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INTERIM REMEDIAL MEASURE REPORT
WATCH CASE FACTORY SITE
SAG HARBOR, NEW YORK

SITE I.D. #152139

December 9, 1994

Prepared for:
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PROFESSIONAL ENGINEER'S CERTIFICATION

INTERIM REMEDIAL MEASURE REPORT
WATCH CASE FACTORY SITE
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I certify that in my professional judgement, the remediation system for the Watch Case factory Site in Sag Harbor, New York was installed in substantial compliance with the design drawings, "INTERIM REMEDIAL MEASURE, SOIL VAPOR EXTRACTION/AIR SPARGING SYSTEM" (design drawings) dated February 4, 1994. This certification is based on my observation of installation activities on August 22 and 30, 1994, review of the "INTERIM REMEDIAL MEASURE REPORT" dated December 9, 1994, and review and development of as-built drawings under cover sheet dated November 11, 1994.

Anne E Proctor 12/9/94

Anne E. Proctor, PE
District Engineer

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APPENDICES

1.0 INTRODUCTION

The Interim Remedial Measure (IRM) for the Former Watch Case Factory Site, in Sag Harbor New York is a Soil Vapor Extraction (SVE) and air sparging system. The system is designed to remediate volatile organic compounds (VOC's) located in the unsaturated and saturated zones in two areas of the site. The two areas are the building's interior and northwest courtyards. The primary compounds that are expected to be remediated by the IRM system are Trichloroethylene (TCE) and 1,1,1-Trichloroethane (TCA) along with several other VOC's present at lower concentrations. All references to drawings in this document refer to the attached "INTERIM REMEDIAL MEASURE, SOIL VAPOR EXTRACTION/AIR SPARGING SYSTEM, AS-BUILT DRAWINGS" (as-built drawings) dated November 7, 1994, unless noted otherwise. The as-built drawings are included as Appendix A of this report.

Installation of the IRM system was completed in September, 1994 and system operation and start-up testing was completed on September 14, 1994. Normal operation of the system was started on September 26, 1994, which is within the schedule of the order on consent and is consistent with the IRM workplan dated February 24, 1994. This report documents the installation "as-built" and results of the start-up testing.

2.0 SYSTEM DESCRIPTION

2.1 Introduction

The system utilizes separate equipment for the remediation of the two areas of the site. The two sets of equipment operate independently of each other. All major equipment is located inside the main building in the "Equipment Room" (see drawing Y1). Additionally, system meters, gauges, and sample ports are also located at remote piping manifolds in the interior and northwest courtyards. The system was installed in substantial compliance with the design drawings, "INTERIM REMEDIAL MEASURE, SOIL VAPOR EXTRACTION/AIR SPARGING SYSTEM" (design drawings) dated February 4, 1994. Variations are documented in the as-built drawings.

2.2 Equipment Specifications

The major system components (blowers, compressors, and control equipment) were purchased from ORS Environmental Systems of Greenville, New Hampshire. The equipment was constructed on four separate skids. Two of the skids are the air sparging sub-systems and include the compressor, heat exchanger, inlet filter, discharge pressure and temperature gauges, and discharge valves. The other two skids are the SVE sub-systems and include the blower, inlet filter, moisture separator, vacuum gauges, and valving. All of the equipment was delivered pre-piped and mounted on the skids. The manufacturer's information about the equipment is included in Appendix B of this report.

Note: The equipment identification numbers (i.e. B 100) reference the as-built drawings P2/2 and P3/2 for the northwest and interior courtyard sub-systems respectively.

2.2.1 Northwest Courtyard Equipment - Major Components

- Air Sparging Compressor (B 100)
  Manufacturer: Roots/Dresser
  Model: 24 URAI Rotary Lobe Blower
  Motor: 5 HP, TEFC, 230 Volt, 3 Phase

- Air to Air Heat Exchanger (HX 100)
  Manufacturer: American Precision Industries, Air Technology Division
  Model: SO4OAC1H
  Motor: 1/6 HP, TEFC, 115 Volt, 1 Phase

- Soil Vapor Extraction Blower (B 200)
  Manufacturer: EG&G Rotron

Model: EN 7 Regenerative Blower
Motor: 10 HP, Explosion-Proof, 230 Volt, 3 Phase

- Equipment Control Panels (HOA 100/200)
  Manufacturer: ORS Environmental Systems
  Model: SitePro 2000

2.2.2 Interior Courtyard Equipment - Major Components

- Air Sparging Compressor (B 300)
  Manufacturer: Gast Manufacturing Corporation
  Model: Oilless 6066 Rotary Vane Compressor
  Motor: 5 HP, TEFC, 230 Volt, 3 Phase

- Air to Air Heat Exchanger (HX 300)
  Manufacturer: American Precision Industries, Air Technology Division
  Model: SO4OAC1H
  Motor: 1/6 HP, TEFC, 115 Volt, 1 Phase

- Soil Vapor Extraction Blower (B 400)
  Manufacturer: EG&G Rotron
  Model: EN 707 Regenerative Blower
  Motor: 5 HP, Explosion-Proof, 230 Volt, 3 Phase

- Equipment Control Panels (HOA 300/400)
  Manufacturer: ORS Environmental Systems
  Model: SitePro 2000

2.3 IRM System Installation

The remedial system equipment for the Interior and Northwest Courtyards was substantially installed according to the design drawings and the manufacturer's instructions, with minor variations in piping runs and locations of equipment due to field conditions. Details of the system installation are shown in the attached as-built drawings and the manufacturer's documentation.

2.3.1 Equipment Installation

The four equipment skids, control panels, and the power distribution panel provided by ORS were delivered to the site on August 30, 1994. The equipment was inspected by Groundwater Technology, Inc. (GTI) personnel to verify that it conformed with the design specifications. The equipment skids were unloaded and placed by GTI personnel. All piping connections to the equipment were completed by GTI personnel.

The electrical installation was completed by Mellen Electric, electricians licensed in Suffolk County, New York. The electrical installation included bringing the electrical service from one of the existing power distribution panels in the building to a new service panel installed in the equipment room, then connecting the service to the ORS supplied power distribution panel. The SitePro control panels and the system electrical equipment were then connected to the ORS power distribution panel. Wiring diagrams and installation instructions for the system were provided by ORS for the installation and are included in Appendix B.

Additionally, on September 6 and 7, 1994, Richard Leger, Field Services Supervisor, and William Dobbs, Field Service Technician, of ORS visited the site to inspect the equipment installation, and provided operational training to GTI personnel. During the visit, the following tasks were completed:

- The installation of all ORS supplied equipment (mechanical and electrical) was inspected and it was verified that the installation complied with ORS specifications.
- The operation of the system interlocks was tested; the following tests were conducted:
    - Engaged the air sparging high temperature switches (TSH 100 and 300) and verified that the air sparging blowers (B 100 and 300) shut down;
    - Engaged the soil vapor extraction system low pressure switches (PSL 200 and 400) and verified that the air sparging blowers (B 100 and 300) shut down;
    - Engaged the soil vapor extraction system high discharge temperature switches (TSH 200 and 400) and verified that the SVE blowers (B 200 and 400) shut down and that the air sparging blowers (B 100 and 300) subsequently shut down;
    - Verified that the air sparging blowers (B 100 and 300) would not operate without the corresponding SVE blower (B 200 or 400) operating.

    All interlocks operated as designed.
- The operation of the remote monitoring software was checked to ensure that it was properly configured and receiving accurate data from the control panels. It was discovered that one of the system programs would not log onto the control network. The software was replaced by ORS. Following the software replacement, all remote operating and monitoring functions operated as specified.
- The ORS representatives also provided on-site training for GTI personnel regarding the proper operation and maintenance of the system.

2.3.2 System Piping Installation

The system piping was installed according to the design drawings and is described in the attached as-built drawings. All piping, except for the connections between the Northwest Courtyard wells and the Northwest Courtyard manifold, is above ground. The below ground piping was installed according to the specifications shown in Section B-B' on Drawing Y4 Revision 1 of the design drawings. The above ground piping was also

installed as per the design drawings. Piping from the Equipment Room to the Northwest Courtyard manifold is secured to the floor along the building corridor running between the two locations. Above ground piping is supported at six (6) to eight (8) foot intervals with additional supports near elevated valves (due to concentrated load).

The below ground piping was pressure tested prior to backfilling the trenches. Each system line was capped at the well end and a compressed air supply was connected at the manifold end of the piping. Thirty (30) PSIG of compressed air was applied to the manifold and then the lines were closed using a ball valve on the compressed air supply line. The pressure in the lines was monitored for 60 minutes, over which time a reduction of 1.7%, or 0.5 PSIG, was measured. Based on GTI testing protocol, this was considered an acceptable loss and the test was concluded. The trenches were subsequently backfilled as detailed in the design drawings.

3.0 START-UP TESTING

3.1 Introduction

Start-up testing was performed on the IRM system following installation according to the Operation and Maintenance Plan for the IRM Work Plan dated February 24, 1994. The testing was conducted from September 6 through September 14, 1994. The testing was performed to verify that the IRM system operated according to the design specifications and that it could influence the approximate region of the site described in the Conceptual Design (Section 3.3. of the IRM Work Plan).

3.1.1 Blower/Compressor Operation

Blowers and compressors were checked to verify the following:

- The equipment was visually inspected for conformance to the specification and presence of damage during shipping.
- The unit had the capacity to generate the required flow and pressure (or vacuum).
- The unit required approximately the rated electrical power at the design operating parameters.

The blowers and compressors operated according to the design and manufacturer's specifications.

3.1.2 Interlock Operation

Testing of the system interlocks was performed while the ORS representatives were present at the site and is described in Section 2.3.1. All interlocks performed according to design and manufacturer specifications. The interlocks are listed below and are the same for the two (2) independent SVE/air sparging systems. The interlocks are:

- The air sparging compressors shut down on:
  - high discharge temperature alarm (TSH 100 or 300 >140°F);
  - SVE blower low influent vacuum alarm (PSL 200 or 400 <10 inches water column);
  - motor thermal overload (B 100 or B 300 >14 Amps).
- The SVE blowers shut down on:
  - high discharge temperature alarm (TSH 200 or 400 >140°F);
  - high liquid level in the moisture separator drum (LSH 200 or 400 alarm, drum approximately 2/3 full)
  - motor thermal overload (B 200 >17 Amps or B 400 >14 Amps)

The air sparging compressors shut down on SVE blower failure due to the resulting low vacuum alarm at the SVE influent.

3.1.3 SitePro Control Panel Operation

There are four (4) SitePro control panels used at the site. Two (2) panels constitute a network for each SVE/air sparging system. Both networks operate independently of one another. The networks consist of a master (SVE) and a slave (air sparging) panel. The slave panel is networked to the master panel, which is equipped with a data modem connected to the outside phone line. Two (2) phone lines are used by the IRM system for remote monitoring.

A portable computer was used at the site to confirm that the remote log on feature of the SitePros operated properly. It was confirmed that the control panels accurately report the status of the system alarms (i.e. the interlocks listed in Section 3.3.1) and the operational status of the blowers and compressors. Also, it was confirmed that the system remote shut down feature operated appropriately. Additional information regarding the SitePro control panels is included in the ORS "SITEPRO MANAGER Remote Monitoring Software Installation Guide & User Manual" (Appendix C).

3.1.4 System Well Performance

All of the system wells, SVE and air sparging, were tested to confirm that the design flow rate could be established with the system equipment. The design well operating parameters were:

- SVE Wells: 50 actual cubic feet per minute (ACFM) with an applied well head vacuum of 11 inches of water column ("WC) per well;
- Air Sparging Wells: 12 ACFM with an applied well head gauge pressure of 5.5 pounds per square inch (PSIG).

In general, the SVE wells required a vacuum below the design value to establish the design influent flow rate (when tested individually), and the air sparging wells required a higher applied pressure to generate the design air flow rate. These variations are attributable to differences in well construction, well condition, and local subsurface conditions. It was possible to maintain the design flow rate in all of the system wells, except for SP-6. It was determined during testing that the SP-6 well screen had collapsed and the well was subsequently replaced on September 22, 1994. The new air sparging well is approximately 3 feet from the original location as shown on as-built drawing Y1. The original SVE well (VP-6) is still being used. Well performances measured during start-up testing for the collocated pairs (SP/VP) of wells operated independently (i.e. only one SVE/air sparging well combination at a time) are listed in Appendix D.

3.2 Radius of Influence Test

Tests were conducted on several of the IRM system wells individually, as per the IRM Work Plan, to determine if they would perform as designed. The start-up SVE and air sparging testing data and analysis are presented in Appendix D and in the section below.

3.2.1 Test Procedure

The procedure used to test the SVE wells was:

- Three SVE wells were tested (VP2, VP5, and VP6).
- The system valves were adjusted such that the extraction rate from the wells was approximately the design flow rate of 50 ACFM.
- The vacuum response in three monitoring wells in the vicinity of the extraction well was monitored.
- The VOC concentration, as measured with a flame ionization detector (FID), in the influent line was recorded.

The procedure used to test the air sparging wells was:

- Background measurements were collected for the depth to water (DTW) and dissolved oxygen (DO) in the monitoring wells near the system wells.
- Five of the wells were tested (SP-1, SP-2, SP-3, SP-4, and SP-5). SP-6 was tested, but it was found that the well had been damaged during installation and was inoperable. The well was subsequently replaced.
- The corresponding SVE well was operated concurrently to collect vapors generated by air sparging.
- The valves were adjusted so that both the air sparging and SVE well were operating at approximately the system design parameters for individual wells; SVE flow rate of 50 ACFM and air sparging flow rate of 12 SCFM.
- DTW, DO, and pressure responses in three surrounding monitoring wells were monitored while testing each well.
- System wells in the immediate vicinity of one another were not tested sequentially to allow the monitored subsurface parameters (i.e. DTW, DO, and pressure) to return to static conditions.
- The VOC concentration, as measured with a flame ionization detector (FID), in the SVE blower influent line was recorded.

3.2.2 Start-up Test Results

Results of the SVE start-up testing were input into Vent-ROI®. Vent-ROI® is a computer model designed by GTI for the evaluation of SVE pilot test data to determine the effective SVE radius of influence (ROI). The model combines field measured results with contaminant properties, site characteristics, and clean-up objectives in order to estimate the ROI. Note that the SVE wells in the system are performing two functions in that they remove volatile constituents from the unsaturated zone and collect vapors generated by air sparging in the saturated zone. The results of the Vent-ROI analysis do confirm that the tested SVE wells

perform similarly, if not better than, the design specifications. The three wells tested had effective ROI's ranging from 27 to 48 feet. The conceptual design for the facility called for a 25 foot SVE ROI for approximately the same extraction flow rate. The Vent-ROI output, which also lists the input parameters, is presented in Appendix D.

The results of the air sparging testing were tabulated for analysis. All five tested wells demonstrated that air sparging would result in elevated VOC concentrations (as measured with an FID) in the SVE influent. The increases ranged from one to two orders of magnitude above the concentrations measured during operation of the SVE wells alone. This demonstrates that air sparging will remediate volatile constituents from the saturated zone at the facility. A significant DO change (7.9 mg/l) at a monitoring point (13.4 feet from the air sparging well) was measured during the test of only one system well (SP-2). The failure of the remainder of the air sparging wells to cause a DO change in the monitoring wells is attributable to the short duration of the test and/or the limited number of monitoring wells available.

It was established during the test that a vacuum would be maintained in the subsurface during normal operation of the IRM system which will mitigate the off-site migration of vapors generated by air sparging. The SVE systems radius of influence extended well beyond the air sparge radius of influence. Therefore, VOC's present in the interior and northwest courtyards and VOC's generated by the air sparge system were captured by the SVE system. This mitigates the off site migration of VOC's in the unsaturated zone from these areas.

3.3 VOC Removal Rates

3.3.1 Individual Well Removal Rates

During start-up testing the collocated pairs of SVE/air sparging wells were monitored to determine the mass removal potential for the wells. Each air sparging and SVE well was operated at approximately the design flow rates. The influent air flow from the SVE well and the blower effluent were monitored with the FID for VOC concentrations. The laboratory analytical results from effluent samples collected from the two SVE blower effluents (before the carbon treatment system in the case of the interior courtyard system) on September 13, 1994 (first samples collected from the system) were compared to the VOC concentrations measured with the FID from the same sample ports on that date. The volume ratios (ppmv/ppmv) of TCE and TCA (laboratory results) to total VOCs (measured with the FID) were calculated to be 17% and 15% respectively for the Northwest Courtyard and 41% and 59% respectively for the Interior Courtyard. The large difference between data collected in the two courtyards is considered to be due to VOCs extracted in the Northwest Courtyard are originating primarily in the saturated zone while VOCs in the Interior Courtyard

system originate in the saturated and unsaturated zones. These ratios were then combined with the FID measurements from the start-up testing to estimate the constituent concentrations from the wells. The concentrations along with the measured air flow rate were used to calculate the removal rate for TCE and TCA for the individual wells. The removal rate calculations are presented in Appendix E. Note that these numbers are based on only one sampling event. The estimated removal rates for the wells operating under design conditions are presented in Table 1 below.

TABLE 1
INDIVIDUAL WELL REMOVAL RATES

OPERATING WELLS	VOC by FIELD FID (PPMV)	EXTRACTION FLOW RATE (ACFM)	COURT-YARD	ESTIMATED REMOVAL RATE TRICHLOROETHYLENE (lbs/hour)	ESTIMATED REMOVAL RATE 1,1,1-TRICHLOROETHANE (lbs/hour)
SP/VP-1	70	49	NW	1.2×10^{-2}	1.1×10^{-2}
SP/VP-2	46	53	NW	8.5×10^{-3}	7.6×10^{-3}
SP/VP-3	24	52	NW	4.3×10^{-3}	3.9×10^{-3}
SP/VP-4	27	48	NW	4.5×10^{-3}	4.0×10^{-3}
SP/VP-5	240	50	INT	1.0×10^{-1}	1.5×10^{-1}

The removal rate for SP/VP-6 was not calculated since the well had not yet been replaced when start-up testing was conducted. It is expected that SP/VP-6 would produce VOC concentrations comparable to SP/VP-5 since both are located in the interior courtyard.

3.3.2 System Removal Rates

Removal rates for the IRM system were calculated for the Northwest Courtyard and Interior Courtyard processes. The removal rates were based on the laboratory analytical results for air samples collected from the SVE systems on September 13, September 26, and October 4, 1994 and field data collected on those dates (see Table 2 below). On October 4, 1994 the sparge blower motor from the northwest courtyard had seized due to an imbalance in one leg of the three phase motor. Therefore, a sample was not submitted to the laboratory on this date. This motor was replaced with a new motor on November 16, 1994. Laboratory reports are presented in Appendix F. The removal rate calculations are presented in Appendix E. The calculated removal rates for the SVE systems are shown in Table 3.

TABLE 2
LABORATORY ANALYTICAL RESULTS

DATE	NW CRTYRD FLOW RATE (ACFM)	NW CRTYRD TCE (ppmv)	NW CRTYRD TCA (ppmv)	INT. CRTYRD FLOW RATE (ACFM)	INT.CRTYRD TCE (ppmv)	INT.CRTYRD 1,1,1-TCA (ppmv)
9/13/94	210	13	12	118	67	95
9/26/94	220	<2.0	<2.0	160	48	70
10/4/94	220	NOT SAMPLED*	NOT SAMPLED*	160	59	39

* Field measurements with FID showed low VOC concentrations of 1.0 ppmv in the process flow so a sample was not collected.

TABLE 3
ESTIMATED SYSTEM REMOVAL RATES

DATE	NW CRTYARD TCE (lb/hour)	NW CRTYARD 1,1,1-TCA (lb/hr)	INT. CRTYARD TCE (lb/hr)	INT. CRTYARD 1,1,1-TCA (lb/hr)
9/13/94	5.7×10^{-2}	5.6×10^{-2}	2.3×10^{-1}	1.6×10^{-1}
9/26/94	$<9.1 \times 10^{-3}$	$<9.0 \times 10^{-3}$	1.6×10^{-1}	2.3×10^{-1}
10/4/94	NOT SAMPLED	NOT SAMPLED	1.9×10^{-1}	1.3×10^{-1}

3.3.3 Granular Activated Carbon Usage Calculation

It was projected, based on pilot test data, that the Northwest Courtyard SVE/air sparging effluent air would contain VOC concentrations low enough that it would not need emission controls to comply with New York State Air Guide-1 guidelines. Therefore, no emission controls were incorporated into the design. The start-up data and subsequent monitoring data have demonstrated that the Northwest Courtyard SVE system effluent does comply with New York regulations.

Based on the higher concentration of soil and groundwater contamination in the Interior Courtyard, it was projected that the SVE/air sparging effluent from this area of the site would require treatment to meet New York State discharge standards for TCE and TCA. Therefore, the Interior Courtyard SVE system effluent is being treated using vapor phase granular activated carbon (GAC) to adsorb VOCs from the air stream. The system uses four (4) drum type (200 pounds of GAC each) units. The average concentration for TCE and 1,1,1-TCA from the first three (3) analytical samples collected from the influent to the GAC system (September 13 and 26 and October 4, 1994) were 68 ppmv and 53 ppmv respectively. It should be noted that noted that the analytical results from September 13, 1994 were extrapolated to the estimated carbon system influent concentration (at 160 ACFM) instead of the listed blower influent concentration (at 118 ACFM)). These concentrations, along with the flow rate and the estimated influent air temperature were

Input into the GTI computer program GAC-USE to estimate the start-up GAC consumption rate. GAC-USE uses empirically derived equations for carbon adsorption capacities for various compounds to estimate the consumption rate. The estimated GAC consumption rate, based on the average influent concentrations, is approximately 11,500 pounds per year, or 960 pounds per month (Appendix G). This translates to a loading rate of 0.30 pounds of contaminants per pound of GAC. Note that this loading rate is based on start-up conditions, and actual break-through will depend on several parameters (such as influent concentration, flow rate, temperature, relative humidity, etc.) that will generally decrease throughout the operation of the IRM system. Therefore, GAC replacement will be based on field and analytical measurements collected at the site. Actual breakthrough of the carbon was reported on November 21, 1994. As anticipated, the emission rates were still below NYSDEC air emission guidelines. As a conservative measure, the interior courtyard system was shut down on November 21, 1994, the carbon was replaced on December 1, 1994 and the system restarted. Based upon the most recent analytical data, the carbon consumption rate has reduced to 221 pounds of GAC per month. (Appendix G)

4.0 CONCLUSIONS

The IRM system has been installed and tested according to the Operational and Maintenance Plan for the IRM Workplan dated February 24, 1994 with minor variations in piping runs and locations of equipment due to field conditions. The IRM installation is documented in the attached drawings titled "Interim Remedial Measure -Soil Vapor Extraction/Air Sparging System, As-Built Details", November 7, 1994.

The following conclusions have been made regarding the results of start-up testing:

- The SVE wells and equipment can maintain the ROIs specified in the Conceptual Design (IRM Work Plan Section 3). Therefore, the SVE system will be able to remediate VOC's in the region of the site shown in the Conceptual Layout (Figure 3-2, IRM Work Plan section 3).
- Air sparging resulted in significant increases in the SVE influent VOC concentrations, as compared to the use of SVE without air sparging. Therefore, the IRM system can remediate VOC in the saturated zone. In addition, the SVE system can maintain a vacuum in the subsurface thus capturing vapors generated by the air sparge system.
- The removal rates for TCE and TCA (combined) ranged from 5.0×10^{-1} to 3.2×10^{-1} lbs/hour during the period from September 13 through October 4, 1994.
- The emission rate for TCE and TCA from the SVE system remediating the Northwest Courtyard will result in concentrations below the New York State guidelines (Air Guide-1, Appendix B (April 1994 edition, New York State Department of Environmental Conservation).
- The emission rate for TCE and TCA from the SVE system operating in the Interior Courtyard could initially result in emission impacts above the New York State guideline concentrations if emitted directly to the atmosphere. Therefore, the system emission is being treated using vapor phase GAC. The initial estimated GAC consumption is 3.3 pounds of GAC per pound of contaminant removed. This results in an initial consumption rate of 960 pounds per month based on start-up conditions. This rate will vary based on current system conditions and should reduce over time as illustrated by the November 8, 1994 analytical results which indicate a consumption rate of 221 pounds of GAC per month.

APPENDIX A

INTERIM REMEDIAL MEASURE, SOIL VAPOR EXTRACTION/AIR SPARGE SYSTEM,

AS-BUILT DRAWINGS (UNDER SEPARATE COVER)

APPENDIX B

ORS EQUIPMENT MANUAL

GROUNDWATER TECHNOLOGY

ENVIRONMENTAL SYSTEMS

A DIVISION OF SIPPICAN, INC.

SOIL VAPOR EXTRACTION AND AIR SPARGING SYSTEM INSTALLATION AND OPERATION MANUAL

#1941269
8/12/94
Rev. 0

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PREFACE

ABOUT THIS MANUAL

This manual contains all the information required to deploy, operate and maintain and troubleshoot the Integrated Soil Vapor Extraction and Sparge System. Included are Warnings and Cautions, complete equipment specifications, detailed system layout drawings and Process and Instrumentation Diagrams. The documentation package is organized to reflect the modular nature of the System. This manual provides information on the system as a whole while the Equipment Supplements provide information specific to the system components. Additional manuals are specific to the SITEPRO™ 2000 Control Panel and the SITEPRO Manager Remote Monitoring Software. The System "Quick Start Envelopes" provide wiring details.

ADDITIONAL DOCUMENTATION REQUIRED

- SITEPRO™ 2000 Blower/Pump Control Panel manuals (one per panel)
- SITEPRO™ Manager Remote Monitoring Software Installation Guide and User Manual

WHAT THIS MANUAL COVERS

Here is what you will find in this manual:

Section 1: System Description includes;

- Equipment Description
- Operating Parameters
- Process & Instrumentation Diagram, Layout Diagram, Power Distribution panel Schematic

Section 2: System Installation includes;

- Deployment instructions
- Plumbing and wiring details

Section 3: System Startup includes;

- System startup procedure

Section 4: System Operation includes;

- System Configuration diagrams
- Routine operation

Section 5: System Manintenance includes;

- Schedule of routine maintenance procedures
- Reference to Equipment Manuals and Appendices

Section 6: System Troubleshooting includes;

- Basic system troublshooting procedures

SVE Supplement includes;

- Manufacturers Specifications for Soil Vapor Extraction Blowers (Rotron Model EN8).
- Moisture Separator and Level Switch Specifications

Sparge Supplement includes;

- Manufacturers Specifications for Sparge Blowers (Roots Model 24URAI & Gast 6066).

Additional Equipment

Heat Exchanger Supplement includes;

- Manufacturers Installation, Operation and Maintenance instructions

Flow Meter Supplement includes;

- Manufacturers Specifications and adjustment procedure

Pressure Relief Valve Supplement includes;

- Installation, Maintenance and Parts ordering information.

Temperature Switch Supplement includes;

- Installation, Operation and Maintenance instructions.
- Temperature Indicator installation and adjustment instructions

DOCUMENTATION CONVENTIONS

This manual uses the following conventions to present information:

WARNING

An exclamation point icon indicates a WARNING of a situation of condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the WARNING message.

CAUTION

A raised hand icon indicates CAUTION information that relates to a situation of condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the CAUTION message.

NOTE

A note icon indicates NOTE information. Notes provide additional or supplementary information about an activity or concept.

SYSTEM WARNINGS AND CAUTIONS

- This System includes equipment components that are potentially hazardous and must be operated and maintained in accordance with the procedures outlined in this manual. Filure to do so could lead to personal injury or equipement damage.
- **Disconnect power prior to opening any electrical enclosures.**
- Always wear eye protection, gloves and proper clothing when performing maintenance procedures. Refer to the Maintenance section of this manual for further recommendations.
- **All Wiring must be in accordance with local codes.**
- Place the system on a level surface to insure proper stability. Refer to the Installation Section of this manual for further recommendations.
- Before wiring power to the Power Distribution Panel, confirm that the service matches the power requirements of the panel. Refer to the System Specifications in Section 1.

WARRANTY

Refer to the back of this manual for the ORS Standard Equipment Limited Warranty.

FOR MORE INFORMATION

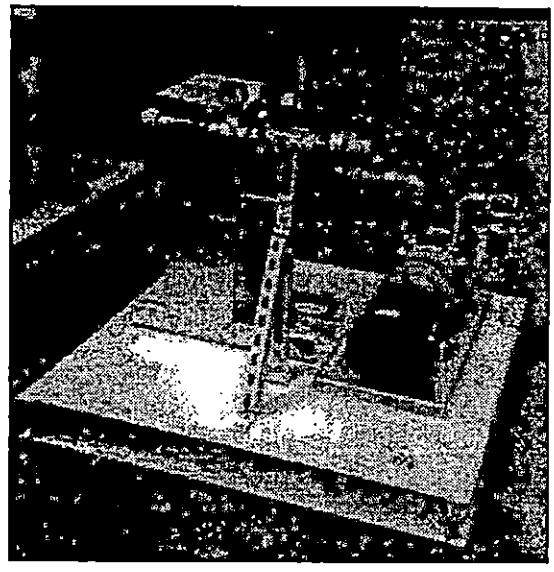
If you need additional information about this or any other ORS product, you can contact our Sales or Technical Support Staff at:

ORS Environmental Systems
32 Mill Street
Greenville, NH 03048
Phone: (800) 228-2310
(603) 878-2500
Fax: (603) 878-3866

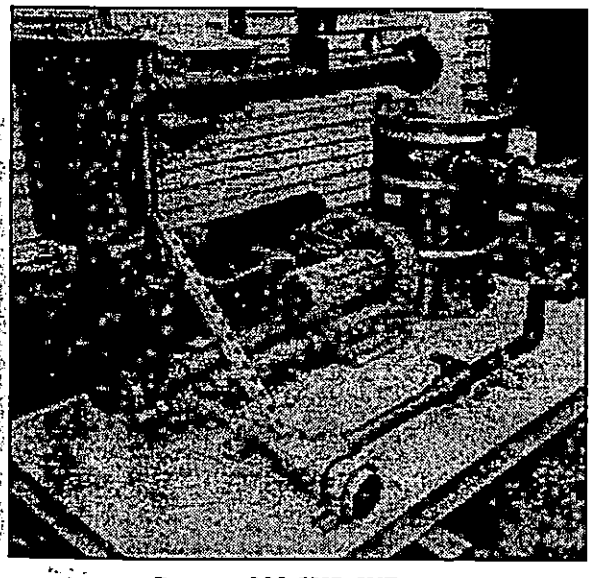
SECTION 1: SYSTEM DESCRIPTION

The Integrated Soil Vapor Extraction and Air Sparging System described in this manual was designed and constructed by ORS Environmental Systems to provide efficient turnkey service at the Bulova Watch Project. The system consists of four open skids (shown below) that support pre-wired and plumbed remediation equipment designed for soil degassing and subsurface ventilation. Sparge skids support a blower, inlet filter, pressure relief valve and heat exchanger system, SVE skids include a blower, filters and moisture separator. The Integrated Control System for all 4 skids is shipped separately, to be installed at the site. Designed for rapid deployment, the Soil Vapor Extraction and Sparge Equipment is reusable and can be transported from site to site.

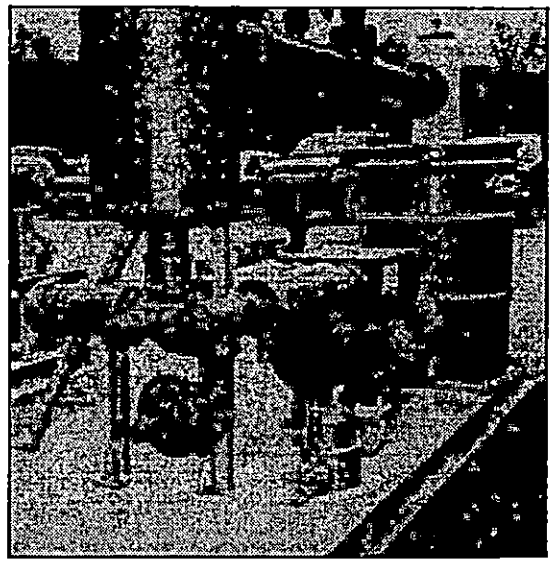
Process 100 Rotary Lobe Sparge



Process 200 Rotary Vane Sparge



Process 300 5HP SVE



Process 400 10 HP SVE

Figure 1. *Equipment Skids.*

SPECIFICATIONS

SKIDS

• Dimensions:	*Process 200 & 400: 48" W x 72"L (1.6m x 2.3m)* *Process 100 & 300: 60"W x 72"L (1.9m x 2.3m)*
• Construction materials	*Steel with latex paint*
• System weight	*Process 100 & 300: 1200 pound approx. dry weight.* *Process 200 & 400: 600 pound approx. dry weight.*

HAZARDOUS AREA CLASSIFICATION

SVE Skids to be installed in a Class 1, Division 1 hazardous area, Sparge skids and control panels are to be located outside of the hazardous area.

CONTROL PANEL

SITEPRO™ 2000 Control Panel: NEMA 4X enclosure

Power Distribution Panel: NEMA 3R enclosire

ELECTRICAL

System is designed to NEC Standards for use with 230VAC, 3-phase power. A 150 Amp service with neutral is required.

PLUMBING

Schedule 80 PVC &Galvanized piping is used on all lines. NPT threaded couplings are used throughout.

Specifications for the SITEPRO 2000 control panel can be found in the separate manual provided with your system. Specifications for the Additional Equipment can be found in the Product supplements at the back of this manual.

SYSTEM COMPONENTS

(2) 4' x 4' steel skids with integral grounding lug. PN 98956

(2) 4' x 8' steel skids with integral grounding lug. PN 98957.

(4) SITEPRO™ 2000 Control Panels, enhanced model with SITEPRO Manager Remote Monitoring Software (see separate Manuals for further information)

(1) Power Distribution Panel (PN 98933) equipped with:
- 150 amp circuit breaker
- six external motor contactors
- integral grounding bar
- fuses and spare terminals sized for 15 amp load

PROCESS 100: 5HP ROTARY LOBE SPARGE SYSTEM

(1) Roots 24URAI blower (PN 98952) equipped with:
- 5 HP, TEFC, 230/460 VAC, 60 Hz, 3-phase motor
- belt drive and guard
- inlet particulate filter
- inlet and discharge silencers (PN 98930)

(1) Gast model AA307 pressure relief valve (PN 98951)

(1) Air Technologies model S040AC1H, heat exchanger system; (PN 10429)

(1) high temperature switch; (PN 99260)

(1) temperature indicator (PN 98934)

PROCESS 200: 10 HP SVE SYSTEM

(1) Rotron model EN8BD72WL (PN 99400) equipped with:
- 10 HP, XP, 230VAC, 60 Hz, 3-phase motor

(1) Rotron model MS500BS Moisture Separator (PN 10326) equipped with
- explosion proof high level switch
- vacuum relief valve

(1) inlet particulate filter equipped with:
- vacuum gauges before and after

(1) silencer (PN 98941) for manual air dilution valve

(1) Erdco model 321116T0 50-400SCFM local readout flow meter (PN98959)

PROCESS 300: 5HP ROTARY VANE SPARGE SYSTEM

Same as Process 100 (above) except

(1) GAST model 6066 equipped with:
- 5 HP, TEFC, 230VAC, 60 Hz, 3-phase motor

PROCESS 400: 5 HP SVE SYSTEM

Same as Process 200 (above) except

(1) Rotron model EN 707F72XL equipped with:
- 5 HP, XP, 230VAC, 60 Hz, 3-phase motor

Figures 2 & 3, page 8 & 9 are the System Process and Instrumentation Diagrams, Figure 4-7, page 10 & 11 show the System Layouts with major components labelled for easy identification.

POWER CONNECTIONS

230 VAC, 3-phase power is connected to the 150 amp circuit breaker inside the Power Distribution Panel; Figure 8, page 12 is the Control Panel Schematic which details system component wiring.

The Power Distribution panel is equipped with a circuit breaker switch which is operated by a lockable handle. When the circuit breaker switch is turned to the ON position, power is applied to the following components:

- Motor contactors for four blowers and heat exchangers
- SITEPRO™ Panels
- lightning arrester

PLUMBING CONNECTIONS

Field plumbing connections are made at the fittings detailed on the System Layout Diagrams (Figures 4-7 , p. 12 & 13). See the table, below, for type and size of fittings.

Process #	Figure / pg.	Inlet Fitting	Outlet Fitting
100	*Fig. 7 / p. 13*	*Ambient Air*	*1" CA-PVC*
200	*Fig. 4 / p. 12*	*4" Sch. 80 PVC Slip*	*4" galv. NPT*
300	*Fig. 6 / p. 13*	*Ambient Air*	*1" CA-PVC*
400	*Fig. 5 / p. 12*	*4" Sch. 80 PVC Slip*	*4" galv. NPT*

SYSTEM FUNCTION

The Integrated SVE and Air Sparging System works by blowing air into, and then pulling it through, ground that has been saturated with hydrocarbon. This causes volatile organic compounds to vaporize. These vapors are carried through the vent ductwork to the outside atmosphere or vapor abatement system.

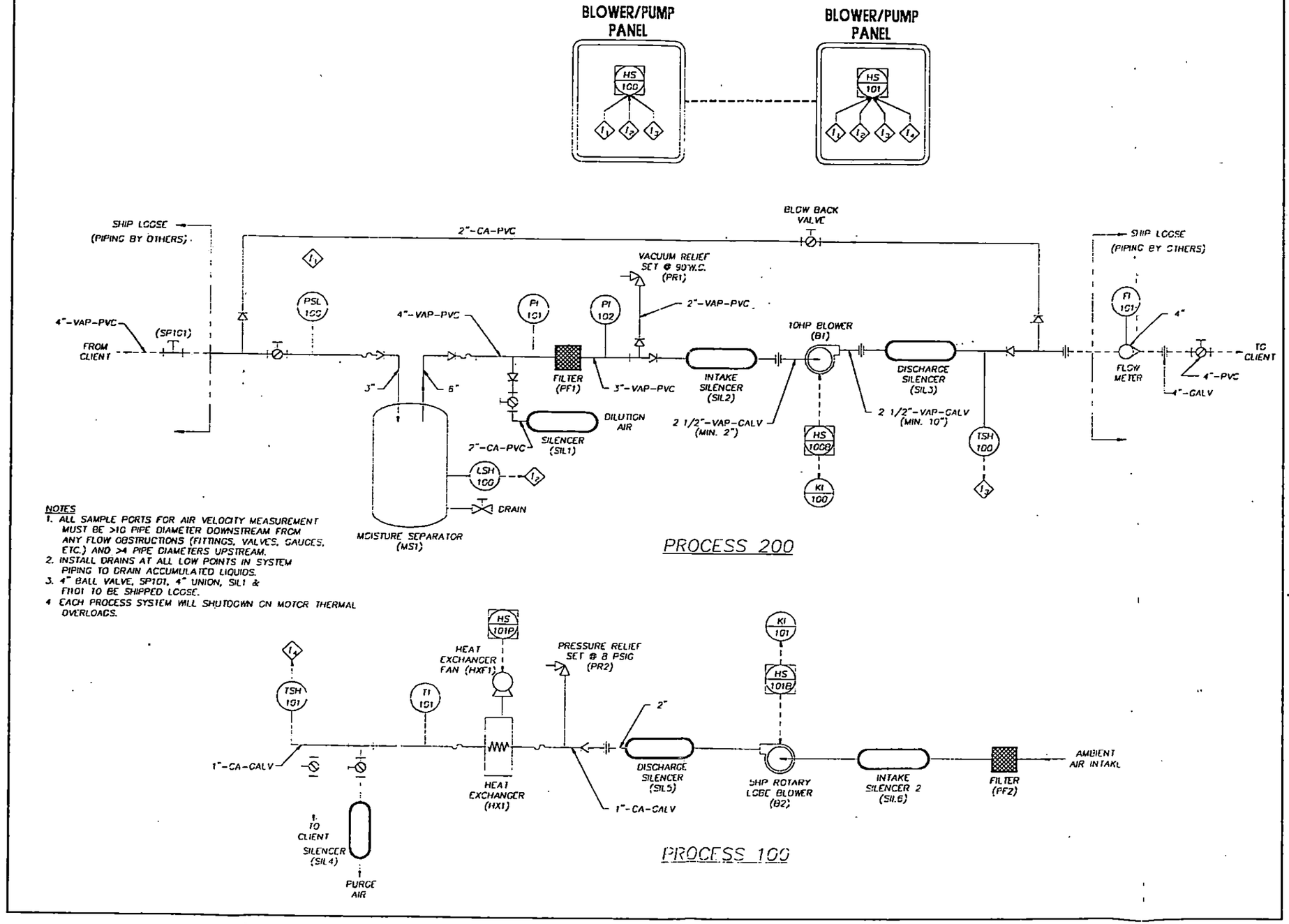


Figure 4. System Process and Instrumentation Diagram.

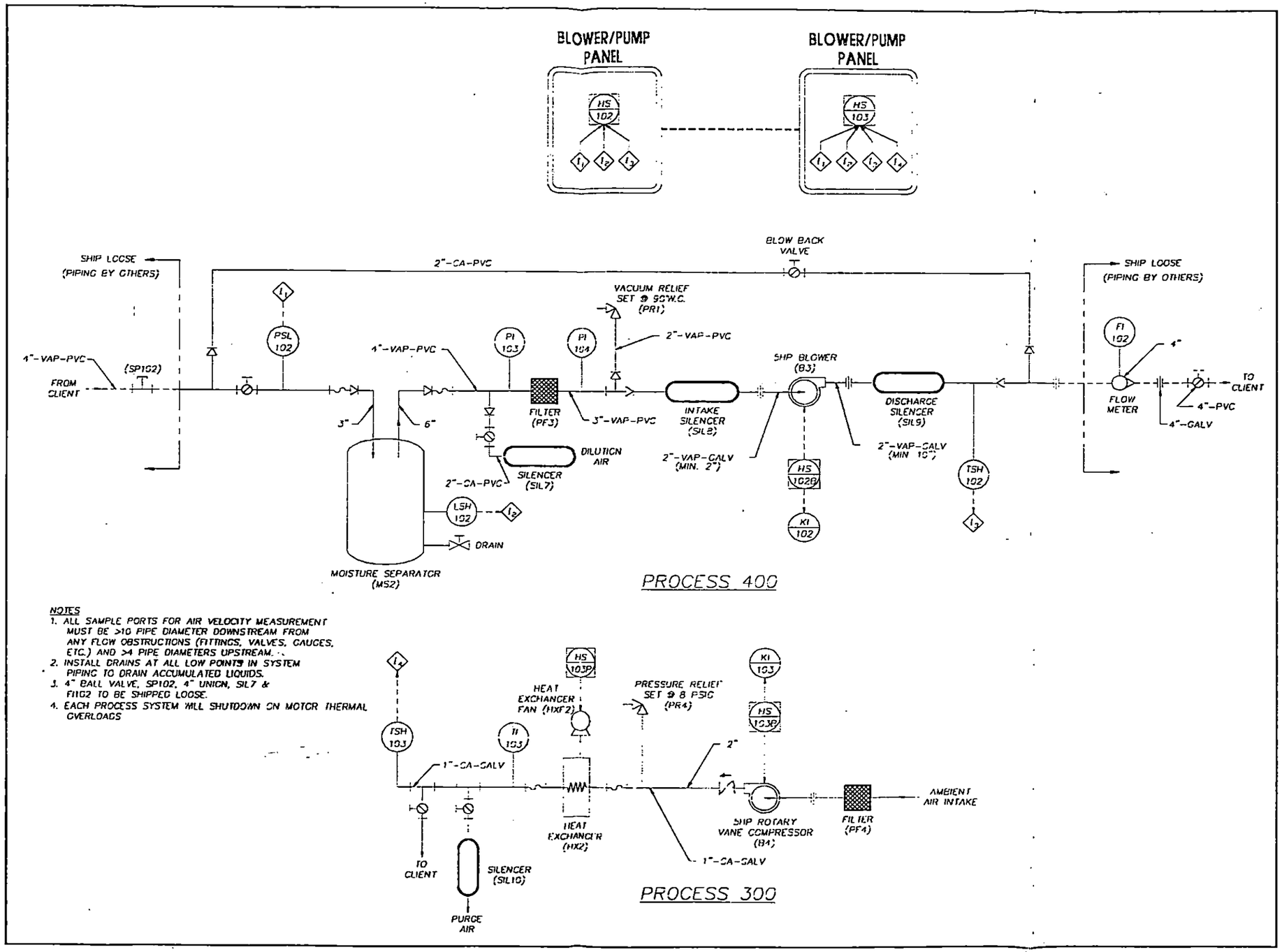


Figure 5. System Process and Instrumentation Diagram.

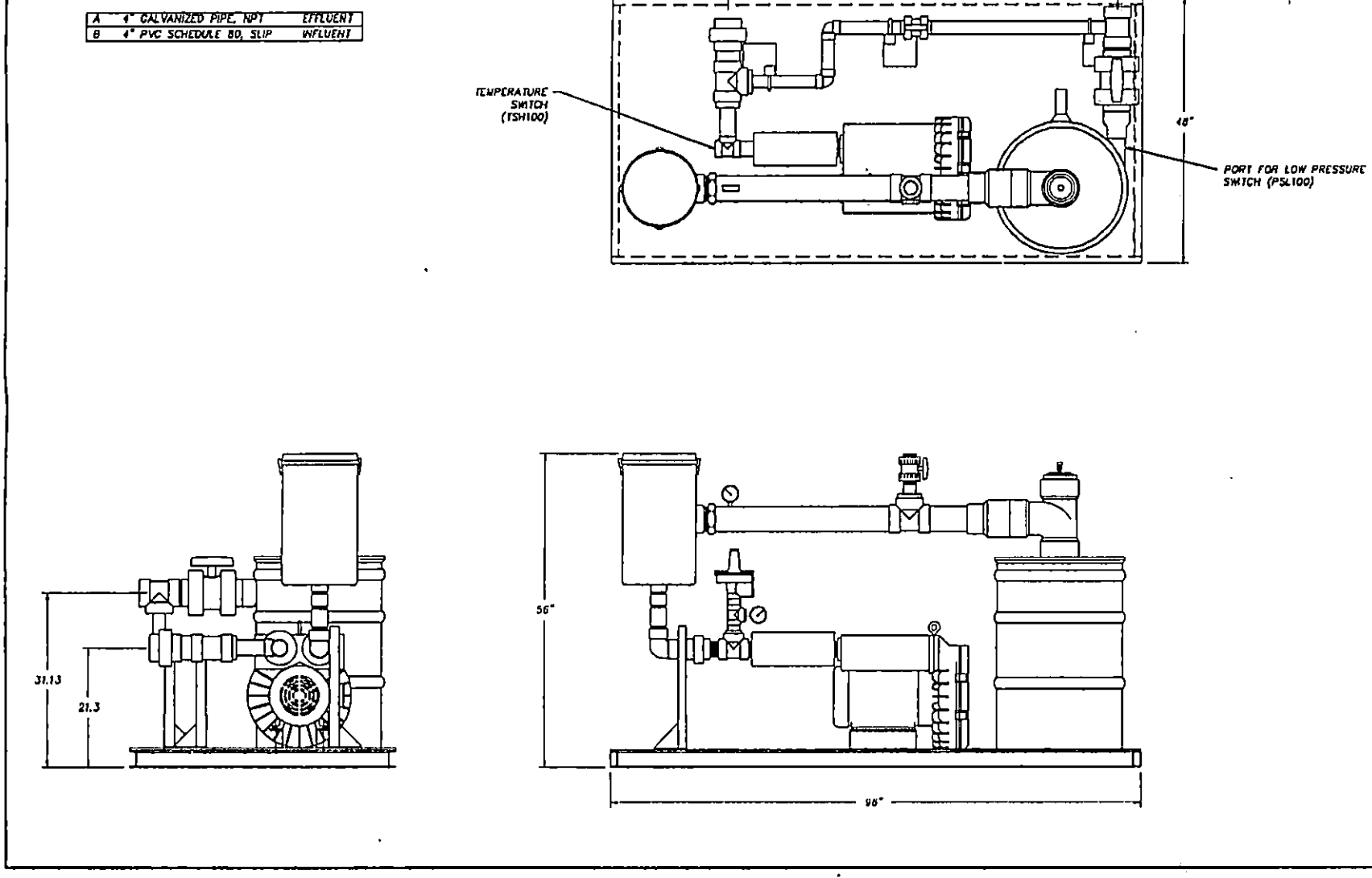


Figure 6. Process 200 Layout Diagram.

