA TSCA Inventory.

EPA Hazardous Waste Number (40 CFR 261.33): U228

EPA Reportable Quantity (40 CFR 117.3): 1000 lbs (454 kgs)

Aquatic Toxicity Rating, TLm 96: Not Listed

SECTION 8. SPECIAL PROTECTION INFORMATION

GOGGLES: Always wear protective eyeglasses or chemical safety goggles. Follow the eye and face protection guidelines of 29 CFR 1910.133. GLOVES: Wear impervious gloves. RESPIRATOR: Use a NIOSH-approved respirator per the *NIOSH Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. Any detectable concentration of TCE requires an SCBA, full facepiece, and pressure-demand/positive-pressure modes. WARNING: Air-purifying respirators will not protect workers from oxygen-deficient atmospheres. OTHER EQUIPMENT: Wear rubber boots, aprons, and other suitable body protection appropriate to the existing work environment. VENTILATION: Install and operate general and local exhaust ventilation systems of sufficient power to maintain airborne concentrations of TCE below the OSHA PEL standards cited in section 2. SAFETY STATIONS: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. OTHER SPECIAL MODIFICATIONS IN THE WORKPLACE: Because of the unresolved controversy about the carcinogenic status of TCE, all existing personal protective equipment and engineering technology should be used to prevent any possibility of worker contact with this material.

COMMENTS: Practice good personal hygiene. Keep material off of your clothes and equipment. Avoid transfer of material from hands to mouth while eating, drinking, or smoking. Adhere to the sanitation requirements of 29 CFR 1910.141 and 29 CFR 1910.142.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Prevent TCE from coming into contact with strong caustics such as NaOH; KOH; chemically active metal like Ba, Li, Na, Mg, Ti; and powdered aluminum or magnesium in acidic solutions. SPECIAL HANDLING/STORAGE: Store this material in a cool, dry, well-ventilated area. Avoid elevated temperatures because products of toxic and corrosive decomposition from TCE may form. Monitor the level of any stabilizer component that may be added to the TCE. (Consult the technical data from the supplier to determine the specifics of any added stabilizer.) If applicable, follow the supplier's recommendation concerning proper rotation of stock, shelf-life requirements, and levels of stabilizers.

ENGINEERING CONTROLS IN THE WORKPLACE: Avoid collecting aluminum fines (very small particles) or chips in a TCE vapor degreaser. Monitor TCE stabilizer levels regularly. Only trained personnel should operate vapor degreasers.

TRANSPORTATION DATA (per 49 CFR 172.101-2):

DOT Hazard Class: ORM-A | DOT ID No. UN1710 | IMO Class: 6.1

IMO Label: St. Andrew's Cross (X)* | DOT Shipping Name: Trichloroethylene | DOT Label: None

* Harmful - Stow away from foodstuffs (IMO Label, Materials of Class 6.1 Packaging Group III).

References: 1-9, 12, 14, 21, 73, 87-94. PI

Approvals JO Peterco

Indust. Hygiene/Safety 11-19-87

Medical Review

1,1-DICHLOROETHANE

DCH

Common Synonyms	Oily liquid	Colorless	Chloroform like ethereal
ylidene chloride ylidene dichloride chlorinated hydrocarbonic ether	Sinks and mixes with water.		

Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Flammable.
POISONOUS GAS MAY BE PRODUCED IN FIRE OR WHEN HEATED.
Containers may explode in fire.
Wear goggles and self-contained breathing apparatus.
Extinguish with alcohol foam, carbon dioxide, or dry chemical.
Water may be ineffective on fire.

Exposure

CALL FOR MEDICAL AID.

LIQUID
If swallowed may cause nausea, vomiting and harmless irritating to skin and eyes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS have victim drink water or milk and induce vomiting.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability.
Restrict access.
Chemical and physical treatment.

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $C_2H_4Cl_2$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2362
3.5 CAS Registry No.: 75-34-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Oily liquid
4.2 Color: Colorless
4.3 Odor: Chloroform

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: In areas of poor ventilation or high concentration, a self-contained breathing apparatus with full face mask should be worn. Chemical workers goggles, rubber gloves, and protective clothing should be worn.

5.2 Symptoms Following Exposure: INHALATION: Irritation of respiratory tract, Salivation, sneezing, coughing, dizziness, nausea, and vomiting. EYES: Irritation, lacrimation, and reddening of conjunctiva. SKIN: Irritation. Prolonged or repeated skin contact can produce a slight burn. INGESTION: Ingestion incidental to industrial handling is not considered to be a problem. Swallowing of substantial amounts could cause nausea, vomiting, faintness, drowsiness, cyanosis, and circulatory failure.

5.3 Treatment of Exposure: Call a doctor. INHALATION: Remove from contaminated area; keep warm and quiet. If breathing has stopped, give artificial respiration. Administer oxygen. EYES: Flush with large amounts of water or weak bicarbonate of soda solution. SKIN: Dilute with large amounts of water. Remove contaminated clothing. INGESTION: Attempt to empty stomach; dilute by administering fluids (tap water, soapy water, salt water, or milk).

5.4 Threshold Limit Value: 200 ppm.
5.5 Short Term Inhalation Limits: 250 ppm.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat).
5.7 Late Toxicity: Chronic exposure may cause liver damage and dermatitis. Animal experimentation has shown this compound to be slightly embryo-toxic and to retard fetal development.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.
5.10 Odor Threshold: Data not available.
5.11 IDLH Value: 4,000 ppm.

6. FIRE HAZARDS

6.1 Flash Point: 57°F O.C. = 22°F C.C.
6.2 Flammable Limits in Air: 5.6% to 11.4%
6.3 Fire Extinguishing Agents: Alcohol foam, water, foam, CO_2, dry chemical, carbon tetrachloride
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: When heated to decomposition emits highly toxic fumes of phosgene.
6.6 Behavior in Fire: Explosion hazard
6.7 Ignition Temperature: 856°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Data not available
7.4 Neutralizing Agents for Acids and Caustics: Data not available
7.5 Polymerization: Data not available
7.6 Inhibitor of Polymerization: None
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity:
TL$_m$ (Marine pinperch) 250 to 275 mg/l
24-hour TL$_m$ Brine shrimp: 320 mg/l
24-hour TL$_m$ Pinperch: 180 mg/l
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD):
Percent, 0.05 g/g for 10 days Percent, 0.002 g/g for 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Data not available
9.2 Storage Temperature: Cool
9.3 Inert Atmosphere: Data not available
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-P-Q-R-S

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 98.97
12.3 Boiling Point at 1 atm: 135.14°F = 57.3°C = 330.5°K
12.4 Freezing Point: −143.32°F = −97.4°C = 175.75°K
12.5 Critical Temperature: 502.7°F = 261.5°C = 534.65°K
12.6 Critical Pressure: 734.8 psia = 50 atm = 5.065 MN/m²
12.7 Specific Gravity: 1.174 at 20°C
12.8 Liquid Surface Tension: 24.75 dynes/cm = 0.02475 N/m at 20°C
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: 3.42
12.11 Ratio of Specific Heats of Vapor (Gas): 1.106 at 20°C (68°F)
12.12 Latent Heat of Vaporization: 131.8 Btu/lb = 73.1 cal/g = 3.06 X 10⁵ J/kg
12.13 Heat of Combustion: −4,774 Btu/lb = −2,652 cal/g = −111 X 10⁵ J/kg
12.14 Heat of Decomposition: Data not available
12.15 Heat of Solution: Data not available
12.16 Heat of Polymerization: Data not available
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 7.36 psia

NOTES

JUNE 1985

MATERIAL SAFETY DATA SHEET

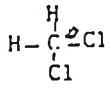
GENIUM PUBLISHING CORPORATION
45 CATALYN ST., SCHENECTADY, NY 12303 USA (518) 377-8854

MSDS # 310
METHYLENE CHLOR
Revision E
Issued:
Revised: September

om Genium's MSDS Collection, to be used as a reference.

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: METHYLENE CHLORIDE (Revision E)
THER DESIGNATIONS: Dichloromethane, FREON 30, Methane Dichloride, CH_2Cl_2; CAS#75-09-2.
ANUFACTURER/SUPPLIER: Available from many suppliers, including;
Dow Chemical USA
2020 Dow Center
Midland, MI 48640
(517) 636-1000

SECTION 2. INGREDIENTS AND HAZARDS	%	HAZAR
METHYLENE CHLORIDE 	ca 100	8 hr TWA: 10 or 350 mg/m Human, Inha TCLo: 500 p (Blood effe TCLo: 500 p (CNS effects Rat, Oral: 2000 mg/kg

* 1988-89 50ppm TLV

ACGIH TLV/TWA (1985-86). OSHA PEL is 500 ppm with a ceiling of 1000 and a permissible peak exposure of 2000 ppm for 5 minutes per any two-hour period.

NIOSH recommends a 10 hr. TWA or 75 ppm with a ceiling concentration of 500 ppm (15 minute TWA). NIOSH also warns that toxic hazards associated with exposure to methylene chloride are increased by the presence of alcohol and/or carbon monoxide and by heavy labor and smoking.

SECTION 3. PHYSICAL DATA

Boiling point, 1 atm	104°F (40°C)	Specific gravity, 25/25C	1.32
Vapor pressure @ 20°C, mmHg	340	Volatiles, %	ca 100
Vapor density (Air=1)	2.9	Evaporation rate (CCl_4=1)	1.47
Solubility in water, wt. % @ 20°C	~1.6	Freezing point	-140.8°
		Molecular weight	84.94

APPEARANCE & ODOR: Colorless liquid with a penetrating ether-like, sweetish odor. The unfatigue threshold for 100% of test panel is 214 ppm.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Low
None (T.C.C.)	1031°F (555°C)	Vol % at 100°C in O	12

EXTINGUISHING MEDIA: Use extinguishing media that are appropriate for the surrounding fire. Us to cool fire-exposed tanks/containers. When heated, methylene chloride forms weakly combustible air. It will form flammable and explosive mixtures in an oxygen-enriched atmosphere. Methylene a high vapor pressure; when spilled, its vapor concentration in air may increase rapidly. Cont methylene chloride may rupture violently during a fire.

Firefighters should wear self-contained breathing apparatus with face piece and full protective Vapors of methylene chloride can flow to low-lying areas.

SECTION 5. REACTIVITY DATA

This material is stable at room temperature under normal storage and handling conditions. It do go hazardous polymerization. Methylene chloride is incompatible with alkali metals including s potassium alloy, finely powdered aluminum and magnesium, n-Methyl-n-nitroso-urea, and potassiu and potassium tert-butoxide. Contact with these materials may cause violent reaction or explos longed exposure to water may cause noticeable hydrolysis to highly corrosive hydrochloric acid re is above 60°C. Avoid contact with oxidizing agents and caustics. In organic-enriched atm when heated (>100°C) vapors may be readily ignited. Exposure to high temperatures (from open surfaces, welding arcs, etc.) can produce corrosive and toxic thermal oxididative decomposition such as hydrogen chloride and small quantities of phosgene.

GENIUM

Revised: 9/85

MSDS # 310, Issued _____ METHYLENE CHLORIDE (Rev. E)

SECTION 6. HEALTH HAZARD INFORMATION

TLV 100 ppm (see Section 2)

Methylene Chloride enters the body mainly by inhalation and skin absorption. Vapors of methylene chloride are narcotic and may cause toxic encephalopathy. Excessive inhalation of vapor (300-700 ppm for 3-5 hrs.) causes slight loss of coordination and equilibrium. Symptoms of overexposure can also include dizziness, nausea, tingling of extremities, stupor, lethargy, convulsions and diminished vision. Severe exposures may cause unconsciousness and death. Symptoms of overexposure to methylene chloride are usually delayed in onset. The liquid is irritating to the eyes and may cause burns if not promptly removed. Prolonged or repeated contact with the skin may cause redness, irritation, dermatitis, frostbite or burns. It may be absorbed through the skin in toxic amounts. Ingestion of methylene chloride causes irritation of the gastrointestinal tract and symptoms resembling those from inhalation of vapor. Long-term exposure to mild or moderate doses of methylene chloride may cause delayed onset (24-48 hrs.) of dizziness, headache, mental confusion, slurred speech, double vision and sleeplessness. Medical recovery may be slow. NOTE: Methylene chloride is stored in body fat and metabolizes to carbon monoxide, which increases and sustains carboxyhemoglobin levels in the blood, reducing its oxygen-carrying capacity. It may damage the liver, kidneys, or blood. Alert medical attendants to its secondary hazard.

FIRST AID: EYE CONTACT: Promptly flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation persists (in-plant, paramedic, or community). SKIN CONTACT: Flush exposed area with water while removing contaminated clothing. Get medical attention if irritation persists. INHALATION: Remove to fresh air. Restore and/or support breathing (O_2 therapy) as required. Keep warm and at rest. Get medical help. Advise physician not to use adrenalin. INGESTION: Get prompt medical help! Do not induce vomiting. If vomiting occurs spontaneously, position victim's head below trunk to resist aspiration hazard. Advise physician not to use adrenalin.

SECTION 7. SPILL, LEAK AND DISPOSAL PROCEDURES

Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Evacuate all personnel from the area except for those involved in clean-up. Remove leaking container to safe place if feasible. Absorb small spills with an absorbent material such as paper towel or vermiculite. Evaporate off solvent in an exhaust hood and place absorbent in a closed container for disposal. Dike large spills and collect for recovery or disposal. Pick up residue with absorbent (as with small spills) or flush to ground (not to sewer) to evaporate. Clean-up personnel should wear respiratory equipment and protective clothing to prevent inhalation of vapor and contact with skin/eyes. DISPOSAL: Reclaim waste solvent by filtration and distillation procedures. Place in closed containers for disposal by a licensed contractor, or burn in an approved incinerator.

Methylene chloride is designated as a hazardous waste by the EPA. The EPA (RCRA) H.W. No. is U080 (40CFR261).