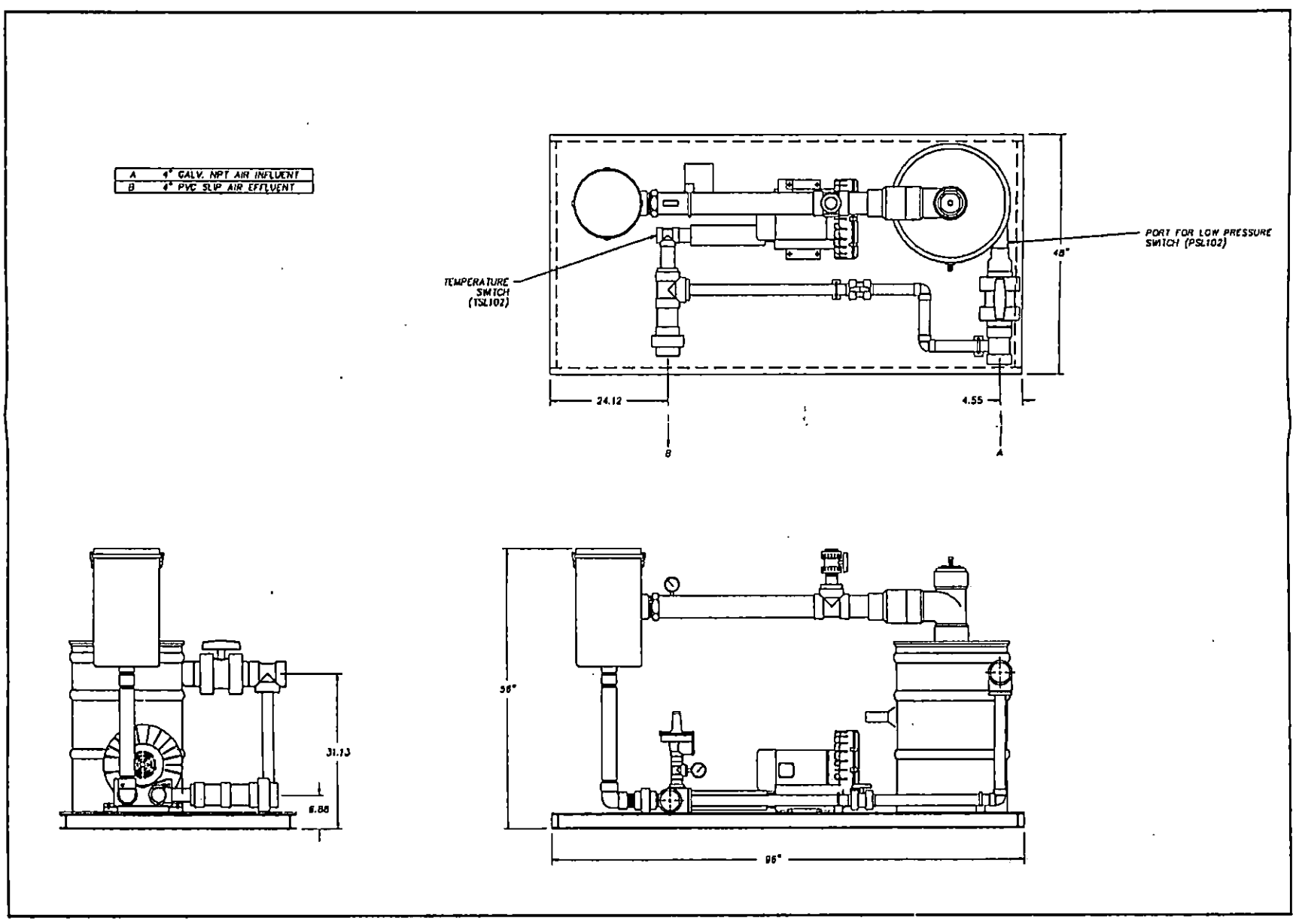


Figure 7. Process 400 Layout Diagram.

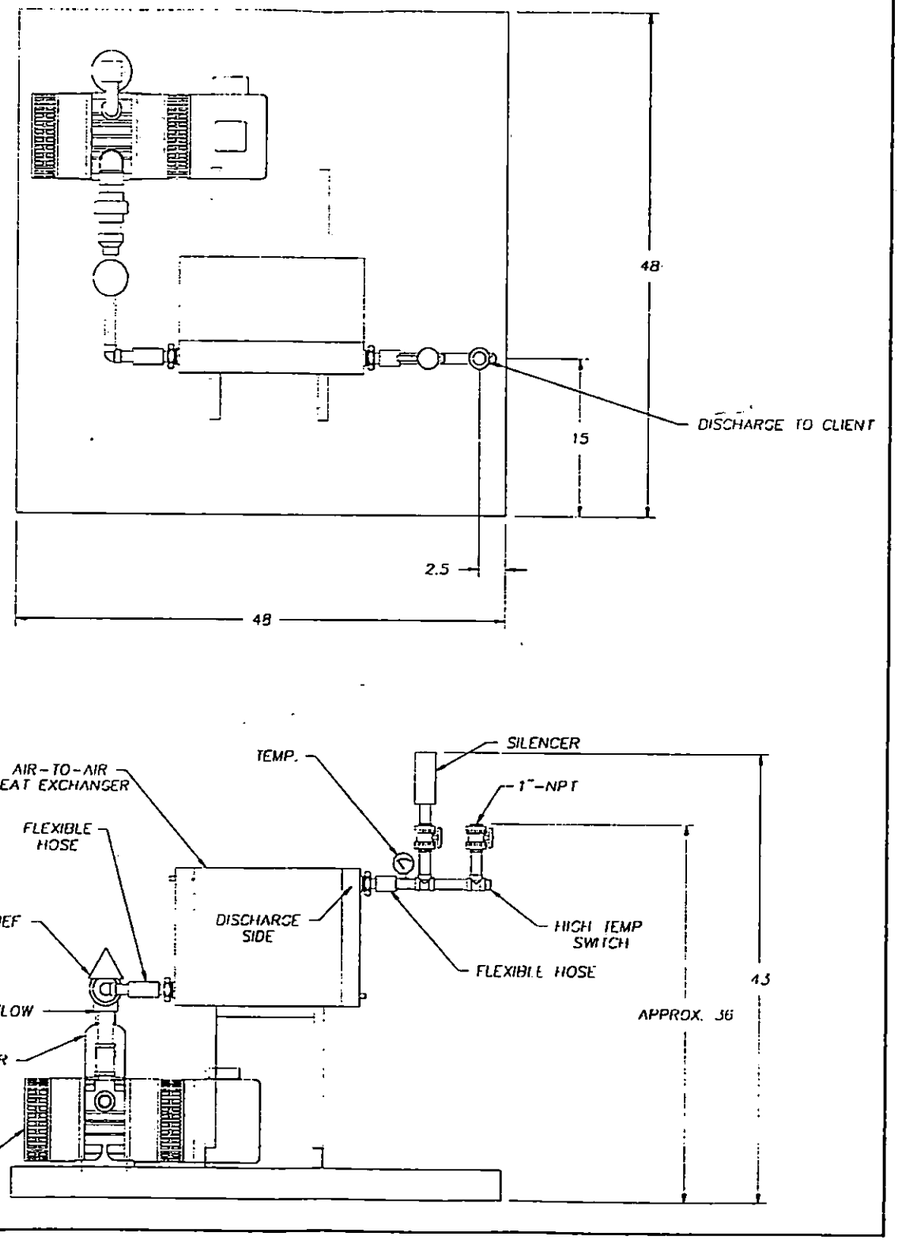


Figure 8. Process 300 Layout Diagram.

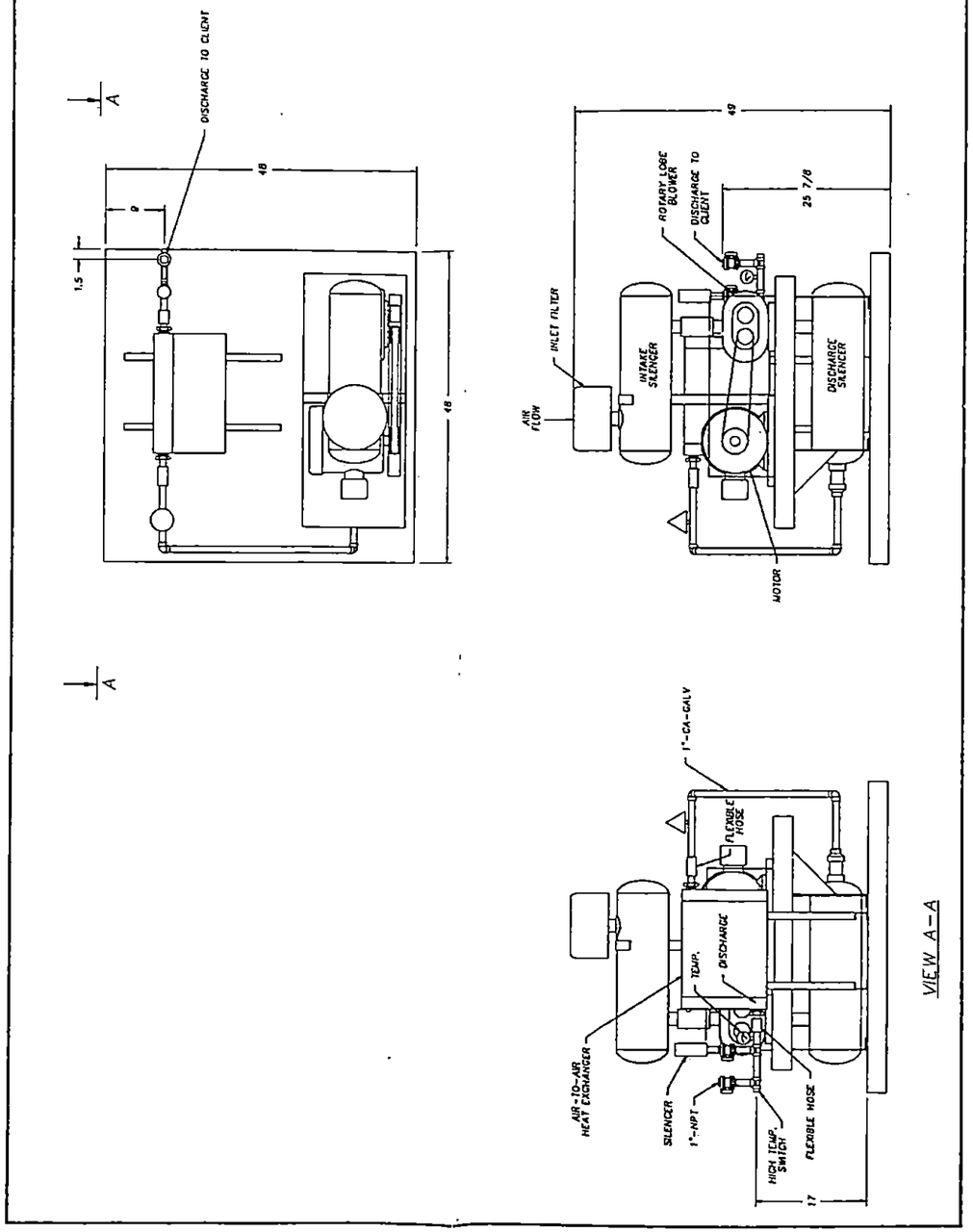


Figure 9. Process 100 Layout Diagram.

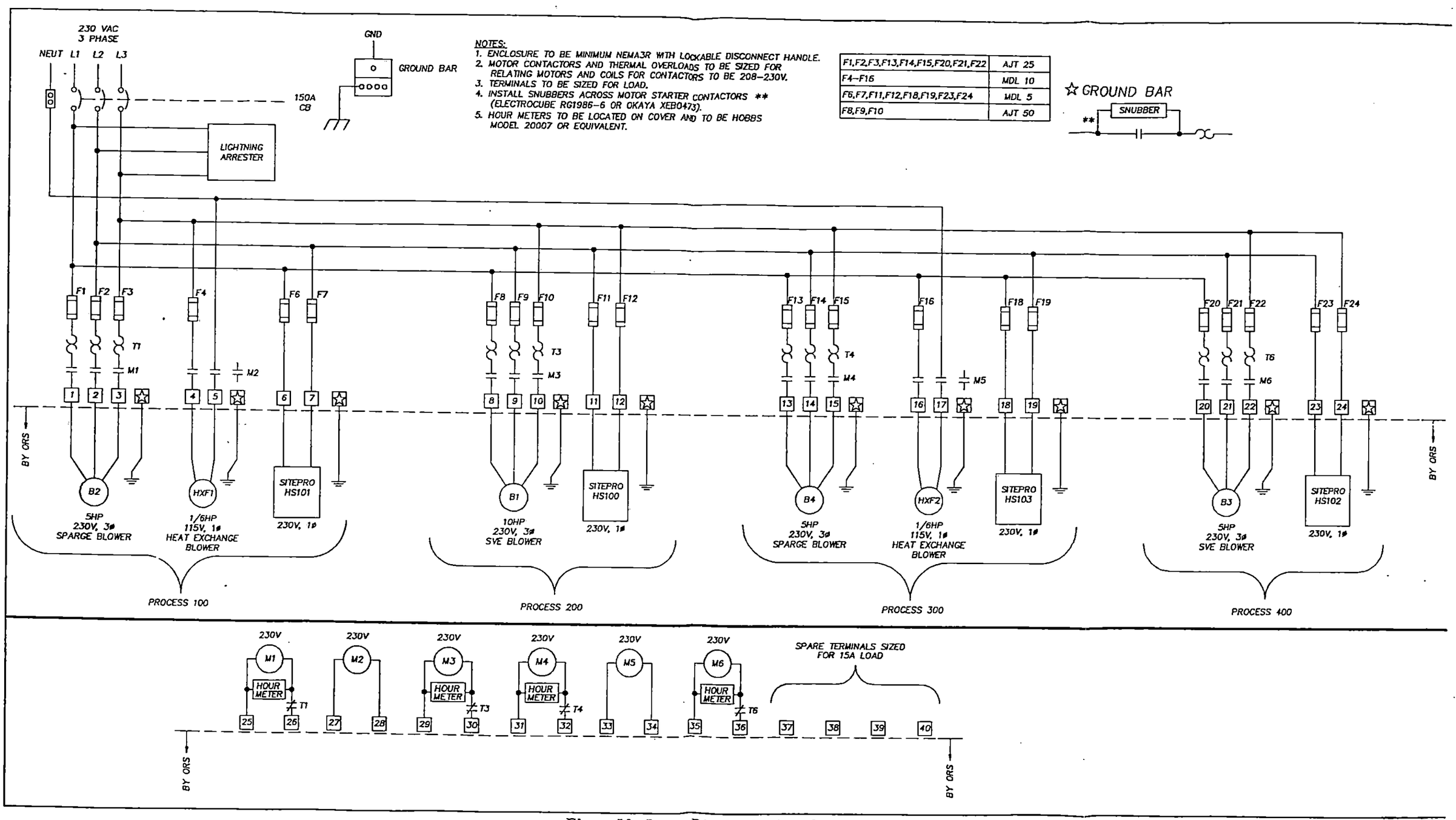


Figure 10. Power Distribution Panel Schematic

SECTION 2: SYSTEM INSTALLATION

The Integrated Soil Vapor Extraction and Air Sparging System is designed for quick, easy installation with a minimum of site preparation required.

INSPECTION

Inspect all equipment upon arrival. Check the contents of packing crates against the System Specifications in Section 1. If any items are missing or damaged, make note of this on the shipping papers and immediately notify ORS Envirnmental Systems at (800) 228-2310.

SITE PREPARATION

The System can be deployed on any flat surface that is firm enough to support the skids.

REQUIRED FACILITIES

The system requires a 230 VAC, 3-phase, 150 Amp electrical service.

DEPLOY SKIDS

Place the skid at the site and ensure that it is level.

CAUTION

Indoor installations require proper ventilation.

PLUMB SKIDS

Manifold the vapor influent of each skid to the vapor source.

Vent all effluent pipes according to local codes.

Install silencers & flow meters according to manufacturers specifications found in the equipment supplements at the back of this manual.

Install all ball valves and plumbing according to industry standards.

PANEL INSTALLATION

WARNING

The SITEPRO™ 2000 Blower/Pump Controller must be deployed in a non-hazardous location and all conduit runs from the vapor source to the panel must conform to Article 501-5 of the National Electrical Code (NEC) 1993.

MOUNT PANELS

Refer to Chapter 2: System Installation of the SITEPRO 2000 manual and mount the panels in the desired location.
Mount Power Distribution Panel adjacent to SITEPRO Panels.

WIRING

Refer to the SITEPRO™ 2000 Blower/Pump Control Panel manual (Chapter 2) and to the accompanying Quick Start Packages for complete Installation and Wiring procedures. The following guidelines refer to specific equipment on the Integrated SVE and Sparge systems.

All wiring must be performed by a qualified electrician and be in accordance with state and local codes. Conduit runs must conform to Article 501-5 of the 1994 National Electrical Code (NEC).

WIRE POWER TO POWER DISTRIBUTION PANEL

Refer to the Power Distribution Panel Schematic (Figure 8, p. 14) and hardwire 230VAC, 3-phase power to the circuit breaker inside the panel.

Power must be disconnected and locked out at the panel or service before any further installation procedures are attempted.

WIRE XP SWITCHES

Wire explosion proof switches as shown on the Field Wiring Diagrams included with the Sitepro 2000 Quick Start Packages. Refer to Figure 8, pg. 14 of this manual for Power Distribution Panel Schematic.

SECTION 3: SYSTEM STARTUP

SYSTEM PRECHECK PROCEDURES

Before starting the system, carry out the precheck procedures outlined in the SITEPRO™ Blower/Pump Control Panel manual (p. 4-11) to familiarize yourself with the controls and confirm correct operation.

Once precheck procedures have been completed, the SITEPRO 2000 control panel network is ready for operation.

APPLY POWER

Set the circuit breaker switch on the Power Distribution Panel in the ON position.

Check the direction of motor rotation (for proper wiring).

NETWORK STARTUP

1. Turn each panel's PUMP and BLOWER POWER switches to ON.

2. Turn each panel's PUMP CONTROL switch to AUTO and BLOWER CONTROL switch to RUN.

3. On the Slave panel (HS #101), turn the CONTROL POWER switch to ON. The panel will then go through its own self-test routine and will begin blinking its MAIN POWER indicator.

4. Make the same switch settings on the Master panel. After going through its self-test routine, the Master will begin blinking its MAIN POWER indicator. The Master will then:

   a. Check the number of Slaves on the network against the setting on its CONTROLLER ADDRESS switch. See Chapter 3 (of SITEPRO manual) for switch configuration procedures.

   b. Poll Slaves at their pre-programmed network addresses until each is accounted for and connected to the network. The Slaves are polled in ascending numerical order as determined by their network addresses.

Once the Slave comes on the network, its MAIN POWER indicator stops blinking and remains steadily illuminated. If the Slave cannot be located by the Master or suffers a fault that prevents it from coming on the network, the Master's MAIN POWER indicator will continue blinking until the problem is eliminated and polling can be completed.

When the Slave has been connected to the network, the Master's MAIN POWER indicator will stop blinking and remain steadily illuminated. The network is now ready for operation.

The pumps and blowers will begin functioning according to the System Process and Instrumentation Diagrams (Figures 2 & 3, page 12 & 13).

SECTION 4: SYSTEM OPERATION

MOISTURE SEPARATOR FLOAT SWITCH

A High level in the moisture separator tank will signal an alarm on Interlock channel 2. All system components will shut down.

LOW PRESSURE SWITCH

Low pressure in the influent line will signal an alarm on Interlock channel 2. All system components will shut down.

FLOW METER

The flow meter measures the instantaneous flow rate of air through the effluent pipe of the SVE Blower.

SVE BLOWER

During normal operation the blower will run continuously. A low pressure condition will signal an alarm on Interlock channel 2 and a high temperature condition will signal an alarm on Interlock channel 3. See the System Configuration Section for details of interlock alarms.

SPARGE BLOWER

During normal operation the blower will run continuously. A high temperature condition will signal an alarm on Interlock channel 4 which will shut down sparge blower. See the System Configuration Section for details of interlock alarms.

HEAT EXCHANGER

During normal operation the heat exchanger will run continuously. Whenever the sparge blower shuts down the heat exchanger will also shut down. See the System Configuration Section for details of Interlock alarms. See the Additional Equipment section at the back of this manual for Operation procedures.

VACUUM RELIEF VALVES

See the Additional Equipment Section at the back of this manual for operation procedures.

TRACING AND CLEARING ALARMS

In network applications, alarms can be generated by interlock devices wired to any panel in the network. Depending upon the configuration of the panels' SEND/RECEIVE switches, any number of panels in the network can be shut down by a single alarm. Also, because a panel shutdown can trigger site conditions that lead to additional alarms, it may not be immediately clear which interlock device initiated the shutdown "cascade." Proceed as follows to restore network operation;

1. Locate the one panel in the network whose ALARM ENGAGED indicator is blinking. This is the first panel to receive the interlock alarm signal. The interlock device can then be isolated by interpreting the channel code being blinked by the indicator.

In large multi-panel networks, some footwork can be eliminated by using the SYSTEM TEST button (pp. 4-4 and 4-7) to isolate the alarm channel. Once the alarm channel has been isolated, refer to your Network Configuration Sheet (p. A-4, Appendix A) to determine which interlock devices are attached to that channel.

2. Correct the condition that caused the alarm.
3. Clear the alarm by turning the PUMP CONTROL switch to OFF and then back to AUTO.

If the ALARM ENGAGED indicator goes out when the PUMP CONTROL switch is reset, then the network is free of interlocks. Normal operation can resume. However, if the indicator blinks an alarm channel code, additional alarms must be cleared. Repeat steps 1-3 above until all alarms have been cleared from the network.

LATCHING AND NON-LATCHING ALARMS

When the telemonitoring option is installed, alarms can be remotely configured to be either latching or non-latching. Non-latching alarms will automatically clear when the condition that caused the alarm is corrected. When a non-latching alarm clears, an automatic "CLEAR INTERLOCKS" command is issued to all panels in the network, clearing all other interlock alarms.

SYSTEM CONFIGURATION

Shown below are the final configuration settings for each of the SITEPRO™ Blower/Pump Control Panels. See the SITEPRO manual for further information.

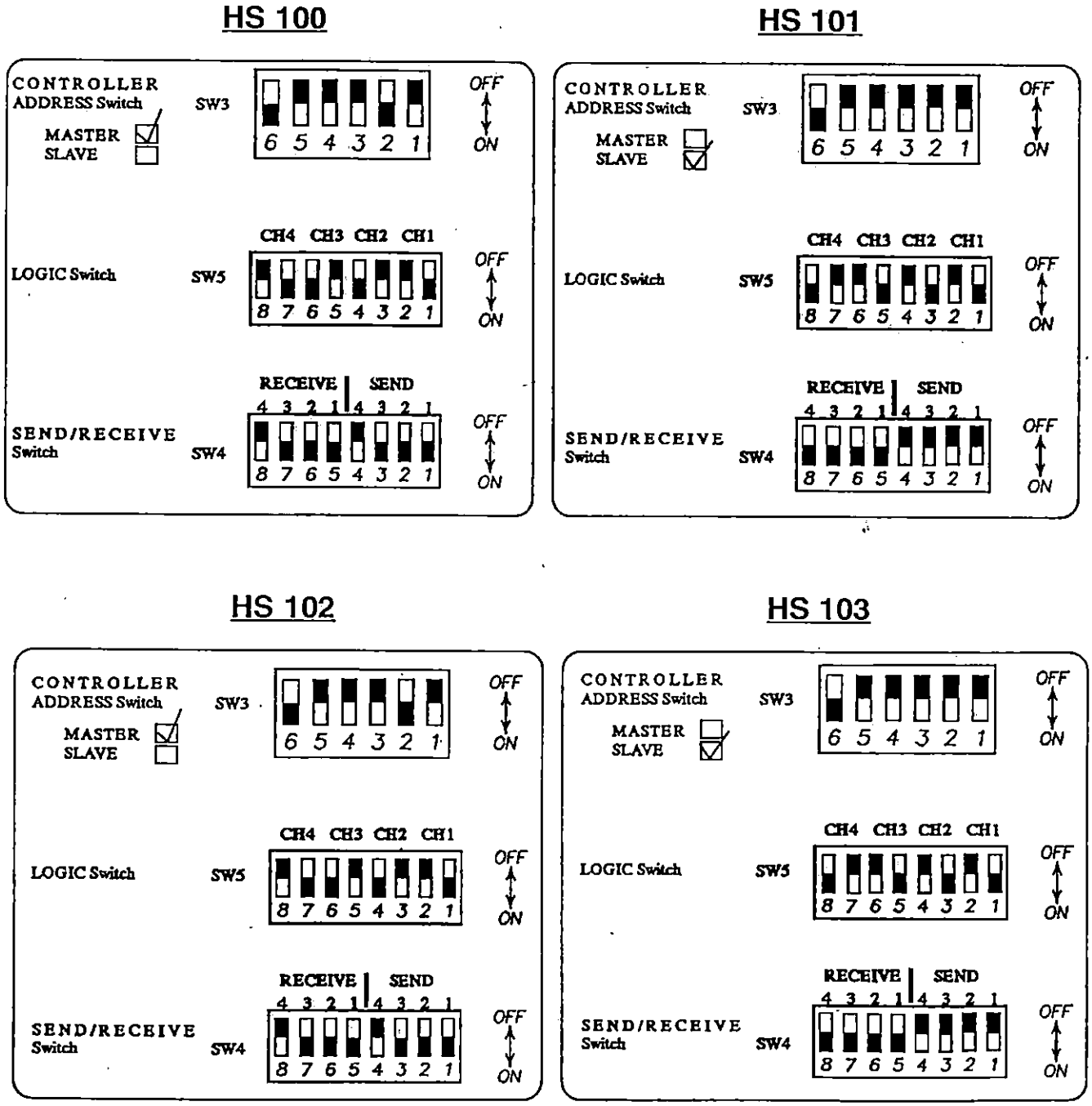


Figure 11. Sitepro Control Panel Configuration Switch Settings.

INTERLOCK SETTINGS

The following table outlines the interlock settings for the Integrated Water Treatment System. See the SITEPRO Blower/Pump Control Panel manual for further information regarding interlocks.

CHANNEL	PID SYM.	SIGNAL	SHUTS DOWN
Interlock 1:	PSL/100 PSL/102	Low pressure in influent line	All system components
Interlock 2:	LSH/100 LSH/102	a) ; Moisture separator tank High Level	All system components
Interlock 3:	TSH/100 TSH/102	SVE High Temperature	All system components
Interlock 4:	TSH/101 TSH/103	Sparge High Temperature	Sparge Blower & Heat Exchanger

Figure 12. Interlock Channel Configuration.

SECTION 5: SYSTEM MAINTENANCE

The table below provides a quick reference to system maintenance procedures. Refer to each of the equipment supplements and manuals included with this system for complete maintenance schedules and requirements.

INTEGRATED SVE and Sparge SYSTEM #1941269

FREQUENCY OF MAINTENANCE TASKS / ANNUAL CALANDER

SYSTEM COMPONENET	TASK	BI	MO	QUA	ANN
System Maintenance	Inspect all hoses and wires for cracks, cuts and abrasions	•			
	Check all terminal connections, tighten and clean if necessary	•			
SITEPRO™ Control Panels, See separate manual for details	Vacuum Enclosure				•
	Clean Window, DO NOT USE AMMONIA!!	As needed			
Filters	Inspect chamber to ensure that water/debris has not accumulated				
	Replace whenever the vacuum gauge indicates significant clogging			•	
Switch boxes	Inspect and drain if moisture has accumulated		•		
	Check amp draw at switch box to monitor motor performance		•		
Vacuum gauge	Check to ensure that Max. Vac. pressure is not exceeded	•			
Heat Exchangers	See Additional Equipment Section at the back of the manual				
All Blowers	See SVE and SPARGE sections at the back of the manual				

SECTION 6: SYSTEM TROUBLESHOOTING

See the Sitepro™ Blower/Pump Control Panel manual and the Sitepro Manager Software manual for complete troubleshooting procedures on these system components. Consult the Equipment supplements for all other system components troubleshooting procedures.

Standard Equipment Limited Warranty

All references to the Customer herein shall mean the Customer or the Lessee as applicable.

(a) ORS Environmental Systems, a Division of Sippican, Inc. (ORS), warrants that any equipment which it manufactures will be free from substantial defects in material and workmanship for a period of (1) year from the date such goods are delivered to a carrier by ORS for shipment to the Customer.

(b) ORS warrants that any Equipment which it repairs after the original warranty expires will be free from substantial defects in material and workmanship for a period of (90) days from the date such goods are delivered to a carrier by ORS for shipment to the Customer.

(c) The Customer agrees that the liability of ORS hereunder shall be limited to replacing, repairing or issuing credit for, at ORS's discretion, any Equipment which is returned F.O.B. ORS's plant within the applicable term of the warranty, provided that (i) upon examination of the Equipment ORS determines that the alleged defect constitutes a substantial defect, and (ii) the warranty made herein is not invalid pursuant to Section (e) hereof. The Customer agrees that such replacement, repair or credit shall be its sole and exclusive remedies hereunder. For purposes hereof, a substantial defect shall mean any defect which prevents the Equipment from operating in accordance with ORS's published specifications. In the event that ORS determines that Equipment which is no longer manufactured by it contains a substantial defect and the warranty covering the defective equipment is not invalid pursuant to Section (e) hereof, the Purchaser's sole and exclusive remedy hereunder shall be the repair of such Equipment or the replacement of such Equipment with new equipment at ORS's discretion. In no case is Equipment to be returned by the Customer without first submitting a warranty claim in writing to ORS and obtaining a return authorization number from ORS. Equipment which is repaired or replaced pursuant to this warranty shall continue to be warranted for the unexpired portion of the warranty term applicable to the Equipment so repaired or replaced. ORS shall make the final determination as to the existence or cause of any alleged defect.

(d) The foregoing warranty shall not be valid (i) if the alleged defect is the result of abuse, misuse, accident, alteration, neglect or unauthorized repair; (ii) if ORS requires installation of Equipment by specifically approved ORS employee and such installation is not effected, or the Equipment is otherwise installed improperly; or (iii) if the Equipment is resold by the Customer. Any repair shall be deemed unauthorized unless it is made (i) by ORS of a duly authorized agent of ORS or (ii) with the written consent of ORS.

(e) The operating efficiency of treatment, abatement and recovery Equipment and systems is affected by factors extrinsic to their manufacture, including operating environment and such conditions of use as contaminant and related substance build-up, the frequency and type of operator maintenance and other external variables. For these reasons, specific levels of performance cannot be guaranteed for such Equipment and systems.

(f) **THIS WARRANTY IS THE SOLE WARRANTY MADE BY ORS TO THE CUSTOMER AND IS IN LIEU OF ALL OTHER WARRANTIES OR OBLIGATIONS, EXPRESS OR IMPLIED. ORS EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.**

(g) **THE CUSTOMER AGREES THAT IN NO EVENT SHALL ORS BE LIABLE FOR SPECIAL, INCIDENTAL, INDIRECT, EXEMPLARY OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS OR LOSS OF USE OR ANY OTHER ECONOMIC LOSS, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.**

(h) **THE REMEDIES PROVIDED HEREIN ARE CUSTOMERS SOLE AND EXCLUSIVE REMEDIES.**

ORS ENVIRONMENTAL SYSTEMS
RETURN POLICY

Permission is required to return equipment to the ORS Environmental Equipment factory in Greenville, NH. A Return Authorization Number will be issued upon receipt of your request to return, which should include reasons for the return. Your return shipment to us must have this R.A.# clearly marked on the outside of each package.

Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN AUTHORIZATION, PLEASE CALL OUR SERVICE DEPARTMENT AT 800-228-2310 or 603-878-2500.

Equipment Decontamination

Prior to return, all equipment must be thoroughly cleaned and decontaminated. During decontamination, personnel should wear protective clothing and observe the cautions outlined below.

- ORS reserves the right to refuse any equipment not properly decontaminated. ORS may also choose to decontaminate equipment at a fee which will be applied to the repair invoice.

Decontamination Solutions

The determination of what decontamination solution to use should be based on the types of contaminants present and the materials to be decontaminated. The fabrics of protective clothing are made of organic polymers which may be dissolved or destroyed by organic solvents. The metals and gaskets of tools may be damaged by overly acidic or basic compounds. Some decontamination solvents should be entirely avoided. The toxicity or physical hazards associated with using some once commonly used decontamination solutions can be as potentially dangerous as the site contaminants.

It is important to be certain that the decon solution, the contaminant, and the material to be cleaned are all compatible with each other. If they are not, it is possible to produce toxic or flammable gases, heat, splattering, bubbling, fire, or explosion. If an uncommonly used method and/or chemical solution is being considered for decontamination, it is important to consult with an experienced chemist to ensure chemical compatibility.

ENVIRONMENTAL SYSTEMS
A DIVISION OF SIPPICAN, INC.

Some common decontamination solutions are listed below along with the contaminants they are effective against:

Solution	Effective Against
Water	Short-chain hydrocarbons, inorganic compounds, salts, some organic acids, other polar compounds.
Dilute Acids	Basic (caustic or alkaline) compounds, amines, hydrazines.
Dilute Bases	Acidic compounds, phenols, thiols, some nitro- and sulfonic compounds.
Organic Solvents	Nonpolar compounds (such as some organic compounds)

The use of organic solvents is not recommended because:

1) organic solvents can permeate and/or degrade the protective clothing, and
2) they are generally toxic and may result in unnecessary employee exposure to hazardous chemicals.

When in doubt, use a dish washing liquid detergent. As a decontamination solution, it is readily available, is the safest of all the above, and is usually strong enough if used generously.

The use of steam can also be effective for decontamination. A water-lazer (pressurized water) is exceptionally valuable.

The following substances are noted for their particular efficiency in removing certain contaminants or for decontaminating certain types of equipment.

Solution	Effective Against
Penetone	PCB Contamination (since penetone may also remove paint, it is a good idea to spot-test before use)
Liquinox	Contaminated pumps
Ivory liquid	Oils
Diluted HTH	Cyanides
Radiac	Low level radioactivity
Isopropanol	Biological agents (should not be used on rubber products since it will break down rubber)
Hexane	Certain types of lab or sampling equipment (use of hexane is discouraged due to its flammability and toxicity)
Zep	General purpose cleaning
Alconox	General purpose cleaning

Decontamination Solutions to Avoid

Some decontamination solutions should be avoided because of their toxicity, flammability, or harmful effects to the environment.

Halogenated hydrocarbons, such as carbon tetrachloride, should not be used because of their toxicity, possible incompatibility, and some because of their flammability.

Organic decontamination solutions should not be used on personal protective equipment (PPE) because they may degrade the rubber or other materials comprising the PPE.

Mercurials are sometimes used for sterilization. They should be avoided because of their toxicity.

Chemical leaching, polymerization, and halogen stripping should all be avoided because of possible complications during decontamination.

Sand-blasting, a method of physical removal, should be avoided because the sand used on the contaminated object usually needs to be disposed of as hazardous waste, a very costly proposition. Also, sand-blasting exposes personnel to silica, a carcinogen.

Freon is known to be particularly effective for the cleansing of PCB's, but its effect on the ozone layer is extremely harmful. Its use should be discouraged.

Strong acids or bases should not be used when cleaning metals and gaskets of tools or other equipment because of the possibility of corrosion.

Disposal of Decontamination Solutions and Waste Water

All solutions and water used for decontamination must be collected. If lab analyses indicate that the water and/or solutions exceed allowable contamination levels, they must be treated as hazardous waste. Alternatively, the solutions and water may be treated on-site to lower the contamination levels and render them nonhazardous.

Containers such as 55-gallon drums should be available for storage of wastes.

Spent decontamination solutions can be collected by using heavy-duty plastic sheets, visqueen sheets, kiddie pools, or if needed, a larger containment basin. The decontamination of equipment must be performed on the sheets or in the basins. They could be placed on a slight angle so that the spent decontamination solutions drain into a collection basin or drum.

Recommended Supplies for Decontamination of Personnel, Clothing, and Equipment

The list below contains recommendations for supplies which should be on hand for the decontamination of personnel, clothing and equipment. Depending on the site activities, not all of these items may be needed. Alternatively, some additional items not listed here may be required.

- Drop cloths of plastic or other suitable material, such as visqueen, for heavily contaminated equipment.
- Disposal collection containers, such as drums or suitably lined trash cans for disposable clothing and heavily contaminated personal protective clothing or equipment to be discarded.
- Lined box with adsorbents for wiping or rinsing off gross contaminants and liquid contaminants.
- Wash tubs of sufficient size to enable workers to place booted foot in and wash off contaminants (without a drain or with a drain connected to a collection tank or appropriate treatment system).
- Rinse tubs of sufficient size to enable workers to place booted foot in and hold the solution used to rinse the wash solutions and contaminants after washing (without a drain or with a drain connected to a collection tank or appropriate treatment system)
- Wash solutions selected to wash off and reduce the hazards associated with the contaminated wash and rinse solutions.
- Rinse solution (usually water) to remove contaminants and contaminated wash solutions.
- Long-handled, soft-bristled brushes to help wash and rinse off contaminants.
- Lockers and cabinets for storage of decontaminated clothing and equipment.
- Storage containers for contaminated wash and rinse solutions.
- Plastic sheeting, sealed pads with drains, or other appropriate method for containing and collecting contaminated wash and rinse water spilled during decontamination.
- Shower facilities for full body wash or, at a minimum, personal wash sinks (with drains connected to collection tank or appropriate treatment system).
- Soap or wash solution, wash cloths and towels.
- Clean clothing and personal item storage lockers and/or closets.

Rev. 3, 7/1/94

ENVIRONMENTAL SYSTEMS

EG&G ROTRON
Industrial Division

EN 8

Explosion-Proof Regenerative Blower For Environmental Remediation

FEATURES

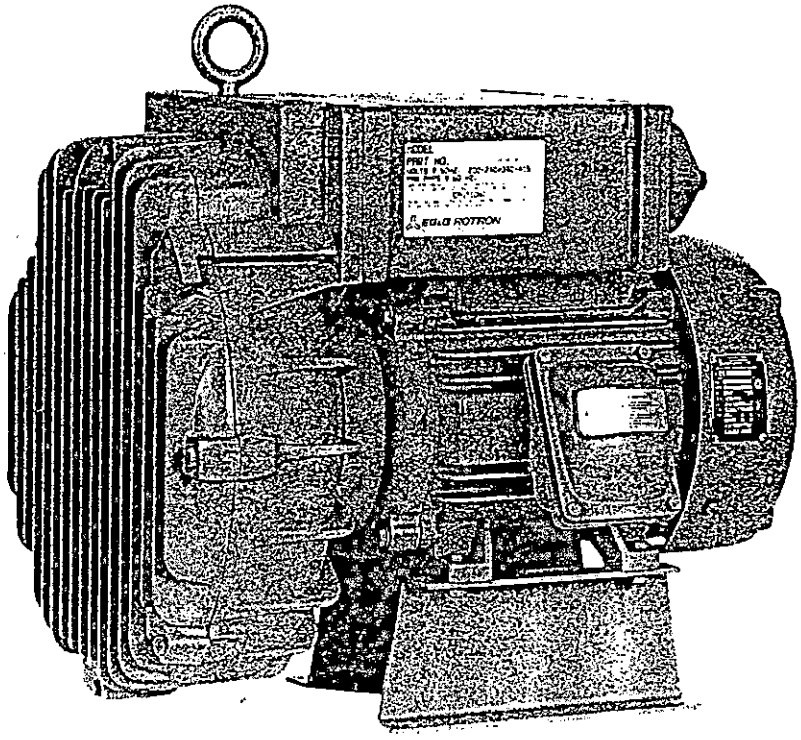
- Manufactured in the USA
- Maximum flow: 400 SCFM
- Maximum pressure: 120" WG
- Maximum vacuum: 98" WG
- Standard motor: 10 HP
- Blower construction — cast aluminum housing, impeller and cover
- UL & CSA approved motors for Class I, Group D atmospheres
- Sealed blower assembly
- Quiet operation within OSHA standards

OPTIONS

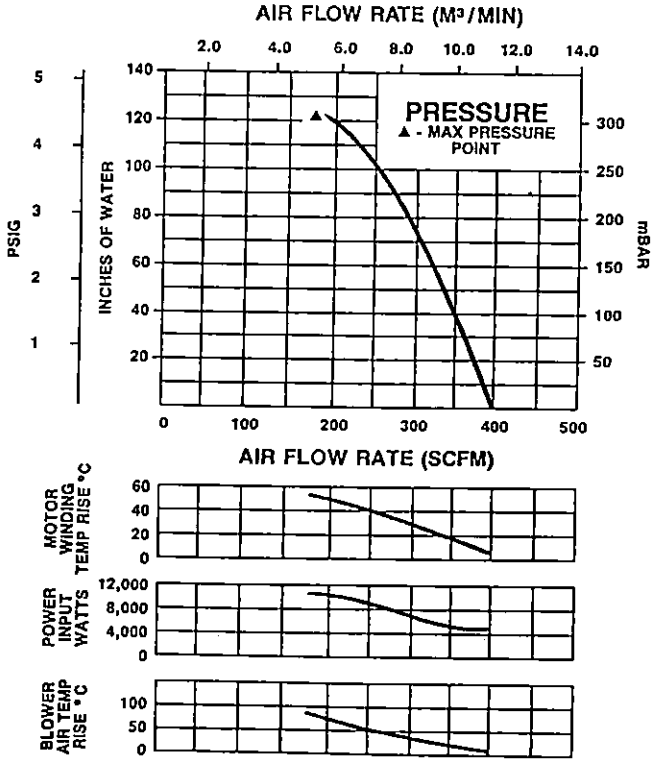
- 50 Hz motors
- International voltages
- Other HP motors
- Corrosion resistant surface treatments
- Remote drive (motorless) models

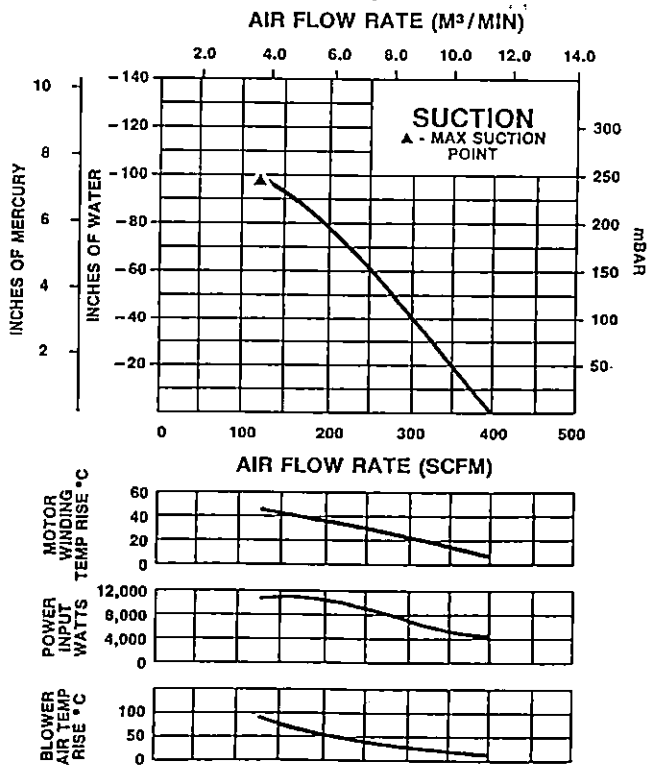
ACCESSORIES

- Moisture separators
- Explosion-proof motor starters
- Inline & inlet filters
- Vacuum & pressure gauges
- Relief valves
- External mufflers



BLOWER PERFORMANCE AT STANDARD CONDITIONS





EG&G ROTRON
Industrial Division

EN 8

EG&G ROTRON
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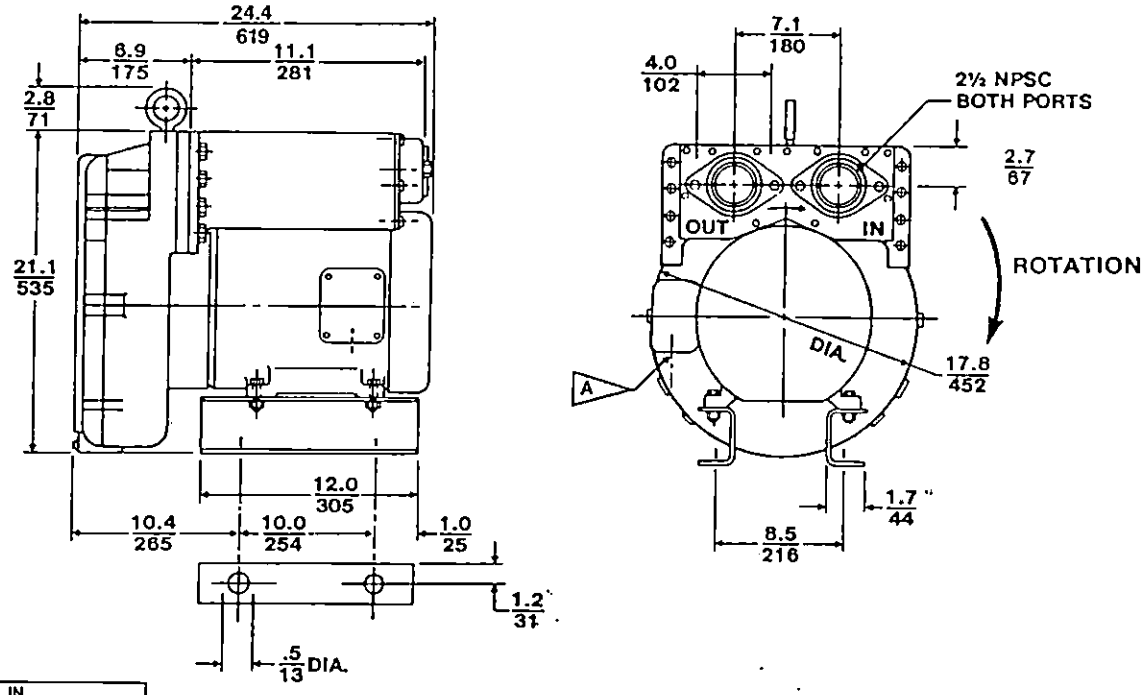


DIMENSIONS: IN / MM
TOLERANCES: .X ± .1 / 2.5
(UNLESS OTHERWISE NOTED)

A 0.75" NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

SPECIFICATIONS

MODEL	EN8BD72WL	
Part No.	038185	
Motor Enclosure Type	Explosion-proof	
Horsepower	10.0	
Phase — Frequency	Three - 60 Hz	
Voltage	230	460
Motor Nameplate Amps	24	12
Maximum Blower Amps[1]	29	14.5
Inrush Amps	258	116
Starter Size	2	1
Service Factor	1.0	
Thermal Protection	Pilot Duty	
Bearing Type	Sealed, Ball	
Shipping Weight	332 lb (151 kg)	

BLOWER LIMITATIONS

Min. Flow @ Max. Suction	125 SCFM @ –98" WG
Min. Flow @ Max. Pressure	175 SCFM @ 120" WG

[1]Corresponds to the performance point at which the blower and/or motor temperature rise reaches the limit of the thermal protection in the motor.