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation (explosion-proof) to meet TLV requirements. Floor level ventilation and sump ventilation may also be necessary. For emergency or non-routine exposures, wear an appropriate NIOSH-approved respirator. All electrical service in use or storage areas should have an explosion-proof design. When handling liquid, wear neoprene, PVA, or vitron gloves and safety glasses. In case of leak or spill or unusual handling where repeated or prolonged contact may occur, use protective clothing, apron, boots, and splash goggles or face shield as necessary. Remove contaminated clothing promptly and do not reuse until it has been properly laundered. Eye wash stations and safety showers should be readily available in use and handling areas. Contact lenses pose a special hazard; soft lenses absorb; all lenses concentrate irritants. NOTE: CO and CH_2Cl_2 content of workplace air are additive and both must be monitored where methylene chloride exposures occur. Preplacement and annual physical exams should emphasize the nervous and respiratory systems liver, kidneys, skin, eyes and carboxyhemoglobin levels. Those with a history of cardiovascular disease or who are heavy drinkers or smokers should avoid exposure to this material.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area away from combustibles and sources of heat and ignition. Open containers slowly and with caution. Protect containers from physical damage. Keep containers and storage tanks free of water and moist air. Be careful when handling this compound. Use only with adequate ventilation. Don't breathe vapors. Avoid contact with eyes, skin and clothing. When methylene chloride vapors are drawn into the combustion chamber of a space heater, severe corrosion damage to the heater can occur, even at levels well below the TLV. LARC Review (1979) listed animal carcinogenic determination as indefinite. A substantial risk notice to EPA (TSCA, 8e) reports a high incidence of lung and liver tumors in mice in long-term inhalation studies at 2000-4000 ppm (1984, preliminary).

DOT CLASSIFICATION: ORM-A DOT I.D. No. UN1593 LABEL: None (or St. Andrew's Cross)

NIO CLASS: 6.1

DATA SOURCE(S) CODE (See Glossary) 1-12, 14, 16, 23, 25, 31, 34, 37, 38, 47, 48.R.

APPROVALS	JO Approved, 11/85
INDUST. HYGIENE/SAFETY	11-85
MEDICAL REVIEW:	

A 5/85IM

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 313

PERCHLOROETHYLENE
(Revision D)
Issued: November 1978
Revised: August 1988

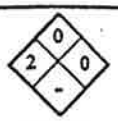
SECTION 1. MATERIAL IDENTIFICATION

Material Name: PERCHLOROETHYLENE

Description (Origin/Uses): Used in commercial dry cleaning and metal-degreasing operations; used to a lesser extent in home products and in veterinary anthelmintics (worming).

Other Designations: Ethylene Tetrachloride; Tetrachloroethylene; C_2Cl_4; CAS No. 0127-18-4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

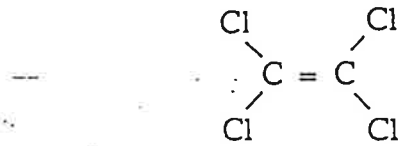


NFPA

HMIS	
H 1	
F 0	R 1
R 1	I 3
PPG*	S 2
*See sect. 8	K 0

SECTION 2. INGREDIENTS AND HAZARDS

Perchloroethylene, CAS No. 0127-18-4



*See NIOSH, *RTECS* (No. KX3850000), for additional data with references to reproductive, irritative, tumorigenic, and mutagenic effects.

%	EXPOSURE LIMITS
Ca 100	OSHA PEL 8-Hr TWA: 100 ppm Ceiling: 200 ppm Maximum Peak above the Ceiling: 300 ppm for 5 min. in any 3 Hrs ACGIH TLVs, 1987-88 TLV-TWA: 50 ppm, 340 mg/m³ TLV-STEL: 200 ppm, 1340 mg/m³ Toxicity Data* Human, Inhalation, TC_{Lo}: 96 ppm/7 Hrs

SECTION 3. PHYSICAL DATA

Boiling Point: 250°F (121°C)
Specific Gravity (H_2O = 1): 1.623
% Volatile by Volume: 100

Water Solubility (%): Insoluble
Molecular Weight: 166 Grams/Mole
Vapor Pressure: 19 Torrs at 77°F (25°C)
Vapor Density (Air = 1): 5.83

Appearance and Odor: A clear, colorless liquid; ethereal odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
*	*	% by Volume	*	*

Extinguishing Media: *Perchloroethylene does not burn. Use extinguishing agents that will put out the surrounding fire.

Unusual Fire or Explosion Hazards: Perchloroethylene vapor is heavier than air and it collects in low-lying areas such as sumps, wells, and underground piping systems. Enter these low-lying areas with appropriate caution.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Use care in selecting safety equipment (see sect. 5, Conditons to Avoid).

SECTION 5. REACTIVITY DATA

Perchloroethylene is stable in closed containers during routine operations. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Hazardous chemical reactions involving perchloroethylene and barium, beryllium, or lithium are reported in Genium reference 84, page 491M-208.

Conditions to Avoid: Prevent contact with incompatible chemicals. Avoid exposure to direct sunlight. Monitor the stabilizer level in the perchloroethylene product; get specifications from your supplier for the proper inhibitor levels. This material forms hydrochloric acid (HCl) if the inhibitor level becomes too low. Do not mix perchloroethylene with caustic soda or potash. This material may degrade or attack rubber and some plastics and coatings, so select protective gear and handling equipment carefully.

Hazardous Products of Decomposition: Although perchloroethylene itself does not burn, it can be very hazardous in fires because of thermooxidative degradation at high temperatures to very toxic phosgene and corrosive hydrogen chloride. Electric arcs and perchloroethylene vapor may also produce these products of hazardous decomposition.

SECTION 6: HEALTH HAZARD INFORMATION

Perchloroethylene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Perchloroethylene affects the central nervous system (CNS), causing incoordination, headache, vertigo, light narcosis, dizziness, unconsciousness, and even death. All of these can occur as the level and duration of exposure continues.

Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: CNS, eyes, skin.
Primary Entry: Inhalation, skin. Acute Effects: Irritation of the skin, eyes, and upper respiratory tract (URT); CNS effects.
Chronic Effects: None reported.

FIRST AID
Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.
Skin: Immediately wash the affected area with soap and water.
Inhalation: Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.
Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. Do not induce vomiting.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7: SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately. Cleanup personnel need protection against contact with and inhalation of vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways. Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 1910.1000 Subpart Z)
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. U210
CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per Clean Water Act (CWA), section 307 (a) and Resource Conservation and Recovery Act (RCRA), section 3001

SECTION 8: SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of perchloroethylene solution may occur, wear a full face shield/splash guard. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). Respirator: Consult the *NIOSH Pocket Guide to Chemical Hazards* for general recommendations on respirator protection. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. Warning: Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. Other: Wear impervious gloves, boots, aprons, and gauntlets, etc., to prevent prolonged or repeated skin contact with perchloroethylene. Suggested material includes polyvinyl alcohol, polyethylene, or neoprene. Leather shoes are also appropriate. Ventilation: Install and operate general and local ventilation systems that are powerful enough to maintain airborne levels of perchloroethylene dust below the OSHA PEL standard cited in section 2. Safety Stations: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment.
Comments: Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Avoid inhaling perchloroethylene vapor. Select safety equipment carefully (see sect. 5, Conditions to Avoid).

SECTION 9: SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store perchloroethylene in a cool, dry, well-ventilated area away from barium, beryllium, and lithium.

Special Handling/Storage: Protect containers from physical damage. Fit all holding tanks with an air-drying venting system that prevents moist air from entering the tank and allows for perchloroethylene vapor expansion and contraction; airtight storage facilities are not recommended. Aluminum is not recommended for storage facilities.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Tetrachloroethylene	DOT Label: None	IMO Label: Saint Andrew's Cross (X)*
DOT ID No. UN1897	DOT Hazard Class: ORM-A	IMO Class: 6.1

*Harmful-Stow away from Foodstuffs (Materials of IMO Class 6.1, Packaging Group III).

References: 1, 12, 73, 84-94, 100, 103.

Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: MJ Hardies, MD

Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 314

TRICHLOROTRIFLUOROETHANE

Issued: February 1986

SECTION 1. MATERIAL IDENTIFICATION

19

MATERIAL NAME: TRICHLOROTRIFLUOROETHANE

OTHER DESIGNATIONS: 1,1,2-Trichloro-1,2,2-Trifluoroethane, FCl_2CCClF_2; CAS #0076-13-1.

TRADENAMES: All registered, ARKLONE P-113 (Alpha Metals); BLACO-TRON TF (Baron-Blakeslee); FREON TF, FREON 113 (du Pont); FRIGEN 113TR-T (Hoechst AG); GENETRON 113, GENESOLV D (Allied Corp.); ISOTRON 113, REFRIGERANT 113 (Pennwalt Corp.); UCON 113 (Union Carbide).

HMIS
H: 1
F: 0
R: 0
PPE: *
* See Sect. 8

Not Found

MANUFACTURER: Available from many suppliers, including: SCM Specialty Chemical, PO Box 1466, Gainesville, FL 32602; Telephone: (800) 331-6313

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
TRICHLOROTRIFLUOROETHANE	ca 100	8-hr TWA 1000 ppm or 7600 mg/m^3*
		Human, Inhalation, TCLo: 4500 ppm (Central Nervous System)
		Rat, Oral, LDLo: 45 mg/kg

* Current OSHA PEL and ACGIH (1985-86) TLV.

SECTION 3. PHYSICAL DATA

Boiling Point, 1 atm ... 117.6°F (47.6°C)
Vapor Pressure @ 70°F, mm Hg ... 285
Vapor Density (Air = 1) ... ca 6
Solubility in H_2O @ 70°F, % ... 0.028

Specific Gravity (20/4°C) ... 1.57
Volatiles, % ... ca 100
Evaporation Rate (Acetone = 1) ... 0.45
Melting Point ... -35°C to -36°C
Molecular Weight ... 187.39

Appearance and odor: Clear, colorless liquid with a slight ethereal odor whose recognition threshold (100% of test panel for UCON-113) is 135 ppm in air. (Vapor may be detected below 50 ppm, unfatigued.)

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
NA	NA	NA	NA	NA

EXTINGUISHING MEDIA: Use whatever is appropriate for surrounding fire. This is a nonflammable material. Vapors are five times heavier than air. High concentrations may tend to accumulate in low-lying areas. Very high concentrations can dilute available oxygen in the air below levels necessary to sustain life.

Fire fighters should wear self-contained breathing apparatus and fully protective clothing against suffocating vapors and toxic and corrosive products of decomposition.

SECTION 5. REACTIVITY DATA

This is a very stable material in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Prevent exposure to alkali or alkaline earth metals such as sodium, potassium, etc. Aluminum, zinc, magnesium, and beryllium may also be reactive, especially in the finely ground or powdered state or at high temperatures.

Thermal-oxidative degradation can produce toxic and corrosive materials such as halogens, halogen acids, and carbonyl halides.

SECTION 6. HEALTH HAZARD INFORMATION TLV

High concentrations of trichlorotrifluorethane vapors may cause asphyxiation due to dilution of available oxygen in air below levels necessary to sustain life. Exposures greater than 2500 ppm can produce central nervous system depression, with psychological and psychomotor interference (disorientation and incoordination). Symptoms can include lightheadedness, giddiness, disorientation, shortness of breath, and possible cardiac arrhythmias. Vapors may have little or no effect on the eyes, but liquid contact may cause irritation and mild conjunctivitis. Repeated or prolonged contact with skin may cause defatting and possible dermatitis.
Trichlorotrifluorethane has not been listed as a carcinogen by the NTP, IARC, or OSHA.
FIRST AID: EYE CONTACT: Flush thoroughly with running water for 15 minutes (including under eyelids). SKIN CONTACT: Remove contaminated clothing. Flush affected area with water. Treat for frostbite if symptoms are present. INHALATION: Remove to fresh air. Restore and/or support breathing as needed. If products of thermal-oxidative decomposition (see Sect. 5) have been inhaled, observe victim for signs of pulmonary edema. INGESTION: Seek physician. Seek prompt medical assistance for further treatment, observation, and support.* DO NOT USE epinephrine or similar drugs, for they can produce cardiac arrhythmias, including ventricular fibrillation.

* GET MEDICAL HELP = In plant, paramedic, community.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of leaks or spills. Remove sources of heat or ignition. Provide adequate ventilation. Cleanup personnel to use self-contained respirator and protective clothing. Stop leakage if possible; remove leaking containers to safe area for discharge and allow to evaporate in an area remote from buildings and people. Residues or small spills can be picked up with an absorbent (vermiculite, dry sand) and placed in a covered metal container for disposal.

DISPOSAL: Material can be reclaimed by filtration and distillation process or disposed of by a licensed solvent waste disposal firm. Avoid discharge to environment when possible. Return scrap to supplier, if possible. Follow Federal, state, and local regulations.

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide adequate mechanical ventilation to keep vapors below the TLV level. Supply ventilation for sumps and low-lying areas where the dense vapors of this material may collect. Local exhaust should be used where large amounts are released. Use approved self-contained or air-supplied breathing apparatus and lifelines for emergencies. Use chemical safety goggles and/or face shield to prevent liquid contact with eyes where splashing is possible. Wear neoprene or polyvinyl alcohol gloves and clothing appropriate for the work situation to minimize skin contact with liquid.
Eyewash stations and safety showers should be readily accessible near areas of use.
Contact lenses may pose a special hazard; soft lenses may absorb and all lenses concentrate irritants.
Vaporization of excessive amounts can displace oxygen necessary for breathing and may cause suffocation when used in confined spaces or areas without ventilation. Make sure that confined or enclosed spaces are safe prior to entry.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed, steel, containers in a cool (below 125°F), dry, well-ventilated area away from open flame, arc welding, and high-temperature surfaces. Protect containers from physical damage. High-density vapors may displace air and present an asphyxiation hazard. Concentrations well below the TLV level can damage space heaters when drawn into the combustion chamber. Heater should have independent air supply.
Prevent skin and eye contact with liquid. Avoid inhalation of vapors. Products of thermal decomposition can form halogen acids that have very sharp, stringent effects and can be detected by odor. Such odor is a hazard warning; when detected, immediately evacuate and ventilate the area. Monitor halocarbons and oxygen levels in the work area.

Data Source(s) Code: 1, 2, 4, 7, 8, 12, 21, 26, 38, 47, 82, 84. CK

Approvals	
Indust. Hygiene/Safety	6/86
Medical Review	

APPENDIX E

Accident Investigation Form

APPENDIX A-4: ACCIDENT/INCIDENT (NEAR MISS) REPORT FORM

Employee's Name:_____ D.O.B._____
Address:_____ D.O.H._____
_____ SS#_____
Job Title:_____ Supervisor's Name:_____
Office Location:_____
Location at Time of Incident:_____
Date/Time of Incident:_____
Project Name:_____
Project Number:_____ Project Mgr._____

==========

Describe clearly how the accident occurred:_____
_____
_____

Was incident: Physical_____ Chemical_____
Parts of body affected_____ Exposure: Dermal_____
right ____ left ____ Inhalation_____
Ingestion_____

Witnesses: 1)_____ 2)_____
Conditions/acts contributing to this incident_____
_____
_____

==========

Managers must complete this section:

Explain specifically the corrective action you have taken to prevent a recurrence:_____
_____
_____

Did injured go to doctor:_____ Where:_____
_____ When:_____
Did injured go to hospital:_____ Where:_____
_____ When:_____

==========

Signatures:

_____	_____	_____
Employee	Reporting Manager	Health & Safety Representative
_____	_____	_____
Date	Date	Date

Accidents must be reported immediately; this form must be completed, signed and returned to the Health and Safety Representative within *24 hours*. The Health and Safety Representative will forward a copy to Corporate Health and Safety.