Specifications subject to change without notice. Please contact factory for specification updates.

EG&G ROTRON
Industrial Division

EN 707

Explosion-Proof Regenerative Blower For Environmental Remediation

FEATURES

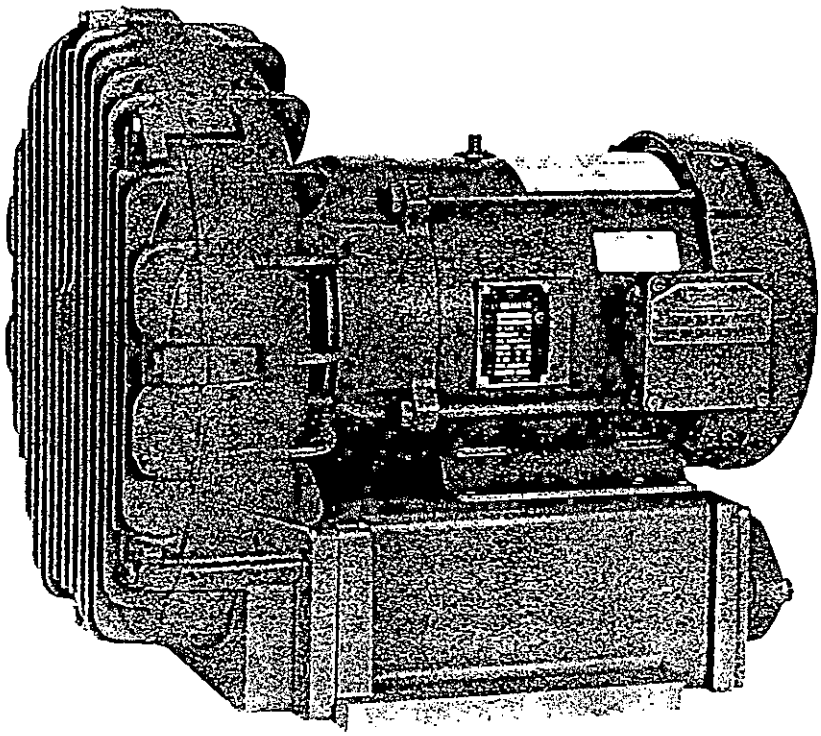
- Manufactured in the USA
- Maximum flow: 280 SCFM
- Maximum pressure: 85" WG
- Maximum vacuum: 87" WG
- Standard motor: 5.0 HP
- Blower construction — cast aluminum housing, impeller and cover
- UL & CSA approved motors for Class I, Group D atmospheres
- Sealed blower assembly
- Quiet operation within OSHA standards

OPTIONS

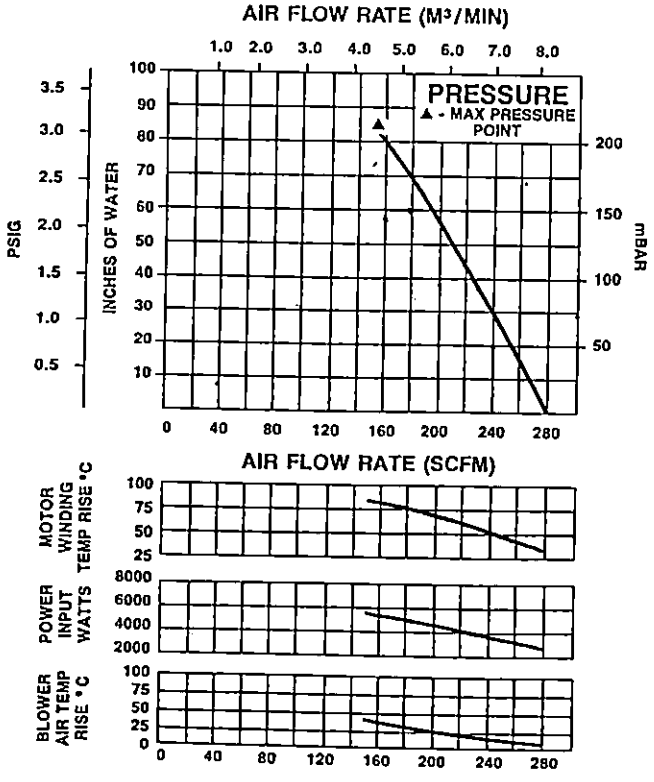
- 50 Hz motors
- International voltages
- Other HP motors
- Corrosion resistant surface treatments
- Remote drive (motorless) models

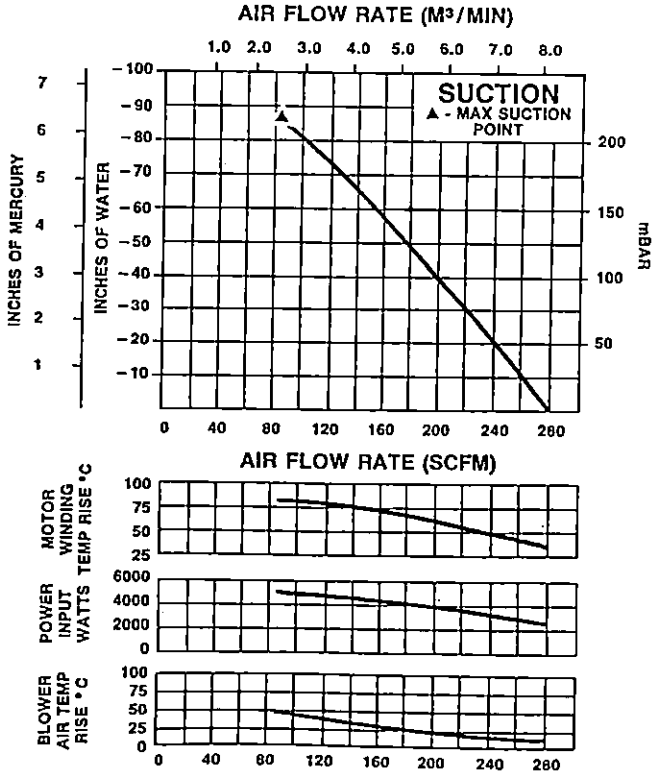
ACCESSORIES

- Moisture separators
- Explosion-proof motor starters
- Inline & inlet filters
- Vacuum & pressure gauges
- Relief valves
- External mufflers



BLOWER PERFORMANCE AT STANDARD CONDITIONS





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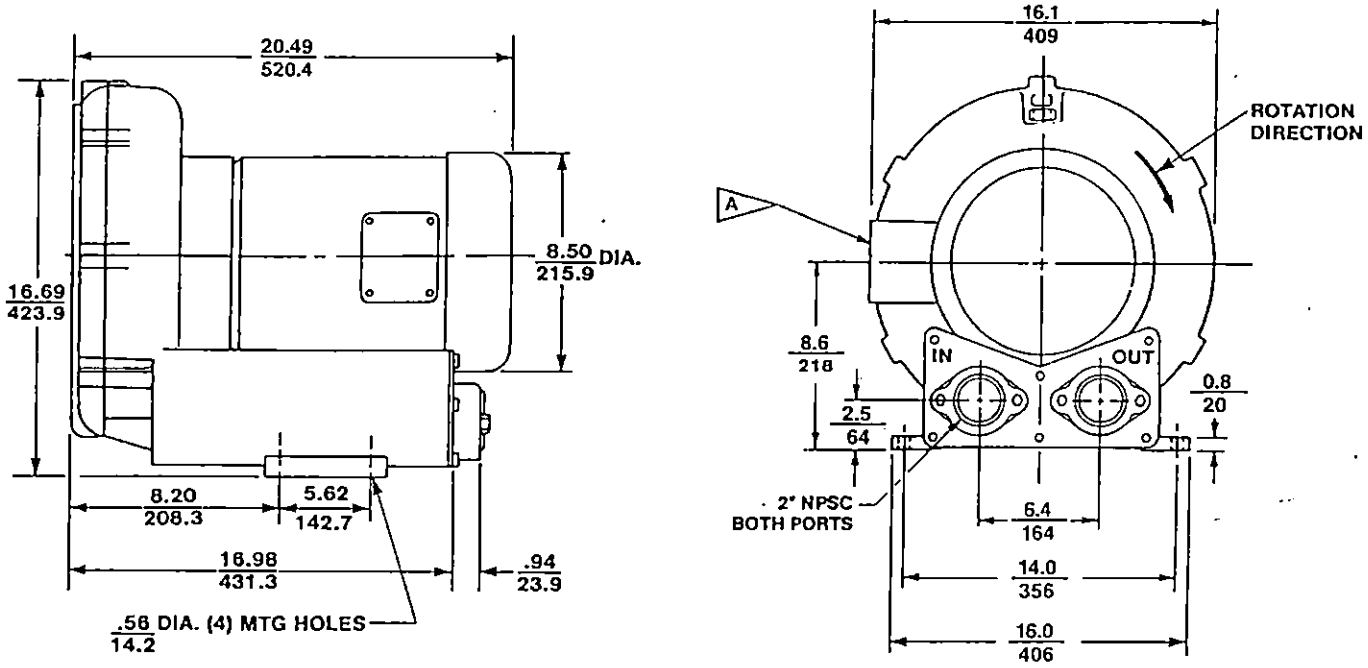


DIMENSIONS: IN / MM
TOLERANCES: .XX ± .1 / 2.5
(UNLESS OTHERWISE NOTED)

A 0.75" NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

SPECIFICATIONS

MODEL	EN707F72XL	
Part No.	038181	
Motor Enclosure Type	Explosion-proof	
Horsepower	5.0	
Phase — Frequency	Three - 60 Hz	
Voltage	230	460
Motor Nameplate Amps	14	7
Maximum Blower Amps[1]	15.8	7.9
Inrush Amps	96	48
Starter Size	1	0
Service Factor	1.0	
Thermal Protection	Pilot Duty	
Bearing Type	Sealed, Ball	
Shipping Weight	174 lb (79 kg)	

BLOWER LIMITATIONS

Min. Flow @ Max. Suction	85 SCFM @ −87" WG
Min. Flow @ Max. Pressure	150 SCFM @ 85" WG

[1]Corresponds to the performance point at which the blower and/or motor temperature rise reaches the limit of the thermal protection in the motor.

Specifications subject to change without notice. Please contact factory for specification updates.

Moisture Separator with level switch

EG&G ROTRON
Industrial Division
North Street, Saugerties, NY 12477
TEL. (914) 246-3401 FAX: (914) 246-3802 TLX: 981511 TWX: 510-247-9033

MOISTURE SEPARATOR INSTALLATION, OPERATION AND MAINTENANCE

Thank you for purchasing an EG&G Rotron MS series moisture separator. When installed and maintained properly, this separator will effectively and efficiently remove moisture and particulates from the airstream. To insure good results, please take the time to read these instructions before starting the installation of your moisture separator.

Installation

Before installation remove the protective cardboard packaging and the cable ties from the screen assembly inside the unit. Figure 1 shows the moisture separator in a typical soil venting set-up. It is attached to the system piping with flexible couplings. This minimizes the stress incurred by rigid system piping, and allows easy removal for maintenance purposes. The connections should be airtight, but not sealed with an adhesive. The separator will only work in an upright position as shown.

Typical Vapor Extraction System

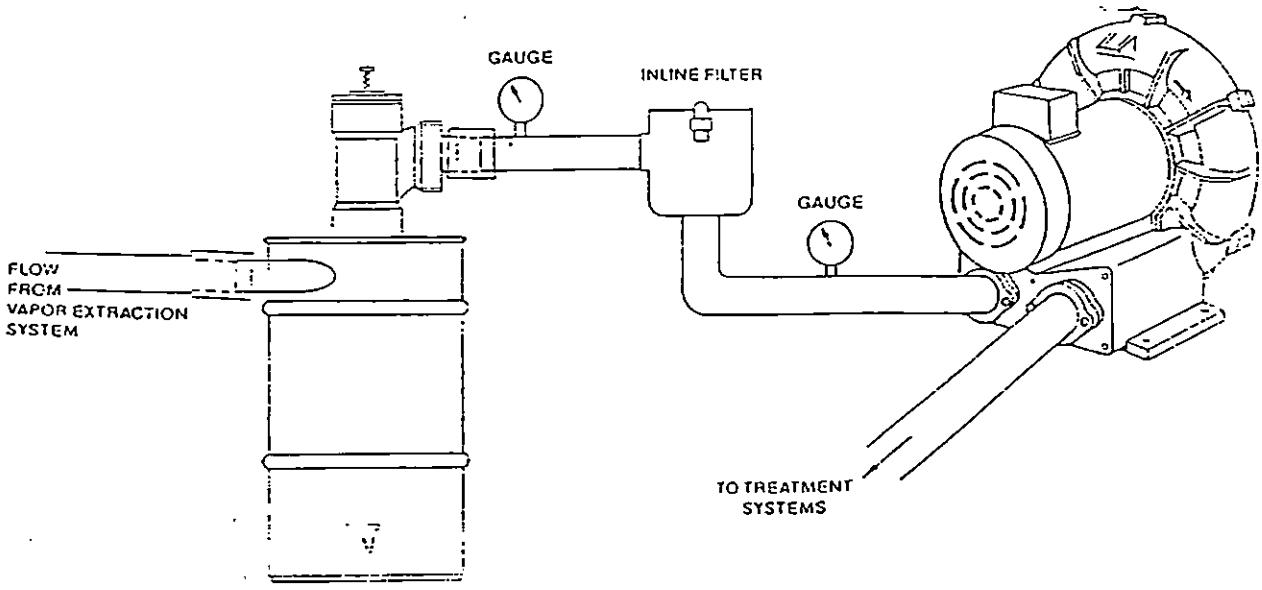


FIGURE 1

Note: A moisture separator is not a substitute for an inline air filter. A Rotron inline filter should be used to remove particles that pass through the separator.

The relief valve should be adjusted before using the moisture separator. First back off of the relief valve adjuster until it can easily be pushed in. Then while measuring the motor current adjust the valve until the motor current is 90% of the Max Blower Amps printed on the nameplate. Once adjusted the relief valve setting must be fixed. Turn off the unit and remove the relief valve assembly. Then use a center punch to peen the relief valve adjustment nut into the slot of the relief valve stem. This is to prevent the valve from losing its adjustment. Finally, reinstall the valve into the piping.

Several draining options are available to automatically remove the liquid from the separator. Contact your local representative for more information.

Appropriate steps should be taken to prevent the unit from freezing in the Wintertime.

Operation

Moisture-laden air enters the separator through the tangential inlet. Cyclonic action removes the moisture from the airstream and allows the air to discharge through the top of the separator. When the separator is full the float valve shuts off the airflow through the separator, and the relief valve opens to limit the vacuum of the blower.

To drain the separator, turn off the blower and open the ball valve at the bottom of the separator. Caution: The liquid contained in the separator should be analyzed before it is released back into the environment. It may be considered hazardous waste in certain geographical areas, and require special treatment/disposal. Once the liquid is drained, the unit can be reset by turning the blower back on.

Maintenance

This MS series moisture separator has been designed to require minimal maintenance. During normal operation a layer of sludge may build up on the bottom of the separator. As necessary the top assembly of the moisture separator should be removed and the inside cleaned out with water. Keeping the inside clean will prevent the valve from becoming clogged with sediment. The relief valve should be inspected upon emptying the separator. It should move freely when pressed.

If you have any questions regarding this product please call our Application Engineering Department at (914) 246-3401.

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

e 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 s for the blower to be bolted directly to the mounting late while the driver is on shims of at least ⅛ inch (3 mm) kness. This allows adjustment of motor position in al shaft alignment by varying the shim thickness.

Satisfactory installation can be obtained by setting he 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 n 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. t 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 nd again check for free impeller rotation. Finally, if lower is direct coupled to the driver, check shaft and coupling alignment carefully and make any necessary corections prior to grouting.

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

When a blower is DIRECT COUPLED to its driver, 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 light slide fit with the blower shaft such that they can be stalled 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 connecting piping, remove any remaining anti-rust 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

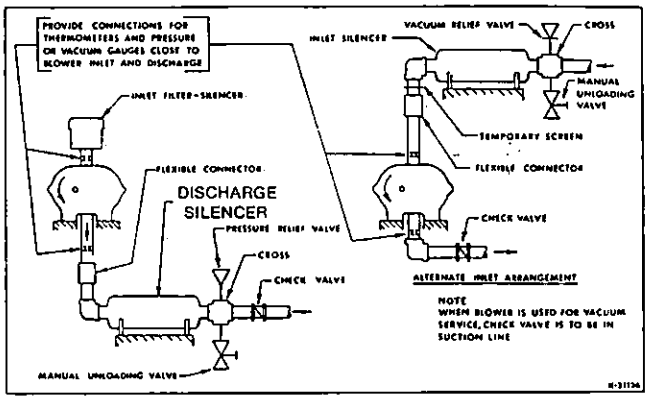


Figure 4 — Installation with Accessories

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 such as Mobil DTE BB, Texaco R&O 220, Amoco 220 or equal.

Table 2 — Recommended Oil Grades

Ambient Temperature ° F.	Viscosity Range SSU at 100° F.	Approx. ISO No.
(°C)	(38°C)	
Above 90° (32°)	1000 - 1200	320
32° to 90° (0° to 32°)	700 - 1000	220
0° to 32° (−18° to 0°)	500 - 700	150
Below 0° (−18°)	300 - 500	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 ready for continuous duty operation at full speed. During the first few days make periodic checks to determine whether all conditions remain steady, or at least acceptable. This may be particularly important if the blower is supplying air to a process system where conditions can vary. At the first opportunity, stop the blower and clean the temporary inlet protective screen. If no appreciable amount of debris has collected, the screen may be removed. See comments under INSTALLATION. At this same time, verify leveling, coupling alignment or belt tension, and mounting bolt tightness.

Should operating experience prove that blower capacity is a little too high for the actual air requirements, a small excess may be blown off continuously through the manual unloading vent valve. **Never rely on the pressure relief valve as an automatic vent.** Such use may cause the discharge pressure to become excessive and can also

TROUBLE SHOOTING CHECKLIST

TROUBLE	ITEM	POSSIBLE CAUSE	REMEDY
No Air Flow	1	Speed too low	Check by tachometer and compare with speed shown on Roots Order Acknowledgement.
	2	Wrong rotation	Compare actual rotation with Figure 2. Change driver if wrong.
	3	Obstruction in piping	Check piping, screen, valves, silencer, to assure an open flow path.
Low capacity	4	Speed too low	See item 1. If belt drive, check for slippage and readjust tension.
	5	Excessive pressure	Check inlet vacuum and discharge pressure, and compare these figures with specified operating conditions on Order.
	6	Obstruction in piping	See item 3.
	7	Excessive slip	Check inside of casing for worn or eroded surfaces causing excessive clearances.
Excessive Power	8	Speed too high	Check speed and compare with Roots Order Acknowledgement.
	9	Pressure too high	See item 5.
	10	Impellers rubbing	Inspect outside of cylinder and headplates for high temperatures areas, then check for impeller contacts at these points. Correct blower mounting, drive alignment.
Overheating of Bearings, or Gears	11	Inadequate lubrication	Restore correct oil levels in gearbox and lubricate.
	12	Excessive lubrication	Check gear oil level. If incorrect, drain and refill with clean oil of recommended grade.
	13	Excessive pressure rise	See item 5.
	14	Coupling misalignment	Check carefully. Realign if questionable.
	15	Excessive belt tension	Readjust for correct tension.
	16	Speed too low	Speeds lower than the minimum recommended will overheat the entire blower.
Vibration	17	Misalignment	See item 14.
	18	Impellers rubbing	See item 10.
	19	Worn bearings/gears	Check gear backlash and condition of bearings.
	20	Unbalanced or rubbing impellers	Scale or process material may build up on casing and impellers, or inside impellers. Remove build-up to retore original clearances and impeller balance.
	21	Driver or blower loose	Tighten mounting bolts securely.
	22	Piping resonances	Determine whether standing wave pressure pulsations are present in the piping. Refer to 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.

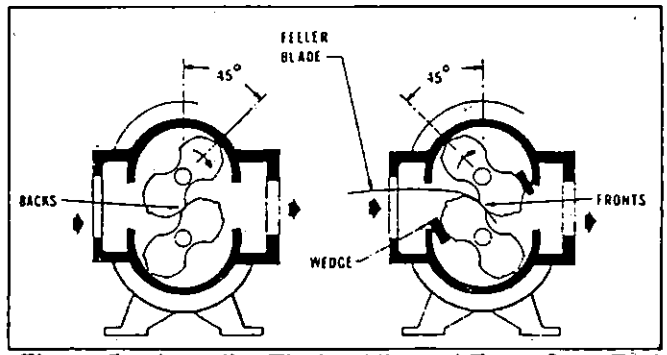


Figure 5 — Impeller Timing Viewed From Gear End

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 mallet. On units, UNIVERSAL RAI®, set end clearances for 6" & 7" by turning capscrews (31) evenly in or out.

16. Install drive end cover (5) after packing bearing cavities with suitable grease. Replace drive shaft seal. Lip must point toward (33) the bearing. Exercise care not to damage the lip as it passes over shaft keyway.

17. Install gasket item (7). Install the gear house after cleaning out the inside. Tighten gear box cap screws (23) evenly. Fill with correct grade of oil until oil flows out through oil level hole. Grease drive and bearings. (See Lubrication.)

18. Reinstall coupling or belt sheave making sure that they have a slight slide fit with the shaft and could be installed by hand.

Where repairs involve parts replacement, it is recommended that Factory Parts be used to insure fit and suitability. Delay in making such repairs can be reduced by having spare parts on hand.

When ordering parts, please furnish all information from the blower nameplate.

Repairs or adjustments to blowers should be performed by personnel with a good back ground of general mechanical experience and the ability to follow the detailed instructions in this manual. No special tools are required. Some operations involve extra care 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 failures is caused by dirt contamination before or during assembly. Therefore, clean the work area before starting disassembly, and protect new or reuseable parts during progress of the work. (See page 23 for Repair Kit Information.)

INTERNAL CLEARANCES

References to operating clearances in this manual include only one mention of the specific amount of clearance to be used or expected. For units in good condition this information is not essential in field service work. Situations may arise, however, when it is desirable to compare existing clearances with the correct Engineering values or to re-establish clearances.

Listed in Table 6 are the ranges of impeller clearances used in factory assembly of normal UNIVERSAL RAI® blowers. It should be kept in mind that clearances may change slightly in service, but should never be less than the minimum values listed. Only well qualified personnel should attempt to measure clearances for direct comparison 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/.005 (.1-.13)	.002/.003 (.05-.08)	.007/.01 (.18-.25)
24	.006/.100 (.15-.25)	.003 (.08)	.003 (.08)	.004/.005 (.1-.13)	.002/.003 (.05-.08)	.007/.01 (.18-.25)
32	.006/.011 (.15-.28)	.003 (.08)	.003 (.08)	.004/.006 (.10-.15)	.002/.003 (.05-.08)	.01/.012 (.25-.30)
33	.006/.011 (.15-.28)	.003 (.08)	.003 (.08)	.004/.006 (.10-.15)	.002/.003 (.05-.08)	.01/.012 (.25-.30)
36	.006/.011 (.15-.28)	.003 (.08)	.003 (.08)	.004/.006 (.10-.15)	.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)	.005/.008 (.13-.20)	.003/.004 (.08-.10)	.011/.013 (.28-.33)
56	.008/.013 (.20-.33)	.004 (.10)	.004 (.10)	.005/.008 (.13-.20)	.003/.004 (.08-.10)	.015/.017 (.38-.43)
59	.008/.013 (.20-.33)	.004 (.10)	.004 (.10)	.005/.008 (.13-.20)	.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)	.010 (.25)	.004 (.10)	.006/.008 (.15-.2)	.006/.008 (.15-.20)	.010/.014 (.25-.36)
615	.014/.018 (.36-.46)	.010 (.25)	.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)

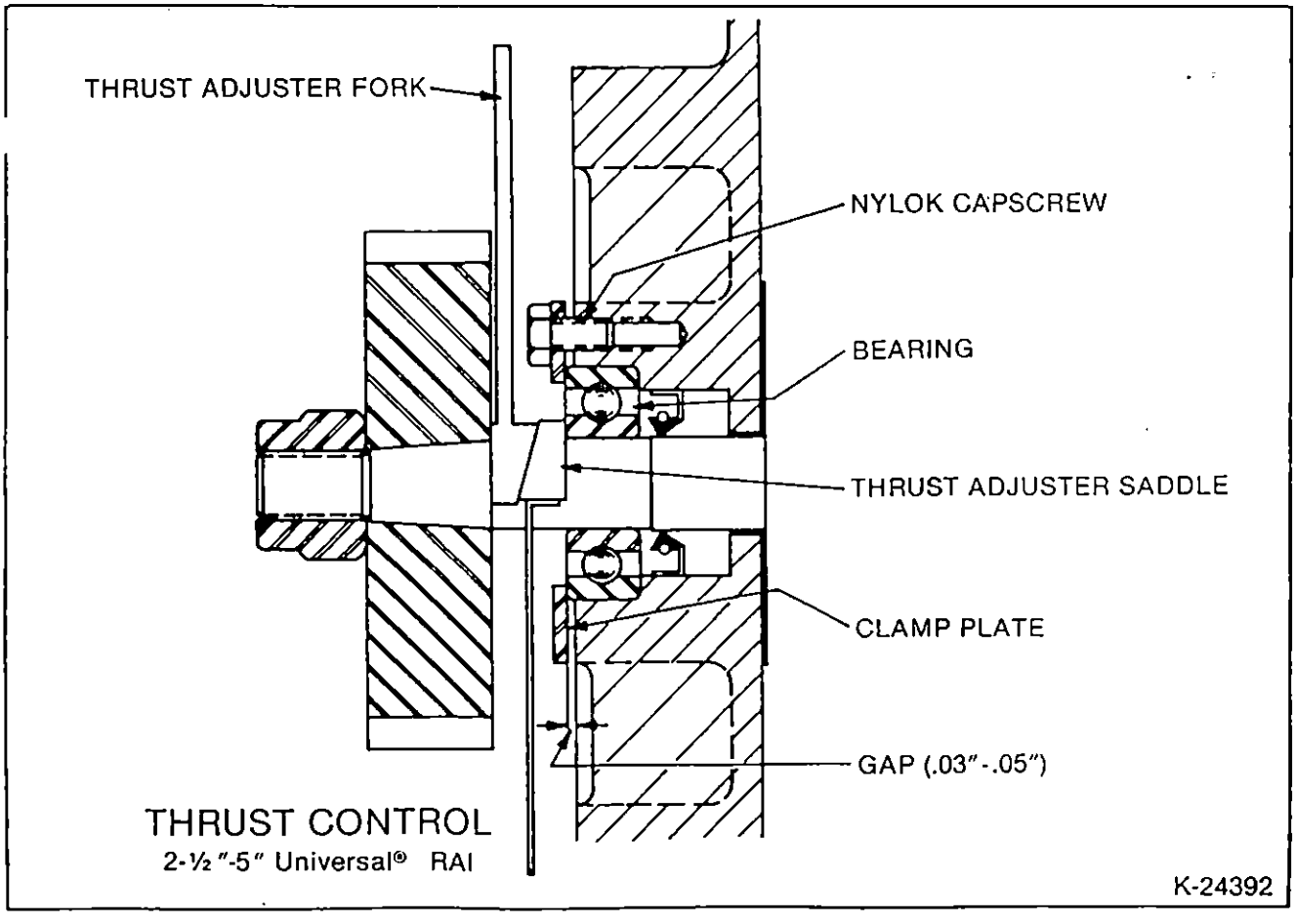
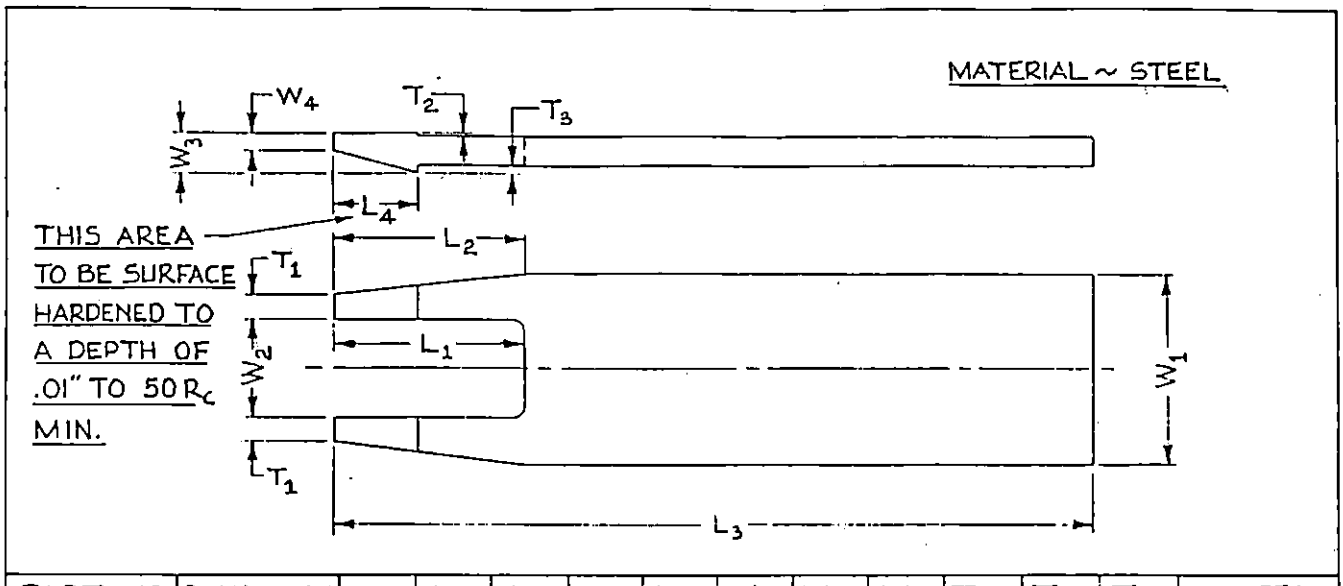
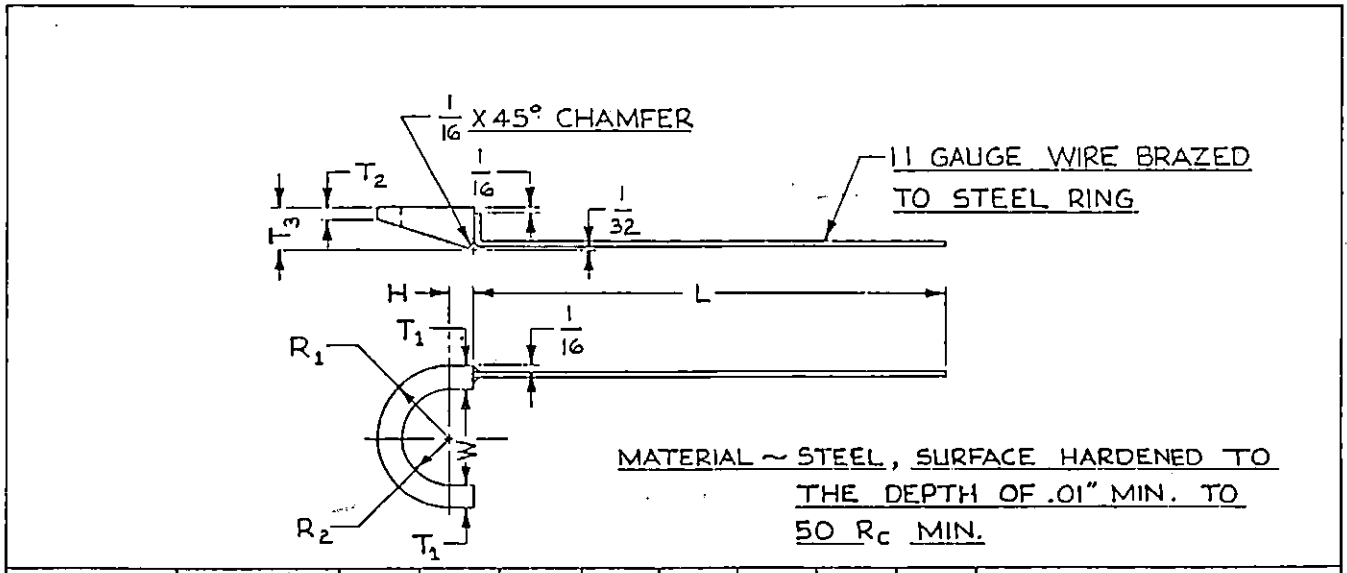


Figure 6 — Thrust Setting, 2½"-5" UNIVERSAL RAI®



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

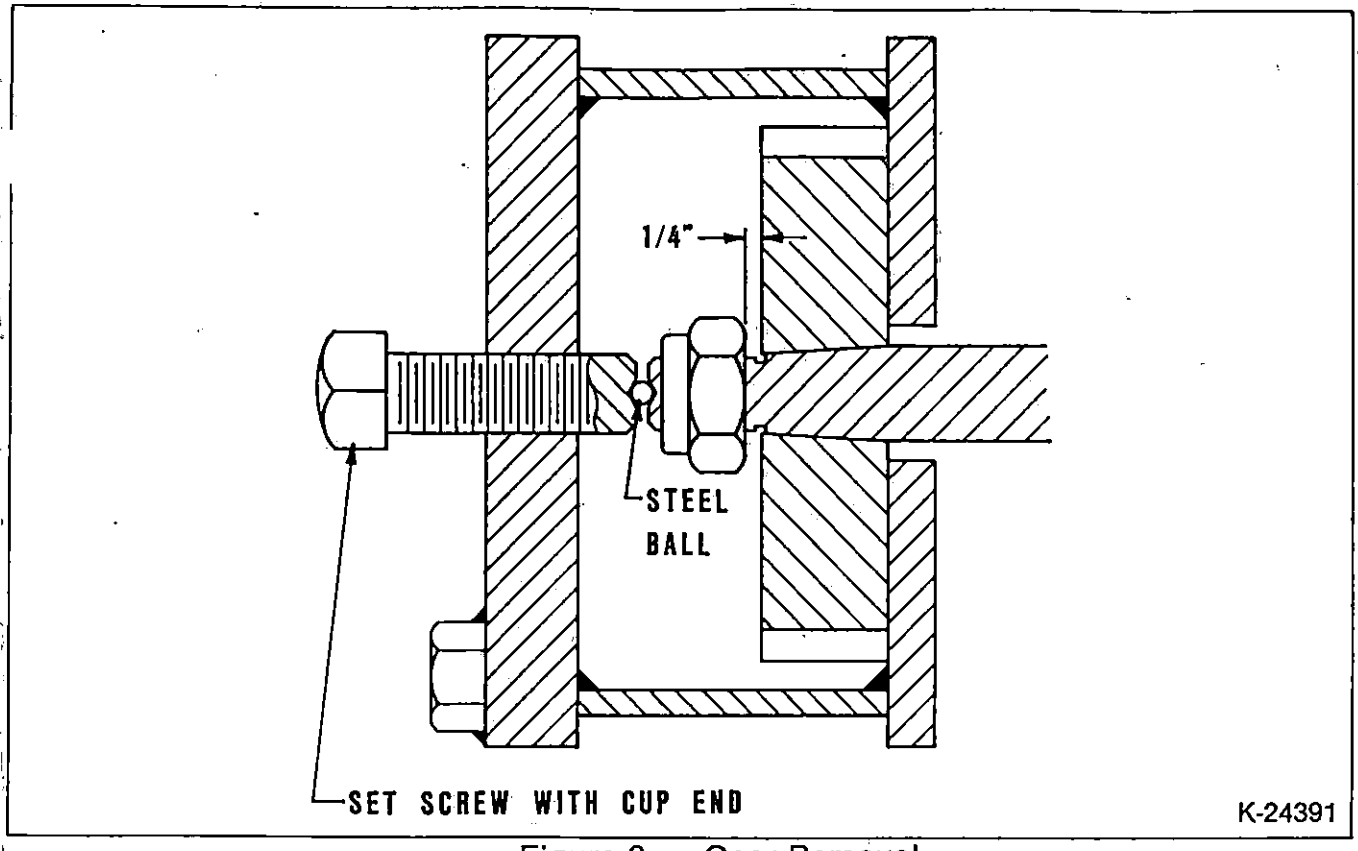
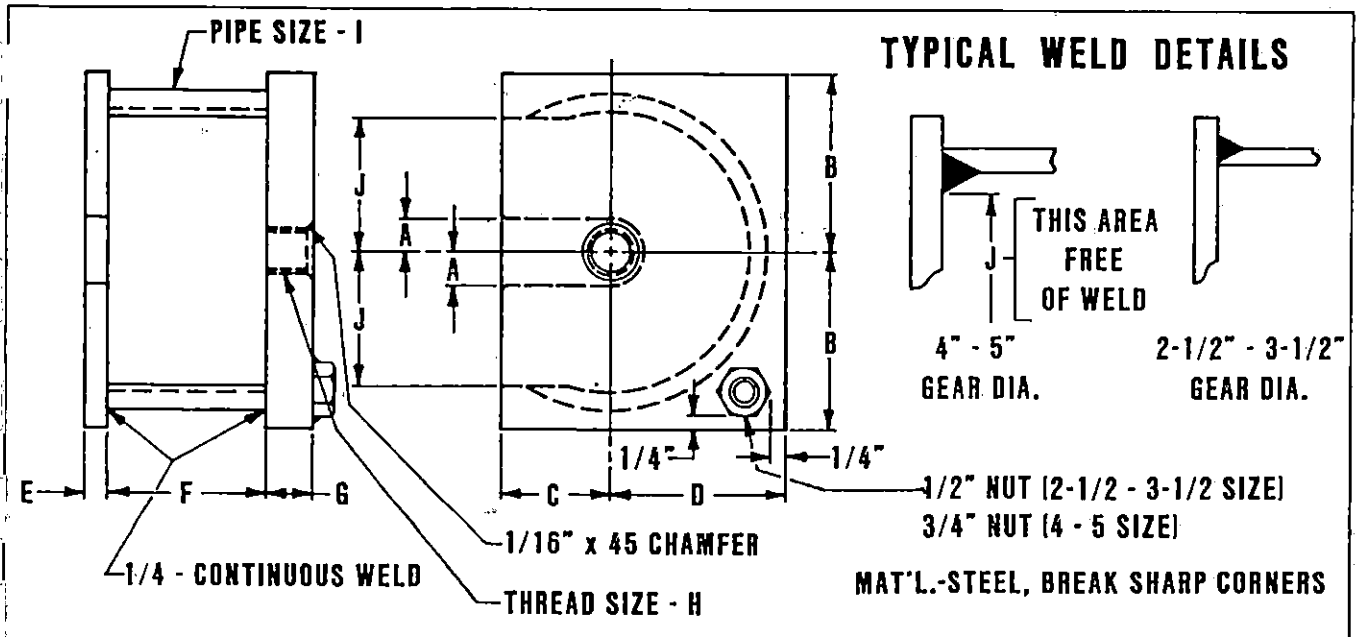
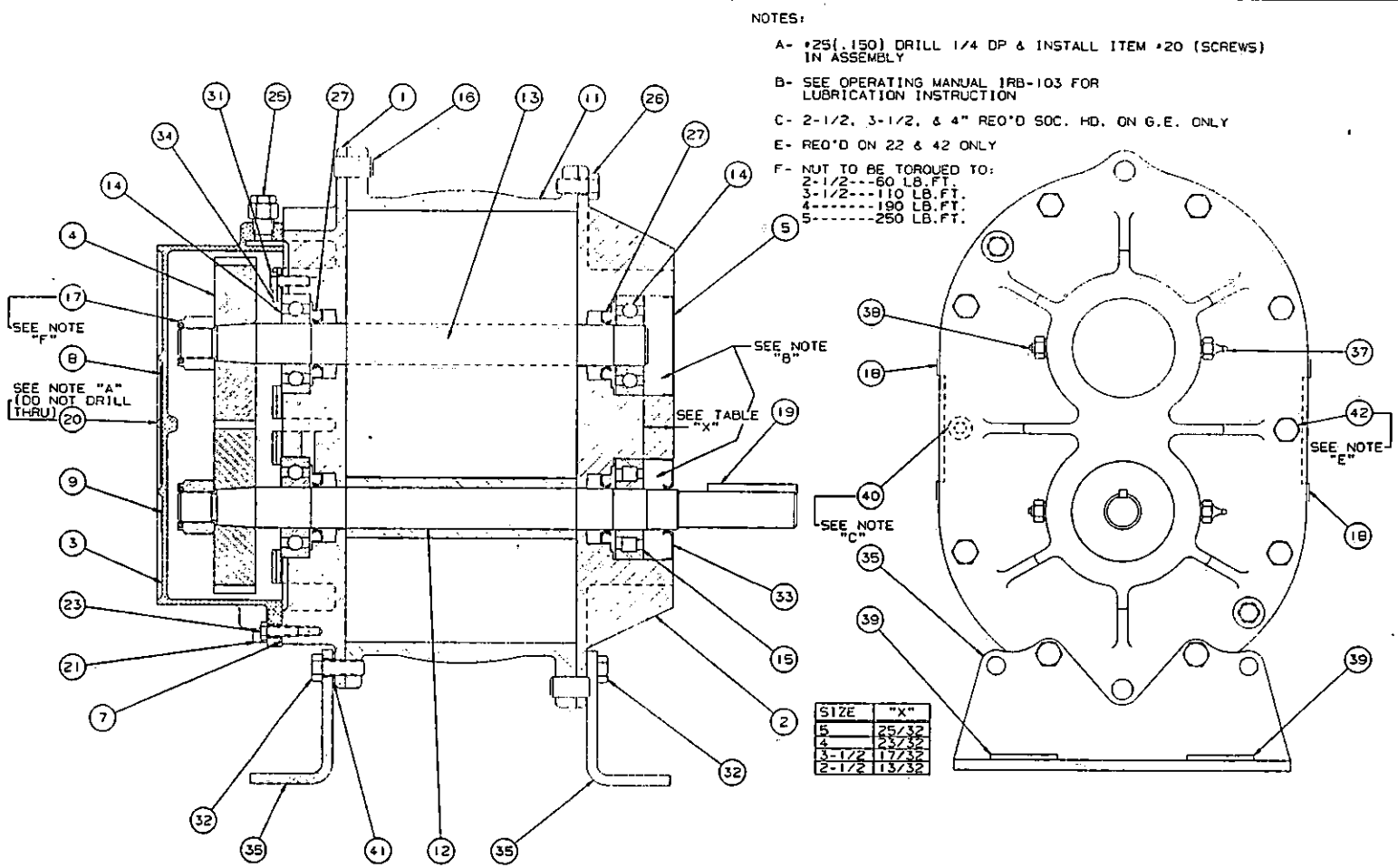


Figure 9 — Gear Removal



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-

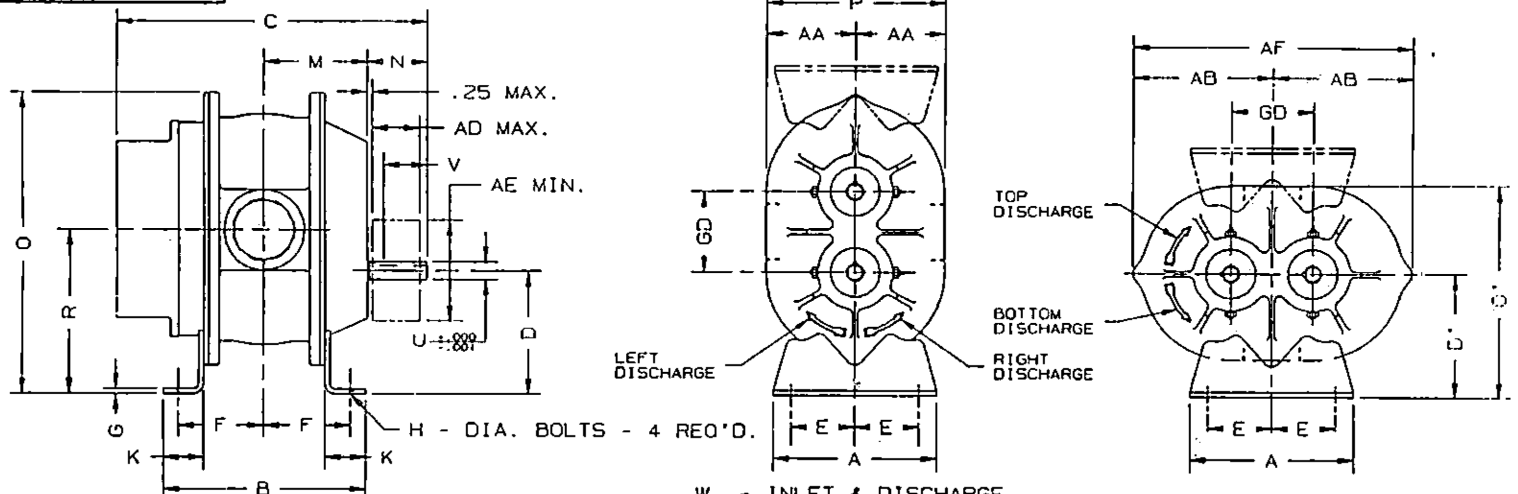


ITEM	PART NAME	ITEM	PART NAME	ITEM	PART NAME	ITEM	PART NAME
1	Headplate Gear End	12	Impeller & Shaft-Drive	21	Plug, Pipe	35	Foot
2	Headplate Drive End	13	Impeller & Shaft-Driven	23	Screw, Hex	37	Fitting, Grease
3	Gearbox	14	Bearing G.E.,-Driven	25	Breather	38	Fitting, Relief
4	Gears	15	Bearing D.E.-Drive	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	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	"	"	"	"	"	109
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	143
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
CENTER DISTANCE