APPENDIX F

Vapor Monitoring Forms

APPENDIX B-3
GROUNDWATER TECHNOLOGY, INC.
VAPOR MONITORING FORM

Project Name:

Project Number:

Contaminants:

Date	Time	Ionization Detector Reading		Explosimeter Reading		Radiation Monitor Reading	
		FID	PID	%LEL	$\%O_2$	mR/hr	

APPENDIX B-3
GROUNDWATER TECHNOLOGY, INC.
VAPOR MONITORING FORM

Project Name:

Project Number:

Contaminants:

Date	Time	Ionization Detector Reading		Explosimeter Reading		Radiation Monitor Reading	Location	Purpose	Initials
		FID	PID	%LEL	$\%O_2$	mR/hr			

APPENDIX B-3
GROUNDWATER TECHNOLOGY, INC.
VAPOR MONITORING FORM

Project Name:

Project Number:

Contaminants:

Date	Time	Ionization Detector Reading		Explosimeter Reading		Radiation Monitor Reading	Location	Purpose	Initials
		FID	PID	%LEL	$\%O_2$	mR/hr			

APPENDIX G

Confined Space Entry Permit

GROUNDWATER TECHNOLOGY, INC.

Confined Space Entry Hazard Analysis Form

Site Name: _____

Site Address _____

_____

CSE Name/Number: _____

CSE Definition:
- ☐ Vault
- ☐ Tank/Vessel
- ☐ Pit
- ☐ Trench
- ☐ Other _____

CSE Dimensions:

Length = _____

Width = _____

Depth = _____

Sketch:

Tasks/Activity/Reasons for Entry:
- ☐ Well Gauging
- ☐ Bailing Product
- ☐ Pump Maintenance
- ☐ Well Sampling
- ☐ Product Recovery
- ☐ _____

Potential hazards within space:
- ☐ Oxygen Deficiency
- ☐ Combustible Vapors
- ☐ Toxic Vapors
- ☐ Engulfment

Other CSE Hazards:
- ☐ Difficult access/egress
- ☐ Energy/isolation *
- ☐ Prone to floodinig
- ☐ Slippery surface
- ☐ Hot surfaces (i.e., pipes)

* Check here if Lo/To must be performed inside CS.

FOR USE BY AUTHORIZED CSE SUPERVISOR

Confined Space Entry Classification:

Class I _____

Class II _____

Class III _____

Completed by: _____ Date: _____

Reviewed by: _____ Date: _____

Requirements:

CONFINED SPACE ENTRY PERMIT

permit must be completed prior to entering any confined space and is ONLY VALID FOR THE DATE AND TIME INDICATED ON THIS FORM. procedural requirements contained in Groundwater Technology, Inc. Health & Safety Policy & Procedure No. 11 must be followed.

e event a confined space emergency situation develops and rescue is required, notify the following appropriate emergency services:

ulance _____ Fire: _____ Police: _____

pose of entry: _____ Location of confined space: _____

_____ Authorized Duration: _____ Expires on: _____

mospheric Hazards: [ ] Oxygen Deficiency [ ] Flammable [ ] Toxic [ ] Other _____ [ ] Other _____
ysical Hazards: [ ] Mechanical [ ] Electrical [ ] Chemical [ ] Engulfment [ ] Other _____

NTRY REQUIREMENTS

N/A		Yes	N/A	
[ ]	Entry area is free of debris and objects	[ ]	[ ]	Non-sparking tools used
[ ]	Warning barriers and signs are in place	[ ]	[ ]	Low voltage (less than 25v) lighting used
[ ]	Atmospheric monitoring conducted	[ ]	[ ]	Electrical equipment rated for explosive atmospheres
[ ]	All hazardous lines have been isolated	[ ]	[ ]	No compressed gas cylinders is the confined space
[ ]	Hot work permit attached	[ ]	[ ]	Host employer and/or contractors notified
[ ]	All energy sources have been locked out/tagged out	[ ]	[ ]	Entry and emergency procedures have been reviewed
[ ]	The confined space has been drained and flushed	[ ]	[ ]	All personnel have been trained (classroom/exercise)
[ ]	Forced air or exhaust ventilation is provided	[ ]	[ ]	All personnel have been informed of potential hazards
[ ]	Electrical equipment is properly grounded	[ ]	[ ]	Attendant stationed at entrance and properly inspected
[ ]	Ground fault circuit interrupters (GFCI) provided	[ ]	[ ]	Rescue equipment on location and readily accessible

OTECTIVE EQUIPMENT

No		Yes	No		Yes	No	
[ ]	Hard Hat	[ ]	[ ]	Protective clothing	[ ]	[ ]	Communications Equipment
[ ]	Eye/Face Protect.	[ ]	[ ]	Hearing protection	[ ]	[ ]	Ventilation to provide fresh air
[ ]	Boots	[ ]	[ ]	Retrieval Device/Tripod	[ ]	[ ]	Respirator (type) _____
[ ]	Gloves	[ ]	[ ]	Harness and Lifeline	[ ]	[ ]	Other _____

mosphere Test(s) to be taken*	Yes	No	Acceptable Entry Conditions		Enter Time and Measurement										
			Allowable Limits												
ygen			19.5% - 22.0%												
Combustible Gas			Below 10% LEL												
O/PID															
Carbon Monoxide			0-15 PPM												
ydrogen Sulfide			0-5 PPM												
yanogen Cyanide			0-2 PPM												
Sulfur Dioxide			0-1 PPM												
mmonia			0-10 PPM												

UPERVISOR APPROVAL: I certify that all necessary precautions have been taken to make this confined space safe for entering and conducting on the prescribed work during the prescribed timeset as well as emergency response procedures.

	Print Name	Sign Name	Date
y Supervisor			
Permit Prepared by			
osphere Tester			
Attendant			

RANT ACKNOWLEDGEMENT: I HAVE BEEN PROPERLY INSTRUCTED FOR SAFE ENTRY INTO THIS CONFINED SPACE AND UNDERSTAND MY DUTIES AND EMERGENCY PROCEDURES

t Entrant Name	Sign Entrant Name	Employee or S.S. No.	Date

evaluation should be performed to consider all potential air contaminants which could be present and represent a hazard.

Rev. 1/94

ENTRANT INSTRUCTIONS

All personnel who enter confined spaces must be thoroughly familiar with the following duties for entrants as listed below. Your primary responsibilities include:

- Understand the hazards of the confined space to be entered and the physical effects of those hazards.
- Continuously monitor the atmosphere inside of the confined space with a calibrated, direct reading, air monitoring instrument.
- Evacuate the confined space:
  - -if atmospheric hazards exceed the action level
  - -if a hazardous condition is identified inside of the confined space
  - -whenever attendant signals entrants to evacuate
- Read and understand the rescue procedures.
- If personal protective equipment is required, the entrant must be properly trained on the use of the equipment prior to entry. Personal protective equipment must be in good working condition.