ROOTS DRESSER

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

DB 8/29 64
FCH

862-795-021

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

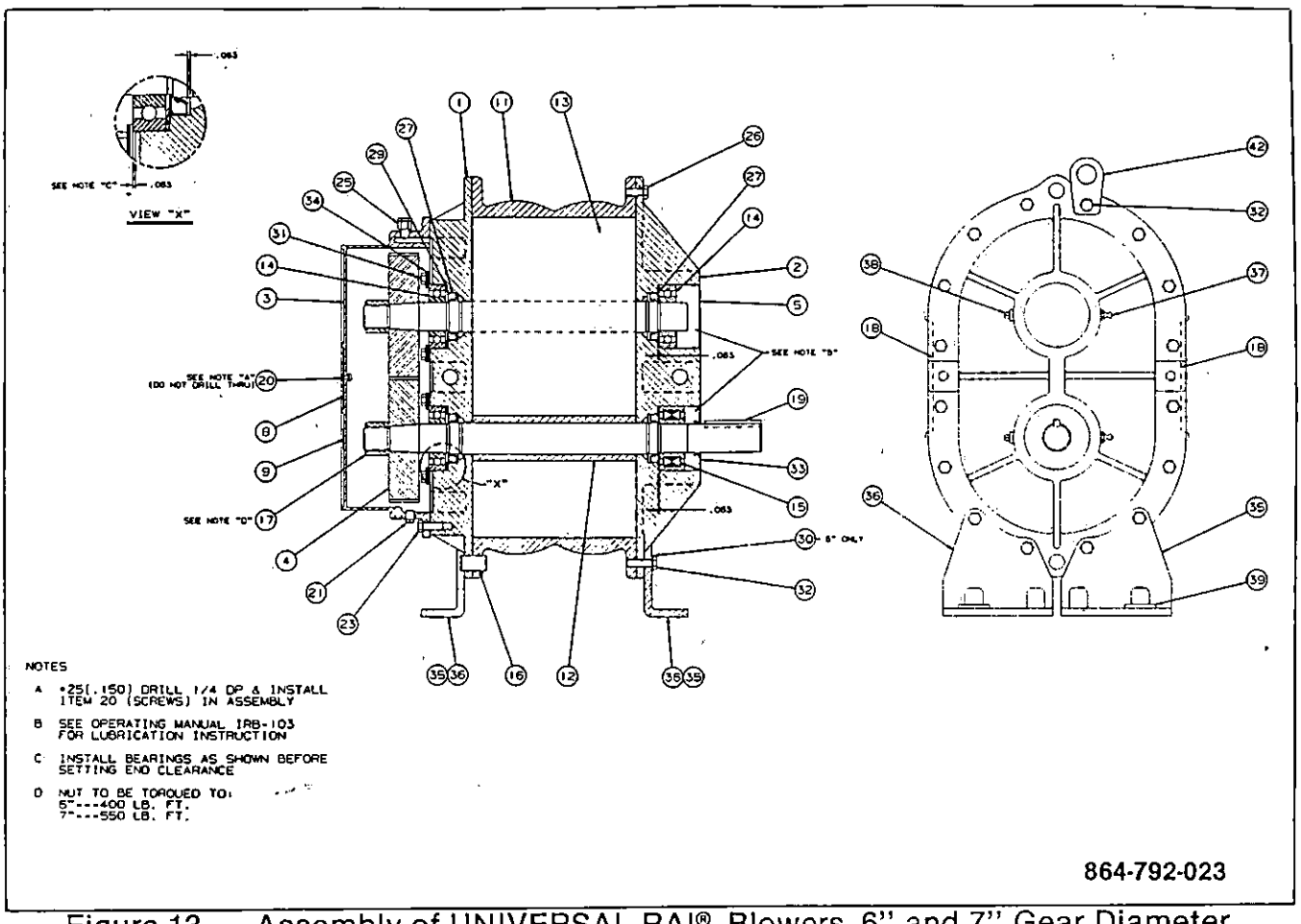
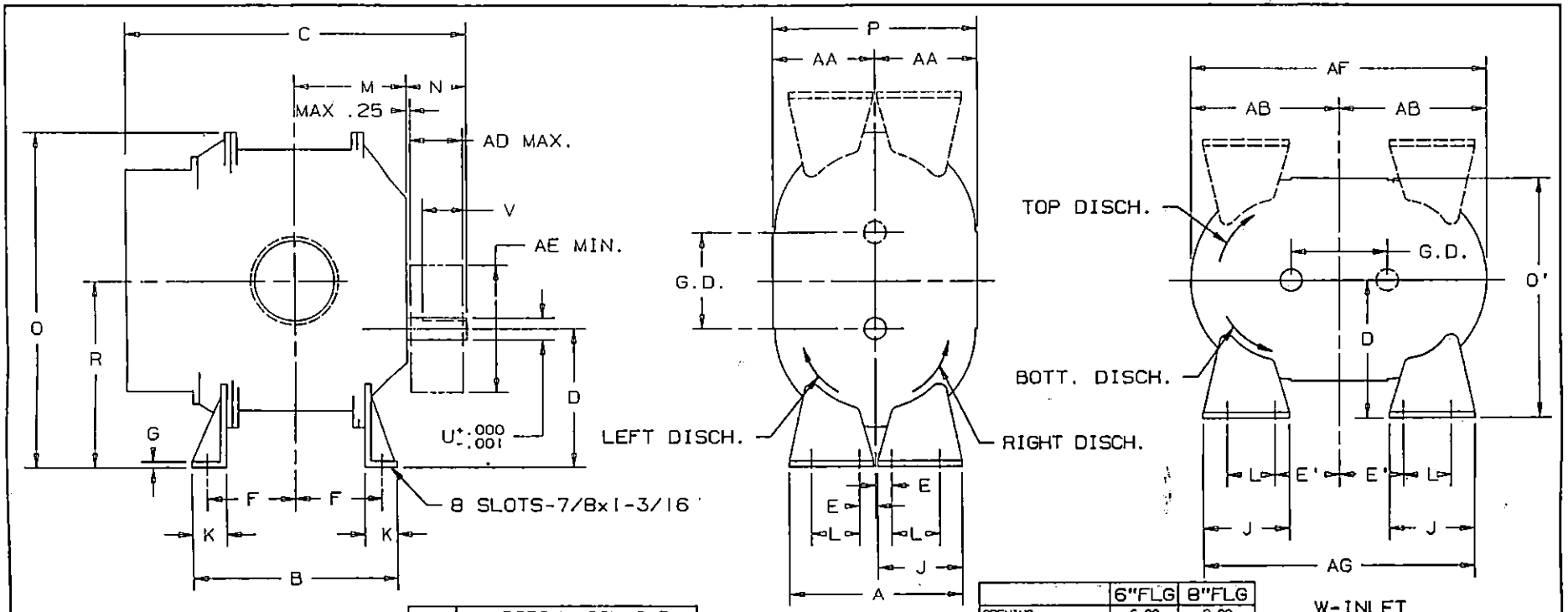


Figure 13 — Assembly of UNIVERSAL RAI® Blowers, 6" and 7" Gear Diameter

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

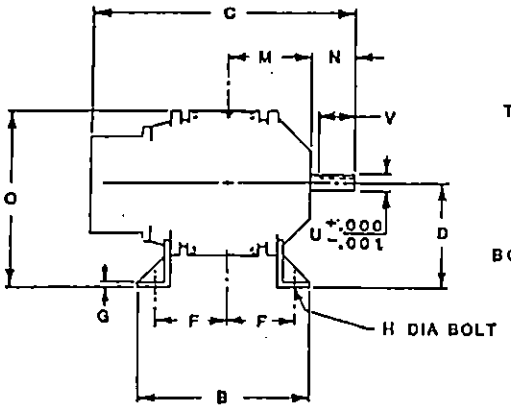
	6"FLG	8"FLG
OPENING	6.00	8.00
BOLT CIRCLE	8.50	11.75
FLANGE O.D.	11.00	13.50
NO. TAPPED HOLES	8	8
SIZE HOLES	3/4-10	3/4-10
TAP DEPTH	1.13	1.13

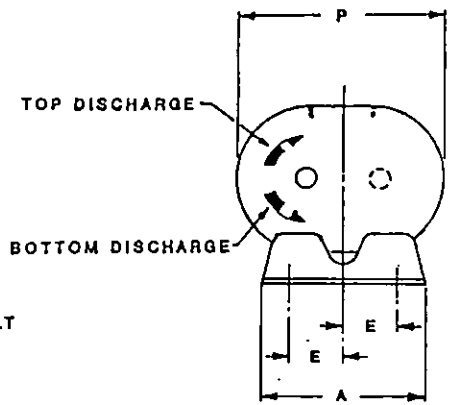
W-INLET
W'-DISCHARGE
AD-SHEAVE WIDTH
AE-SHEAVE DIA.
ALL DIM. IN INCHES

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	1.56	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	3.16	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	3.68	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	2.88	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

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COMPARING ROOTS UNIVERSAL RAI® TO ROOTS AF

DB 1-7-86
FOR
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.

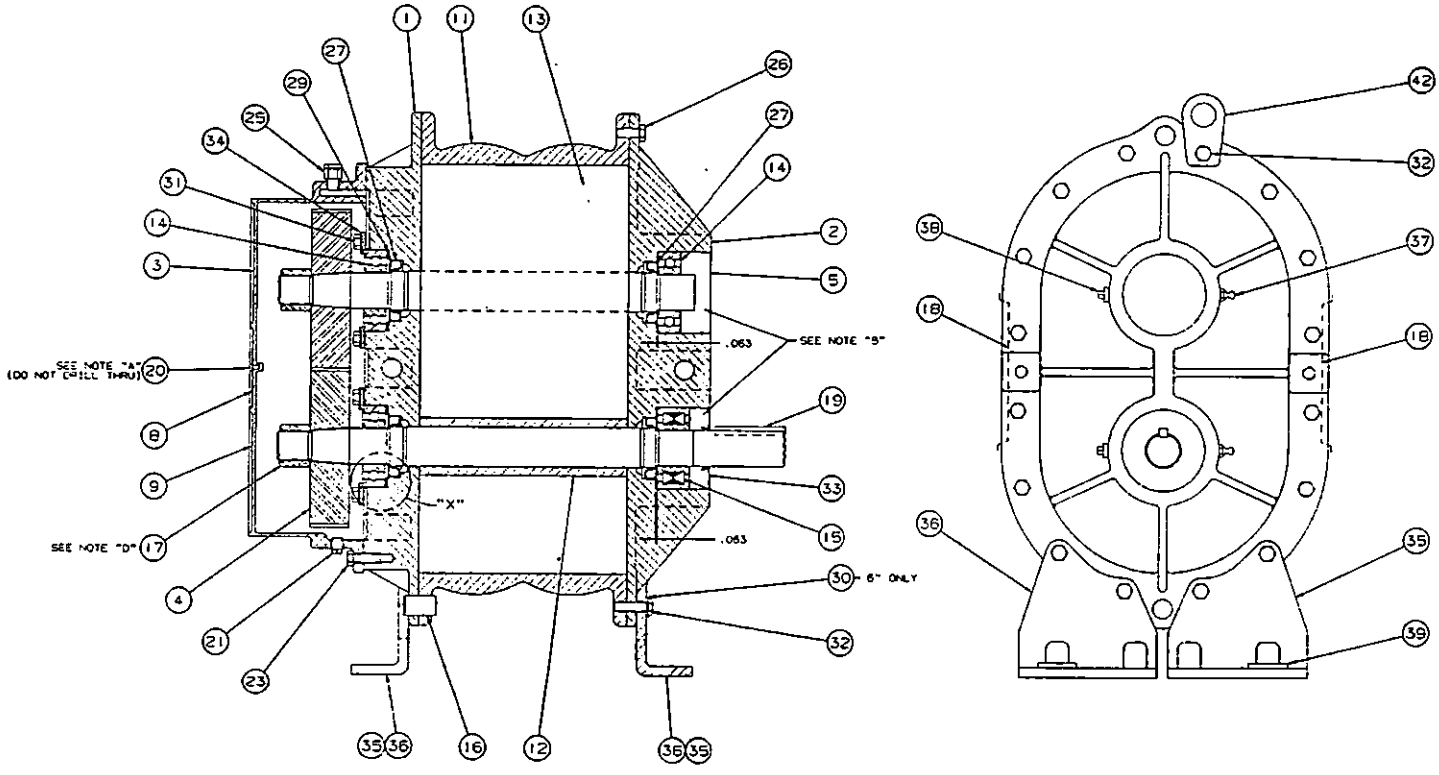
C. The warranty specified herein shall apply to this contract, but it is specifically understood that products sold hereunder are not warranted for operation with erosive or corrosive fluids or those which may tend to build-up within the product quoted. No product or part shall be deemed to be defective 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.	
4	1 Pr.	Timing Gear	FRAME SIZE	REPAIR KIT NO.
5	1	Plug — Opening	2″	65-101-ORK
7	1	Gasket	3″	65-104-ORK
14	1	Bearing, D.E. — DRVN	4″	65-107-ORK
14	2	Bearing, G.E.	5″	65-111-ORK
15	1	Bearing, Dr. Shaft	*6″	65-115-ORK
17	1	Gear Nut	*7″	65-119-ORK
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.

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*Hydromatics Inc. (S09)
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P.O. Box 320129
Birmingham, AL 35232
N. 49th St. (35222)
205/592-6302
Fax: 205/592-6209

ARIZONA
Airnetics Engineering Company (W01)
4130 East Madison Street
Phoenix, AZ 85034
602/273-1964
Fax: 602/273-0108

ARKANSAS
*Arkansas Industrial Machinery (S02)
3804 North Nona Street
North Little Rock, AR 72118
501/758-2745
Fax: 501/758-3223

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**American Compressor Company (W02)
10144 Freeman Avenue
Santa Fe Springs, CA 90670
310/944-6188
Fax: 310/946-8365

J. J. Ban Company (W08)
P.O. Box 4544
Walnut Creek, CA 94596
3000 Citrus Circle
Suite 220 Zip 94598 (shipping)
510/944-0494
Fax: 510/947-3978

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Fluid Technology, Inc. (W06)
1315 Nelson #H
Lakewood, CO 80215
303/233-7400
Fax: 303-233-0093

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

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Barney's Pumps, Inc. (S03)
12080 N.W. 40th Street
Coral Springs, FL 33309
305/346-0669
Fax: 305/346-0993

*Barney's Pumps, Inc. (S03)
P.O. Box 3529
1907 Highway 98 South
Lakeland, FL 33802-3529
813/665-8500
Fax: 813/666-3858

Barney's Pumps of Jacksonville (S03)
P.O. Box 56170
Jacksonville, FL 32241-6170
11306 Business Park Blvd. (32256)
904/260-0669
Fax: 904/260-4913

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Pye-Barker Supply Co. (S11)
2805 Palmyra Road
Albany, GA 31707
912/436-2479
Fax: 912/883-6222

*Pye-Barker Supply Co. (S11)
P.O. Box 1387
Forest Park, GA 30051
121 Royal Drive (30050)
404/363-6000
Fax: 404/361-8579

Pye-Barker Supply Co. (S11)
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11 Magazine Avenue
Savannah, GA 31402
912/238-0303
Fax: 912/238-5214

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P.O. Box 30188
Honolulu, HI 96820-0188
719 Ahua Street (96819)
808/839-7731
Fax: 808/839-7874

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*AMCO Industries
Compressor Engrg. Co. (M05)
625 District Drive
Itasca, IL 60143
708/773-1100
Fax: 708/773-1063

Cochrane Compressor Co. (M04)
819 S.W. Adams
Peoria, IL 61602
309/674-9104
Fax: 309/674-5242

*Cochrane Compressor Co. (M04)
2209 3rd Avenue
Rock Island, IL 61201
815/965-1860
Fax: 815/965-1874

*Cochrane Compressor Co. (M04)
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Melrose Park, IL 60160
708/345-0225
Fax: 708/345-1339

*Cochrane Compressor Co. (M04)
505 North Madison
Rockford, IL 61107
815/965-1860
Fax: 815/965-1874

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AMCO Industries
Compressor Engrg. Co. (M05)
1994 Griffith Boulevard, Unit E
Griffith, IN 46319
219/923-8300
Fax: 219/923-8324

*Powered Equipment & Repair (M10)
P.O. Box 147
Terre Haute, IN 47808-0147
600 Voorhees (47802)
812/232-0241
800/234-0404
Fax: 812/232-0055

KANSAS
*Pump & Power Equipment, Inc. (M11)
9010 Rosehill Road
Lenexa, KS 66215
913/492-7991
Fax: 913/492-7994

KENTUCKY
*Air Systems, Inc. (M02)
4512 Bishop Lane
Louisville, KY 40218
502/452-6312
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9929 Florida Blvd.
P.O. Box 969 (70727)
Denham Springs, LA 70726
504/665-1666
Fax: 504/665-1855

*Gulf States Engineering (S08)
P.O. Box 26156 (70186)
252 Harbor Circle
New Orleans, LA 70126
504/241-8510
504/243-5500 (Sales)
Fax: 504/242-0844
Fax: 504/243-5508 (Sales)

MARYLAND
*Cole Compressor (E07)
1201A Ridgely Street
Baltimore, MD 21230
410/539-3883
Fax: 410/539-3905

*Tate Eastern Shore (E07)
RD 3, Box 858
Delmar, MD 21875
410/546-3293
Fax: 410/546-3461

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*PEECO, INC. (E13)
10 Brent Drive
Hudson, MA 01749
508/562-9112
800/762-9720 (MA)
800/225-9242 (CT, ME, NH, RI & VT)
Fax: 508/562-6915

MICHIGAN
*Air Components & Engineering, Inc. (M01)
1181 58th Street, S.W.
Grand Rapids, MI 49509
616/532-1181
Fax: 616/532-0099

Detroit Air Compressor & Pump Company (M07)
3205 Bermuda
Ferndale, MI 48220
313/544-2982
Fax: 313/544-2027

MINNESOTA
*Grubb Equipment Corporation (M08)
1754 Washington Avenue North
Stillwater, MN 55082-7561
612/430-1055
Fax: 612/430-3947

MISSISSIPPI
*Gulf States Engineering (S08)
4881 I-55 South
Jackson, MS 39212
601/373-1999
Fax: 601/373-1580

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Industrial Process Equipment Co. (IPECO) (M09)
2800 Locust Street
St. Louis, MO 63103
314/534-3100
Fax: 314/533-0022

*St. Louis Compressor Service Co. (M13)
3863 Laclede Avenue
St. Louis, MO 63108
314/652-3400
Fax: 314/652-3405

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33 Terminal Avenue
Clark, NJ 07066
908/574-2400
Fax: 908/574-2339

*Argo Industrial (E05)
1707 Imperial Way
Thorofare, NJ 08086
609/848-4200
Fax: 609/848-9077

**R & M Associates, Inc. (E14)
2 Main Street
Ridgefield Park, NJ 07660
201/641-0051
800/635-4500
Fax: 201/641-7538

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Mesa Equipment & Supply Co., Inc. (S14)
3820 Commons Avenue, N.E.
Albuquerque, NM 87109
505/345-0284
Fax: 505/345-9227

NEW YORK
Hayes Distributors, Inc. (E12)
1103 43rd Road
Long Island City, NY 11101
718/784-7965
Fax: 718/392-2399

*Siewert Equipment Co., Inc. (M12)
175 Akron Street
Rochester, NY 14609
716/482-9640
Fax: 716/482-4513 (Parts)
Fax: 716/482-4149 (Sales)

NORTH CAROLINA
**Edmac Compressor Co. (E08)
P.O. Box 227
1151 M. L. King Drive
Winston-Salem, NC 27102-0227
919/725-2395
Fax: 919/725-2161

OHIO
Argo International Corp. (M03)
9001 Dutton Drive
Twinsburg, OH 44087-0407
216/425-3121
Fax: 216/425-4612

Crane-Liebing Company (M06)
1214 California Avenue
Akron, OH 44314
216/745-6544
Fax: 216/745-1110

Crane-Liebing Company (M06)
11801 Clifton Blvd.
Cleveland, OH 44107
216/228-7900
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SYTEK, IEM Div. (M14)
1089 Claycraft Road
Blacklick, OH 43004
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Fax: 614/864-0326

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800/447-8962
Fax: 513/874-5508

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Fax: 513/278-0270

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242 Poplar Street
Toledo, OH 43605
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Duncan, OK 73533
405/255-1216
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Tulsa, OK 74146
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800/375-5678 (OK)
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Fax: 412/863-5531

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801/973-0154
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Fax: 703/988-9325

*Engineered Systems & Products, Inc. (E09)
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Fax: 804/352-0795

*Engineered Systems & Products, Inc (E09)
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Fax: 804/271-8317

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Fax: 206/736-8630

*Rogers Machinery Co., Inc. (W09)
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Seattle, WA 98108
206/763-2530
Fax: 206/763-1187

*Rogers Machinery Co., Inc. (W09)
Spokane Industrial Park
East 16615 Euclid Avenue
Spokane, WA 99216
509/922-0556
Fax: 509/922-0910

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Guyan Machinery Co. (E10)
P.O. Box 150
Chapmanville, WV 25508
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Fax: 304/855-8601

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1907 Salt Creek Highway
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*A. G. Dunbar Co., Ltd. (C01)
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Burnside Industrial Park
Dartmouth, Nova Scotia B3B 1K8
902/468-1717
Fax: 902/468-3157

*Beckland Equipment Ltd. (W03)
3250 Beta Avenue
Burnaby, B.C. V5G 4K4
604/299-8808
Fax: 604/299-6162

*Canadian Air Compressor Ltd. (C02)
1875 Industrial Boulevard
Laval, Quebec H7S 1P5
514/669-9117
Fax: 514/334-3138

*Canadian Air Compressor, Ltd. (C02)
57 Atomic Avenue
Toronto, Ontario M8Z 5K8
416/252-9505
800/387-7270
Fax: 416/252-9228

*Prolew-Scott Limited (C03)
1515 Matheson Boulevard, Unit C-1
Mississauga, Ontario L4W 2P5
416/624-6330
Fax: 416/624-7590

*Prolew-Scott Limited (C03)
5859 CH St. Francois
Montreal, Quebec H4S 1B6
514/336-5661
Fax: 514/336-1158

AUSTRALIA
Godfrey Howden Pty. Ltd.
P.O. Box 84
Niddrie, Victoria 3042, Australia
011-61-3-338-3811
Fax: 011-61-3-338-6136

WEST INDIES
Engineering Agencies, Ltd.
11 Borde Street
Port of Spain, Trinidad, West Indies
809/625-3043
809/625-3160
Fax: 809/627-0880

ROOTS' AUTHORIZED TRUCK BLOWER DISTRIBUTOR LIST

Canadian Air Compressor, Ltd.
57 Atomic Avenue
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800/387-7270
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Don Johns Inc.
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Chicago, IL 60607
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Fax: 312/666-0777

Girard Equipment, Inc.
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1004 Route 1
Rahway, NJ 07065
908/382-4600
800/526-4330
Fax: 908/382-4650

H.N.L. Corporation
304 Leominster Road
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Fax:	313/861-4609
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The Power Train Co.'s
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800/999-3912
Fax: 317/243-1433
Branches:

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Lafayette, IN	800/999-1098
Richmond, IN	800/999-0288
Elizabethtown, KY	800/999-5707
Lexington, KY	800/999-6529
Louisville, KY	800/999-8972
Cincinnati, OH	800/999-0163

R & M Mobile Power Co.
915 Madison Avenue
P.O. Box 920
Valley Forge, PA 19481
215/666-0678
800/962-0670
Fax: 215/666-1766

Trans-Spec Co.
14852 Columbiana-Canfield Road
Columbiana, OH 44408
216/482-5536

OPERATING AND MAINTENANCE INSTRUCTIONS
MODELS 6066-P102 AND 6066-V103

CAUTION: Running this pump in the wrong rotation will cause severe internal damage. Check rotation arrow on pump. **NEVER LUBRICATE THIS DRY "OILLESS" AIR PUMP.** The carbon vanes and grease packed bearings require no oil.

CONSTRUCTION: This precision pump has only .004 clearance between the top of the rotor and cylinder bore, and a total of .016 clearance between the ends of the rotor and the end plates. Any thrust on the shaft (such as forcing pulley or coupling on) will tend to close these clearances. Foreign particles or excessive dirt or dust could also cause eventual "jamming" of the pump. The basic materials used in the pump are cast iron and steel. Consequently, any moisture (especially when the pump stands idle) will tend to corrode the interior. Precision ground vanes are made of hard carbon and will last 10,000 - 20,000 hours depending upon speed and degree of vacuum or pressure. Excessive dirt, foreign particles, oil or moisture could cause the vanes to stick in the rotor slots and even break. Periodic flushing could prevent this.

WARNING - THE MOTOR MAY BE THERMALLY PROTECTED AND CAN AUTOMATICALLY RESTART WHEN THE PROTECTOR RESETS. *ALWAYS* DISCONNECT POWER SOURCE BEFORE SERVICING.

FLUSHING: With the pump stopped, remove the felts from the intake and exhaust filters and wash them in a solvent. When clean and dry, replace them. Flushing of the pump is accomplished by removing the filter assemblies and while pump is running, add several tablespoons of solvent. **Recommended solvent is Gast Flushing Solvent Part #AH255. Do Not Use Kerosene, Gasoline or any other flammable liquid.** After the solvent has passed through the pump, replace the filter assemblies. Flush unit in a well ventilated area. Eye protection is recommended. Keep face away from exhaust port and do not flush unit with flammable solvent (Gast AH255A recommended).

DISASSEMBLY: To replace the vanes or inspect the pump interior, remove only the end plate opposite the drive shaft. *Caution:* The retainer ring in under tension. Remove the end plate bolts and use a standard gear puller to remove the dead end plate and bearing assembly. Do not disturb the drive end cap unless a new bearing is being installed. The drive end cap may be removed by using a standard adjustable face spanner wrench (commercial tool). Do not loosen or remove the drive end plate from the body. Use the gear puller or an arbor press to press the rotor shaft out of the bearing and end plate.

REASSEMBLY: If only the dead end plate was removed, insert the vanes with the beveled edge fitting the contour of the body bore. Turn the pump to a vertical position, drive shaft pointed downward. Replace the dead end plate and end plate bolts finger tight. Insert the deflector over the bearing shoulder on the shaft. Keep the unit in a vertical position and support the end of the shaft. Press the bearing (on inner race only) until it bottoms on the shaft shoulder. An arbor press is recommended. Tighten the end plate bolts. Install the Belleville springs, washer, and retainer ring. If these procedures have been followed, the pump should be in proper alignment. Check for free rotor movement by turning it by hand. If interference is detected, the rebuilding procedure was not correctly followed. If new bearings are being installed, rebuild by first placing the rotor shaft through the drive end plate. Install the deflector over the bearing shoulder, support the dead end of the rotor shaft, and press the bearing (on inner race) into its bore until it bottoms on the shaft shoulder. Install vanes, dead end plate, and bearings as directed above. Replace drive end cap, turn in until the shaft turns freely. Rotor should then be properly aligned.

INSPECTION: Regular inspection may prevent expensive repairs. Do not be alarmed if pump temperature reaches 150 - 200 degrees Fahrenheit when running continuously. If pump shows evidence of overheating or excessive noise, stop immediately for repairs. It is quickest and cheapest to remove pump from base and return it for rebuilding

DANGER: To prevent explosive hazard DO NOT pump combustible liquids or vapors with these units.

Gast Manufacturing Co. Ltd.
Halifax Road, Cressex Estate
High Wycombe, Bucks HP12 3SN
England
Ph: 44 494 523571
Fax: 44 494 436588

Gast Manufacturing Corporation
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Ph: 616/926-6171
Fax: 616/925-8288

Gast Manufacturing Corporation
505 Washington Avenue
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Ph: 201/933-8484
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Brenner Fiedler & Associates
13824 Bentley Place
Cerritos, CA. 90701
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Fax: 310/404-7975

Wainbee Limited
121 City View Drive
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Wainbee Limited
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Pointe Claire, Quebec
Canada H9R 4R7
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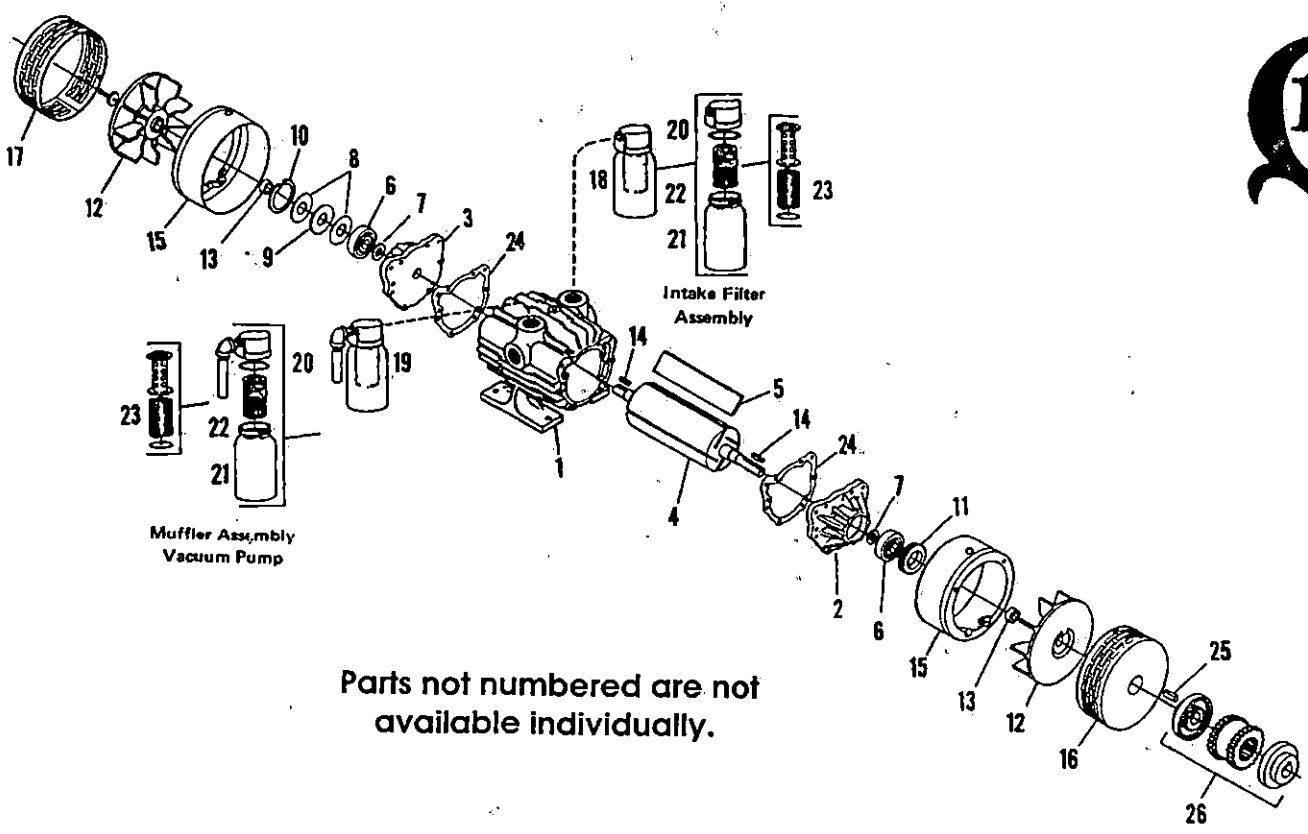
Fax: 514/-697-3070

Japan Machinery
Central PO Box 1451
Toyko 100-91, Japan
Ph: 813 3573-5421
Fax: 813 3571-7896



Parts not numbered are not available individually.

Reference Number	Description	Part Quantity	Compressor 6066-P102	Part Quantity	Vacuum Pump 6066-V103
1	Body	1	AC309	1	AC309
2	End Plate, Drive	1	AE293	1	AE293
3	End Plate, Dead	1	AE294	1	AE294
4	Rotor Assembly	1	AE295A	1	AE295A
*5	Vane	4	AK738	4	AK738
*6	Bearing	2	AB964B	2	AB964B
7	Bearing Shoulder Ring	2	AB926T	2	AB926T
8	Belleville Spring	2	AB791	2	AB791
9	Shim Washer	1	AB792	1	AB792
10	Retaining Ring	1	AB793	1	AB793
11	End Cap	1	AB790	1	AB790
12	Fan	2	AK735	2	AK735
13	Fan Spacer	2	AE299	2	AE299
14	Square Key	2	AB136A	2	AB136A
15	Shroud	2	AE300A	2	AE300A
16	Fan Guard Assembly, Drive	1	AK736	1	AK736
17	Fan Guard Assembly, Dead	1	AK737	1	AK737
18	Intake Filter Assembly	1	AD560	1	AD560
19	Muffler Assembly			1	AD560B
*20	Cover Gasket	1	AD562	2	AD562
21	Jar	1	AD563A	2	AD563A
22	Filter Element Assembly	1	AD750	2	AD750
*23	Filter Felt	1	AD752	2	AD752
24	Body Spacer	2	AE315B	2	AE315B
25	Key, Coupling	1	AB136D	1	AB136D
26	Coupling Assembly	1	AE765	1	AE544B
	Service Kit	1	K503	1	K503

* Denotes parts included in service kit. One extra cover gasket and filter felt is included in service kit when used for a compressor.

Air Technologies®

AIR COOLED
AFTERCOOLERS
AND LIQUID COOLERS

INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS

AMERICAN PRECISION INDUSTRIES
Heat Transfer Equipment Group
AIR TECHNOLOGIES DIVISION

- When it is necessary to provide air ducts, a duct area 50 percent greater than the fan opening is suggested. Pressure drop shall not exceed the equivalent of 30 feet of straight, round duct, with the cross section area 50 percent greater than fan opening. An access panel should be provided in the duct to service motor and fan. Fan guards should be left in place for air duct installations.

PIPING:

- All requirements of local codes should be followed.
- When connecting pipe fittings to the cooler, support the threaded coupling with a pipe wrench when tightening the connection. Use silicone sealant on all steel-to-aluminum threaded connections.
- All piping should be firmly supported to avoid strain on cooler manifold and connections.
- Flexible connections should be installed as shown on the schematic diagrams — Fig. 2 & 3 — to avoid transmitting compressor or pump vibrations to the cooler elements. To omit them will invalidate the warranty.
- Unions or flanges should be installed in the piping to permit installation or maintenance without major disruption of existing piping.
- All piping should be installed by qualified craftsmen in accord with current pipefitting standards and practice.
- Before beginning installation, check to be sure that no debris or foreign matter such as fragments of plastic shipping plug remain in the couplings or cooler bodies.
- Complete installation as indicated on the suggested piping diagram — Fig. 2 & 3.

MOISTURE SEPARATOR:

- Refer to typical piping schematic for placement or moisture separator and drain trap.
- The separator trap should discharge into an open drain so that its operation can be visibly monitored. It should never be connected into a closed drain which could create back pressure and resistance to flow.
- The separator should be rigidly supported on the floor or to the building structure.

ELECTRICAL:

- All local and national codes and regulations and standards should be followed for all electrical connections to the fan motor. Outdoor installations require appropriate weatherproof connections.
- All electrical connections should be made by qualified electricians who are familiar with all code requirements.
- The installation should include provision for a separate fused disconnect (furnished by others), so that the system may be isolated for service.
- Fan motors are usually multi-voltage and should be wired according to voltage requirements shown on the motor nameplate. Refer to specific motor instructions.
- Direction of fan rotation is important. Refer to the "fan rotation label", either on the motor or fan housing, to determine proper direction of rotation.
- A conveniently located start/stop switch should be installed or the cooler fan motors may be wired directly to the compressor starting switch at the option of the user.

START-UP AND OPERATION:

- Check all piping joints for leakage prior to start-up. Pressurize system with air, and inspect connections with Leak-Tec solution.

FOR LIQUID COOLERS:

- Vent trapped air from system of liquid coolers.
- With air by-pass valves closed, open inlet and outlet valves to the cooler.
- Turn on power to fan at fused disconnect and/or switch.

FOR AIR AFTERCOOLERS:

- Turn on power to fan at fused disconnect and/or switch.
- With cooling fan operational, the compressor may then be started.
- When the system has been operating for approximately thirty minutes, check moisture separator trap discharge and continue to monitor it for proper operation. The amount of drainage will depend upon ambient humidity.

WARNING:

- Fan guard must be in place at all times while fan is operating.
- Heat exchanger must never be operated at a pressure higher than the maximum pressure shown on the cooler nameplate.

INTRODUCTION:

The information in this manual is intended to provide instruction for proper installation, operation and maintenance of air cooled heat exchangers and accessories manufactured by the Air Technologies Division of American Precision Industries, Inc. These instructions will supplement normal practices for equipment of this type and are not intended to cover each specific equipment item since construction details may vary. The user must assume the responsibility for the installation, operation and maintenance of this equipment by qualified personnel.

RECEIVING INSPECTION:

- Upon receipt of equipment, carefully check all parts for shortages and any type of damage. Do not remove item from shipping skid until a receiving inspection is completed and the material is found to be satisfactory.
- Shipping damage should be reported immediately, and a claim filed with the carrier.

INSTALLATION:

- Carefully lift the cooler assembly from the shipping skid, using the eyebolt or lifting brackets provided for that purpose. Some smaller units are not equipped with a lift point, in which case a woven fabric sling should be used to avoid damage to the unit. Do not use the cooler connections or manifolds to lift or move assembly, as severe damage may result.
- Some small models may require partial assembly of the supporting members. Use the fasteners and lock washers supplied with the unit. Be sure that they are securely tightened to withstand normal unit vibration. (See Fig. 1)
- The cooler should be located to permit the free movement of air around it. The warm discharge air must be free to dissipate to avoid recycling into the cooler inlet.
- The cooler must be installed level and the supports firmly anchored to a concrete pad or a major element of the building structure. Roof mounted units should be firmly anchored to building structural steel to avoid excess vibration. It is important that no vibration from other moving machinery is transmitted to the cooler supports.
- Adequate clearance should be provided around cooler and fan motor to permit proper maintenance.
- Aftercooler drain traps should be independently supported to avoid placing strain on cooler units.

FIG. 1 LEG ASSEMBLY

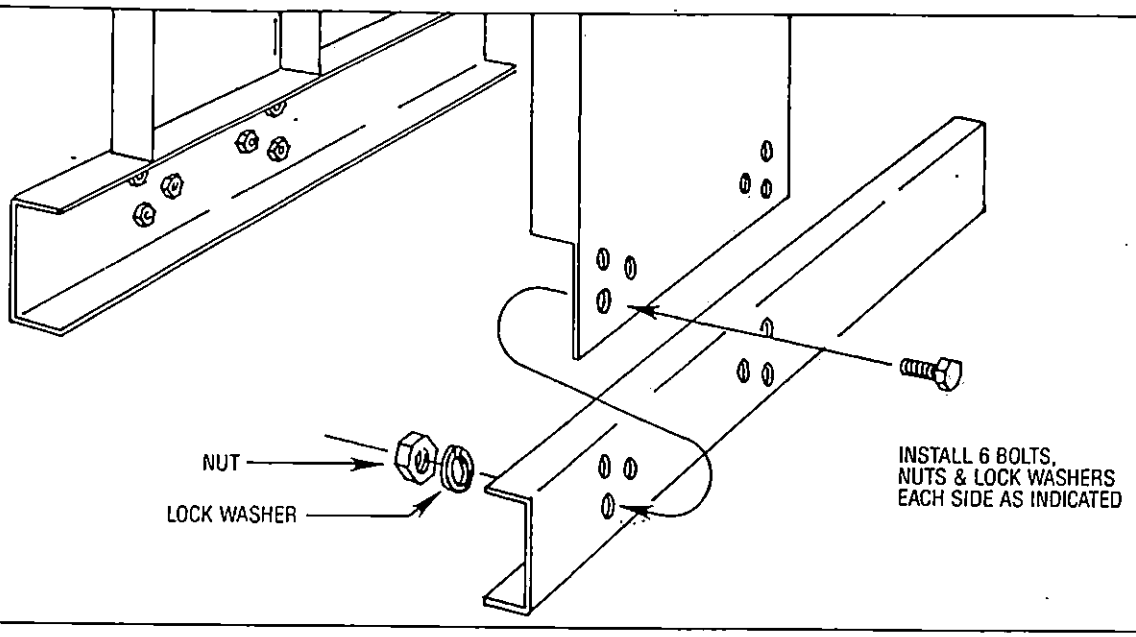


FIG. 2 SUGGESTED LIQUID COOLER INSTALLATION/FLOW DIAGRAM

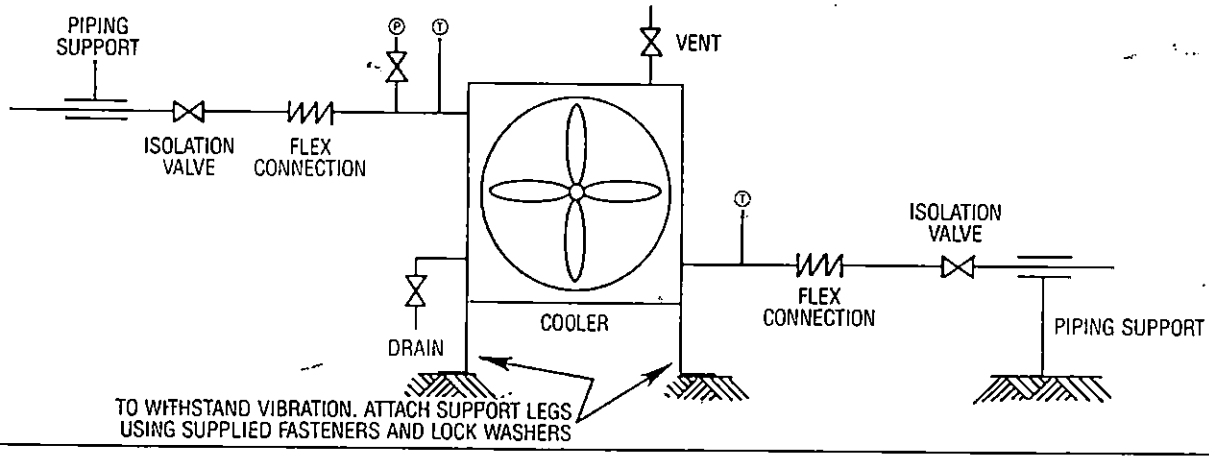
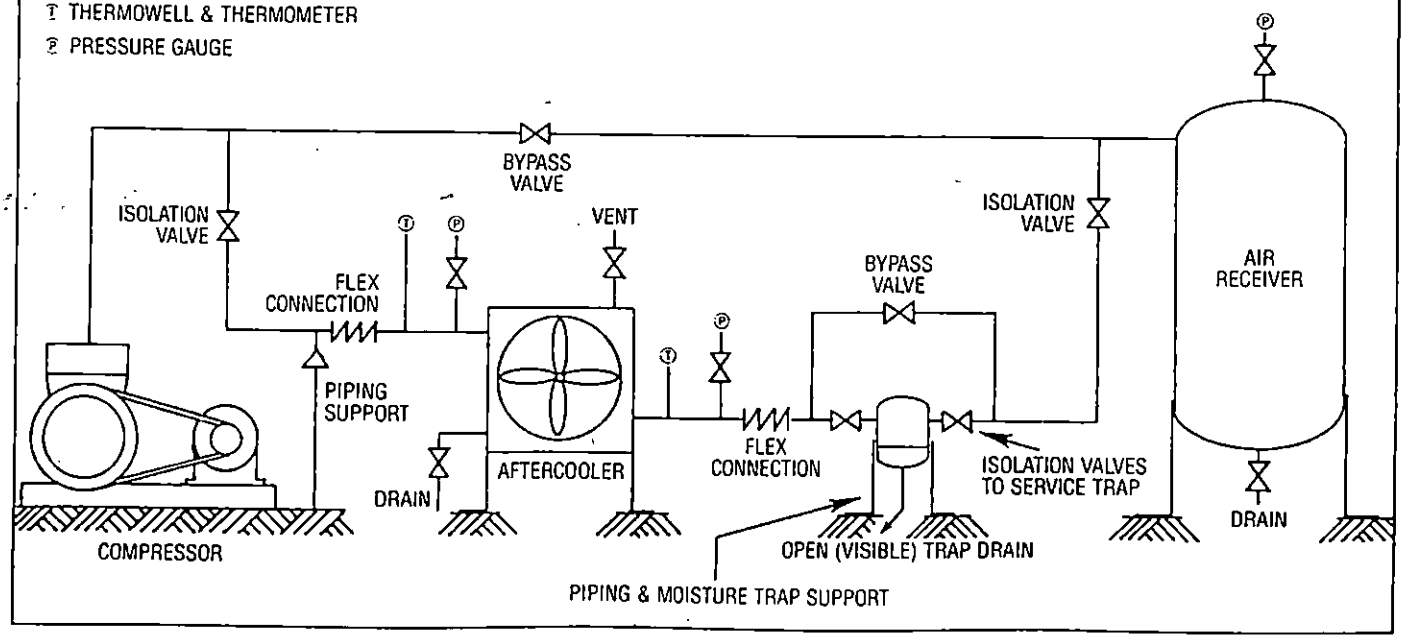


FIG. 3 SUGGESTED AFTERCOOLER INSTALLATION/FLOW DIAGARAM



MAINTENANCE:

- Caution — Power should be disconnected and cooler depressurized prior to any repairs or adjustments. A valve should be installed on the vent connection on top of the cooler for depressurizing aftercooler. The cooler isolation valves should be closed before venting.

- Cleaning of the exterior fin surface may be required when discharge temperature increases beyond design conditions. Cleaning may be accomplished by low pressure steam lancing (with detergent added, if necessary). Caution — Do not use caustic base chemicals. Check with supplier of cleaning solution to insure compatibility with aluminum.

- Cleaning of the internal fin surfaces may be accomplished by circulating a degreaser solvent or cleaning solution through the internal passages. Caution — Solutions must be compatible with aluminum. Alkaline material should never be used.

- Operation of moisture drainage trap should be checked on a routine basis. The drain float trap valve should be examined approximately three months after initial start-up to establish a regular maintenance schedule. Cleaning of the drain valve and seat will vary with air quality. It is important that a trap by-pass be installed as shown to accommodate trap maintenance.

If you have any questions, please call your
sales representative or the Air Technologies factory direct.

AMERICAN PRECISION INDUSTRIES
Heat Transfer Equipment Group
AIR TECHNOLOGIES DIVISION

2777 Walden Avenue, Buffalo, New York 14225 Phone 716/684-6700 Fax 716/684-2129

Installation & Operation

ERDCO direct reading flowmeters provide simple and reliable flow rate measurement. These rugged variable area meters work well in a wide variety of applications. Measurement is generally linear over 80% of the range.

The indicating pointer is part of the vane and directly visible through the sight window of the See-Flo® indicator/meter. Compare the vane position with the externally mounted scale to determine flow rate. The sight window may also be used to observe turbulence, cleanliness or other fluid conditions.

The Armor-Flo meter utilizes the same simple design with the added benefit of a flow isolated housing. High intensity magnets couple the vane and indicator without mechanical linkage and dynamic seals. Temporary decoupling of the vane and indicator may occur due to abrupt changes in flow rate. This condition will self correct as the indicator moves through the flow range.

Installation

Your ERDCO flowmeter is complete and ready to use. It has been individually calibrated and tested in accordance with your order. Orient the face of the meter in a vertical plane. Piping must be the same pipe size as the flowmeter. Install in a full pipe system noting the inlet and outlet markings. For maximum accuracy, ten pipe diameters of straight pipe on the upstream side and five pipe diameters of straight pipe on the downstream side of the meter are required. Locate valves and other restrictions downstream of the flowmeter where possible.

Do not exceed the maximum operating parameters (pressure, temperature) as stated on the nameplate of the flowmeter. Accuracy will be affected if a different fluid is measured or operating conditions vary from those specified.

Limit Switches

Mount the flowmeter in its specified orientation. Contacts are rated 0.25 ampere at 120 VAC (single pole, double throw). Reed switches can be set for High or Low flow actuation.

To adjust set points:

1. Remove cover ring screws, cover ring and window.
2. Locate the indicator at the desired trip point, and temporarily hold it in place. Do not bend the indicator arm.
3. Monitor switch continuity (light, horn, ohmmeter, etc.) while sliding the switch along the switch guide until the switch contacts open or close.
4. Secure switch and release indicator arm.
5. If a second set point is provided, repeat Steps 2 through 4 for the second switch.

Signal Ouputs

Please refer to the detailed Instruction Manual furnished.

Service

Factory repair and recalibration services are available. For more information or assistance call 708-328-0550. (Fax 708-328-3535).

ERDCO®

ERDCO Engineering Corporation
Box 6318, 721 Custer Avenue
Evanston, IL 60202-6318
USA

Form FM 0890
Printed in the USA

- Sizing Calculations -

Gas Applications

The tables on page 7 of the See-Flo® and Armor-Flo literature provide flow rate capacities by connection size in standard cubic feet per minute for air at 60°F/0 psig. For gas applications at other conditions you can utilize the following Correction factor to verify sizing:

$$Cf = .1682 \sqrt{\frac{(460+T)(SG)}{(14.7+P)}}$$

where:

Cf = Correction factor
T = operating Temperature
SG = Specific Gravity
P = operating Pressure
Q = scale flow rate

Cf x Q = scfm ranges on table

Fisher Controls

Instruction Manual

289 Series Relief Valves

FISHER

August 1990 *Form 1724*

Introduction

Scope of Manual

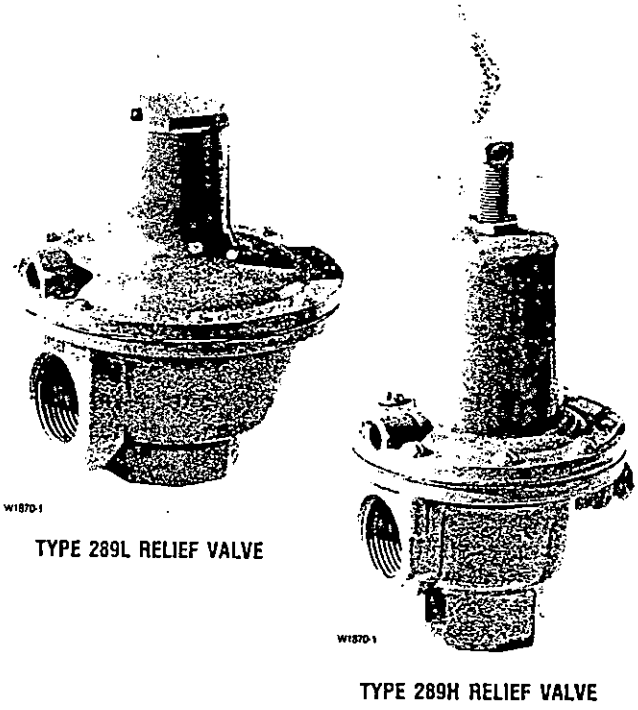
This instruction manual provides installation, maintenance, and parts ordering information for the 289 Series relief valves. Instructions for other equipment used with these relief valves can be found in separate instruction manuals.

Description

The 289 Series pressure relief valves (see figure 1) are throttling relief valves used downstream of pressure regulators to protect the downstream system from overpressure. These relief valves can be used for natural gas, air, propane, or other noncorrosive, gas-flow service.

Specifications

Specifications for the 289 Series relief valves are given in table 1.



TYPE 289L RELIEF VALVE

TYPE 289H RELIEF VALVE

Figure 1. Typical 289 Series Relief Valves

Installation

WARNING

Installing a 289 Series relief valve where its capabilities can be exceeded or where proper operation might be impaired may cause personal injury, property damage, or leakage due to bursting of pressure-containing parts or explosion of accumulated gas. To avoid such conditions, install a 289 Series relief valve where:

- **Service conditions are within the unit capabilities specified in tables 1 and 2, and**
- **The relief valve is protected from exposure to physical damage and/or corrosive substances.**

1. When installing a 289 Series relief valve, make sure that the installation of the system complies with applicable local, state, or federal codes or regulations.

2. Use qualified personnel when installing, operating, and maintaining a 289 Series relief valve. Before installation, make sure there is no damage to or foreign material in the relief valve and that all piping is clean and unobstructed.

3. For installation of Type 289H, 289HH, and 289L relief valves, the vent in the spring case must remain plugged or undrilled in order for the pitot tube to function properly.

D100280X012

Table 1. Specifications

Available Configurations

See table 2

Body Sizes and End Connection Styles

Type 289L: ■ 3/4 or ■ 1 in. NPT screwed
Types 289A and 289U: 1/4 in. NPT screwed
Type 289H: ■ 1 or ■ 2 in. NPT screwed
Type 289HH: 1 in. NPT screwed

Maximum Allowable Relief (Inlet) Pressure and Relief Pressure Set Ranges

See table 2

Material Temperature Capabilities

With Nitrile and Neoprene Elastomers: −20 to 150°F (−29 to 66°C)
With Fluoroelastomer[1]: 20 to 300°F (−7 to 149°C); available with Types 289H and 289HH only

1. Bubble-tight shutoff can not be attained at settings below 5 psig (.34 bar) with fluoroelastomer O-ring seat.

Pressure Setting Adjustment

Adjusting screw

Pressure Registration

Internal

Approximate Weight, LB (kg)

Types 289A and 289U: 0.75 (0.3)
Type 289H:
1 In. Size: 4 (1.8)
2 IN. Size: 1.5 (0.7)
Type 289HH: 4 (1.8)
Type 289L: 1.5 (0.7)

Additional Specifications

For construction materials, see parts list

4. The 289 Series relief valves may be installed in any orientation. However, if installing the relief valve at an outside location, adequate protection, such as raincaps or elbow piping (see figure 2), must be attached to the outlet to keep the relief valve from getting plugged or from collecting moisture, corrosive chemicals, or other foreign materials. If piping is to be attached to the valve outlet, the following parts (if they are connected to the valve outlet as shown in figures 4 through 8) must first be removed: the screen (key 9), the snap ring (key 13), and the gasket (key 15). A typical installation of a 289 Series relief valve is shown in figure 2.

WARNING

If using a 289 Series relief valve on hazardous or flammable gas service, personal injury and property damage could occur due to fire or explosion of vented gas that may have acumulated. To prevent such injury or damage, provide piping or tubing to vent the gas to a safe, well-ventilated area. Also, when venting a hazardous gas, the piping or tubing should be located far enough away from any buildings or windows so to not create a further hazard, and the vent opening should be protected against anything that could clog it.

5. Apply pipe compound to the male pipeline threads only; do not apply pipe compound to the internal body threads. Then install the relief valve so that the flow through it will match the direction arrow or marking cast on the valve body.

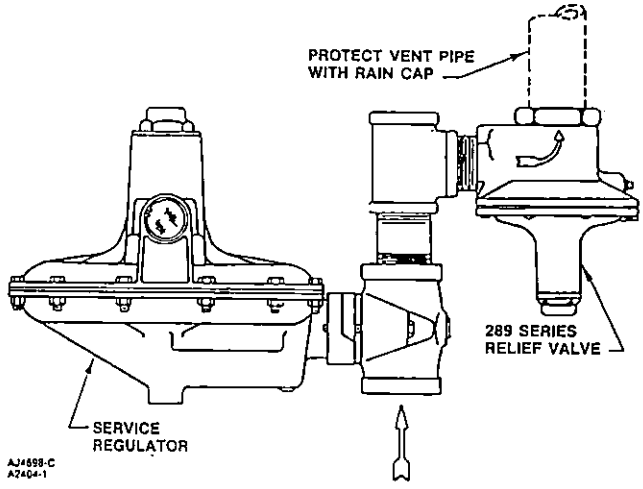


Figure 2. Typical Installation

Startup

Key numbers are shown in figures 4 through 8.

With proper installation completed and system equipment properly adjusted, close any vent valves, and slowly open the upstream shutoff valve while using pressure gauges to monitor pressure.

Note

To ensure proper operation of the pitot tube, if present, the spring case (key 2) must be tightly sealed. It is recommended that the gasket (key 15) be replaced whenever the closing cap (key 14) is removed.

Table 2. Maximum Allowable Relief (Inlet) Pressure

AVAILABLE CONFIGURATION	BODY SIZE, INCH	SPRING PART NUMBER	COLOR CODE	SPRING RANGE (RELIEF PRESSURE SETTINGS)		MAXIMUM ALLOWABLE RELIEF (INLET) PRESSURE(1)	
						Psig	Bar
289A	1/4	0Z0563 27022 1B2682 27022	Silver	3 to 13 psig 11 to 22 psig	0.2 to 0.9 bar 0.8 to 1.5 bar	45	3.1
289H	1	1F8269 27052 1D8923 27022 1D7515 27022 1D7455 27142	Pink Red Silver Green	1 to 4.5 psig 4 to 15 psig 10 to 20 psig 15 to 50 psig	69 to 310 mbar 0.3 to 1.0 bar 0.7 to 1.4 bar 1.0 to 3.4 bar	100	6.9
	2	1B5365 27052 1B5366 27052 1B5368 27052 1B5369 27052	Dark blue Gray Dark green Red stripe	7 to 18 inch wc 0.5 to 2.25 psig 1.75 to 7 psig 4 to 10 psig	17 to 45 mbar 35 to 155 mbar 121 to 483 mbar 0.3 to 0.7 bar	25	1.7
289HH	1	1D7455 27142	Green	45 to 75 psig	3.1 to 5.2 bar	100	6.9
289L	3/4 or 1	1B4135 27222 1N3112 X0012 13A7917 X012 13A7916 X012	Silver Stainless steel Silver Silver	3 to 8 inch wc 5 to 18 inch wc 10 to 18 inch wc 12 to 40 inch wc	7 to 20 mbar 12 to 45 mbar 25 to 45 mbar 30 to 100 mbar	7	0.5
289U	1/4	0V0602 27022 0F0582 27022	Silver Silver	5 to 25 inch wc 20 inch wc to 3 psig	12 to 62 mbar 50 to 206 mbar	10	0.7

1. This value indicates the relief pressure setting plus pressure buildup.

Antiseizing sealant should be applied to the adjusting screw (key 6) threads on valves without closing caps.

If set pressure adjustment is necessary, monitor the inlet pressure with a gauge during the adjustment procedure. Remove the closing cap (key 14), or loosen the hex nut (key 11), and turn the adjusting screw (key 6) clockwise to increase or counterclockwise to decrease the relief pressure setting.

For 2-inch Type 289H relief valves, when changing from one spring range to another, it is recommended that a new spring case be used so that the travel stop drive screw will be positioned correctly for the corresponding spring range. Each spring range requires that the travel stop drive screw be positioned appropriately in the spring case to prevent setting the relief valve pressure too high. The location of the travel stop drive screw for each spring and spring range is shown in figure 3.

SPRING PART NUMBER	SPRING RANGE (RELIEF PRESSURE SETTING)		DIMENSION A	
			Inch	mm
1B5365 27052	7 to 18 inch wc	17 to 45 mbar	Drive screw not required	
1B5366 27052	0.5 to 2.25 psig	35 to 155 mbar	1-17/32	39
1B5368 27052	1.75 to 7 psig	121 to 483 mbar	2-5/32	55
1B5369 27052	4 to 10 psig	0.3 to 0.7 bar	2-5/16	59

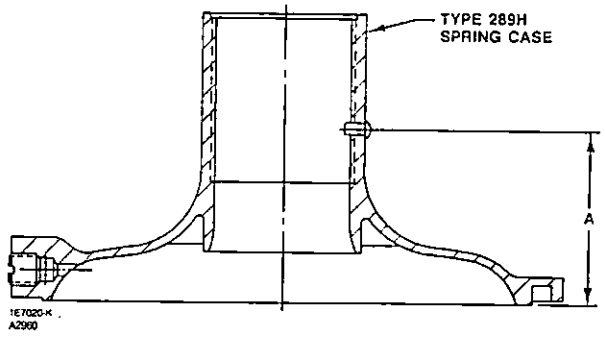


Figure 3. Location of Travel Stop Drive Screw for 2-Inch, Type 289H Relief Valve

Shutdown

Close the upstream shutoff valve, and release all pressure from the relief valve.

Maintenance

Relief valve parts are subject to normal wear and should be inspected periodically for maintenance. The frequency of inspection and replacement of parts depends upon the severity of service conditions.

This section contains information for inspection and maintenance of 289 Series relief valves. Maintenance procedures are presented for relief valve configurations of similar construction. Refer to the appropriate procedure and figure for the particular relief valve configuration when changing the control spring to one of a different range or when inspecting, cleaning, or replacing any other relief valve parts. The screen (key 9, figures 4 through 7) and vent piping, if present, should be free of foreign material that might impair relief flow.

Note

The relief valve body (key 1, figures 4 through 8) may remain in the pipeline during maintenance unless replacement of the valve body is necessary.

WARNING

Avoid personal injury or property damage from sudden release of pressure or explosion of accumulated gas. Before starting disassembly:

- **Isolate the relief valve from line pressure, and**
- **Release trapped pressure from the valve body and pressure line.**

Type 289A Relief Valves

All key numbers are shown in figure 4.

1. Loosen the hex nut (key 11), and unscrew the adjusting screw (key 6) to relieve spring compression.

2. Unscrew the machine screws (key 8), and remove the spring case (key 2), the spring seat (key 4), the spring (key 7), the diaphragm head (key 3) and the diaphragm (key 5).

3. Inspect the diaphragm and seating surfaces for damage or wear, and replace parts as necessary. To remove the orifice (key 10) unscrew it from the body.

4. Reinstall the orifice, the diaphragm, the diaphragm head, the spring, and the spring seat.

5. Reattach the spring case using the machine screws.

6. If a new spring with a different range is installed, stamp the spring case with the new spring range.

7. Adjust the spring compression according to the procedures outlined in the Startup section.

Type 289U Relief Valves

All key numbers are shown in figure 5.

1. Loosen the hex nut (key 11), and unscrew the adjusting screw (key 6) to relieve spring compression.

2. Unscrew the machine screws (key 8), and remove the spring case (key 2), the spring seat (key 4), the spring (key 7), and the diaphragm assembly (key 5).

3. Inspect the diaphragm assembly and seating surfaces for damage or wear, and replace parts as necessary.

4. Reinstall the diaphragm assembly, the spring, and the spring seat.

5. Reattach the spring case using the machine screws.

6. If a new spring with a different range is installed, stamp the spring case with the new spring range.

7. Adjust the spring compression according to the procedures outlined in the Startup section.

Type 289L Relief Valves

All key numbers are shown in figure 6.

1. Remove the closing cap (key 14) and the gasket (key 15), and then unscrew the adjusting screw (key 6) to relieve spring compression.

2. Unscrew the machine screws (key 8), and then remove the spring case (key 2), the spring (key 7), and the diaphragm assembly (key 5).

3. Inspect the diaphragm and seating surfaces for damage or wear, and replace parts as necessary. To remove the orifice (key 10), unscrew it from the body. Check the pitot tube in the diaphragm assembly for blockage, and remove any foreign material that might impair proper operation of the relief valve.

4. Reinstall the orifice, the diaphragm assembly, and the spring.

5. Reattach the spring case using the machine screws.

6. If a new spring with a different range is installed, stamp the closing cap with the new spring range.

7. Adjust the spring compression according to the procedures outlined in the Startup section, and then reinstall the closing cap and gasket.

Type 289HH and 1-Inch Type 289H Relief Valves

All key numbers are shown in figure 7.

1. Loosen the hex nut (key 11), and then unscrew the adjusting screw (key 6) to relieve spring compression.

2. Unscrew the machine screws (key 8), and remove the spring case (key 2), the spring seat (key 4), and the spring (key 7).

3. Unscrew the hex nut (key 24), and remove the lower spring seat (key 17), the diaphragm head (key 3), and the diaphragm (key 5).

4. Unscrew the machine screws (key 29), and then remove the stem guide assembly (key 31) and attached parts from the valve body (key 1).

5. Slide the spacer (key 23) and the pitot tube (key 18) and attached parts from the valve body.

6. Remove the washer (key 27), the gasket (key 19), the spacer, the O-rings (key 30), the O-ring holder (key 21), the O-ring (key 20), and the O-ring washer (key 22) from the pitot tube.

7. Inspect the O-rings, the gaskets, the spacer, the orifice, and the seating surfaces for damage or wear, and replace parts as necessary.

8. Apply antiseizing sealant to the adjusting screw threads, and to the end of the adjusting screw that contacts the spring seat.

9. Slide the O-ring washer, the O-rings (keys 30 and 20), the O-ring holder, the O-ring (key 30), the spacer, the stem guide assembly, the gasket, and the washer (key 27) onto the pitot tube.

10. Reinstall the stem guide assembly with attached parts into the valve body, and then attach this assembly with the machine screws (key 29).

11. Replace the diaphragm, the diaphragm head, and the lower spring seat, and then secure these parts with the hex nut (key 24).

12. Reinstall the spring and the spring seat, and then attach the spring case to the valve body using the machine screws (key 8).

13. If a new spring with a different range is installed, stamp the spring case with the new spring range.

14. Adjust the spring compression according to the procedures outlined in the Startup section.

2-Inch Type 289H Relief Valves

All key numbers are shown in figure 8.

1. Remove the closing cap and the gasket (keys 14 and 15), and then unscrew the adjusting screw (key 6) to relieve spring compression.

2. Unscrew the machine screw (key 8), and remove the spring case (key 2), the washer (key 27), and the spring (key 7).

3. Unscrew the hex nut (key 24), unscrew the lifting stem (key 25), and then unscrew the hex nut (key 11).

4. Remove the lower spring seat (key 17), the diaphragm head (key 3), the diaphragm (key 5), the lower diaphragm head (key 26), and the gasket (key 19).

5. Unscrew the machine screws (key 29), and then remove the stem guide assembly (key 31) and attached parts.

6. Slide the spacer (key 23) and the pitot tube (key 18) and attached parts out of the stem guide assembly.

7. Remove the gaskets (key 19), the spacer (key 23), and the O-ring washer (key 22) from the pitot tube. Then remove the O-ring washer (key 20) and the orifice (key 10) from the valve body (key 1).

8. Inspect the O-rings, the gaskets, the spacer, the orifice, and the seating surfaces for damage or wear, and replace parts as necessary.

9. Apply antiseizing sealant to the orifice threads, and then to the adjusting screw threads.

10. Reinstall the orifice and the O-ring (key 20) into the valve body.

11. Slide the gasket, the O-ring washer, the gasket, the spacer, the stem guide assembly, and the gasket onto the pitot tube.

12. Reinstall the stem guide assembly with attached parts into the valve body, and attach it with the machine screws (key 29).

13. Replace the lower diaphragm head, the diaphragm, the diaphrahm head, and the lower spring seat; then secure these parts with the hex nut (key 11). Screw in the lifting stem, and lock it in place with the hex nut (key 24).

14. Reinstall the spring and the washer.

Note

For 2-inch Type 289H relief valves, when changing from one spring range to another, use a new spring case to position the travel stop drive screw correctly for the corresponding spring range. Each spring range requires that the travel stop drive screw be positioned appropriately in the spring case to prevent setting the relief valve pressure too high. The location of the travel stop drive screw for each spring and spring range is shown in figure 3.

15. Attach the spring case to the valve body using the machine screws (key 8).

16. If a new spring with a different range is installed, stamp the spring case with the new spring range.

17. Adjust the spring compression according to the procedures outlined in the Startup section. Then install the gasket and the closing cap.

Parts Ordering

When corresponding with your Fisher sales office or sales representative about this equipment, always reference the equipment serial number stamped on the spring case (Key 2) or the closing cap (key 14). When ordering replacement parts, specify the complete 11-character part number of each required part as found in the following parts list.

Parts List

Key	Description	Part Number
	Parts Kit (included are keys 5, 9, 15, 19, 20, 30 and 38). Screen is stainless steel and gaskets are composition and neoprene.	
	Type 289A (includes only keys 5 and 9)	
	Neoprene diaphragm	R289A X00012
	Type 289L (includes only keys 5, 9, and 15)	
	Nitrile diaphragm and O-rings	
	3/4-inch body	R289L X00012
	1-inch body	R289L X00022
	Type 289H (1-inch body) and 289HH	
	Nitrile diaphragm and O-rings	R289H X00012
	Fluoroelastomer diaphragm and O-rings	R289H X00032
	Type 289H, 2-inch body (includes keys 5, 9, 15, 19, 20 and 38)	
	Nitrile diaphragm and O-rings	R289H X00022
	Fluoroelastomer diaphragm and O-rings	R289H X00042
	Type 289U (includes only keys 5 and 9)	
	Nitrile diaphragm	R289U X00012
1	Valve Body	
	Type 289A, zinc	0Y0710 44022
	Type 289U, zinc	1B0438 44012
	Types 289H (1-inch body) and 289HH, Aluminum	3U8882 08012
	Type 289H (2-inch body), cast iron	31B1992 X012
	Type 289L, aluminum	
	3/4-inch body	3L4070 08012
	1-inch body	3L4069 08012
2	Spring Case/Spring Case Assembly	
	Type 289A, zinc	1A5051 44022
	Types 289H (1-inch body) and 289HH, Aluminum	1P9017 08012
	Type 289H (2-inch body), zinc/steel	1E7020 000A2
	Type 289L, aluminum	3L3338 X0012
	Type 289U, zinc	0B0616 44022
3	Diaphragm Head	
	Type 289A, zinc	0T0227 44022
	Type 289H, plated steel	
	1-inch body	1D6664 28982
	2-inch body	0W0202 25072
	Type 289HH, zinc plated steel	1P9014 25062
4	Spring Seat	
	Type 289A, brass	0T0226 14012
	Type 289U, zinc	1B3725 44022
	Types 289H (1-inch body) and 289HH, Plated steel	1D6671 25072
5*	Diaphragm/Diaphragm Assembly	
	Type 289A, neoprene	1A5052 02102
	Types 289H (1-inch body) and 289HH	
	Nitrile	1E6066 02052
	Fluoroelastomer	1E6066 02342
	Type 289H (2-inch body)	
	Nitrile	1D7800 02052
	Fluoroelastomer	1D7800 02332
	Type 289L	
	Nitrile(1)	
	3/4 & 1-inch body, standard	AL4068 000A2
	Fluoroelastomer(2) (1-inch body)	1N3130 X0012
	Type 289U(3), nitrile	18A281 5X012
6	Adjusting Screw	
	Type 289A, brass	1A5684 14012
	Types 289H (1-inch body) and 289HH, plated steel	1D9954 48702
	Type 289H (2-inch body) zinc	1B5379 44012
	Type 289L, Delrin(4)	T10071 06642
	Type 289U, brass	0F0581 14012
7	Spring	See table 2
8	Machine Screw, plated steel	
	Type 289A (6 req'd)	1B7774 28982
	Types 289H and 289HH, 1-inch body (8 req'd)	1A3917 24052
	Type 289H, 2-inch body (8 req'd)	1A4078 24052
	Type 289L (8 req'd w/o wire seal, 7 req'd w/wire seal)	1B2856 28982
	Type 289L (1 req'd w/wire seal)	1L9277 28982
	Type 289U (6 req'd)	1A3451 28982
9	Screen, Stainless steel	
	Type 289L	
	3/4-inch body	1B6335 38392
	1-inch body	1E5648 43122
	Types 289A and 289U	0L0783 43062
	Types 289H and 289HH, 1-inch body	1E5648 43122
	Type 289H, 2-inch body	11B1994 X012
10	Orifice	
	Type 289A, Aluminum	0T0225 09012
	Type 289H (2-inch body)	
	Brass	1E7026 13012
	Stainless steel	1E7026 35072
	Type 289L	
	Aluminum	1L4064 09012
11	Hex Nut	
	Types 289A and 289U, Brass	1A5054 18992
	Types 289H (1-inch body) and 289HH, Zinc plated steel	1D6677 28982
	Type 289H (2-inch body), Zinc plated steel	D7801 24272
13	Snap Ring	
	Type 289L, Stainless steel	
	3/4-inch body	1B6336 38992
	1-inch body	1E5649 37022

* Recommended spare part.
1. Assembly also includes an aluminum pitot tube and brushing, a zinc plated steel spring seat and diaphragm head, and a neoprene seat pad.
2. Assembly also includes an aluminum pitot tube, bushing, and diaphragm head, a 302 stainless steel spring seat, and a neoprene seat pad.
3. Assembly also includes a zinc diaphragm head.
4. Trademark of E.I. duPont de Nemours Co.

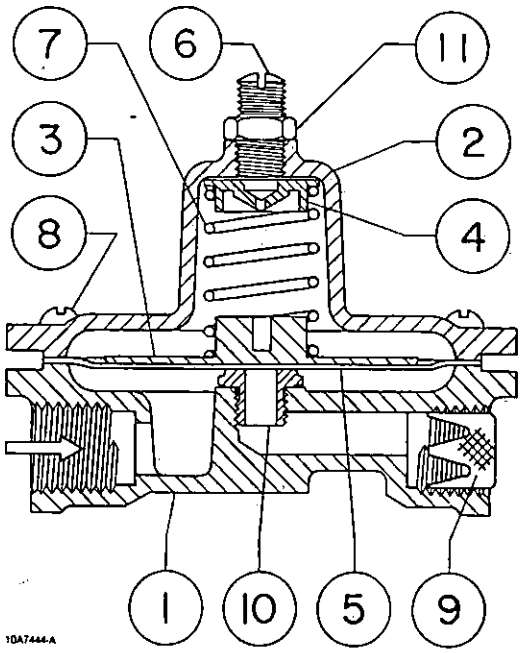


Figure 4. Type 289A Relief Valve

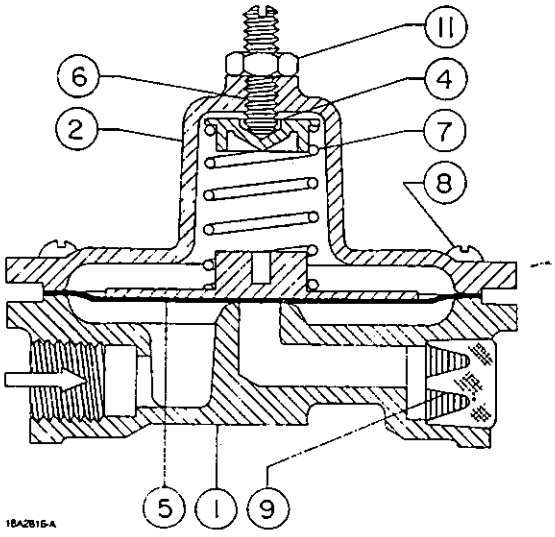


Figure 5. Type 289U Relief Valve

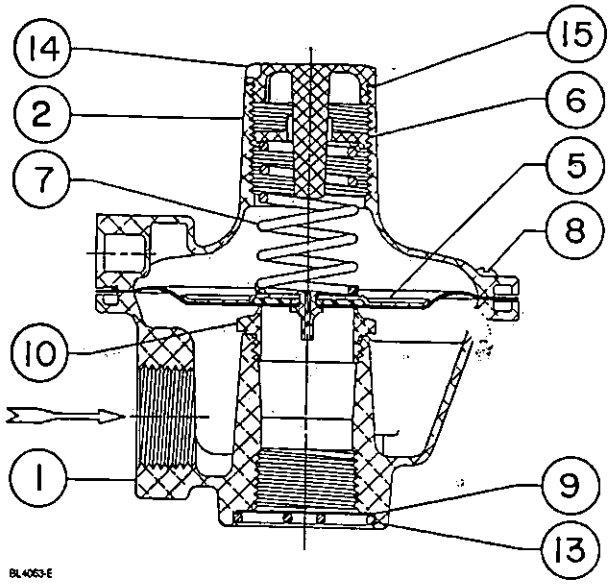


Figure 6. Type 289L Relief Valve

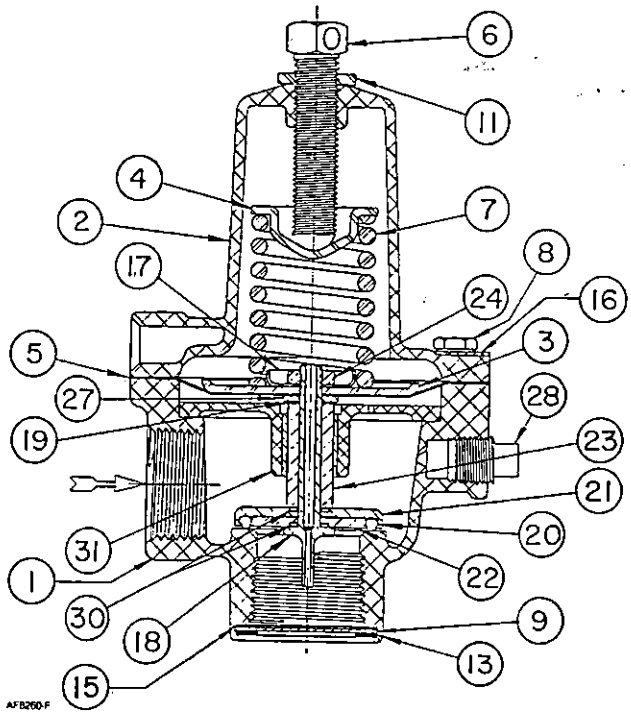


Figure 7. Typical of Type 289HH and 1-Inch Type 289H Relief Valves

Key	Description	Part Number
13	Snap Ring (Cont.)	
	Types 289H and 289HH, 1-inch body	
	Plated steel	13A993 8X012
	Type 289H, 2-inch body	10B9241 X012
14	Closing Cap	
	Type 289H, 2-inch body, zinc	1B5416 44012
	Type 289L	
	W/o wire seal, plastic	T10072 06992
	W/o wire seal, zinc	1H9669 X0012
15*	Gasket	
	Types 289H and 289HH, 1-inch body	
	Neoprene	13A9929 X012
	Type 289H, 2-inch body	
	Neoprene	1P7533 06992
	Type 289L	
	Neoprene	1E1056 06992
16	Nameplate, aluminum	
	Types 289H and 289HH, 1-inch body	1F8527 11992

*Recommended spare part.

Key	Description	Part Number
17	Lower Spring Seat	
	Types 289H and 289HH, 1-inch body	
	Plated steel	1D6666 25072
	Type 289H, 2-inch body, zinc plated steel	1D7799 25062
18	Pitot Tube	
	Types 289H and 289HH, 1-inch body	
	Aluminum	1F8262 09012
	Type 289H, 2-inch body	
	Brass	1E7019 14012
	Stainless steel	1E7019 35032
19*	Gasket composition	
	Type 289HH, 1-inch body (1 req'd)	1F8268 04022
	Type 289H, 2-inch body (3 req'd)	1D7798 04022
20*	O-Ring	
	Type 289H, 1-inch body	
	Nitrile	1F8266 06992
	Fluoroelastomer	1F2692 X0012
	Type 289H, 2 in. body	
	Nitrile	1P3361 06992
	Fluoroelastomer	1V6646 06382
	Type 289HH	
	Nitrile	1F2692 06992
	Fluoroelastomer	1F2692 X0012
21	O-Ring Holder, aluminum	
	Types 289H and 289HH, 1-inch body	1F8264 09012
22	O-Ring Washer	
	Types 289H and 289HH, 1-inch body	
	Aluminum	1F8265 09012
	Types 289H, 2-inch body, stainless steel	1E7021 36072
23	Spacer	
	Types 289H and 289HH, 1-inch body	
	Stainless steel	1F8263 35242
	Type 289H, 2-inch body	
	Brass	1E7022 14172
	Stainless steel	1E7022 35162
24	Hex Nut, plated steel	
	Types 289H and 289HH, 1-inch body	1A4997 24122
	Type 289H, 2-inch body	1B2282 28982
25	Lifting Stem, plated steel	
	Type 289H, 2-inch body	1D7802 24092
26	Lower Diaphragm Head, plated steel	
	Type 289H, 2-inch body	1E7031 25072
27	Washer, aluminum	
	Types 289H and 289HH, 1-inch body	1F8267 09012
	Type 289H, 2-inch body	1C6805 11032
28	Pipe Plug, plated steel	
	Types 289H and 289HH	1D7548 28982
29	Machine Screw, plated steel (not shown)	
	Types 289H and 289HH	
	1-inch body (2 req'd)	1D3869 28982
	Type 289H, 2-inch body (4 req'd)	1F3865 28992
30*	O-Ring (2 req'd)	
	Types 289H and 289HH, 1 in. body	
	Nitrile	1D6875 06992
	Fluoroelastomer	1N4304 06382

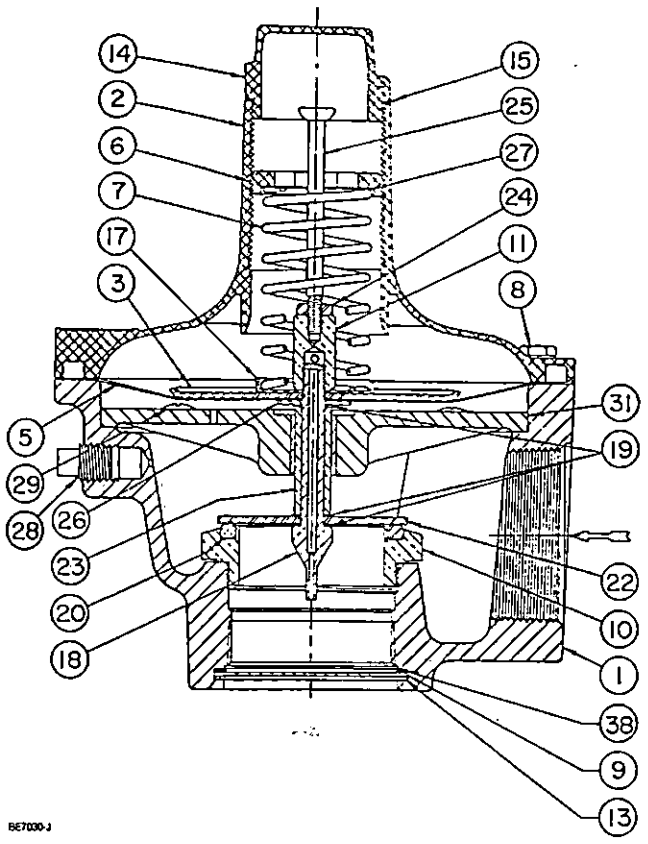


Figure 8. 2-Inch Type 289H Relief Valves

Key	Description	Part Number
31	Stem Guide Assembly	
	Type 289HH, 1-inch body	
	Zinc/brass	1F8272 000A2
	Zinc/303 stainless steel	1F8272 X0012
	Type 289H, 2 in. body	
	Cast iron/brass	1E7028 000A2
	Cast iron/303 stainless steel	1E7028 X00A2
32	Lifting Lever (not shown)	
	Type 289H, 2-inch body	0R0617 25092
33	Wire Seal (not shown)	
	Type 289L, 1-inch body	1D8847 99012
34	Diaphragm Protector (not shown)	
	Types 289A and 289U	10A511 6X012
38*	Gasket, Type 289H, 2-inch body	11B1993 X012

*Recommended spare part.

Fisher Controls

For information, contact Fisher Controls:
Marshalltown, Iowa 50158 USA
Cernay 68700 France
Sao Paulo 05424 Brazil
Singapore 2158

Printed in USA

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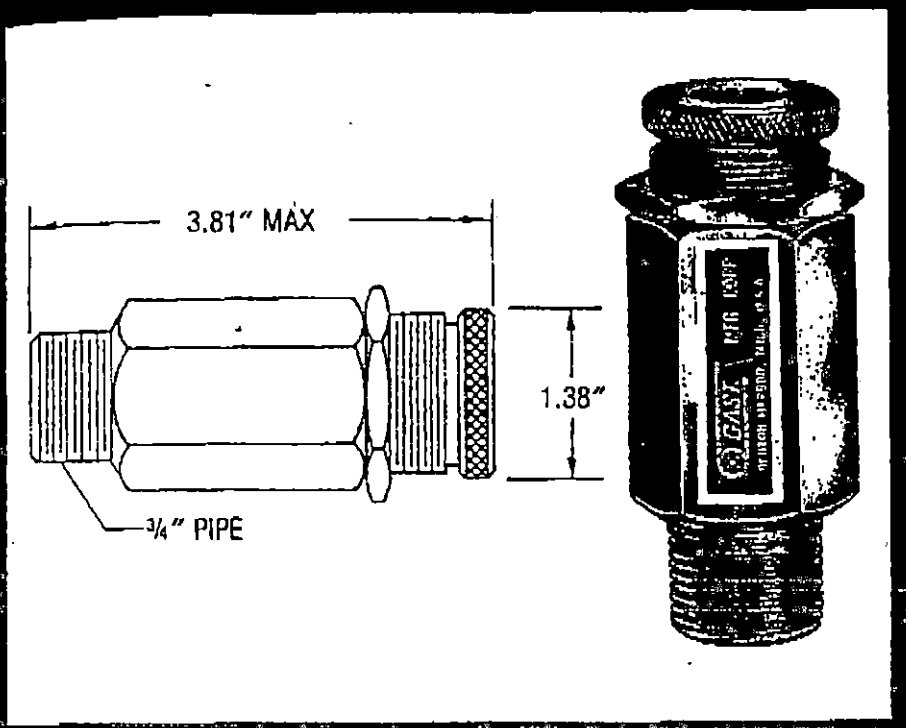


Relief valves #AA307 and #AA308

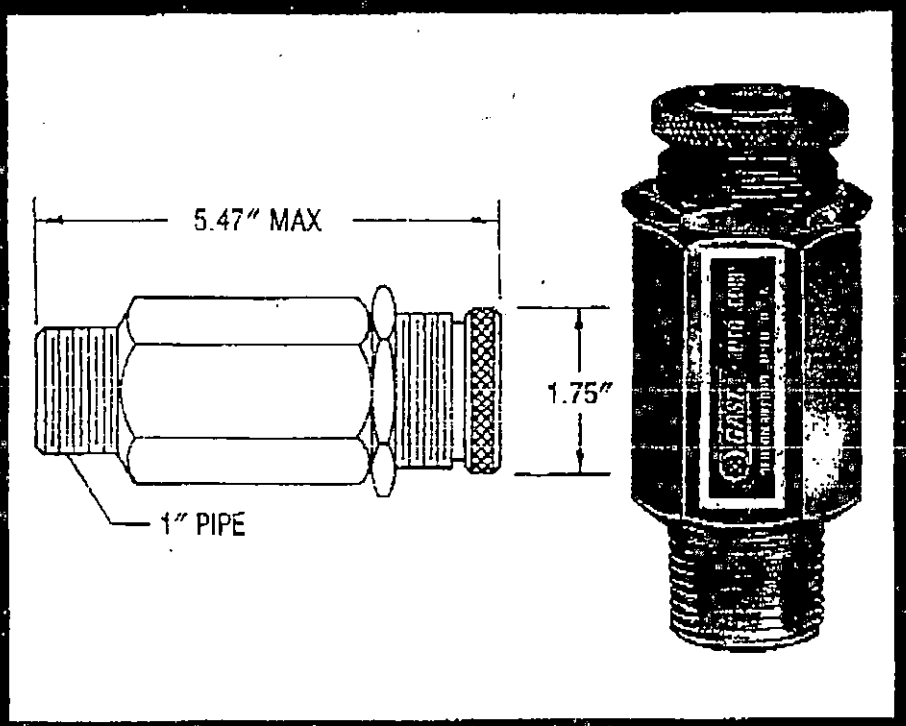
Pressure Relief Valve #AA307

• • •

Vacuum Relief Valve #AA308

Made from high-quality anodized aluminum for corrosion resistance. Non-chattering, quiet operation with minimum restriction; ¾" pipe size. Suitable for temperatures to 300° F.

- Model #AA307 relieves **pressure** from 2 to 25 psig; flow to 50 scfm.
- Model #AA308 relieves **vacuum** from 5" to 27" Hg; flow to 50 scfm.



Relief valves #AE960 and #AE961

Pressure Relief Valve #AE960

• • •

Vacuum Relief Valve #AE961

High-quality anodized aluminum valves resist corrosion. Quiet operation; minimum restriction. One-inch pipe size. Suitable for temperatures to 300° F.

- Model #AE960 relieves **pressure** from 2 to 20 psig; maximum flow 60 scfm.
- Model #AE961 relieves **vacuum** from 5" to 27" Hg; flow to 60 scfm.

TO: LOUISE
ORS ENVIR

FROM: DEBBIE
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p6 2/2

PRESSURE RELIEF VALVES

MODEL	MAXIMUM FLOW SCFM	PRESSURE ADJUSTMENT RANGE PSIG	PIPE SIZE
AA203	2	2-25	1/8"
AA205	2	2-25	1/4"
AA600	15	2-30	3/8"
AA307	50	2-25	3/4"
AE960	60	2-20	1"

VACUUM RELIEF VALVES

MODEL	MAXIMUM FLOW SCFM	PRESSURE ADJUSTMENT RANGE INCHES Hg	PIPE SIZE
AA204	2	5-27	1/8"
AA207	2	5-27	1/4"
AA840A	15	5-27	3/8"
AA308	50	5-27	3/4"
AE961	60	5-27	1"

GAST
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INSTRUMENTS INC.

INSTRUCTIONS 1-DE-7
6-90

INSTALLATION & OPERATING INSTRUCTIONS

DIFFERENTIAL EXPANSION TYPE TEMPERATURE CONTROLS & LIMITS

Before installing a Burling Temperature Control or Limit, read and understand the following instructions. If in doubt, call Burling at (201) 635-9481

1. MODEL IDENTIFICATION

All models incorporate a nameplate or label, which shows the MODEL NUMBER and a SERIAL NUMBER or IDENTIFICATION NUMBER. Use these numbers to identify your particular model and also to re-order an identical replacement.

2. PRIOR TO INSTALLATION

2.1. Each Burling model has a nameplate or label which specifies in inches, what length the sensing tube **must** be exposed to the temperature of the process being controlled. This length is normally marked on the nameplate in the box within the statement "EXPOSE ☐ IN TO HEAT". This length is referred to in our Catalog DE as the "Active Length".
It is permissible to expose slightly more but never less than the "Active Length".
Exposing less than the correct "Active Length" will result in increasing the set point to possible unsafe levels.

2.2. Maximum tube temperature limits specified on nameplates must never be exceeded, even by surges in the system.

2.3. The adjustable range must be selected so that incorrect, inadvertent, or malicious settings at any range point can not result in an unsafe system condition.

2.4. Types of covers or housings are indicated by suffix model number:
"S" is general purpose (Nema type 1)
"C" is watertight and dust-tight (Nema types 4 & 5)
"X" is explosion proof (see nameplate for rating)
"O" has no cover
Only models with "C" or "X" suffix should be operated below 32°F for extended periods, and only then if conduit connection is properly sealed to prevent entrance of moisture to inside of case.
Ambient temperature at microswitch should not exceed 250°F. For longer switch life, it is best not to exceed 175°F.
Ambient temperature at valve in pneumatic models should not exceed 200°F.
See special information for "Couple-Switches" in paragraph 7.

3. INSTALLATION

3.1. When received, model is ready for installation and operation.

3.2. Install model where shock, vibration, and temperature fluctuations are minimal so that moisture is prevented from entering the enclosure via the conduit.

3.3. Install the sensing tube of the model in the equipment being controlled or protected by using one of the following mounting fittings:
a) Flange
b) Welded bushing or union

3.4. Do not use force on the tube or head of the model. **Use a wrench on the hex of the mounting fitting only.**

3.5. Do not turn the head on the tube. This upsets temperature calibration.

3.6. Do not fasten, clamp, or otherwise restrict expansion of the tube anywhere except at mounting fitting.

4. WIRING OF ELECTRIC TYPES

4.1. *WIRING AND SAFETY PRECAUTIONS:*
Wiring should comply with local codes, regulations, and ordinances.
Do not run sensor wires in same conduit as power wires.
Shut off power to model before wiring.
Read all labels before connecting wire or applying power.
Observe all electrical ratings.
Be sure any unused wiring conduit openings are sealed before applying power.

4.2. Remove cover by one of the following methods:
a) Remove or loosen screws and lift off cover or cover plate.
b) On models with threaded cover, unscrew upper half while holding bottom half of housing (Avoid holding by tube or mounting fitting).

4.3. For electric rating, see model nameplate. This is an Underwriters Laboratory rating of the microswitch, but for longest life it is not advisable to operate at or near full rated load.

4.4. Microswitches are S. P. D. T. The switch terminals, terminal plate, or lead wires are marked or colored to indicate the following action:

C (white): Common
N.C. (red): Normally Closed - opens on temperature rise.
N.O. (blue): Normally Open - closes on temperature rise.

4.5. On two and three switch models, each switch is independent of the others.

4.6. To improve access to the lower terminal of the microswitch in models B-1C and B-2C, loosen the ⅞" hex nut securing the enclosure. Unscrew the top half of the enclosure, then pull the assembly away from the bottom half of the enclosure. When reassembling follow instruction printed on CAUTION label affixed to bottom half of the enclosure.

4.7. Manual Reset Microswitches. This type has a plastic or metal button or plunger on the bottom of the switch, located between the terminals. This must be manually reset each time the switch is actuated at the lever. On the Model A-1S it projects through the top cover. On the Model H-1S, it projects through the bottom of the head casting. On most other Models, the cover or cover plate must be removed to gain access to the reset button.