ATTENDANT INSTRUCTIONS

You should be thoroughly familiar with the following duties when you assume the responsibility of attendant for a person or persons inside of a confined space. Your primary responsibilities are:

- The safety of the personnel inside.
- Understand the hazards of the confined space to be entered and the physical effects of those hazards.
- Maintain the conditions and requirements listed on entry permit.
- Evacuate the space if you observe any condition which you consider hazardous.
- Read and understand the rescue procedures. Get help if an emergency situation develops. Never enter the confined space in an emergency unless you are trained and equipped with the proper equipment for confined space rescue operations (i.e., self contained breathing apparatus, safety harness, life line) and are relieved by another attendant.
- Keep an accurate count of all personnel inside of the confined space at all times.
- Do not leave the entrance to the confined space while any personnel are still inside unless you are properly relieved. These instructions must be passed on to your relief.
- If you have any questions regarding the job, check with your supervisor or a health and safety professional.

ENTRY SUPERVISOR'S INSTRUCTIONS

You should be thoroughly familiar with the following details to qualify as the Entry Supervisor for a permit-required confined space entry procedure.

- Requirements for confined space entrant and attendant instructions.
- Knowledge of the hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of exposure.
- Verifies that the appropriate entries have been made on the permit, and that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.
- Terminate the entry permit when the confined space entry operations have been complete or when a condition exists that is not allowed under entry permit requirements.
- Verifies that rescue services are available and that the means for summoning them are operable.
- Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.
- Responsibility for the confined space when entry is transferred to other personnel.
- Determines that entry operations are still consistent with the terms of the confined space entry permit and at the prescribed intervals regardless of changes in entry personnel.

APPENDIX H

Excavation and Trenching

EXCAVATION/TRENCHING

Purpose

The intent of these requirements is to help reduce the risk of injury to all person's working in or around trenching and excavation operations. These requirements are in accordance with OSHA Subpart P 29 CFR 1926.65 - .653.

Definitions

According to the OSHA construction safety and health standards, 29 CFR 1926, the following is defined:

Trench: A narrow excavation in which the depth is greater than the width, although the width is not greater than 15 feet.

Excavation: Any mechanically made cavity or depression in the earth's surface. This can include excavations for anything from cellars to highways. --

General Requirements

OSHA requires that, in all excavations, employees exposed to danger from moving ground shall be protected by a shoring system, sloping of the ground, or some other equivalent means.

In addition, OSHA requires that all trenches over 5 feet deep in either hard and compact or soft and unstable soil be sloped, shored, sheeted, braces or otherwise supported and that trenches less than 5 feet in depth also be effectively protected when hazardous ground movement may be expected.

One method of ensuring the safety and health or workers in a trench or excavation is to slope the sides of the cut to the "angle of repose," the greatest angle above the horizontal plane at which a material will lie without sliding. The angle of repose varies with different kinds of soil, and must be determined on each individual project. When an excavation has water conditions, silty material or loose boulders, or when it is being dug in areas where erosion, deep frost, or slide planes are apparent, the angle of repose must be flattened.

Specific Requirements

a. Prior to excavation, all utility companies should be contacted and underground utilities located to reduce accidental damage to gas, sewer, electric, telephone lines, etc. In areas where available, the utility "DIG-SAFE" hot line, located in front of the local telephone book, should be contacted.

b. To reduce the risk of collapse, all trenches more than 5 feet deep, and those less than 5 feet deep in unstable soil, should be provided with adequate shoring or the trench should be sloped back to the angle of repose.

c. To reduce the risk of injury from materials falling into excavations, all excavated soils or other materials should be stored 2 feet or more from the edge of the excavation.

d. To reduce the risk of trips/falls, trenches more than 4 feet deep should have ladders or steps located so as to require no more than 25 feet of lateral base and extend a minimum of 36 inches above the landing and secured against movement.

e. To reduce the risk of collapse from adverse weather conditions, diversion ditches, dikes, or other suitable means should be used to prevent surface water from entering an excavation or trench.

f. To help prevent unauthorized traffic and personnel from entering trenching and excavation sites, cones with 6 foot flags, barricades and flagging tape should be used to cordon off the immediate area.

APPENDIX I

OSHA

IMMEDIATE OSHA INSPECTION STEPS

- Identify the Inspector.

  (a) Ask to see credentials.

  (b) Write down the relevant information, including the inspector's name, agency affiliation, address, telephone number and the statutory authority under which the inspection is being conducted.

  (c) If any doubts, *call* OSHA office to verify the visit.

  (d) If inspection occurs at a project site, ask for written certification of medical monitoring (including respiratory evaluation) and for 40 hour hazardous waste training certification. *No one* may venture out of the clean zone without it. *DOUBLE CHECK* it with his/her office if in doubt.

- Notify the Regional Safety Director and Project Manager immediately.

- The Project Manager should notify the District Manager.

- The Regional Safety Director should notify Corporate Health and Safety (ELD).

- Take notes on:

  (a) What is said
  (b) What is seen
  (c) Who spoke to whom
  (d) Any sample or copies taken
  (e) Any corrective actions done in the inspector's presence
  (f) Any activity, including where, when, who, and what
  (g) Any other occurrence, even if seemingly minor

- When in doubt on any question, *do not bluff an answer.* Ask the inspector to put the question in writing, addressed to company counsel. Never lie, even by omission; jail can be the penalty.

- If inspection occurs on site, carefully review the Site Safety Plans with the Inspector if asked to do so.

- If inspection occurs at an office, have accident reports, OSHA 200 logs ready at all times for inspection. Always make sure OSHA poster is visible.

- Determine the scope of the inspection: Ask the OSHA inspector what areas of the company activity are of interest and the reason for the inspection. Discover what has triggered the inspection. If complaints initiated the inspection, find out specifically what they were.

APPENDIX J

Electrical Safety

APPENDIX C-1: SITE-SPECIFIC LOCKOUT/TAGOUT PROCEDURES

APPENDIX C-1 SITE-SPECIFIC LOCKOUT/TAGOUT PROCEDURES		
Equipment	**Operation**	**Lockout Method/Location**
Air Compressor, AC1	Repairs to unit	Lockout local disconnect switch in Air Compressor Room
Air Sparge Wells, SP-1 - SP-11	Repair, monitoring	Lockout valve before flowmeter allow air pressure to dissipate through sparge well.
Air Sparge Flow Meters, FI 326 - 336	Repair, replace, or clean	Lockout valve before flowmeter allow air pressure to dissipate through sparge well.
Air Sparge Solenoid Valves	Repair, replace or clean	Lockout pressure at main sparge manifold valve. Lockout electric at breaker panel.
Soil Vapor Extraction Blower, B2	Repair, monitoring, change oil	Turn control switch off. Lock out local disconnect switch above blower located on wall.
Moisture Separator, MS1	Repair, cleaning	Turn control switch off. Lock out local disconnect switch above blower located on wall.
Soil Vapor Extraction Wells, VEP-1 - VEP-6	Repair, monitoring	Turn ball valve off inside equipment area this valve can not be locked out. To lock out use local disconnect switch above blower located on wall.
Bag Filter, F2	Repair, filter change	Turn control switch off. Lock out local disconnect switch above blower located on wall.
Transfer Pump, P10	Repair	Turn control switch off. Lock out local disconnect switch above blower located on wall.
Filter in Moisture Separator, F1	Cleaning, replacement	Turn control switch off. Lock out local disconnect switch above blower located on wall.
Recovery Wells, RW-1 -3, OW-3 -5 & OW-10	Redevelopment	Make sure associated pump is locked out. (see below)
Centrifugal Pumps, P4 -6 at well locations OW-3 -5	Repair, replacement	Local disconnect or beaker box located above pump.
Pneumatic Pumps, P1 -3 & P7 at well locations RW-1 -3 and OW-10	Repair, replacement	Lockout valve prior to regulator valve located inside warehouse building. Check line pressure with pressure gauge at valve location.

APPENDIX C-1 SITE-SPECIFIC LOCKOUT/TAGOUT PROCEDURES		
Equipment	**Operation**	**Lockout Method/Location**
Cooling Tower, CT1	Repair replacement of blower, clean-out of trays	Local power disconnect switch located on the side of the tower.
Sump Pump, P9	Repair, replacement	Plug located next to carbon units.
Transfer Pump, P8	Repair, replacement	Local disconnect or beaker box located above pump.
Granular Activated Carbon, GAC 3 & GAC 4	Replace carbon	Shut off sump pump, P9 at plug located next to carbon

APPENDIX K

Contingency Plans

CONTINGENCY PLANS

I. CONTINGENCY PLAN FOR EVACUATION

Although very unlikely, it is possible that a site emergency could necessitate evacuating all personnel from the site. If such a situation develops, the Site Safety Officer, or designated representative will notify the Project Supervisor, or vice versa, of the event and appropriate signal will be given for site evacuation. The above officers shall ensure that the evacuation is carried out in a calm, controlled fashion.

All personnel shall exit the site and shall congregate in an area designated by the Project Supervisor and/or Site Safety Officer. The route of evacuation will be dependent on wind direction, severity and type of incident, etc.

The Project supervisor and/or Site Safety Officer shall ensure that all personnel are accounted for. If someone is missing the Site Safety Officer will alert emergency personnel. This may be done by contacting the local Police Department. Advise them of the situation and request and expedient response by Emergency Services personnel.

Contact the Project Manager, Health & Safety Manager and/or District Manager as soon as possible after attending to the evacuation.

II. CONTINGENCY PLAN FOR MEDICAL EMERGENCY

The following procedures should be instituted immediately in the event of a medical emergency involving illness or injury to one of Groundwater Technoloyg's employees while on-site.

The site should be shut-down and immediately secured. The area in which the injury or illness occurred should be considered off-limited until the cause of the illness or injury is known.

In the event of a non-trauma related illness or injury, instantaneous real-time air monitoring with flame or photoionization detectors should be acquired to ascertain if the illness or injury was caused by potential exposure to hazardous materials. Monitoring should be done both upwind and downwind of the incident site.

Assess the victim's condition for the nature of injury or illness. Pay close attention to the level of consciousness and any cardiac or respiratory involvement.

If the victim appears to be critically injured (i.e. unconsciousness, cardiac or respiratory abnormalities, stroke, seizures, etc.), support the victim's vital functions. Administer CPR if needed. Notify Police, Fire Department and EMS Units immediately.

The victim should be decontaminated as soon as possible after removal from the contaminated environment. This should be done in non-contaminated area well away from the source of the problem.

If the victim appears to be critically injured, they should be transported to the nearest Emergency Room by an EMS Unit staffed with qualified personnel.

If the victim's condition appear to be non-critical, and is anything more severe than minor cuts or bruises, they should be transported to the nearest hospital. Under no circumstances should the victim be transported to the hospital in anything other than an EMS Unit staffed by qualified personnel.

If the victim has sustained extremely minor injuries or a minor illness, it will be up to the discretion of the Site Safety Officer whether or not the victim should be treated on-site, and, may continue to work. If the Site Safety Officer determines that the victim may not continue to work, the victim should be decontaminated, relieved of duty for the day and returned to the office, if during normal working hours. An occupational physician from the current medical surveillance contractor, or the victim's family physician should be contacted.

Contact the Project Manager, Health & Safety Manager or District Manager as soon as possible after attending the needs of the victim. The incident should be documented both in the project file and on the Groundwater Technology Accident/Incident/Near-Miss.

III. CONTINGENCY PLAN FOR CONTAMINATION EMERGENCY

The following procedures should be instituted immediately in the event of contamination to one of the Groundwater Technology's employees by Hazardous Materials.

If Emergency Rescue is needed to remove the victim from the contaminated area, notify, Police, Fire Department and EMS Units immediately. Advise them of the situation and request an expedient response by Emergency Services Personnel.

Absolutely no Emergency Rescue is to be attempted without having a trained back-up present.

If the victim is able to move under their own power, escort them to a non-contaminated area as soon as possible.

The site should be shut-down immediately secured. The area in which the contamination occurred should be considered off-limits until the arrival of trained personnel who are properly equipped with the appropriate personal protective equipment and monitoring instrumentation.

Assess the victim's condition for the nature of injury or contamination. The victim should be considered symptomatic if they exhibit any evidence of abnormal symptoms. Pay close attention to the level of consciousness and any cardiac or respiratory involvement. Use special care to insure that you do not become contaminated as well. If any abnormal symptoms are present, notify Police, Fire Department and EMS units immediately.

Attempted to identify the exact type of material involved. Use extreme caution if the danger of being contaminated exists.

The victim should be decontaminated as soon as possible after removal from the contaminated environment. This should be done in non-contaminated area well away from the source of the problem. Extreme care should be used to avoid cross-contamination. The victim should be washed by water spray or safety shower. Contaminated protective clothing should be removed after washing.

The victim should not be transported until decontamination is performed to the degree that medical personnel will not be subjected to cross-contamination.

If the victim appears to be critically injured (i.e. unconsciousness, cardiac or respiratory abnormalities, seizures, etc.), support the victim's vital functions. Administer CPR if needed.

If the victim appears to be symptomatic, they should be transported to the nearest Emergency Room by an EMS unit staffed with qualified personnel.

If the victim appears to be asymptomatic, the victim should be decontaminated, relieved of duty for the day and returned to the office, if during normal working hours. An occupational physician from the current medical surveillance contractor should be contacted.

Contact the Project Manager, Health & Safety Manger and/or District Manager as soon as possible after attending to the needs of the victim. The incidents should be documented both in the project file and on the Groundwater Technology Accident/Incident/Near-Miss Report Form.

IV. CONTINGENCY PLAN FOR FIRE EMERGENCY

The following procedures should be instituted immediately in the event of a fire on-site.

The site should be shut-down and immediately secured. The area in which the fire occurred should be considered off-limits until the cause can be determined. All non-essential site personnel should be evacuated from the site to a safe, secure area. Notify the Fire Department immediately.

This may be done by contacting the local Fire Department. Advise them of the situation and the identify of any hazardous material involved.

The four classes of fire along with their constituents are as follows:

Class A:	Wood, cloth, paper, rubber, many plastics, ordinary combustible materials.
Class B:	Flammable liquids, gases and greases.
Class C:	Energized electrical equipment.
Class D:	Combustible metals such as magnesium, titanium, sodium, potassium.

Small fires on-site may be actively attached for control and extinguishment. Extreme care should be taken while in this operation.

The designated Site Fire Safety Officer, or his representative, will be responsible for all fire fighting activities on the site.

All approaches to the fire should be done from the upwind side if possible. Distance from the employee to the fire should be close enough to ensure proper attach of the extinguishing material, but far enough away to ensure that the employee is safe. The proper extinguisher should be utilized for the Class(s) of fire present on the site.

If possible, the fuel source should be cut off or separated from the fire. Care must be taken when performing operations involving the shut-off values and manifolds, if present.