5. PIPING OF PNEUMATIC TYPES

5.1. Connect tubing or piping to external air connections. Nameplate indicates proper connections for direct or reverse action. Bleed outlet should be exhausted to atmosphere.

5.2. Special care must be taken that air entering the valve is clean, dry, and free from oil. A filter should be installed in the supply line for this purpose.

5.3. When used as a high temperature limit, connect branch line from other controller to air supply connection.

5.4. Air supply pressure depends on the requirements on the diaphragm valve or motor being used. The Burling pneumatic control can handle any pressure up to 30 psig.

5.5. On the valve stem, there is a collar and pointer. There are also two stop pins on top of the valve to limit rotation of the stem. For most conditions, pointer should be exactly midway between stop pins. To reduce throttling range, turn clockwise toward stop pin; to increase, turn counterclockwise.

6.ADJUSTMENT OF TEMPERATURE SET POINT

6.1. All controls and limits are always factory tested and set at the mid-point of the temperature range unless otherwise marked.

6.2. All controls/limits marked with the FM approved insignia ⟨FM⟩ have their set points 'sealed' with either a brass cap or blue 'Sentry' seal. These set points must not be changed.

6.3. To change the temperature set point (within the range shown on the nameplate) turn the adjusting screw or knob. On models without a dial calibrated in degrees, the amount to turn it can be estimated from the data in Burling catalog DE. For an accurate temperature set point, it is very important that the active portion of the tube is exposed to the desired temperature long enough for both inner and outer members to reach a uniform temperature. Then, turn the adjusting screw or knob until switch button is just actuated.

6.4. On Models A-10 and A-1S, turn screw located directly above tube. Turn carefully, this is a coarse adjustment. **Turn clockwise to raise.** (On the A-1SL(U.L.), this adjustment is sealed and cannot be changed. The factory temperature set point is stamped on the nameplate.)

6.5. a) On Models B-1C, B-10, and B-1X, use the adjusting screw which activates the switch. Approximately five turns are required to cover range listed on nameplate. **Counterclockwise to raise temperature set point.**

b) On Models B-2C, B-20, and B-2X, use the adjusting screws which actuate the switches, one turn covers full range. **Clockwise to raise temperature set point.**

6.6. On Models C-1S and K-1S, use the knob. On Model C-1S only, a separate high limit screw is provided next to the main adjusting screw. **Turn clockwise to raise temperature set point.**

6.7 On Models F-1C, F-2C, F-3C, V-2S, and V-2X, use the main adjusting knob or screw. For those models having the hex set screw adjust, approximately 4 turns cover full range. **Clockwise to raise temperature set point.**

6.8. On Models F-2C-1075, F-2C-1076, and other Model F-2C having two ranges, dials, and pointers on the nameplate, make all adjustments with the two main external adjusting screws. Do not touch the small internal set screws which actuate the switches. These are for factory calibration only.

6.9. On two or three switch models, each switch is intended to operate at a different temperature and is factory set at whatever temperature is specified. The individual adjusting screw at each switch may be used to change the temperature difference between switches. Do not exceed the maximum differential between switches listed in Catalog DE. **Counterclockwise to raise temperature set-point.**

6.10. On Models H-1S, HR-A, and V-1X, approximately six turns of the adjusting screw are required to cover range listed on nameplate. Turn in direction indicated by dial. On the H-1SL(U.L.) the temperature is factory set, sealed, and stamped on the nameplate. **Counterclockwise to raise temperature set point.**

6.11. On Model M-1C, use the hex head screw which actuates the switch. Approximately five turns are required to cover the full range listed on nameplate. **Counterclockwise to raise temperature set point.**

6.12. On Model OR-A, use main adjusting knob or set screw. Since these are pneumatic units with throttling action instead of snap action, this adjustment changes temperature of zero pressure output. **Clockwise to raise temperature set point.**

6.13. The R-1 is essentially a fixed setting thermostat, the factory set point is marked on the nameplate. Some field adjustment is possible with the pin and collar located between the lever and switch. **Move clockwise to raise temperature set point; counterclockwise to lower.**

7. COUPLE SWITCHES®

7.1. Burling Couple-Switches® include a thermocouple installed in the tube assembly with the 'hot junction' held against the inside of the tube end. The size and type of thermocouple are indicated on a separate nameplate, and it is connected either to a terminal strip marked "+" and "–", or direct to an indicating meter which may be installed in the housing or fastened to the outside of it. **Never connect power to this terminal strip.**

7.2. Installation, Wiring, and Adjustment of Temperature Set point, is identical to all other models described in previous paragraphs.

7.3. Thermocouple Wiring. When no meter is included, the thermocouple may be connected to any suitable indicator or recorder, local or remote, using suitable thermocouple extension wire. A separate conduit connection is provided in the head; do not run in the same conduit as power leads.

Limitation of Warranty

We warrant to the original purchaser the product manufactured by us to be free from defects in material and workmanship when leaving our factory. Our obligation under this warranty is limited to the repair or replacement without charge, F.O.B. our factory, any product which may prove to be defective when it left our factory and which our examination shall disclose to our satisfaction to be thus defective, provided such product is returned to our factory, transportation prepaid, within one year from date of shipment from our factory. In no event shall we be liable for injury or damages, including consequential damages, directly or indirectly arising from the use of the product. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE AND ALL OTHER OBLIGATIONS OR LIABILITIES ON OUR PART, AND WE NEITHER ASSUME, NOR AUTHORIZE ANY OTHER PERSON TO ASSUME FOR US, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF OUR PRODUCT.

Disclaimer Statement

Burling does not authorize any other person or party to inspect, repair, rework and/or recalibrate Burling differential expansion type temperature controls and/or limits. All such products requiring same, must be returned to our Chatham, N.J., U.S.A. factory.

P.O. Box 298, 16 River Road, Chatham, N.J. 07928 • (201) 635-9481 • FAX (201) 635-9530

INSTALLATION AND ADJUSTMENT INSTRUCTIONS

INSTALLATION OF THERMOMETERS

Good practice requires the use of a thermowell in all pressurized applications. Case temperature should not exceed 200°F (93°C).

Avoid bending the stem, as this will result in frictional errors in indication.

To tighten thermometer to its fitting, use a wrench applied to the hex or flats above the threads. *Never tighten by hand.*

Thermometer stem should be immersed at least four inches (or entire stem, whichever is less) for best reading.

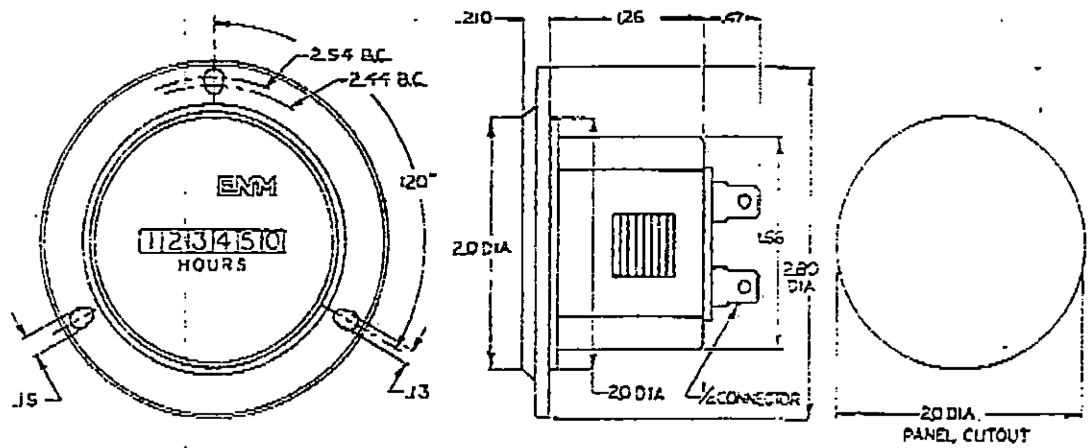
RESETTING POINTER (Resettable models only)

If it is necessary to make an adjustment to the thermometer, proceed as follows:

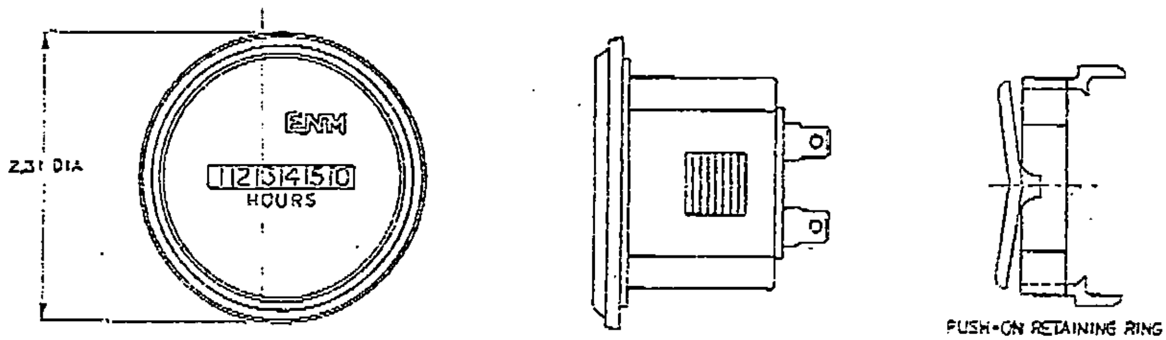
1) Place thermometer to be recalibrated in an agitated liquid for at least 3 Minutes, alongside a master reference thermometer.
2) Using a wrench, coin, or screwdriver, turn the slotted hex nut on the back of the case until the pointer is at the proper reading on the scale.
3) Re-install thermometer, following above installation steps.

Series T50 AC — Dimensional Data

Round 3-Hole Bezel



Round SAE Bezel



Custom face plates are available.

Above data is for reference only.

Certified dimensions available upon request.

Limited Warranty/Hour Meters

ENM Company hour meters are warranted to the consumer to be free from defects in material and workmanship for a period of 10,000 operating hours or for a period of 3 years, whichever first occurs.

All ENM products which fall within the warranty period due to defects in material or workmanship will be repaired or replaced, at ENM's option, without charge to the consumer when returned with proof of purchase to any authorized ENM dealer in the United States, transportation charges prepaid, provided there is no evidence of improper installation, tampering, or other abuse.

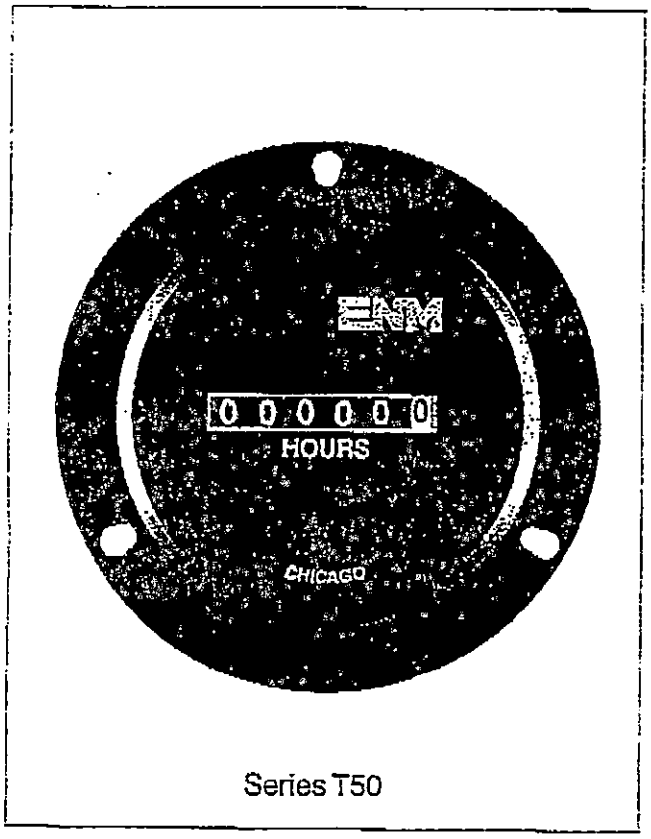
All implied warranties, including any implied warranty of merchantability or fitness for a particular purpose, shall be limited in duration to the express warranty period specified above.

disclaims any liability for consequential damages due to breach of any written or implied warranty on its hour meters.

ENM Company
5617 Northwest Highway
Chicago, IL 60646-6135
Phone: (312) 775-8400
FAX: (312) 775-5068

Electronic Hour Meter Technical Data

AC Hour Meter, Series T50



Series T50

ENM's Series T50 electronic AC hour meter is a low cost reliable hour meter incorporating the latest state-of-the-art in electonics. It's quartz-crystal time base insures accurate long term time-keeping.

A reliable electromechanical wheel-type indicator is used to store accumulated hours.

This compact tamperproof meter is sealed against the environment to provide years of service.

The T50 elapsed time indicator was designed for use on test and recording equipment, for providing maintenance control, for establishing warranty programs, for measuring machine utilization and production time, or for any application where time-in-use is to be determined.

FEATURES:

- Solid State Electronic Circuit
- Quartz-Crystal for Accurate Timing
- Absolutely Will Not Lose Count
- High Impact, Tamperproof Plastic Case
- Sealed Against Moisture and Dirt
- UL and CSA Recognized
- Indicates Operating Time in Hours and Tenths
- MADE IN THE USA

SPECIFICATIONS:

Time Scale:	6-digits 99,999.9 Hours Automatic recycle to zero
Figures:	Hours — White on black Tenths — Black on white Height — 0.140"
Operating Voltage:	117V AC ±10% Other voltages available
Frequency:	50 or 60 Hz
Power Consumption:	Less than 0.4 Watts
Accuracy:	Better than ±0.02% over entire range
Temperature:	From -40°C to 85°C
Vibration Resistance:	Withstands 10 to 75 hz at 1 to 8 g's
Termination:	1/4" male blade terminals
Configuration:	Round 3-hole Bezel Round SAE Bezel with new push-on retaining ring

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To MORINE	From BRUCE R
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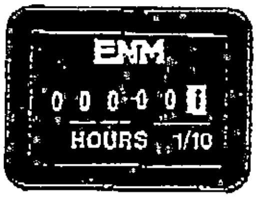
HOUR METERS

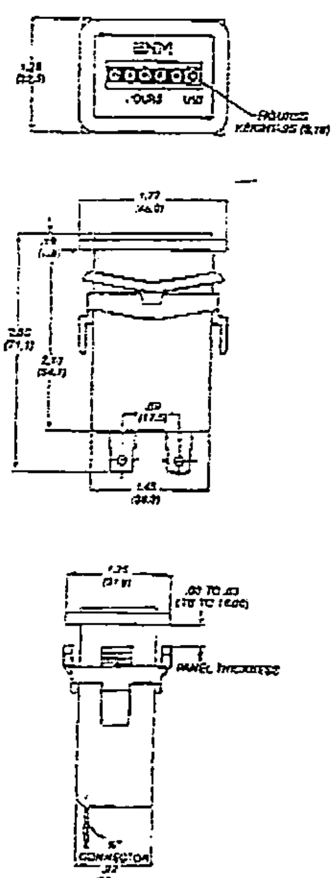


T41 Series
Quartz DC Hour Meter

This is the panel mount version of the T41 Series is secured with an easy to install spring clip. No fasteners are required. This unit has all the standard features which includes a 6-digit display, low power design, and a water sealed case. This model is also polarity insensitive.

Power: .03 Watts @ 12 VDC
.70 Watts @ 48 VDC

Voltage	Part No.
10-80 DC	T41D45



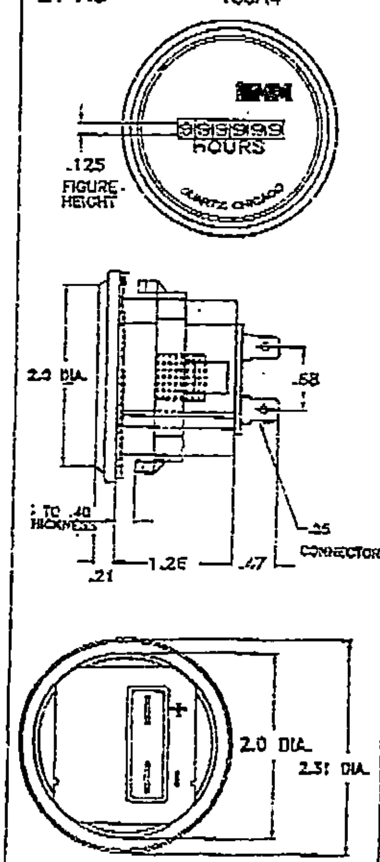
Technical Data Sheet #210

T50 Series
Quartz AC Hour Meter

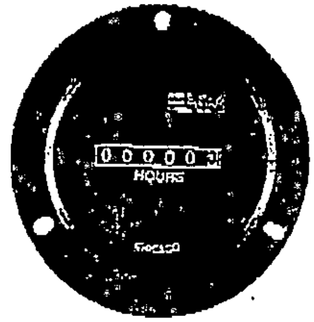
ENM's T50 Series low power AC hour meter is the answer to applications requiring a low power, economical, and reliable hour meter. This compact tamper-resistant meter is sealed against the environment to provide years of service. A quartz crystal time base insures accurate time keeping. This model is also frequency insensitive.

Power: Less than 0.4 Watts

Voltage	Part No.
230 AC	T50A1
115 AC	T50A2
24 AC	T50A4



Technical Data Sheet #211

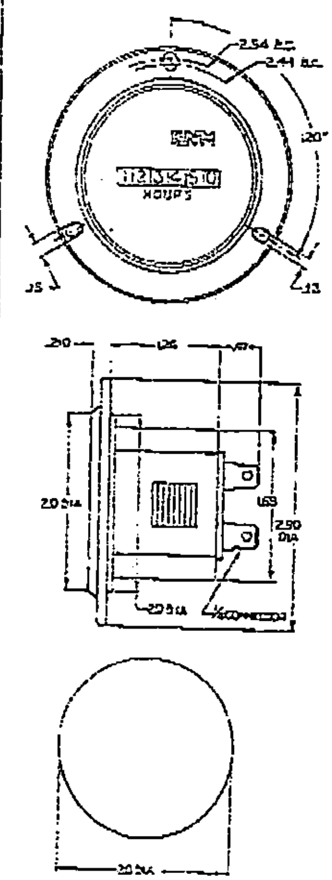


T50 Series
Quartz AC Hour Meter

ENM's Series T50 in a large 3-hole flange. This unit has all the standard features which includes a quartz crystal time base in a sealed and tamper-resistant case. NEMA 4X, 12 rated gasket for corrosion and water resistant panel mouting is available (see accessories). This model is also frequency insensitive.

Power: Less than 0.4 Watts

Voltage	Part No.
230 AC	T50B1
115 AC	T50B2
24 AC	T50B4



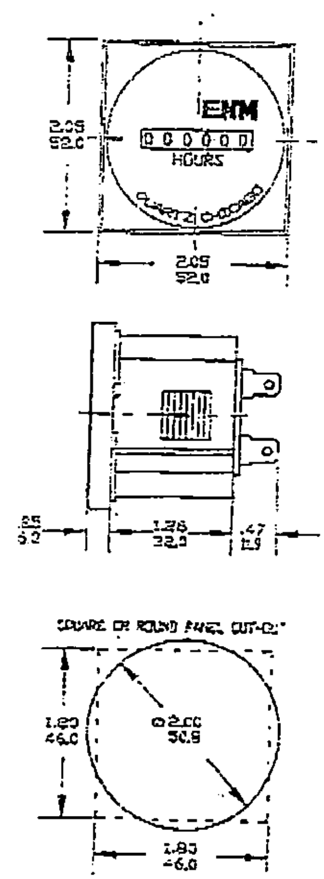
Technical Data Sheet #211

T50 Series
Quartz AC Hour Meter

This is the standard T50 Series in the attractive 52 mm² panel mount. This hour meter has all the standard features which includes a 6-digit display, low power requirements, accurate quartz time base, and a environmentally sealed case. This model is also frequency insensitive.

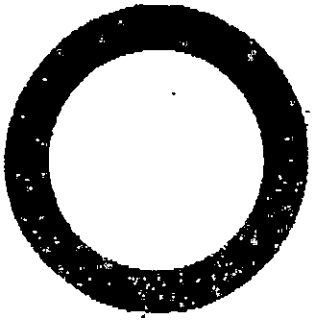
Power: Less than 0.4 Watts

Voltage	Part No.
230 AC	T50E1
115 AC	T50E2
24 AC	T50E4



Technical Data Sheet #201

ACCESSORIES

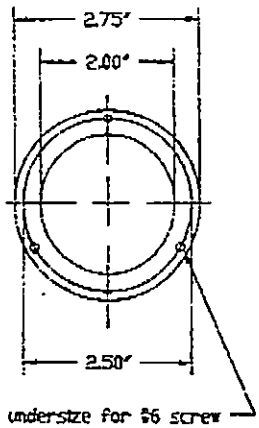


Panel Gasket UL/NEMA 4X,12

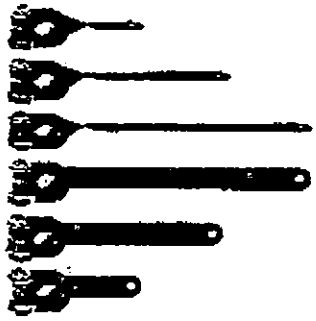
This UL listed gasket was designed and tested for use with the T40B and T50B series hour meters for water sealed panel mounting. Material is heat, oil resistant, and resists commpression set. Designed to protect electronic panels against moisture and corrosion from periodic wash-downs or accidental submersion. Stainless steel mounting hardware is also available.

Description	Part No.
NEMA Gasket	A40047-S

NEMA Gasket
w/ Mounting Hardware B20017



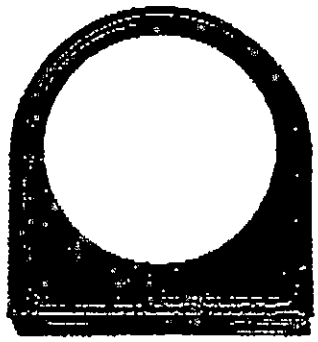
.200"Dia. undersize for #6 screw
3 Holes Equally Spaced



B15000 Series Mechancial Counter Levers

A variety of levers can be purchased separately or as standard with the M2BA and M3CA Series stroke counters.

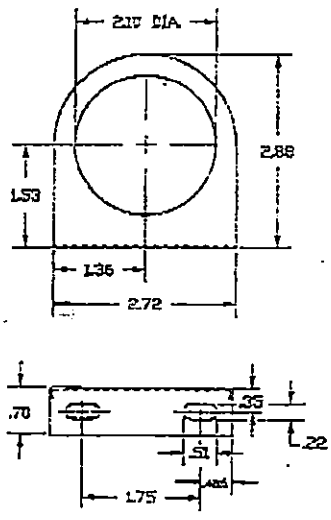
Description	Part No.
1" straight	B15005A
2" straight	B15005C
3" standard	B15005E
1" twisted	B15004A
2" twisted	B15004C
3" twisted	B15004E



Mounting Bracket for T40 and T50 Series Hour Meter

This mounting bracket was designed for mounting the T40A and T50A Series hour meters in areas where a panel is not available, such as underneath a dashboard. This steel "L" bracket is coated with a durable black coating and two eliptical holes allow for variable screw size.

Description	Part No.
L-Bracket	A15042



Panel Mount Kit for T40B & T50B Series Hour Meters

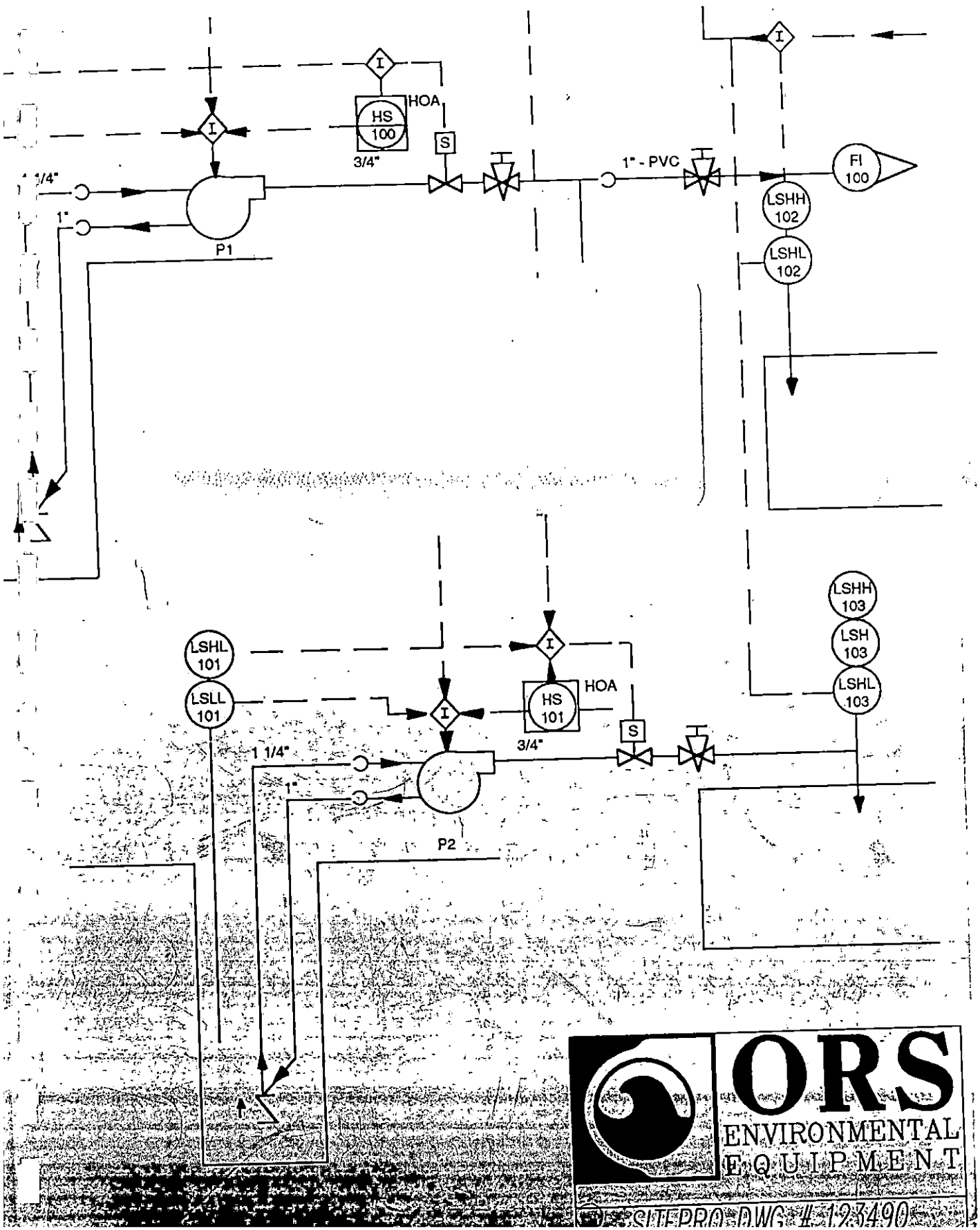
This mounting kit is designated for use with the T40B and T50B Series hour meters for securing the three-hole flange into panel cut-out. Kit consists of three #6 stainless steel machine screws, lock washers, and hex nuts.

Description	Part No.
Mounting Kit	B20014

APPENDIX C

SITEPRO MANAGER REMOTE MONITORING SOFTWARE INSTALLATION GUIDE AND USER MANUAL

GROUNDWATER TECHNOLOGY


I
HOA
HS
100
S
3/4"
1" - PVC
FI
100
LSHH
102
LSHL
102
1/4"
1"
P1
LSHH
103
LSH
103
LSHL
103
LSHL
101
LSLL
101
HOA
HS
101
S
3/4"
1 1/4"
1"
P2
ORS
ENVIRONMENTAL
EQUIPMENT
SITEPRO DWG # 123490

ORS ENVIRONMENTAL EQUIPMENT

SITEPRO™ MANAGER
Remote Monitoring Software
Installation Guide & User Manual

Default Password
ORSEE

2/17/94
Rev. 3
10425

32 Mill St., Greenville, NH 03048
Phone (800) 228-2310/ (603) 878-2500
FAX (603) 878-3866

IMPORTANT - Read Carefully Before Opening Disk Packet.

SITEPRO™ MANAGER Software License Agreement

This is a legal agreement between you (the end user) and ORS Environmental Equipment, a division of Groundwater Technology, Inc. ("The Company"). By breaking the seal on the software disk packet, you signify that you have read this SITEPRO™ MANAGER License Agreement and accept its terms. If you do not agree to the terms of this agreement, promptly return the unopened disk package and accompanying written material for a full refund.

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TABLE OF CONTENTS

QUICK START SUMMARY

Read This Section Even If You Don't Read Anything Else.

If you are an experienced computer user, you may wish to jump directly into installation and operation of SITEPRO™ Manager. Proceed as follows:

To Install SITEPRO Manager

1. Run Windows™.

2. Insert the SITEPRO Manager diskette into the appropriate drive of your computer - for example, Drive A or B.

3. Open the Windows Program Manager and select "Run" from the File menu.

4. At the command line, type (drive):\SETUP - where (drive) is the name of the drive into which you inserted the SITEPRO Manager diskette. For example, A:\SETUP.

5. Click on "OK"

6. SITEPRO Manager will prompt you through the installation process.

7. The Setup Program asks where to install the ORS icon and creates a new Program Group.

To Get Into SITEPRO Manager

Double click on the ORS icon to bring up the **Main Menu** screen.

To Set Up SITEPRO Manager For Your Computer

1. Select the SET UP PROGRAM option from the **Main Menu.**

2. Follow on-line setup instructions. Refer to Chapter 3 for more information.

To Run SITEPRO Manager

1. Set up the program as explained in Chapter 3.

2. Configure a site as explained in Chapter 4.

3. Access the site as explained in Chapter 5.

CAUTION: LIGHTNING PROTECTION REQUIRED!

If your SITEPRO system is installed in an area that is prone to lightning strikes, have your electricial install a phone line lightning arrestor. Consult your local telephone company for further information.

CHAPTER 1: INTRODUCTION

Chapter Summary
This chapter contains the following introductory information:

- ***Welcome to SITEPRO™ Manager*** - a general introduction to the software package and its features.
- ***What You Need*** - a list of hardware required to run SITEPRO Manager.
- ***What You Get*** - a list of materials you receive when you purchase SITEPRO Manager.
- ***What You Should Know Before Starting*** - a list of basic skills required to get the most from SITEPRO Manager.
- ***About This Manual*** - a description of documentation conventions used in the manual.
- ***What This Manual Covers*** - a list of topics covered in the manual.

WELCOME TO SITEPRO™ Manager

SITEPRO Manager is a user friendly remediation site management software package that runs under the Microsoft Windows operating environment. Designed to complement the optional remote monitoring and data logging features available with the ORS SITEPRO 2000 series of control panels, SITEPRO Manager can monitor networks of up to 16 SITEPRO panels over a standard phone line using a Hayes compatible modem. Any SITEPRO panel is compatible with the SITEPRO Manager software package as long as the optional remote monitoring and data logging (telemonitoring) package has been installed both at the remote site and in the host PC.

Using the Microsoft Windows user interface, SITEPRO Manager features a series of interactive screens that allow you to configure and access sites.

CONFIGURE SITE

- Allows you to specify site specific parameters (site name, dial-out numbers, etc.) for up to 10 different networks of SITEPRO panels.

- Allows you to configure individual panel parameters such as panel type, interlock, analog and monitoring and alarm as well as dialout and data logging options.

ACCESS SITE (Local or Remote)

- Allows you to determine the operational, diagnostic and monitoring input status of SITEPRO panels at up to ten different remediation sites.

WHAT YOU NEED

Minumum Requirements:

- A personal computer capable of supporting Windows™ 3.1 or later and that has an 80286 processor and 2 megabytes (MB) of RAM memory, 4 MB of free disk space and at least one high density floppy disk drive.
- Microsoft Windows™ version 3.1 or later.
- Hayes compatible modem (external recommended).
- A Mouse that is supported by Windows.

Recommended Equipment:

- A 486SX, 25MHZ PC with 4.0 MB RAM.
- Microsoft MS-DOS version 5.0 or 6.0.

- A VGA monitor.
- A Windows Accelerated Video Card
- A 130 MB hard drive.
- A 3.5" or 5.25" high density floppy drive.
- A Microsoft compatible mouse.
- A 2400 Baud Hayes compatible modem (external recommended).

SITEPRO Manager requires that at least one of your SITEPRO panels be equipped with the optional telemonitoring package. If you wish to upgrade your SITEPRO network for SITEPRO Manager, return one panel (the Master) to ORS for installation of the telemonitoring upgrade.

WHAT YOU GET

Check the contents of your SITEPRO Manager package. The package should contain the following items: SITEPRO Manager Registration Card, SITEPRO Manager Program Disk, and SITEPRO Manager User manual.

WHAT YOU SHOULD KNOW BEFORE STARTING

This manual explains how to use SITEPRO Manager. It assumes that you are familiar with your computer, its operating system and directory structure. Since many of the techniques you need to use SITEPRO Manager are common to all Windows applications, you should also know how to do the following:

- Use a mouse
- Choose commands
- Type text into premade fields

In addition to basic computer skills, you should have a thorough familiarity with the SITEPRO 2000 Control Panel and its documentation.

ABOUT THIS MANUAL

This manual uses the following conventions to present information:

An exclamation point icon indicates a WARNING of a situation or condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the WARNING message.

A raised hand icon indicates CAUTION information that relates to a situation or condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the CAUTION message.

A note icon indicates NOTE information. Notes provide additional or supplementary information about an activity or concept.

A single clicking mouse icon indicates that you are expected to click once on a control button, icon or option box.

Double clicking mouse icons indicate that you are expected to double-click on a control button, icon or option box.

A keyboard icon indicates that you are expected to type text into a screen field

WHAT THIS MANUAL COVERS

QUICK START SUMMARY includes;

- How to survive without reading the manual.

CHAPTER 1: INTRODUCTION, includes;

- Basic overview of the SITEPRO Manager software package, its capabilities and hardware requirements

CHAPTER 2: INSTALLING SITEPRO Manager, includes;

- Instructions for installing SITEPRO Manager

CHAPTER 3: PROGRAM SETUP, includes;

- Procedures for setting up your computer to run SITEPRO Manager

CHAPTER 4: CONFIGURE SITE, includes;

- Descriptions of the Site Configuration screens
- Procedures for configuring SITEPRO panels

CHAPTER 5: ACCESS SITE, includes;

- Descriptions of the Equipment Status screens
- Procedures for accessing the site and assessing the status of all SITEPRO panels
- Procedures for preparing the host computer to receive dial out messages from the remote site

CHAPTER 6: UTILITIES, includes;

- Procedures for saving site configurations to disk
- Procedures for loading site configuration files onto a second computer

- Procedures for viewing logged data

APPENDIX A: DOWNLOADING DATA, includes;

- Procedures for downloading logged data

APPENDIX B: GRAPHICS PACKAGE, includes;

- Procedures for using Windows™ Paintbrush package to customize you **Site Screen**

APPENDIX C: UP-TIME MONITORING, includes;

- Explanation of how system UP-TIME is calculated.

FOR MORE INFORMATION

If you need additional information on this or any other ORS product, contact our Sales or Technical Support staff at:

ORS Environmental Equipment
32 Mill St.
Greenville, NH 03048
Phone: (800) 228-2310
(603) 878-2500
Fax: (603) 878-386

CHAPTER 2: INSTALLATION & STARTUP

Chapter Summary
This chapter contains the following information:

- ***Installing SITEPRO™ Manager*** - how to load SITEPRO Manager on your computer.
- ***Opening SITEPRO Manager*** - how to open the program and choose basic options.

INSTALL SITEPRO MANAGER

SITEPRO Manager installation is simple and trouble-free. The installation program on your SITEPRO Manager program disk ensures that the installation is optimized for your computer.

Please follow the installation process as described below. Do not simply copy files from the diskette to your hard drive.

To install SITEPRO Manager:

1. Run Windows on your machine.

2. Insert the SITEPRO Manager diskette into the appropriate drive of your computer - for example, Drive A or B.

3. Open the Windows Program Manager and select "Run" from the File menu.

4. At the command line, type (drive) SETUP - where (drive) is the name of the drive into which you inserted the SITEPRO Manager diskette. For example, A:\SETUP.

5. Click on "OK"

6. SITEPRO Manager will prompt you through the installation process.

When selecting a drive on which to install SITEPRO Manager, confirm that there is at least 3 MB of space available. The installation program will provide this information.

Open Program

At the conclusion of the installation process, an ORS icon and Program Group will be incorporated into the Windows Program Manager. Double click on this icon to open SITEPRO Manager and display the **Title** screen (Figure 2-1, below).

If desired, move the ORS icon to an existing Windows Program Group and delete the empty Program Group originally occupied by the icon.

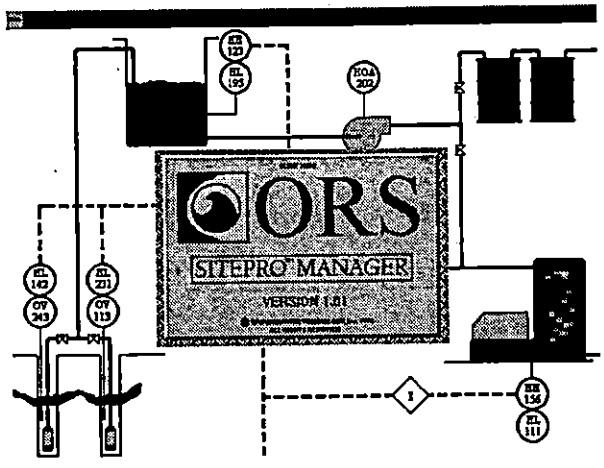


FIGURE 2-1. The SITEPRO™ Manager **Title** screen.

Display Main Menu Screen

To display the SITEPRO Manager **Main Menu** screen (Figure 2-2, below), click on the center of the **Title** screen.

The **Main Menu** screen displays buttons for accessing **Program Setup, Site Screen** and **Utilities** options.

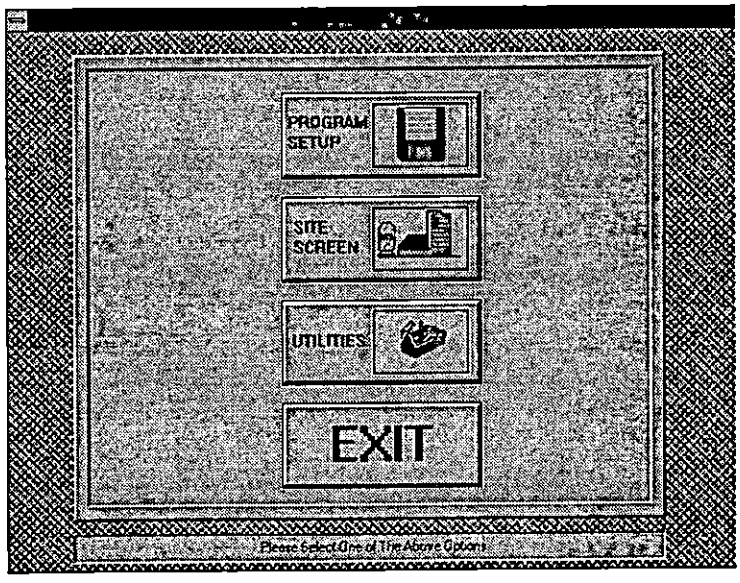


FIGURE 2-2. The SITEPRO™ Manager **Main Menu** screen.

Program Setup (Chapter 3) allows you to modify your computer's configuration to run SITEPRO Manager.

Site Screen provides access to procedures for configuring the site (Chapter 4) and assessing site status (Chapter 5).

Utilities (Chapter 6) allows you to save configuration files, load site data or examine logged data.

CHAPTER 3: PROGRAM SETUP

Chapter Summary
This chapter contains the following information:

- ***Set up computer** - how to configure your computer to run SITEPRO™ Manager.*

PROGRAM SETUP PROCEDURES

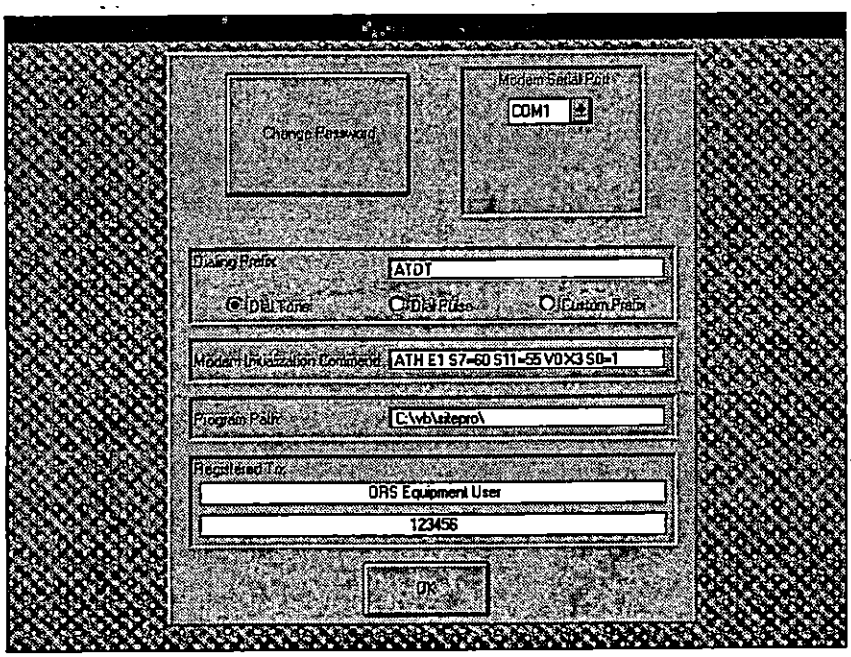


FIGURE 3-1. PROGRAM SETUP Dialog Box.

From the **Main Menu** screen (Figure 2-2, Chapter 2), click on the PROGRAM SETUP button to access the **Program Setup** dialog box (Figure 3-1, above).

Change Password

Click on the CHANGE PASSWORD button if you wish to change your password. When you receive SITEPRO Manager, the default password will be "ORSEE".

Choose Serial Port

Click on the DOWN ARROW under the Modem Serial Port heading and choose the serial port (COM1, 2, 3 or 4) you are using for modem communications.

If you choose the wrong serial port, you will get an error message the first time you attempt to establish modem contact with the site. If this happens, consult your computer manual to determine the correct COM port.

Choose Dialing Prefix

Click on **Dial Tone** (ATDT) for rotary phones or **Dial Pulse** (ATDP) for touch tone phones. Click on **Custom Prefix** if you require a special prefix (e.g., "9" to bypass a switchboard).

Initialize Modem

The default Modem Initialization Command string (shown in Figure 3-1) assumes that you are using a low speed (2400 baud) Modem. Do not modify this string unless you have a Modem that can transmit at rates faster than 2400 baud. If you do have a high speed Modem, you may have to change the initialization string to lock the baud rate at 2400. Refer to the documentation provided with your Modem to determine the proper "AT Command". Type this command at the end of the default Modem Initialization Command string. For example, for a Zoom 14.4 baud Modem, add "F5" to the end of the string.

Set Path

In the Program Path field, type in the appropriate program path in the form shown in Figure 3-1. For example, C:\SITEPRO\.

WARNING: The path is set at installation and should not be changed.

Save Setup Configuration

Click on the OK button to save your setup.

Once program setup has been completed, refer to Chapter 4 of this manual and carry out configuration procedures.

CHAPTER 4: CONFIGURATION

Chapter Summary
This chapter contains the following information:

- ***Important terms** - definitions of terms used in this chapter.*
- ***Overview** - what is configuration?*
- ***Configure site** - how to configure your remediation site.*
- ***Configure panels** - how to configure each panel on your site.*

Important Terms

Site A network of up to 16 interconnected SITEPRO™ 2000 control panels. In order for the site to communicate with a computer, one of the panels in the network must be equipped with the SITEPRO telemonitoring option which includes a modem. This panel is called the Master.

Host The computer running SITEPRO™ Manager (host end software) and communicating with the Master panel at the remediation site (Remote) via a modem.

Remote The Master panel (at the remediation site) containing the remote end software.

Configuration The act of adjusting hardware/software parameters, limits and units to permit communication between the host computer and the panels at the remediation site and to allow the panels to function as desired.

Upload To copy the host end software configuration to the remote. This is done automatically the first time the site is accessed after a change has been made to the host end configuration

OVERVIEW

Once SITEPRO Manager has been installed (Chapter 2) and your computer has been set up to run the program (Chapter 3), the next step is to configure the site. Configuration of remote panel and host computer software determines (1) which site and equipment parameters will be monitored, (2) which site conditions will generate interlock alarms and (3) which site conditions will cause the site to call the host computer.

Configuration can be carried out either remotely, using the modem, or locally, using the RS-232 port on the Master panel at the site. During configuration, changes are initially made only to the host end copy of the software. Configuration information is uploaded to the remote end software the next time the site is accessed for monitoring. This uploading process requires a password, and occurs any time configuration changes are made at the host end.

Additionally, whenever the site is accessed, the host end software configuration is checked against that of the remote end. If a discrepancy is detected, a password is requested, and the configuration of the host end software is uploaded to the remote. This feature protects against unauthorized or accidental modification of the remote configuration.

The interlock configuration procedures described in this chapter must be carried out in conjunction with panel dip switch configuration as described in Chapter 3 of your SITEPRO 2000 control panel manual.

Configuration is facilitated by a series of interactive screens described in the following sections.

CONFIGURATION PROCEDURES

From the **Main Menu** screen(Figure 2-2, Chapter 2), click on the SITE SCREEN button to access the **Site Menu** screen (Figure 4-1, below).

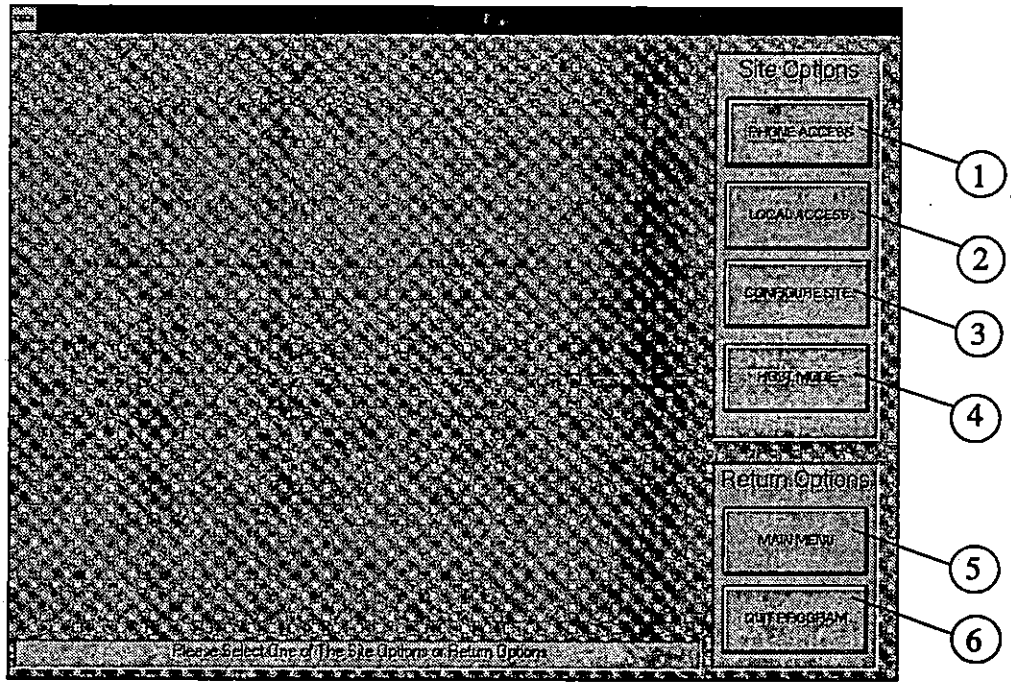


FIGURE 4-1. Site Menu screen. 1) PHONE ACCESS button - click to call site using modem(See Chapter 5); **2) LOCAL ACCESS button** - click to access site using RS-232 port (See Chapter 5); **3) CONFIGURE SITE button** - click to configure site (See Chapter 4); **4) HOST MODE button** - click to prepare host computer to receive dial out messages from site; **5) MAIN MENU button** - click to return to **Main Menu** screen; **6) QUIT PROGRAM button** - click to exit SITEPRO™ Manager and return to Windows.

From the **Site Menu** screen (Figure 4-1, p. 4-3) click on the CONFIGURE SITE button. This will display the **Site List** dialog box (Figure 4-2, below).

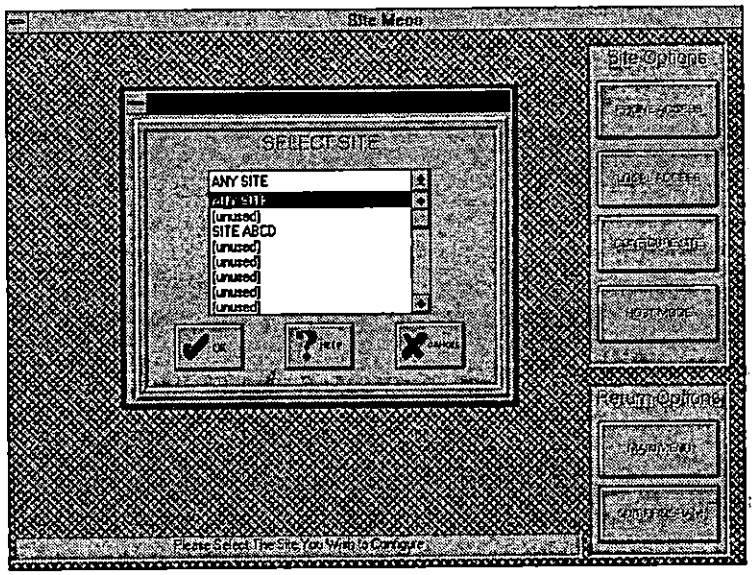


FIGURE 4-2. SITE LIST Dialog Box.

Select Site

Click on the DOWN ARROW at the top of the SELECT SITE list to reveal a drop down list of unconfigured site names.

Click on the first available unconfigured site name and then click on the OK button to display the **Configure Site** screen (Figure 4-3, p. 4-5).

Before any configuration procedures have been carried out, all the names in the list will read "Unused". Click on the HELP button for further information.

The **Configure Site** screen (Figure 4-2, below) allows the user to configure individual panels and sites made up of multiple interconnected panels. The screen is divided into a Panel Parameters sidebar and a field for display of control panel icons.

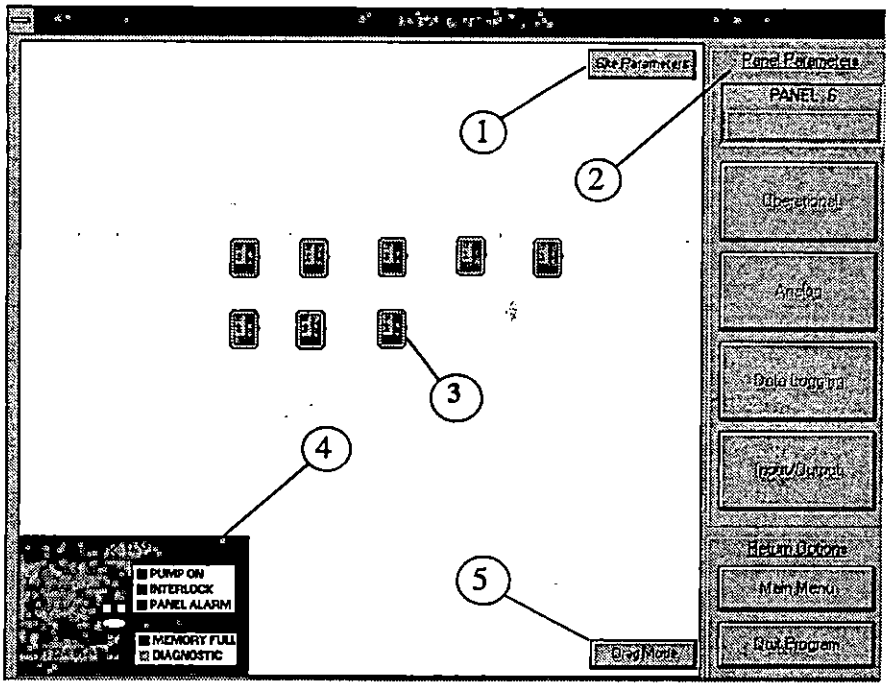


FIGURE 4-3. CONFIGURE SITE Screen. 1) Site Parameters button - used to access the Configure New Site dialog box (Figure 4-4, p. 4-7); **2) Panel Parameters sidebar** - contains buttons for accessing panel configuration dialog boxes; **3) Panel icons** - represent actual panels on site and are user generated from Panels On Site dialog box (Figure 4-5, p. 4-8); **4) Pump Function Key** - provides color codes for panel function (used when accessing site for monitoring (Chapter 5)); **5) Select/Drag Mode button** - used to select a panel for configuration (Select Mode) or to move a panel icon (Drag Mode); **6) Modify screen graphics** - double click on any part of screen to access Windows graphics package. See Appendix B.

The example **Configure Site** screen shown in Figure 4-3 has six SITEPRO panels displayed in its icon field. This indicates that a six panel site has already been configured. When you first install SITEPRO Manager, the icon field will show the Master, only.

Configure Site

Before configuring the individual panels at a site, some parameters relating to the site itself must be input into the software. On the **Configure Site** screen:

Click on the Site Parameters button in the upper right corner of the icon field. This will display the **Configure New Site** dialog box (Figure 4-4, p. 4-7).

1. In the **Configure New Site** dialog box, select the Site Name field, delete the existing site name and type in a name for your site.

2. Select the Site Phone Number Field and type in the site's phone number in the form shown in Fig. 4-4. This is the number you will call to access the site.

3. Go to the Dial Out Phone Numbers list and type in the phone number of the host computer. Space is available for two alternate Dial Out numbers. Click on the Fax Number box to indicate that a Dial Out number is a Fax number.

4. Select the number of times the site will attempt to call each of the Dial Out numbers by clicking on 3 or 6 in the Number Of Retries field.

5. Fill in the Fax Information fields (required).

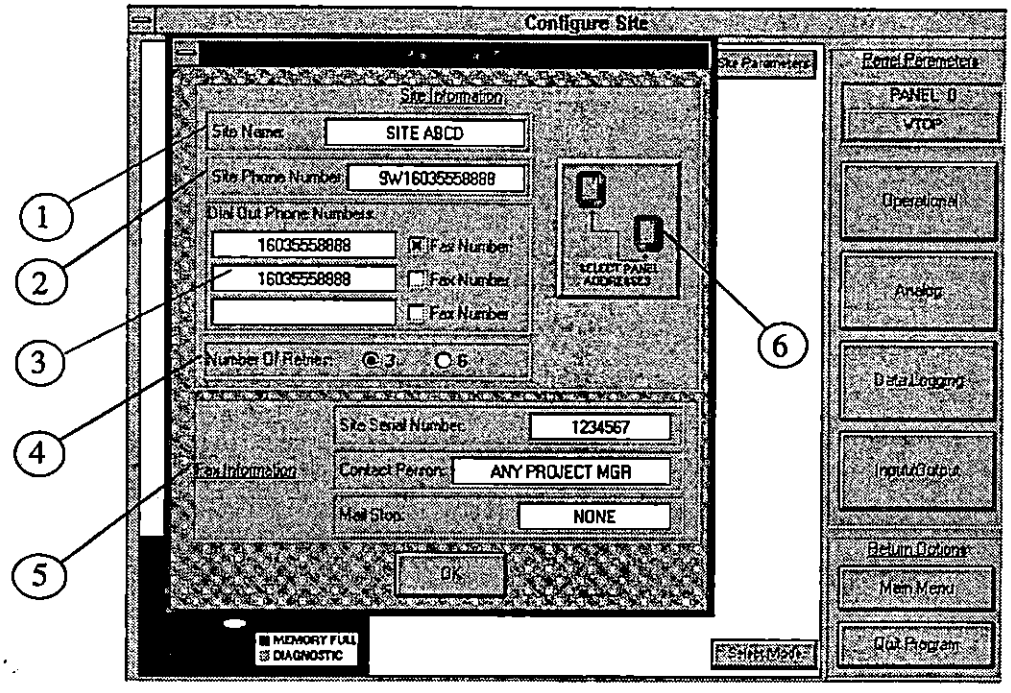


FIGURE 4-4. CONFIGURE NEW SITE Dialog Box. 1) Site Name field - delete the existing dummy name and enter a new name (in this case "site ABCD") for the site; **2) Site Phone Number field** - enter phone number for site; **3) Dial Out Phone Number fields** - enter numbers you wish site to call during alarms; **4) Number Of Retries selection** - click on number of times you wish site to try each dial out number; **5) Fax Information field** - all three fields must be filled out; **6) Select Panel Addresses button** - click on button to access **Panels On Line** dialog box (Figure 4-5, p. 4-8).

6. Click on the SELECT PANEL ADDRESSES button to display the **Panels On Line** dialog box (Figure 4-5, p. 4-8).

Use the **Panels On Line** dialog box to indicate how many SITEPRO panels are networked at the site. The numbers in the dialog box indicate panel network addresses as explained

in your SITEPRO 2000 manual. Panel 0 (the Master) is always selected. For additional panels (Slaves) work up in ascending numerical order, if possible. For example, if seven panels are on site, click on panels 1 through 6 in the dialog box.

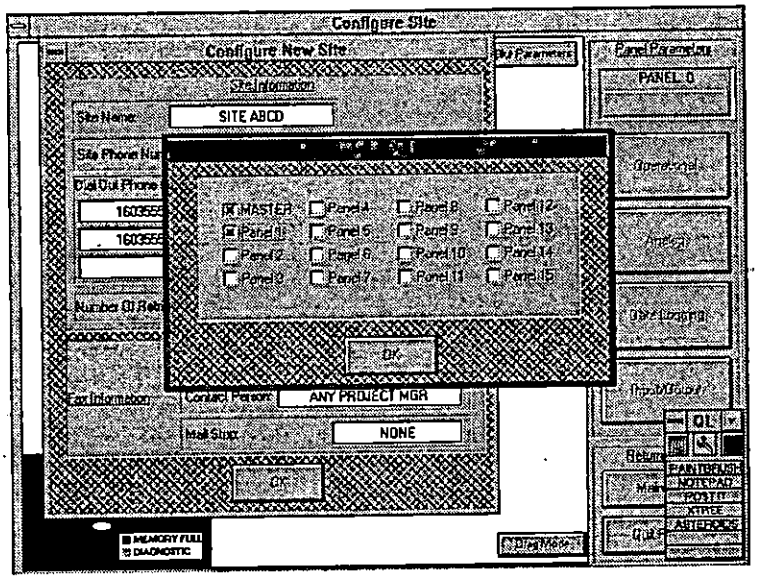


FIGURE 4-5. PANELS ON LINE Dialog Box. Use this dialog box to indicate how many panels are networked at the site.

When all panels on site have been selected (checked) in the **Panels On Line** dialog box, click on the OK button to return to the **Configure New Site** dialog box. Then click on the OK button on the **Configure New Site** dialog box to return to the **Configure Site** screen. Note that the **Configure Site** screen now shows a control panel icon for each panel checked in the **Panels On Line** dialog box.

Configure Panels

Site configuration is now complete and you can move on to configuring individual control panels.

Once the site parameters have been entered as explained in the sections above, each of the panels in the site network must be configured individually. This is accomplished by using the buttons on the Panel Parameters sidebar (Figure 4-3, p. 4-5).

To begin, first click on one of the panel icons displayed on the **Configure Site** screen. When this is done, the panel's network address will appear at the top of the Panel Parameters sidebar and the door of the selected panel icon will open (see Figure 4-3). The Operational, Analog, Data Logging and Input/Output buttons on the Panel Parameters sidebar can now be accessed.

To Configure Operational Parameters...

Use the **Operational Parameters** dialog box (Figure 4-6, p. 4-10) to designate panel type (Water Table Depression Pump, Blower/Water Pump, etc.), configure interlock alarm channels and set up dial out options. To access the dialog box, click on the Operational button in the Panel Parameters sidebar at the right side of the **Configure Panel** screen. Proceed as follows to configure the panel:

1. Configure Interlock Alarm Channels

At the upper left of the **Operational Parameters** dialog box, fill in the required information for each of the external interlock devices wired to the SITEPRO panel. Proceed as follows for each of the four interlock alarm channels;

a. In the Interlock Configuration field, enter the names of the external interlock devices you are using.

b. Click on Latching or Self-Resetting for each interlock alarm channel. Latching alarms will not allow equipment to restart even after the condition that caused the alarm has cleared. Self-Resetting alarms will allow the equipment to restart

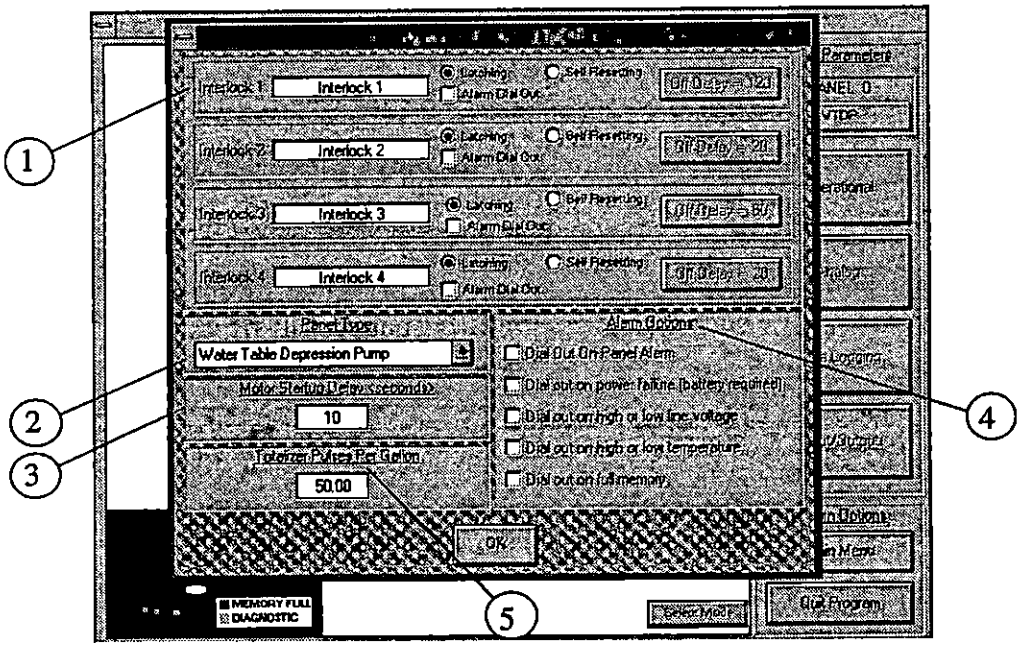


FIGURE 4-6. OPERATIONAL PARAMETERS Dialog Box. 1) Interlock Configuration field - enter name of interlock device, whether alarm is latching or self-resetting and whether or not panel will dial out on alarm. If the self-resetting interlock option is chosen, use the **On Delay** button to set the time delay before the equipment restarts after the alarm has cleared; **2) Panel Type list** - select the type of panel being configured; **3) Motor Startup Delay field** - enter a different startup delay for each panel; **4) Alarm Options** - check conditions that will cause panel to dial out; **5) Totalizer Configuration** - set number of pulses per gallon.

immediately after the alarm has cleared and a time delay has elapsed.

c. If you select the Self-Resetting option, click on the Off Delay button to adjust the number of seconds that will elapse between the time the alarm clears and when the equipment restarts.

d. Click on Alarm Dial Out if you want the remote panel to call the host in the event of an alarm.

2. Choose Panel Type

Under the Panel Type heading, click on the DOWN ARROW to display the drop down list of panel types. Click on the appropriate description for the panel being configured.

3. Set Motor Startup Delay

The Motor Startup Delay feature allows the user to stagger the startup times of the various panels in a network. This prevents power surges that could result if all the equipment on a site started simultaneously. To use this feature, input a different delay for each panel at the site. We recommend delay increments of approximately 3 seconds between panels.

Avoid long Motor Startup Delays that could cause alarm conditions to occur. USE EXTREME CAUTION!

4. Select Alarm Options

Under the Alarm Options heading at the lower right of the dialog box, click on any or all of the following dial out options:

- Dial Out On Panel Alarm

Panel will dial out on any alarm other than an interlock. For example, WTDP panels will dial out on OVERRIDE alarms.

- Dial Out On Power Failure

Panel will dial out in the event of a panel power failure. Panel must have optional battery backup.

- Dial Out On Bad Line Voltage

Panel will dial out if the line voltage deviates from preset upper or lower limits (+ /- 20% of nominal value).

- Dial Out On High Or Low Temperature

Panel will dial out if the internal temperature of the panel deviates from preset upper or lower limits.

- Dial Out On Full Memory

Panel dials out at 75% of full memory and then again at 90% of full memory.

If you are logging at a rapid rate, the panel may dial out at 75% only.

5. Set Totalizer Pulses/Gallon

Under the **Totalizer Pulses/Gallon** heading at the bottom right of the dialog box, input the value appropriate for your totalizer. Consult the manual for your totalizer.

When the **Operational Parameter** dialog box has been filled out as described above, click on OK to return to the **Configure Panel** screen.

To Configure Analog Parameters...

Click on the Analog button to access the **Analog Parameters** dialog box (Figure 4-7A-B, p. 4-14). This dialog box allows you to configure the SITEPRO Manager software to accept input from a variety of analog sensors such as pressure transducers and thermocouples. Two views of the **Analog Parameters** dialog box are shown to illustrate the different ways that analog input channels can be configured.

Parameters must be input for each analog sensor wired to the SITEPRO control panel's Analog Input terminals on terminal block TB3. A total of six input channels are available and these are listed under the Input Channels heading in the dialog box. Inputs 1-3 are general purpose analog inputs, Input 5 is for the motor current sensor already built into the panel, Input 4 is for an additional motor current sensor in dual motor panels, and Input 6 is for the built in panel temperature sensor. Proceed as follows to configure an analog input:

1. Select Analog Input Channel

Begin by selecting the first Analog Input Channel you wish to configure. Do this by clicking on one of the inputs in the Analog Input list.

2. Name Sensor

Once a channel has been selected, enter a name for the sensor in the Analog Sensor Name field at the bottom of the dialog box.

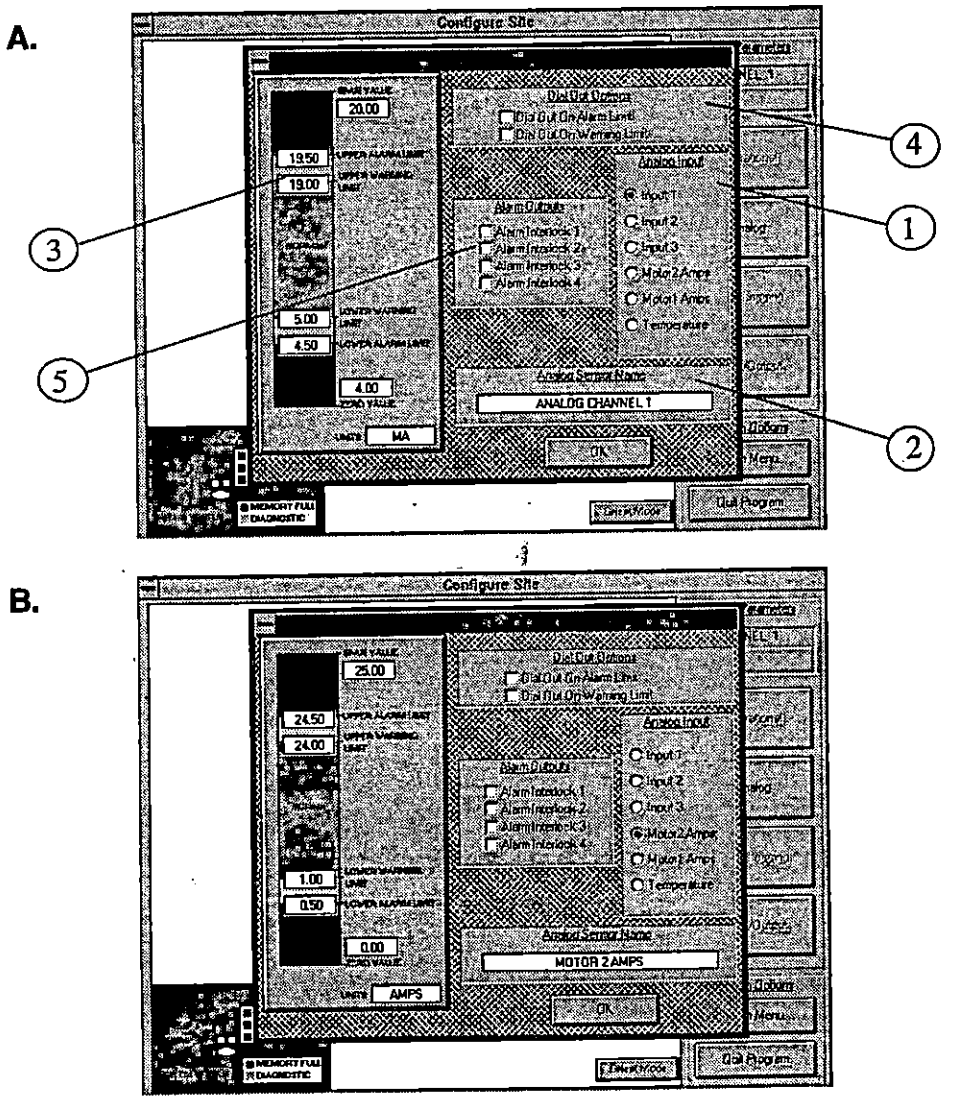


FIGURE 4-7. ANALOG PARAMETERS Dialog Box. 1) Analog Input Options - select input to be configured; **2) Analog Sensor Name** - enter name of analog input device connected to input selected in 1); **3) Alarm/Warning Limit bar** - set limits for analog sensor input values; **4) Dial Out Options** - determine if panel will dial out when input value exceeds alarm or warning limit; **5) Alarm Output Options** - determine interlock channels to be activated;

3. Enter Alarm/Warning Limits

The multi-colored bar on the left hand side of the **Analog Parameters** dialog box provides a visual representation of the total range of input values for the analog input being monitored. The bar is divided into a NORMAL zone, and upper and lower ABNORMAL zones. Fields are provided for input of the following values:

- Units

The units of measurement appropriate to the input parameter being monitored. Note that in the example screens shown in Figures 4-7A and 4-7B, Input 1 is calibrated in milliamps. Input 2 is calibrated in Amps.

- Zero Value

The minimum value the measured parameter can assume. For a 4-20 mA temperature sensor scaled in degrees from 0°C to 100° C, the zero value (0° C) would be equivalent to 4 mA.

- Span Value

The maximum value the measured parameter can assume. In the temperature sensor example described above, the span value of 100° C would be equivalent to 20 mA .

- Alarm Limits

The upper and lower limits beyond which the computer will trigger an interlock alarm and/or a dial out message.

- Warning Limits

Upper and lower limits that can trigger a dial out warning message but not an interlock alarm.

Enter numbers in each of the fields described above. Span must be greater than zero.

4. Select Dial Out Options

Under the Dial Out Options heading at the top of the **Analog Parameters** dialog box, click on either "Dial Out On Alarm Limit" or "Dial Out On Warning Limit."

5. Configure Alarm Interlocks

In addition to triggering a dial out alarm, abnormal sensor input can be used to generate interlock alarms on any of the SITEPRO's four alarm channels. Refer to your SITEPRO 2000 Control Panel manual for a discussion of how to set up your panel to receive and send interlock alarms.

Under the Alarm Outputs heading, select the channel(s) on which interlock alarms will be sent.

Repeat the procedures described above to configure each of the Analog Inputs to which a sensor is wired.

When the **Analog Parameters** dialog box has been filled out as described above, click on OK to return to the **Configure Panel** screen.

To Configure Data Logging Parameters...

Click on the Data Logging button to access the **Data Logging Parameters** dialog box (Figure 4-8, below). This dialog box allows you to record and store data monitored by the SITEPRO's digital and analog inputs. Two basic types of data logging are available;

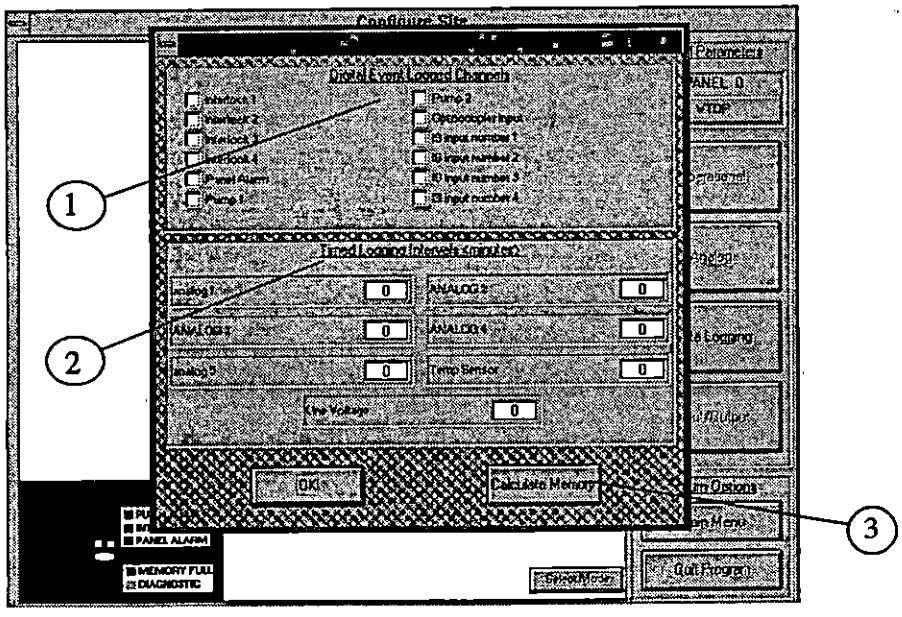


FIGURE 4-8. DATA LOGGING PARAMETERS Dialog Box. 1) Digital Logged channels - check parameters to be logged; **2) Timed Logging channels** - enter desired logging interval (2-1440 minutes) for parameters to be logged. If interval is left at the default value of 0, parameter will not be logged; **3) Calculate Memory button** - click to determine how many days of logging will be required to fill the SITEPRO's memory.

- Digital Event Logging

In this type of logging, the ON/OFF status of monitored inputs is logged at three minute intervals. For example, if the ON/OFF status of a pump is being logged, the computer monitors the pump continuously over three minute time segments. If the pump is running for any portion of that three minute time segment, a status of ON is logged for the segment.

To configure for Digital Event Logging, simply click on the inputs you wish to log. Note that the input names in the **Data Logging Parameters** dialog box reflect any changes previously made on other configuration screens. For example, if Interlock 1 were renamed "Pressure Switch" in the **Operational Parameters** dialog box, this name would replace "Interlock 1" on the **Data Logging Parameters** screen.

- Timed Event Logging

In this type of logging, the actual value of an analog input is logged at user-specified intervals from 2 to 1400 minutes. For example, assume that the temperature readings of a thermocouple are being monitored at five minute intervals. Every five minutes, the computer will log the actual temperature reading (0-1550 degrees F) of the thermocouple.

To configure for Timed Event Logging, simply enter the desired logging interval for each parameter to be logged.

Do not set logging intervals to values between 0 and 2 minutes.

Calculate Memory

Once data logging configuration is completed, click on the CALCULATE MEMORY button for the number of days of logging that will be required to fill the SITEPRO's memory.

When the **Data Logging Parameter** dialog box has been filled out as described above, click on OK to return to the **Configure Panel** screen.

To Configure Input/Output Parameters...

Click on the Input/Output button to display the Input/Output Parameters dialog box (Figure 4-9, p. 4-20). This dialog box allows you to configure inputs and outputs that provide additional control and monitoring functions.

Inputs

In addition to the standard probe and interlock inputs, single motor SITEPRO 2000 Control Panels are equipped with one Non-Intrinsically Safe and four Intrinsically Safe inputs to be used for monitoring pressure switches, level switches and other sensing devices. The Non-Intrinsically Safe input corresponds to terminal 6 on TB4. The Intrinsically Safe inputs (1-4) correspond to terminals 5-8 on TB1 at the top of the SITEPRO circuit board and are not available on dual pump, blower/pump or dual blower panels.

- Intrinsically Safe Inputs

For each of the four Intrinsically Safe inputs, fill in the Input Contact Name field with a description of the input sensor. In the Closed Status and Open Status fields, indicate the status of the equipment when the sensor switch is Closed and Open, respectively. For example, if an Intrinsically Safe pressure switch monitoring a blower is wired to terminal 5 on TB1, fill in the IS Input # 1 fields as shown in Figure 4-9, below). As

long as the blower is running, the pressure switch contact remains closed. If the blower should fail, the pressure switch contact opens.

The number of IS inputs available is dependent on panel type (i.e., dual function panels have no additional IS inputs beyond those used for the probes).

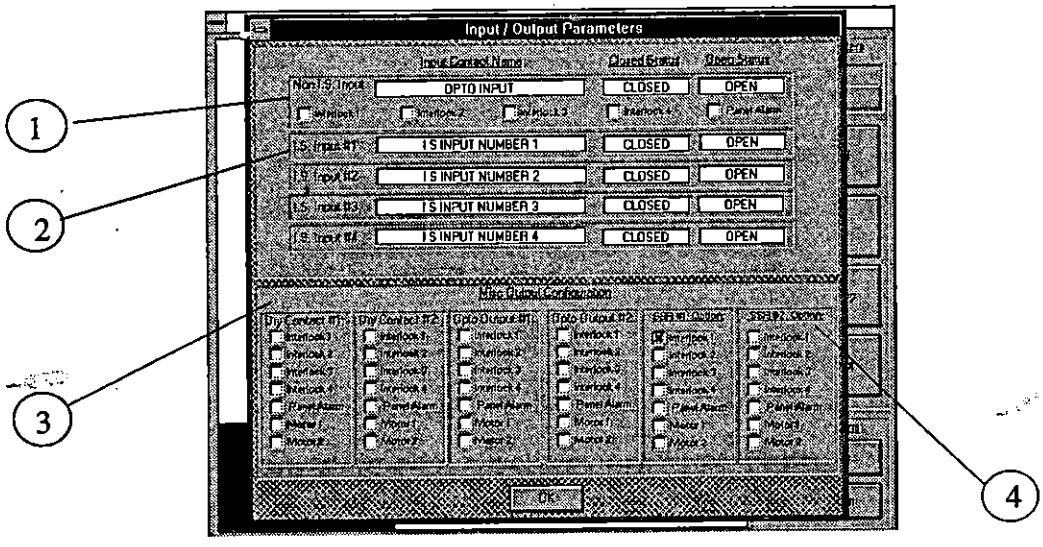


FIGURE 4-9. Input/Output Parameters Dialog Box. 1) Non-Intrinsically Safe Input field - enter input name & status, check alarm option; **2) Intrinsically Safe Input field** - enter input name & status; **3) Output options** - click on any outputs used in your application; **4) SSR Outputs** - These outputs are available **only** if the panel has been ordered with the necessary optional hardware.

- Non-Intrinsically Safe Input

All SITEPRO panels are equipped with one optically coupled Non-IS input. This input can be used to monitor the status of additional equipment components at the site and can be

configured to shut down SITEPRO panels with an interlock alarm. This input is generally wired through a relay on the equipment component being monitored. Configuration is the same as for Intrinsically Safe inputs except that the Non-Intrinsically Safe input can be used to generate an interlock or panel alarm.

Caution: Use unpowered relay contacts only!

The opto input is not available on some dual function panels.

Outputs

The Input/Output Parameters dialog box can be used to configure three different types of outputs. These are:

- Dry Contact Outputs

These are 100 mA capacity contact outputs for interfacing with additional equipment components, buzzers, indicators and security alarms. Dry contact outputs 1 & 2 are wired to TB6 in the SITEPRO panel.

- Opto Outputs

Optically isolated transistorized outputs are used primarily for interfacing with programmable logic controllers (PLCs). Opto outputs 1 & 2 are wired to TB4 in the SITEPRO panel.

- SSR Outputs

These outputs are used to drive small AC powered devices such as solid state relays (SSRs) and light bulbs.

All three types of outputs are activated by interlock or panel alarms as determined by the selections made in the Input/Output Parameters dialog box. For example, assume that Dry Contact Output # 1 is wired to a security alarm buzzer. If Interlock 3 is selected in the dialog box, then the buzzer will sound whenever the SITEPRO panel receives an interlock on Alarm Channel 3.

Click on any outputs used in your application.

When the **Input/Output Parameters** dialog box has been filled out as described above, click on OK to return to the **Configure Site** screen. Configuration is now complete.

UPLOAD CONFIGURATION

When configuration is complete, upload the configuration from the host computer to the remote software. Proceed as follows:

Click on the **Main Menu** button on the **Configure Site** screen to return to the **Main Menu**.

Click on the SITE SCREEN button on the **Main Menu** to access the **Site Menu** screen.

Click on the PHONE ACCESS button on the **Site Menu** screen. When the modem connection is made, you will be prompted to enter your password to permit reconfiguration of the remote software. While the host end configuration is being uploaded to the remote, a "Sending Configuration To Panel" message will be displayed on screen.

When the uploading process has been completed, the configurations of the host and the remote software will be identical.

CHAPTER 5: ACCESS SITE

Chapter Summary
This chapter contains the following information:

- ***Calling the site*** *- how to use the modem to call the remote site.*
- ***Monitoring panels*** *- how to monitor the status of each panel at the site.*
- ***Collecting site data*** *- how to download logged data.*
- ***Using RS-232 port*** *- how to access the site locally using RS-232 communications.*

The procedures described in this chapter assume that the SITEPRO Manager software has been configured according to the instructions provided in Chapter 4 of this manual.

ACCESS SITE

The site can be accessed either over a phone line using the modem or locally by plugging a cable into the RS-232 serial port on the front of the Master panel.

Using The Modem

From the **Site Menu** screen (Figure 4-1, p. 4-3), click on the PHONE ACCESS button to display the **Available Sites** dialog box (Figure 5-1, p. 5-2).

Click on the DOWN arrow to reveal the drop down list of site phone numbers entered during system configuration (See Chapter 4).

Select the site to be called by clicking on one of the available phone numbers.

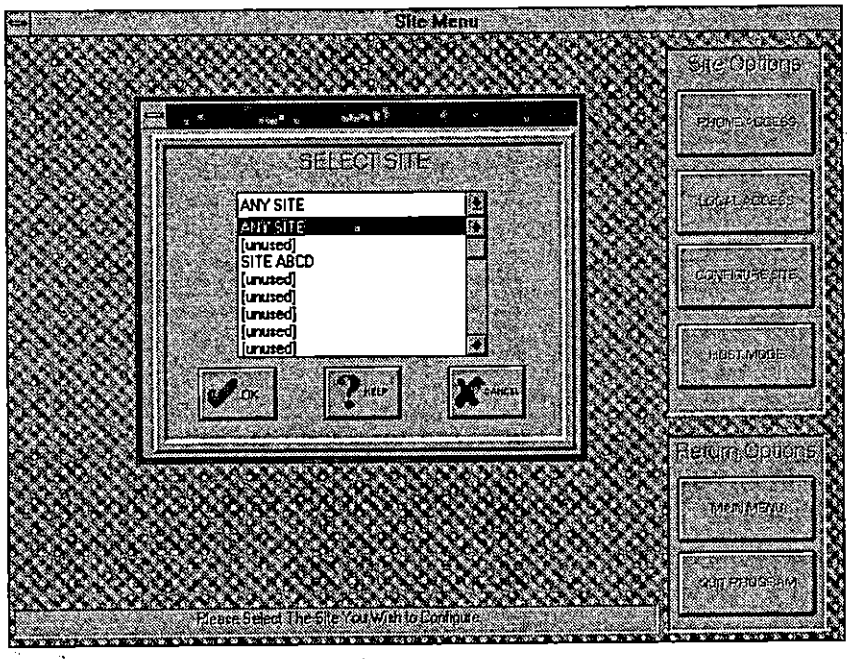


FIGURE 5-1. SITE LIST Dialog Box.

Click on the OK button to dial the site, or click on the CANCEL button to abort the operation and return to the **Site Menu** screen.

When the OK button is clicked, the message "Initializing Modem" will flash on the screen and the modem will beep. When the connection to the site has been made, the **Site Map** screen (Figure 5-2, p. 5-3) should appear. However, if the configuration of the remote does not match that of the host, a "Configuration Error" message will be displayed.

If a "Failure To Initialize" error is displayed, check COM port and modem hookup.

Click on the OK button to update the remote software to match that of the host.

During the updating process, a "Send Configuration Information" message will be displayed and you will be prompted that the panel is being configured.

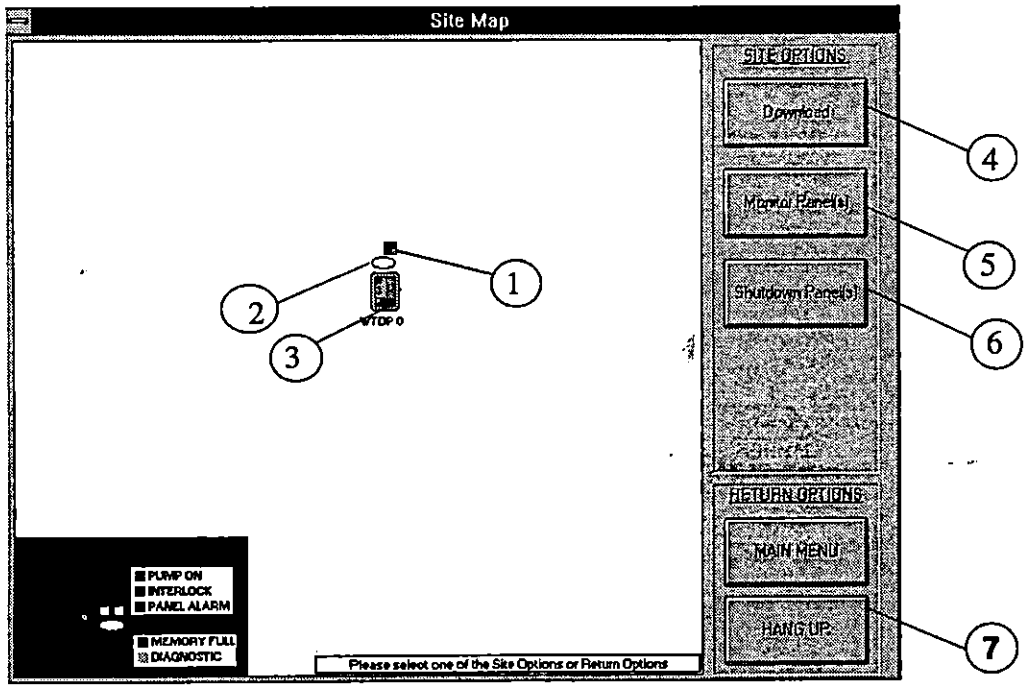


FIGURE 5-2. SITE MAP Screen. 1) Motor Status color code - Green = Motor ON, Red = Interlock, Blue = Panel Alarm; **2) System Status color code** - Yellow = Diagnostic (Refer to **Diagnostic Info Screen**, Figure 5-4, p. 5-6), Purple = Memory Full (Download data); **3) Panel icon** - one icon will be displayed for each panel configured in Chapter 4; **4) DOWNLOAD button** - click to download logged data to disk; **5) MONITOR PANEL(S)** - click to access **Panel Display Screen** (Figure 5-3, p. 5-5); **6) SHUTDOWN PANEL(S) Screen** - click to shut down panel currently selected (See Warning on next page); **7) HANG UP button** - click to terminate communication with site and return to **Site Menu Screen.**

The **Site Map** screen (Figure 5-2, p. 5-3) displays icons for each panel configured at the site. Note that the icon color codes (See Key) provide basic information on panel and system-status. The **Site Options** sidebar has the following buttons:

- **DOWNLOAD** - Transfer logged data to the host computer.
- **MONITOR PANEL(S)** - View panel diagnostic, operational and monitoring status.
- **SHUTDOWN PANEL(S)** - Shuts off selected panel.

The Panel Shutdown option is to be used as a short term exceptional procedure only. After shutting down a panel, visit the site as soon as possible and rectify the problem that necessitated the shutdown. Power outages and other events outside control of the SITEPRO can cause the panel(s) to restart spontaneously.

To Download Logged Data...

Select a panel and then click on the DOWNLOAD button. Logged data will be downloaded to the Sitepro directory on the host computer's hard disk. See Appendix A for details.

To Monitor A Panel...

Click on the icon representing the panel you wish to monitor. The door of the panel icon will open.

Click on the MONITOR PANEL(S) button to access the **Panel Display** screen (Figure 5-3, p. 5-5).

If you click on a sidebar button without first opening a panel, the "You Must Select a Panel First!" warning will appear on screen. Click on "OK" and then click on the panel to be monitored.

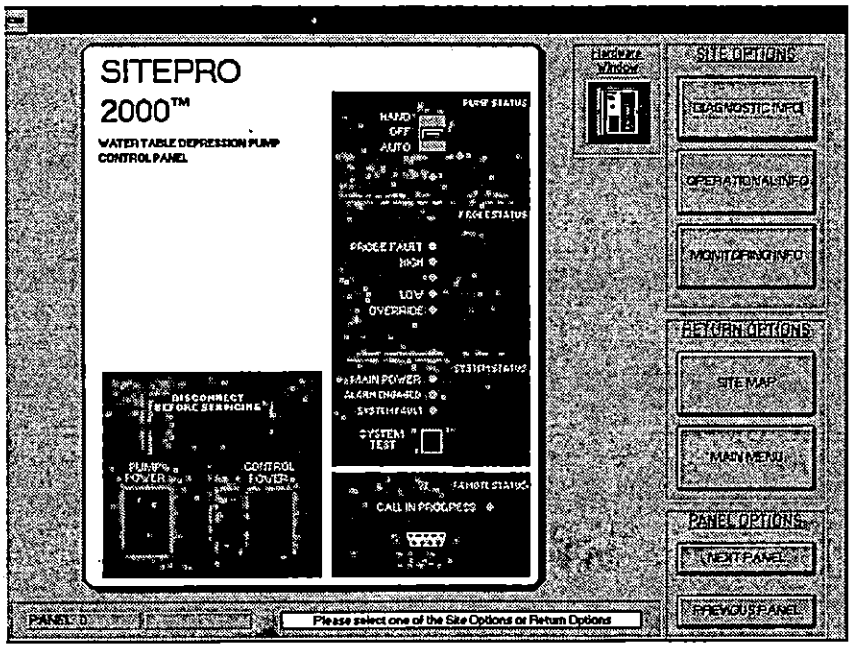


FIGURE 5-3. PANEL DISPLAY Screen. Functions of sidebar buttons are described below. Refer to page 5-9 for function of Hardware Window button.

The **Panel Display** screen (Figure 5-3, above) shows the faceplate of the selected panel displayed in an active mode that mimics in real time the indicator functions of the actual panel at the site. Figure 5-3 shows the faceplate of a Water Table Depression Pump panel. The Panel Options sidebar includes the following buttons:

- **DIAGNOSTIC INFO** - System status information
- **OPERATIONAL INFO** - System function information
- **MONITORING INFO** - Monitoring input status information

If the "Communications Error" warning is displayed on screen, the panel has lost contact with the host computer. Click on "RETRY" to attempt to reestablish contact. If the error message persists, return to the main menu and repeat PHONE ACCESS procedures.

To Display Diagnostic Information...

Click on the DIAGNOSTIC INFO button in the Panel Options sidebar to access the **Diagnostic Status** screen (Figure 5-4, below).

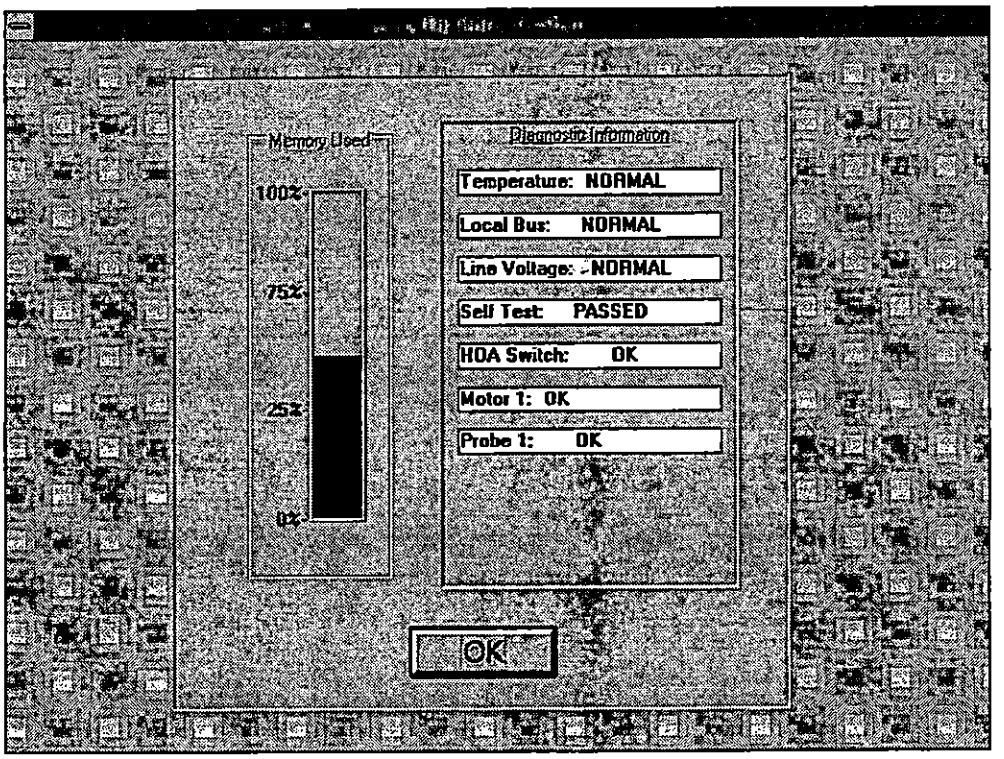


FIGURE 5-4. DIAGNOSTIC STATUS Screen.