Examples of proper extinguishing agents are as follows:

Class A -	Water Water with 1% AFFF Foam (Wet Water) Water with 6% AFFF or Fluoroprotein Foam ABC Dry Chemical Halon 1211
Class B -	ABC Dry Chemical Purple K Halon 1211 Carbon Dioxide Water with 6% AFFF Foam
Class C -	ABC Dry Chemical Halon 1211 Carbon Dioxide
Class D -	Metal-X Dry Powder

No attempt should be made against large fires. These should be handled by the Fire Department.

Contact the Project Manager, Health & Safety Manager and/or District Manager as soon as possible. The incident should be documented both in the project file and on the Groundwater Technology Accident/Incident/Near-Miss Report Form.

V. CONTINGENCY PLAN FOR SPILL OR AIR RELEASE

The following procedures should ne instituted IMMEDIATELY in the event of a spill or air release of a hazardous material on-site.

The site should be shut-down and immediately secured. The area in which the spill or release occurred should be considered off-limits until the cause can be determined and site safety can be evaluated. All non-essential site personnel should be evacuated from the site to a safe, secure area.

The spilled or released product should be immediately identified and appropriate measures, such as dikes or birms, should be instituted to halt and contain the flow. If the spill extends into waterways, the National Response Center should be notified immediately. Spill booms should be put in place in an attempt to prevent downstream contamination.

Real-time air monitoring with ionization and combustible has indicators should be started. Monitoring should be done both upwind and downwind of the spill site or release point. An evaluation of upgrades in personnel protective equipment should be made based upon the results of the air monitoring.

If the material is unknown, Level B protection is mandatory. Samples of the material should be acquired to facilitate identification of the material.

If the results of the monitoring show that the levels of contaminants exceed IDLH values, the site should be immediately evacuated and the appropriate Federal, State, County and local regulatory authorities and emergency response personnel should be notified.

Notify the Police and Fire Departments IMMEDIATELY if contaminants are found to have migrated off-site into populated areas, a large spill or flammable products is involved, or, the material is considered acutely toxic or exceeding published IDLH values.

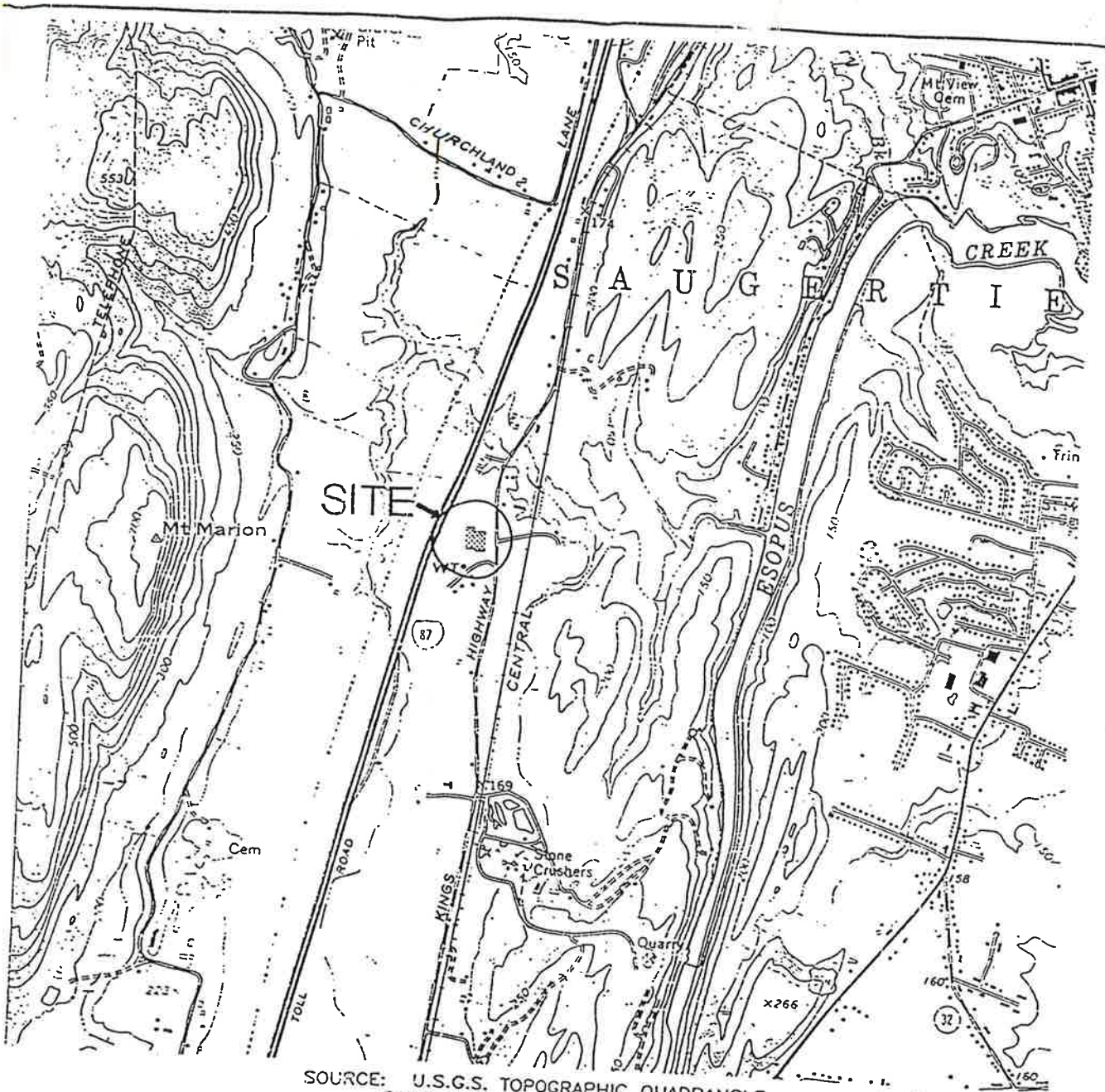
The procedures as listed above should be instituted if there is a discovery of an acutely toxic material in must larger quantities than expected. In this case, all employees on the site should be cleared to a safe area and briefed.

The spill or release should be reported to the appropriate Federal, State, County and local regulatory authorities per the reporting standards of those regulatory agencies.

Contact the Project Manager, Safety Director, and/or District Manager as soon as possible. The incident should be documented both in the project file and on the Groundwater Technology Accident/Incident/Near-Miss Report Form.

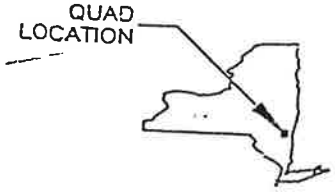
APPENDIX L

Maps



SOURCE: U.S.G.S. TOPOGRAPHIC QUADRANGLE
SAUGERTIES, N.Y. QUADRANGLE
7.5 MINUTE SERIES
DATE: 1963/REVISED 1978

QUAD LOCATION



SCALE 1:24,000

0 2,000 4,000
SCALE FEET

N

GROUNDWATER TECHNOLOGY

1245 KINGS ROAD
SCHENECTADY, NY 12303
(518) 370-5631

DESIGNED: RAH	SITE LOCATION MAP
DETAILED: DEO	CLIENT: PHILIPS COMPONENTS
CHECKED:	LOCATION: 5083 KINGS HIGHWAY SAUGERTIES, NEW YORK
	DRAWING DATE: 8/10/93
	FIGURE: 1-1