The **Diagnostic Status** screen shows the status of all relevant diagnostic parameters. Abnormal values are displayed in red.

This screen also monitors the status of the data logger memory. Before the Memory Used bar reaches 100%, the logged data should be downloaded to the host computer.

Click on the OK button to return to the **Panel Display** screen.

To Display Operational Information...

Click on the OPERATIONAL INFO button in the Panel Options sidebar to access the **Operational Status** screen (Figure 5-5, below).

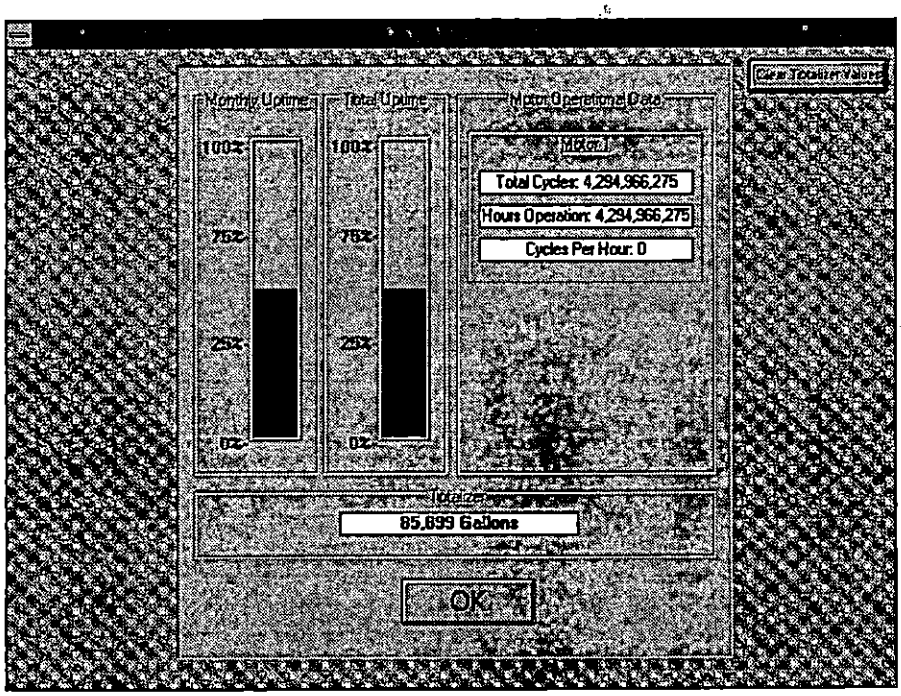


FIGURE 5-5. OPERATIONAL STATUS Screen. The screen above shows operational information for a dual pump panel.

The **Operational Status** screen shows the status of all relevant panel operational parameters. It also displays Monthly Up-time and Total Uptime bars to indicate the percentage of time the system has been in operation. Refer to Appendix C for definition and discussion of up-time monitoring.

Details of the **Operational Status** screen will vary depending upon what type of Sitepro panel is being monitored. The screen in Figure 5-5 (p. 5-7) is for a water pump panel. The screen for a Blower/Pump panel would be slightly different.

Click on the OK button to return to the **Panel Display** screen.

To Display Monitoring Information...

Click on the MONITORING INFO button to access the **Monitoring Information** screen (Figure 5-6, below).

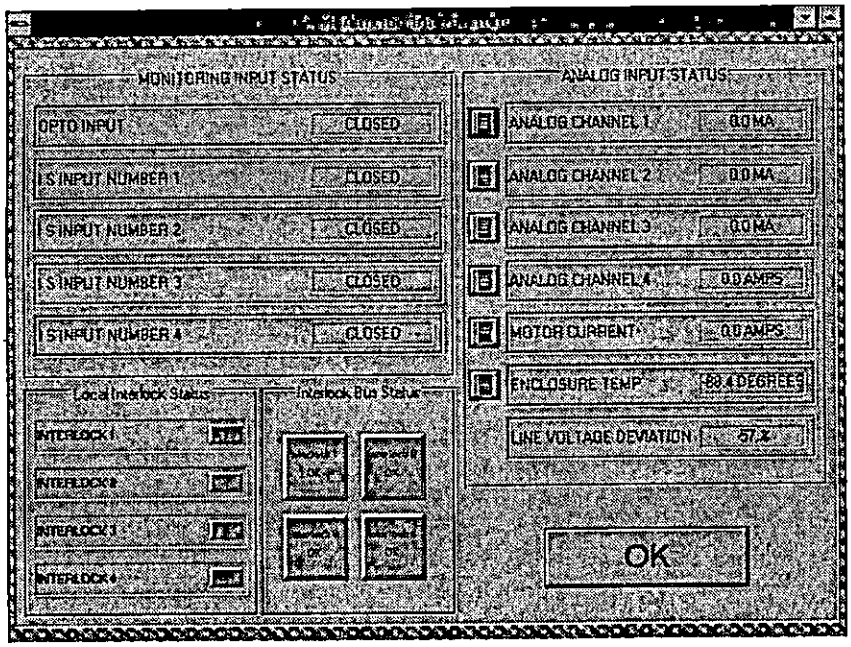


FIGURE 5-6. MONITORING INFORMATION Screen.

The **Monitoring Information** screen shows the status of all the inputs being monitored by the Sitepro panel. This includes the analog inputs, the four Intrinsically Safe inputs and the one non-Intrinsically Safe input (opto input).

Also shown is the interlock status of the panel being monitored (Local Interlock Status) and the Interlock Communication Bus (Interlock Bus Status).

Local Interlock Status

The Local Interlock Status indicators read the status of the interlock devices wired directly to the panel being monitored. If one of these interlock devices generates an alarm, the appropriate indicator button turns from green to red.

Interlock Bus Status

These indicators monitor the four channels of the Interlock Communication Bus that handles communication between panels at the site. The appropriate indicator button turns from green to red when an alarm is generated anywhere on the Interlock Communication Bus.

Click on the OK button to return to the **Panel Display** screen.

To Display Hardware Status...

Click on the Hardware Window button to access a real-time view of the panel's configuration dip switch settings and input status. The Hardware Window screen (Figure 5-7, p. 5-10) provides the following information:

- Dip switch settings of the SEND/RECEIVE and CONTROLLER ADDRESS switches.

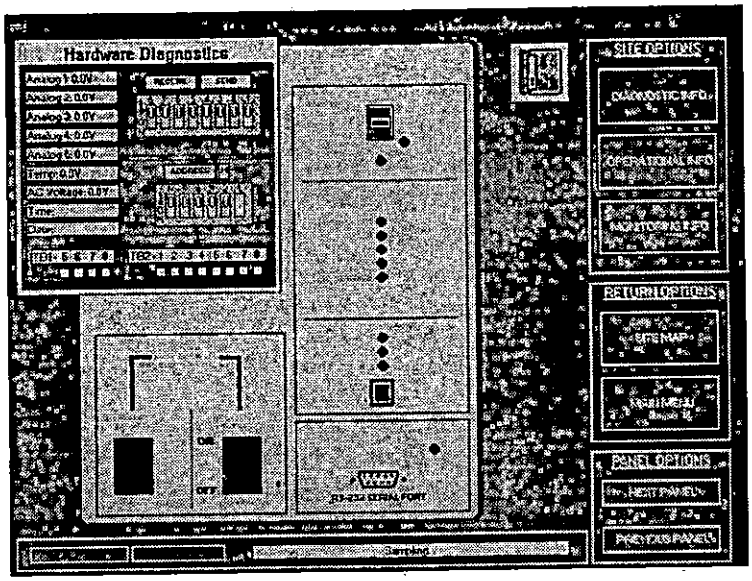


FIGURE 5-7. PANEL DISPLAY Screen with Hardware Window open.

- Input status of TB1 pins 5-8 and TB2 pins 1-8. Pins are highlighted if a voltage is applied.
- Voltage levels of all six analog inputs.
- Time and date.

Using The RS-232 Port

In addition to using modem communications, the site can be accessed locally through a lap top computer cabled to the RS-232 Serial Port on the front of the Sitepro panel. Proceed as follows:

1. Use a special RS-232 cable (available from ORS) to connect your computer to the RS-232 port on the Master panel at the site.

2. Open SITEPRO Manager and, from the **Site Menu** screen (Figure 4-1, p. 4-3), click on the LOCAL ACCESS button to display the **Available Sites** dialog box (Figure 5-1, p. 5-2).

3. Click on the DOWN arrow to reveal the drop down list of site phone numbers entered during system configuration (See Chapter 4).

4. Select the site to be called by clicking on one of the available phone numbers.

5. Click on the OK button to dial the site, or click on the CANCEL button to abort the operation and return to the Site Menu screen.

When the OK button is clicked, the message "Logging On To Sitepro Network" will flash on the screen. When the connection to the site has been made, the **Site Map** screen (Figure 5-2, p. 5-3) should appear. However, if the configuration of the remote does not match that of the host, a "Configuration Error" message will be displayed.

6. Click on the OK button to update the remote software to match that of the host.

When the **Available Sites** dialog box has been accessed, operation of the Local Acces mode is identical to that of Phone Access.

APPENDIX A: DOWNLOADING TO SITEPRO DIRECTORY

The SITEPRO Directory

When you download logged data from the remote site to the host computer (See page 5-4), the data files will be saved to the SITEPRO directory that is created on your hard drive during system installation (See Chapter 2). Data downloaded from each of the ten user-configurable sites (See Chapter 4) will be saved to a separate subdirectory under the SITEPRO directory. Figure A-1 (below) shows how the ten SITEPRO subdirectories correspond to the ten available sites listed on the **Site List** dialog box. Refer to Chapter 4 for site naming and other configuration procedures.

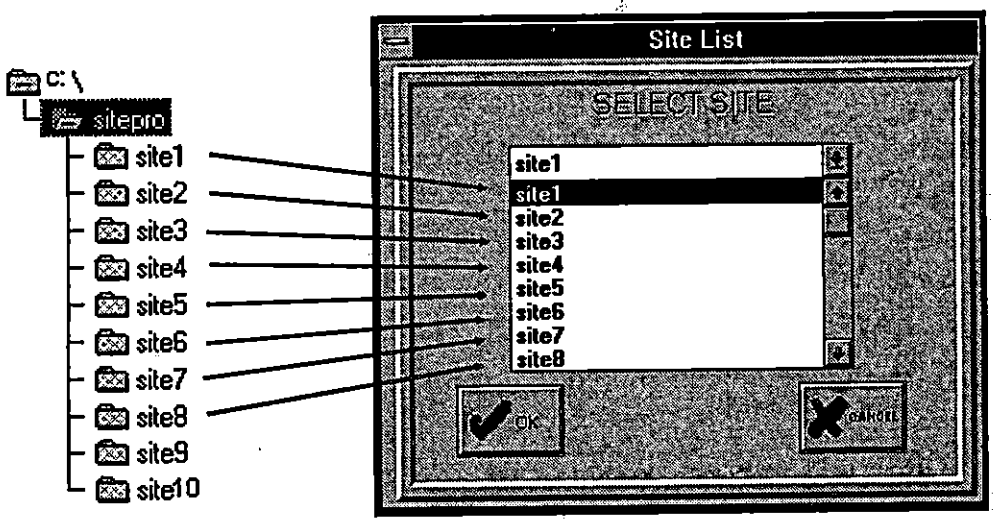


FIGURE A-1. SITEPRO Directory Structure. Above left is the SITEPRO™ directory structure as it will appear when accessed through the Windows File Manager. Above right is the SITEPRO Manqager **Select Site** dialog box with the available sites named "site 1" through "site 10". Any names can be chosen for these sites.

Data Files

The logged data downloaded from a site are stored in the form shown below.

Month	Day	Year	Panel Address	File Type *
09	25	93	00.	001

* Three separate files are created whenever data are downloaded. These files are distinguished by their file extensions:

.001 = Spreadsheet file
.002 = Raw Data file
.004 = Text file

Back up your files on a regular basis and delete them from the SITEPRO directory. This practice will guard against loss of data and will conserve space on your hard drive.

APPENDIX B: CUSTOMIZING YOUR SITE SCREEN

SITEPRO™ Manager allows you to access the Windows™ Paintbrush utility to add graphics to your **Configure Site** screen (Figure 4-3, p. 4-5). You can use this feature to draw in equipment components and add messages to the screen. This capability can help you keep track of how the SITEPRO panels interface with the remediation system as a whole.

Simply double-click on the white portion of the **Configure Site** screen to open Windows Paintbrush (Figure B-1, below). Refer to your Windows documentation for the details of Paintbrush operation.

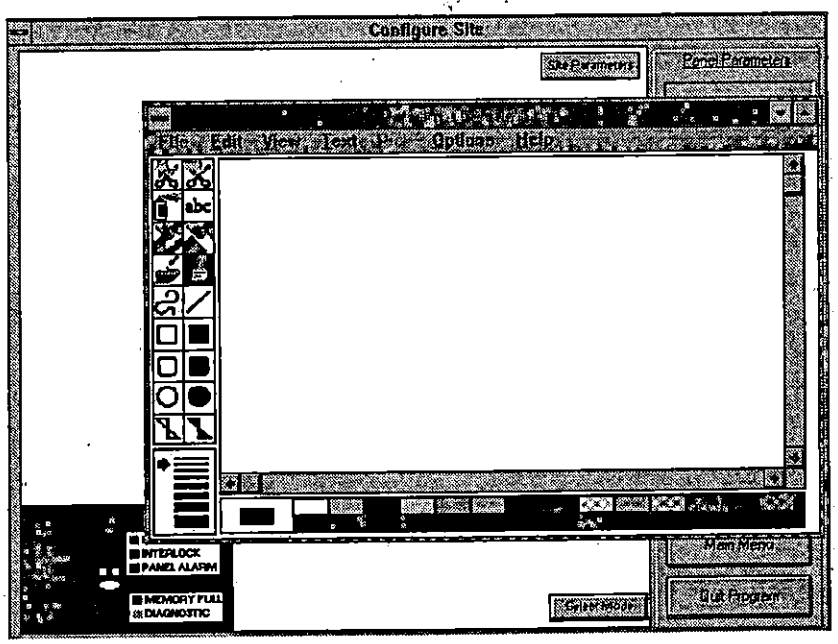


FIGURE B-1. The Windows™ Paintbrush utility as accessed from the SITEPRO Manager **Configure Site** screen.

APPENDIX C: UP-TIME PERFORMANCE MONITORING

UP-TIME is the amount of time the system is operating. The % UP-TIME is the percent of the time the system is operating relative to the time available for operation. The SITEPRO™ calculates % UP-TIME based on the following formula:

% UP-TIME = (UP-TIME / AVAILABLE TIME) * 100

UP-TIME = AVAILABLE TIME - ALARM TIME

AVAILABLE TIME - Available time is recorded by the SITEPRO whenever the panel power is on and the system switch is in the automatic position.

ALARM TIME - Alarm time is recorded by the SITEPRO whenever it detects a probe failure, detects a motor failure, generates a panel alarm, or receives an interlock alarm. For example, if one SITEPRO sends a panel alarm to another SITEPRO which is configured to receive the alarm, then both SITEPROs will record this as alarm time.

Example

UP-TIME calculation executed by the panel:

Given:

Available time recorded in the period = 720 hours

Alarm time recorded in the period = 5 hours

Then:

UP-TIME = 720 - 5 = 715 hours

% UP-TIME = (715 / 720) x 100 = 99.3%

UP-TIME REPORTING

Each SITEPRO panel continuously monitors and reports its own UP-TIME performance. UP-TIME is monitored by an electronic totalizer and is displayed on the **Operational Info** screen shown on page 5-7 of this manual. Two measures of UP-TIME are provided:

TOTAL UP-TIME

TOTAL UP-TIME is measured from system start-up. If the totalizer is cleared after system start-up, the date on which the totalizer was cleared and restarted is recorded in the SITEPRO Manager software.

MONTHLY UP-TIME

MONTHLY UP-TIME is measured and displayed for the current month. At 12:00 a.m. on the last day of the month, the PERCENT UP-TIME for the month is logged in the panel memory and the totalizer is cleared to begin the next month. The monthly UP-TIME percentage can be downloaded from the panel memory through the SITEPRO Manager software.

TOTAL SYSTEM UP-TIME CALCULATION

Each individual panel in a system tracks its own PERCENT UP-TIME. In order to manually calculate the TOTAL SYSTEM MONTHLY PERCENT UP-TIME, first the MONTHLY PERCENT UP-TIME must be downloaded from each panel. The TOTAL SYSTEM MONTHLY PERCENT UP-TIME is the average of the individual panel results. The following is an example:

Example

If the monthly PERCENT UPTIME totals for three SITEPRO panels are 95%, 90% and 100%, then the TOTAL SYSTEM MONTHLY PERCENT UP-TIME for the 3-panel system = (95% + 90% + 100%) / 3 = 95%.

Standard Equipment Limited Warranty

All references to the Customer herein shall mean the Customer or the Lessee as applicable.

(a) ORS Environmental Equipment, a Division of Groundwater Technology, Inc. (ORS), warrants that any Equipment which it manufactures will be free from substantial defects in material and workmanship for a period of one (1) year from the date such goods are delivered to a carrier by ORS for shipment to the Customer.

(b) The Customer agrees that the liability of ORS hereunder shall be limited to replacing, repairing or issuing credit for, at ORS's discretion, any Equipment which is returned F.O.B. ORS's plant within the applicable term of the warranty, provided that (i) upon examination of the Equipment ORS determines that the alleged defect constitutes a substantial defect, and (ii) the warranty made herein is not invalid pursuant to Section (d) hereof. The Customer agrees that such replacement, repair or credit shall be its sole and exclusive remedies hereunder. For purposes hereof, a substantial defect shall mean any defect which prevents the Equipment from operating in accordance with ORS's published specifications. In the event that ORS determines that Equipment which is no longer manufactured by it contains a substantial defect and the warranty covering the defective equipment is not invalid pursuant to Section (d) hereof, the Purchaser's sole and exclusive remedy hereunder shall be the repair of such Equipment or the replacement of such Equipment with new equipment at ORS's discretion. In no case is Equipment to be returned by the Customer without first submitting a warranty claim in writing to ORS and obtaining a return authorization number from ORS. Equipment which is repaired or replaced pursuant to this warranty shall continue to be warranted for the unexpired portion of the warranty term applicable to the Equipment so repaired or replaced. ORS shall make the final determination as to the existence or cause of any alleged defect.

(c) The foregoing warranty shall not be valid (i) if the alleged defect is the result of abuse, misuse, accident, alteration, neglect or unauthorized repair; (ii) if ORS requires installation of Equipment by specifically approved ORS employee and such installation is not effected, or the Equipment is otherwise installed improperly; or (iii) if the Equipment is resold by the Customer. Any repair shall be deemed unauthorized unless it is made (i) by ORS or a duly authorized agent of ORS or (ii) with the written consent of ORS.

(d) The operating efficiency of treatment, abatement, and recovery Equipment and systems is affected by factors extrinsic to their manufacture, including operating environment and such conditions of use as contaminant and related substance build-up, the frequency and type of operator maintenance and other external variables. For these reasons, specific levels of performance cannot be guaranteed for such Equipment and systems.

(e) **THIS WARRANTY IS THE SOLE WARRANTY MADE BY ORS TO THE CUSTOMER AND IS IN LIEU OF ALL OTHER WARRANTIES OR OBLIGATIONS, EXPRESS OR IMPLIED. ORS EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

(f) **THE CUSTOMER AGREES THAT IN NO EVENT SHALL ORS BE LIABLE FOR SPECIAL, INCIDENTAL, INDIRECT, EXEMPLARY OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS OF LOSS OF USE OR ANY OTHER ECONOMIC LOSS, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.**

(g) **THE REMEDIES PROVIDED HEREIN ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES.**

ORS ENVIRONMENTAL EQUIPMENT RETURN POLICY

Permission is required to return equipment to the ORS Environmental Equipment factory in Greenville, NH. A Return Authorization Number will be issued upon receipt of your request to return, which should include reasons for the return. Your return shipment to us must have this R.A.# clearly marked on the outside of each package.

Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN AUTHORIZATION, PLEASE CALL OUR SERVICE DEPARTMENT AT 800-228-2310 or 603-878-2500.

Equipment Decontamination

Prior to return, all equipment must be thoroughly cleaned and decontaminated. During decontamination, personnel should wear protective clothing and observe the cautions outlined below.

ORS reserves the right to refuse any equipment not properly decontaminated. ORS may also choose to decontaminate equipment at a fee which will be applied to the repair invoice.

Decontamination Solutions

The determination of what decontamination solution to use should be based on the types of contaminants present and the materials to be decontaminated. The fabrics of protective clothing are made of organic polymers which may be dissolved or destroyed by organic solvents. The metals and gaskets of tools may be damaged by overly acidic or basic compounds. Some decontamination solvents should be entirely avoided. The toxicity or physical hazards associated with using some once commonly used decontamination solutions can be as potentially dangerous as the site contaminants.

It is important to be certain that the decon solution, the contaminant, and the material to be cleaned are all compatible with each other. If they are not, it is possible to produce toxic or flammable gases, heat, splattering, bubbling, fire, or explosion. If an uncommonly used method and/or chemical solution is being considered for decontamination, it is important to consult with an experienced chemist to ensure chemical compatibility.

Some common decontamination solutions are listed below along with the contaminants they are effective against:

Solution	Effective Against
Water	Short-chain hydrocarbons, inorganic compounds, salts, some organic acids, other polar compounds.
Dilute Acids	Basic (caustic or alkaline) compounds, amines, hydrazines.
Dilute Bases	Acidic compounds, phenols, thiols, some nitro- and sulfonic compounds.
Organic Solvents	Nonpolar compounds (such as some organic compounds)

The use of organic solvents is not recommended because 1) organic solvents can permeate and/or degrade the protective clothing, and 2) they are generally toxic and may result in unnecessary employee exposure to hazardous chemicals.

When in doubt, use a dish washing liquid detergent. As a decontamination solution, it is readily available, is the safest of all the above, and is usually strong enough if used generously.

The use of steam can also be effective for decontamination. A water-lazer (pressurized water) is exceptionally valuable.

The following substances are noted for their particular efficiency in removing certain contaminants or for decontaminating certain types of equipment.

Solution	Effective Against
Penetone	PCB Contamination (since penetone may also remove paint, it is a good idea to spot-test before use)
Liquinox	Contaminated pumps
Ivory liquid	Oils
Diluted HTH	Cyanides
Radiac	Low level radioactivity
Isopropanol	Biological agents (should not be used on rubber products since it will break down rubber)

Hexane	Certain types of lab or sampling equipment (use of hexane is discouraged due to its flammability and toxicity)
Zep	General purpose cleaning
Alconox	General purpose cleaning

Decontamination Solutions to Avoid

Some decontamination solutions should be avoided because of their toxicity, flammability, or harmful effects to the environment.

Halogenated hydrocarbons, such as carbon tetrachloride, should not be used because of their toxicity, possible incompatibility, and some because of their flammability.

Organic decontamination solutions should not be used on personal protective equipment (PPE) because they may degrade the rubber or other materials comprising the PPE.

Mercurials are sometimes used for sterilization. They should be avoided because of their toxicity.

Chemical leaching, polymerization, and halogen stripping should all be avoided because of possible complications during decontamination.

Sand-blasting, a method of physical removal, should be avoided because the sand used on the contaminated object usually needs to be disposed of as hazardous waste, a very costly proposition. Also, sand-blasting exposes personnel to silica, a carcinogen.

Freon is known to be particularly effective for the cleansing of PCB's, but its effect on the ozone layer is extremely harmful. Its use should be discouraged.

Strong acids or bases should not be used when cleaning metals and gaskets of tools or other equipment because of the possibility of corrosion.

Disposal of Decontamination Solutions and Waste Water

All solutions and water used for decontamination must be collected. If lab analyses indicate that the water and/or solutions exceed allowable contamination levels, they must be treated as hazardous waste. Alternatively, the solutions and water may be treated on-site to lower the contamination levels and render them nonhazardous.

Containers such as 55-gallon drums should be available for storage of wastes.

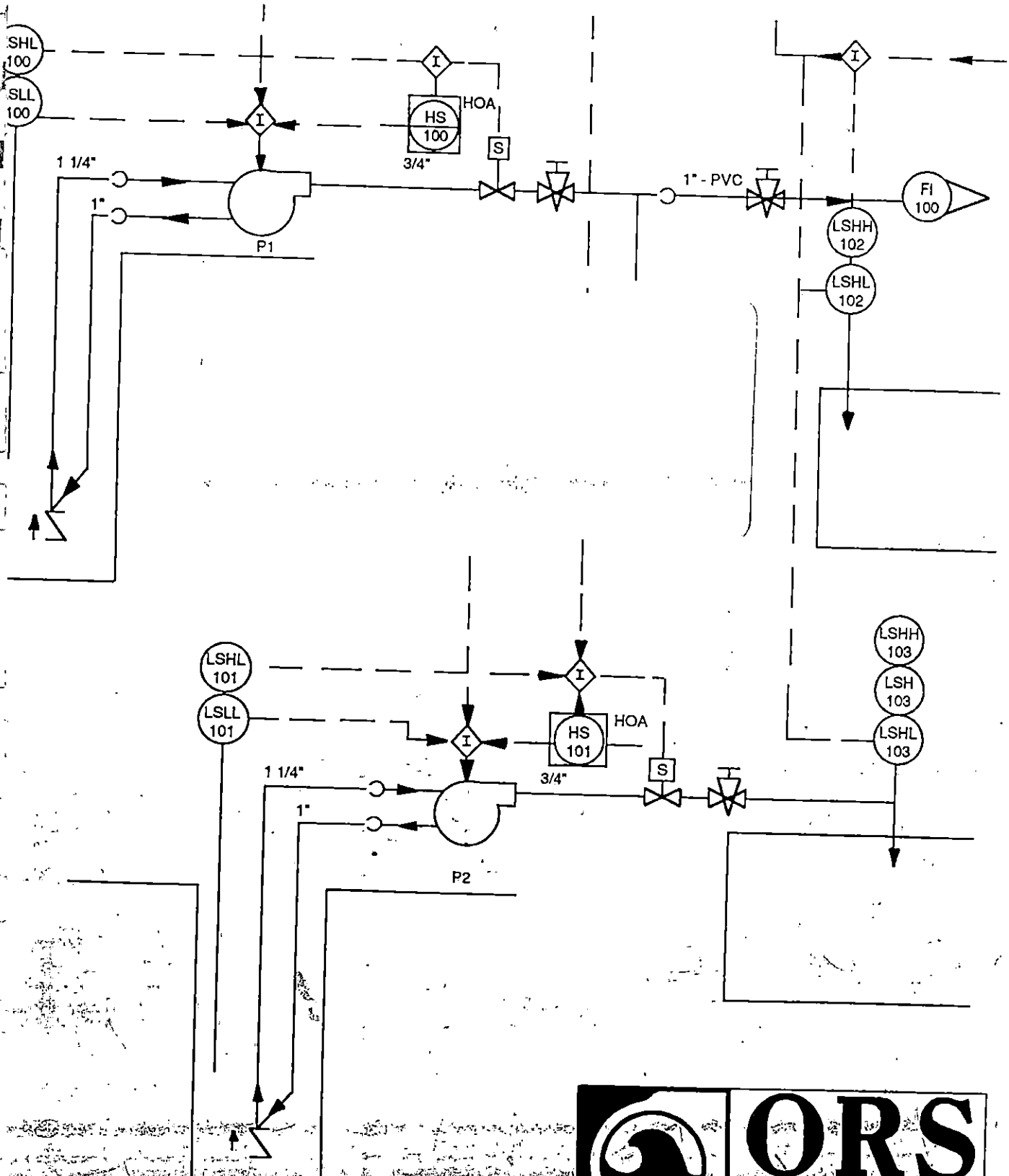
Spent decontamination solutions can be collected by using heavy-duty plastic sheets, visqueen sheets, kiddie pools, or if needed, a larger containment basin. The decontamination of equipment must be performed on the sheets or in the basins. They could

be placed on a slight angle so that the spent decontamination solutions drain into a collection basin or drum.

Recommended Supplies for Decontamination of Personnel, Clothing, and Equipment

The list below contains recommendations for supplies which should be on hand for the decontamination of personnel, clothing and equipment. Depending on the site activities, not all of these items may be needed. Alternatively, some additional items not listed here may be required.

- Drop cloths of plastic or other suitable material, such as visqueen, for heavily contaminated equipment.
- Disposal collection containers, such as drums or suitably lined trash cans for disposable clothing and heavily contaminated personal protective clothing or equipment to be discarded.
- Lined box with adsorbents for wiping or rinsing off gross contaminants and liquid contaminants.
- Wash tubs of sufficient size to enable workers to place booted foot in and wash off contaminants (without a drain or with a drain connected to a collection tank or appropriate treatment system).
- Rinse tubs of sufficient size to enable workers to place booted foot in and hold the solution used to rinse the wash solutions and contaminants after washing (without a drain or with a drain connected to a collection tank or appropriate treatment system)
- Wash solutions selected to wash off and reduce the hazards associated with the contaminated wash and rinse solutions.
- Rinse solution (usually water) to remove contaminants and contaminated wash solutions.
- Long-handled, soft-bristled brushes to help wash and rinse off contaminants.
- Lockers and cabinets for storage of decontaminated clothing and equipment.
- Storage containers for contaminated wash and rinse solutions.
- Plastic sheeting, sealed pads with drains, or other appropriate method for containing and collecting contaminated wash and rinse water spilled during decontamination.
- Shower facilities for full body wash or, at a minimum, personal wash sinks (with drains connected to collection tank or appropriate treatment system).
- Soap or wash solution, wash cloths and towels.
- Clean clothing and personal item storage lockers and/or closets.



ORS ENVIRONMENTAL EQUIPMENT

ORS ENVIRONMENTAL EQUIPMENT

SITEPRO™ 2000
BLOWER/PUMP CONTROL PANEL
Installation & Operation Manual

10/18/93
Rev. 3
10367

32 Mill St., Greenville, NH 03048
Phone (800) 228-2310/ (603) 878-2500
FAX (603) 878-3866

SITEPRO™ 2000 SYSTEM SPECIFICATION SHEET

MODEL: Blower / Pump Control Panel HS 100

MODEL NUMBER: 1392100

SERIAL NUMBER: 10538

DATE OF MFG.: 6/94

PANEL VOLTAGE: 115____ 230 XX

BLOWER OUTPUT:

HP _____ Phase _____ Voltage_____

PUMP OUTPUT:

HP _____ Phase _____ Voltage_____

OPTIONS:

- Telemonitoring (includes Modem) YES__X_ NO____

SITEPRO™ 2000 SYSTEM SPECIFICATION SHEET

MODEL: Blower / Pump Control Panel HS101

MODEL NUMBER: 1392100

SERIAL NUMBER: 10539

DATE OF MFG.: 6/94

PANEL VOLTAGE: 115____ 230 XX

BLOWER OUTPUT:

HP____ Phase ____ Voltage_____

PUMP OUTPUT:

HP____ Phase ____ Voltage_____

OPTIONS:

- Telemonitoring (includes Modem) YES___ NO XX

SITEPRO™ 2000 SYSTEM SPECIFICATION SHEET

MODEL: Blower / Pump Control Panel HS 102

MODEL NUMBER: 1392100

SERIAL NUMBER: 10537

DATE OF MFG.: 6/94

PANEL VOLTAGE: 115____ 230 XX

BLOWER OUTPUT:

HP _____ Phase _____ Voltage_____

PUMP OUTPUT:

HP _____ Phase _____ Voltage_____

OPTIONS:

- Telemonitoring (includes Modem) YES XX NO___

SITEPRO™ 2000 SYSTEM SPECIFICATION SHEET

MODEL: Blower / Pump Control Panel HS103

MODEL NUMBER: 1392100

SERIAL NUMBER: 10536

DATE OF MFG.: 6/94

PANEL VOLTAGE: 115____ 230 XX

BLOWER OUTPUT:

HP _____ Phase _____ Voltage_____

PUMP OUTPUT:

HP _____ Phase _____ Voltage_____

OPTIONS:

- Telemonitoring (includes Modem) YES____ NO XX

QUICK START INSTRUCTIONS

Read This Section Even If You Don't Read Anything Else.

The large envelope shipped with your SITEPRO™ 2000 control panel contains Quick Start Installation & Configuration Instructions. Familiarity with the information in this envelope is absolutely essential for safe and trouble free operation of the SITEPRO control panel.

The SITEPRO Quick Start envelope contains the following instruction sheets:

- A Field Wiring Diagram that shows basic wiring of motors and probes.
- An Optional Feature Wiring Diagram that shows how to wire network connections, interlocks, analog sensors and other specialized devices.
- A Site Configuration Guide that explains how to lay out your site and define network interlocks.
- A Panel Configuration Guide that explains how to configure individual panels after the SITEPRO network has been laid out.

The information in this supplement is provided to complement the SITEPRO™2000 Installation & Operation manual. Although we highly recommend that all users read the entire Installation & Operation manual, we also recognize that some

experienced technicians may desire a quick start summary of essential information.

Please proceed as follows:

1. Refer to the Site Configuration Guide to determine the basic layout of your site.

2. Mount the SITEPRO panel(s) and carry out basic wiring according to the generic Field Wiring Diagram.

3. Carry out additional site-specific wiring according to the recommendations and examples provided in the Optional Features Wiring Diagram.

4. Configure each panel according to the Panel Configuration Guide.

5. Document the configuration of each panel by filling out the Panel Configuration Sheet included in Appendix A of the SITEPRO manual. Be certain that these sheets are available for reference before calling ORS for assistance.

Observe all Warnings and Cautions included in the SITEPRO manual.

TABLE OF CONTENTS

PREFACE

ABOUT THIS MANUAL

The SITEPRO™ 2000 Blower/Pump Controller is available in two configurations; the standard blower/pump control model, and an enhanced model that includes telemonitoring and data logging features. This manual contains all the information required to install and operate the standard SITEPRO system. Instructions for configuring and operating the enhanced model are provided in the separate SITEPRO™ Manager software manual. Refer to the System Checklist at the front of this manual to determine whether or not your system includes the telemonitoring option.

ADDITIONAL DOCUMENTATION REQUIRED

- **Water Table Depression Pump manual**
- **Air Stripper/Blower manual**

In addition to this SITEPRO 2000 manual, you will need the manuals provided with your blower and water pump. Each ORS water pump or air stripper blower is accompanied by a comprehensive manual that contains all the information required for installation and operation with a SITEPRO 2000 Control Panel. If you plan to use the SITEPRO 2000 Control Panel with another manufacturer's water pump or blower, be sure to confirm that the unit's electrical requirements match those of the panel. Refer to Chapter 1 of this manual for a list of SITEPRO 2000 specifications.

- **SITEPRO™ Manager Software manual**

If your SITEPRO is equipped with the optional telemonitoring features, you will also need the manual that accompanies the SITEPRO Manager remote monitoring software package.

WHO SHOULD READ THIS MANUAL

This manual is intended for field technicians, project engineers or anyone responsible for installing, operating or maintaining site remediation equipment.

WHAT THIS MANUAL COVERS

Here is what you will find in this manual:

Chapter 1: System Description includes;

- Features and Specifications
- Introduction to User Interface
- Sample Applications

Chapter 2: System Installation includes;

- Panel mounting instructions
- Wiring instructions
- Wiring diagrams

Chapter 3: System Configuration includes;

- Instructions for configuring the panel to handle input from external shutoff devices
- Instructions for configuring the panel for ***network*** use

Chapter 4: System Operation includes;

- Descriptions of all SITEPRO controls and indicators
- Startup and operating procedures for single panels
- Startup and operating procedures for multi-panel networked systems
- Tracing and clearing interlock alarms

Chapter 5: System Maintenance includes;

- Maintenance procedures for the panel and probe

Chapter 6: Problem Solving includes;

- Procedures designed to help you determine if your SITEPRO is working properly
- What to do if a problem is detected

Appendix A: Panel Configuration Sheet includes;

- A blank Panel Configuration Sheet for documenting the final panel configuration

Appendix B: Glossary includes;

- Definitions of technical terms used in the manual

Appendix C: Index includes;

- Index of key words used in the manual

Appendix D: Application Notes includes;

- How to wire and configure for specific applications

WHAT YOU SHOULD KNOW BEFORE STARTING

Although the ***microprocessor*** technology used by the SITEPRO 2000 is highly sophisticated and powerful, the panel itself is easy to install, configure and operate. No special training or skills are required to gain the benefits of this product.

An important feature of the SITEPRO 2000 is that it is extremely flexible and has a range of capabilities that extends from basic pump control to the coordination and management of complex multi-component remediation systems. The user will find that although basic operation of the SITEPRO 2000 is intuitively simple, experience with the panel's more advanced features will enhance his or her site engineering and system management skills.

Although ORS strongly recommends that you read all parts of this manual before installing or operating the SITEPRO 2000, experienced users may wish to skip directly to the installation and configuration sections in Chapters 2 and 3.

DOCUMENTATION CONVENTIONS

This manual uses the following conventions to present information:

An exclamation point icon indicates a WARNING of a situation or condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the WARNING message.

A raised hand icon indicates CAUTION information that relates to a situation or condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the CAUTION message.

A note icon indicates NOTE information. Notes provide additional or supplementary information about an activity or concept.

Words or phrases printed in ***bold italics*** are defined in the glossary at the back of the manual.

WARRANTY

SITEPRO™ 2000 Control Panels are warranteed only when they are connected to ORS equipment components or to components recommended by ORS. Refer to the back of this manual for the ORS Standard Equipment Limited Warranty.

FOR MORE INFORMATION

If you need additional information on this or any other ORS product, you can contact our Sales or Technical Support staff at:

ORS Environmental Equipment
32 Mill St.
Greenville, NH 03048
Phone: (800) 228-2310
(603) 878-2500
Fax: (603) 878-3866

CHAPTER 1: SYSTEM DESCRIPTION

Chapter Summary
This chapter contains the following introductory information:

- ***Overview*** *- A general description of SITEPRO™ 2000 features & options.*
- ***Specifications*** *- Panel dimensions, site requirements, sensor input.*
- ***User Interface*** *- Manual operation, on site computer interface, remote modem communications.*
- ***How SITEPRO Works*** *- An introduction to basic single panel and panel network function.*

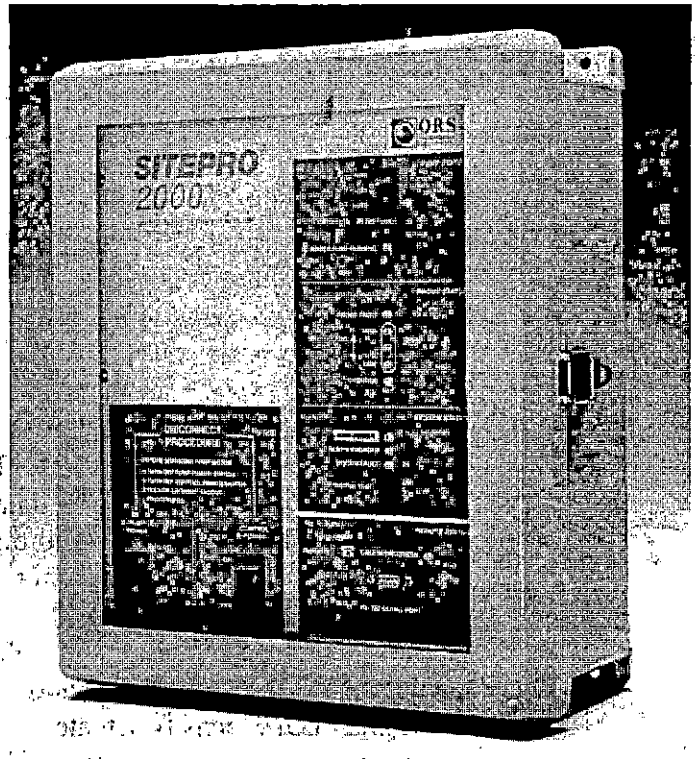


FIGURE 1-1. The SITEPRO™ 2000 Control Panel.

OVERVIEW

The ORS SITEPRO™ 2000 Blower/Pump Control Panel (Figure 1-1, p. 1-1) is designed for simultaneous control of one blower (air stripper or SVE) and one water pump. The controller is housed within a weather-proof ***NEMA 4 (IP 66)*** enclosure and incorporates circuitry to receive ***intrinsically safe*** input from sensors deployed in hazardous locations.

Each control panel can be operated by itself or can be linked to as many as 15 other similar panels in a user configurable alarm communication ***network***. Because each panel in the network has access to alarm inputs from all the other panels, entire remediation sites can be tied together and configured to respond appropriately to sensor input received by any panel in the network.

The SITEPRO 2000 is fully instrumented and includes status displays that provide a visual representation of pump and blower operating conditions. The panel also incorporates a self-test feature that continuously monitors line voltage, condition of the pump and blower control switches, panel temperature and probe integrity whenever the SITEPRO 2000 is in operation. An additional self-test routine that runs at panel startup (or whenever SYSTEM TEST button is pressed), checks internal program and data memory, ***RS-232*** serial communications, the ***analog*** to digital (A/D) converter and the integrity of all panel indicators.

The standard SITEPRO 2000 Blower/Pump controller is equipped with terminals that allow the panel to interface with a standard ORS density actuated level sensing probe, pressure switches as well as external ***interlock*** devices. ***Form C dry contact*** outputs are also available for interfacing with additional external equipment components, buzzers, indicators and security alarm systems. Additional inputs (including

those for ***analog*** devices, and a ***totalizer***), become available when the telemonitoring option is installed or when the standard panel is networked to an enhanced model.

Each standard SITEPRO 2000 Blower/Pump Control Panel is designed to run a single blower up to 5-1/2 HP in size and a water pump up to 2-1/2 HP in size.

Optional features include a telemonitoring package that incorporates remote monitoring and data logging as well as auto dial-out on alarm to either PC or Fax machine. Computer synthesized voice is also optional. Panels are available for 6 HP blowers. Pumps larger than 2-1/2 HP can be controlled with the addition of a contactor.

To complement the optional remote monitoring and data logging features, ORS offers a comprehensive software package (SITEPRO™ Manager) to provide graphical representations of the SITEPRO 2000 panel as it operates on site. Optional features of this software package allow the user to generate reports, graphs and active P&IDs of remediation functions. SITEPRO Manager is available at no extra cost when the telemonitoring package is purchased.

SPECIFICATIONS

Refer to Figure 1-2 (p. 1-4) for a panel layout diagram showing dimensions and wiring access points.

Enclosure

Height: 14" (35.5cm)

Width: 12" (30.5cm)

Depth: 6" (15.2cm)

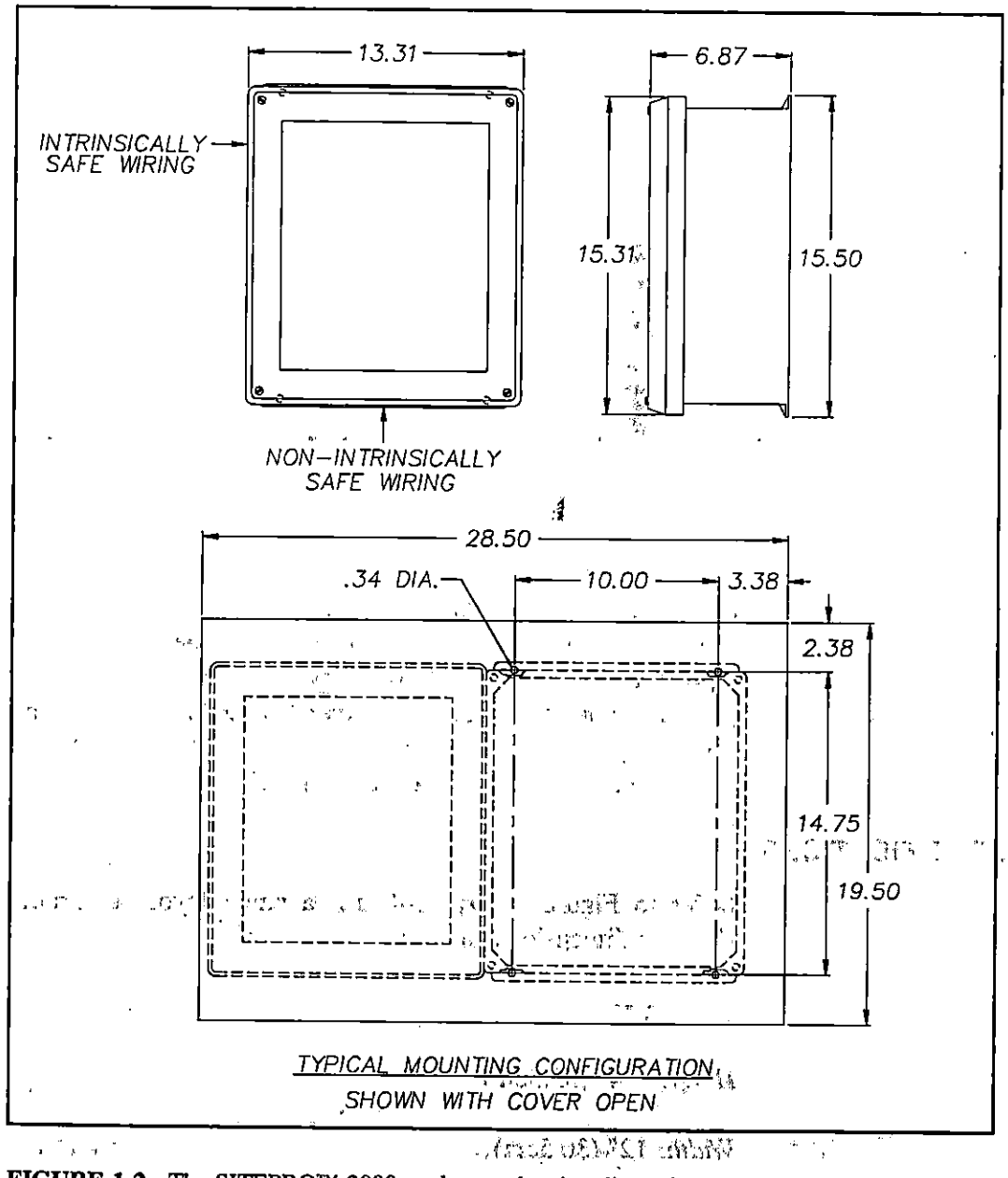


FIGURE 1-2. The SITEPRO™ 2000 enclosure showing dimensions, mounting footprint, wiring access and clearance required for door opening.

Rating: NEMA 4, IP 66

Purging: For use in Class I, Div. II, Groups C, D locations (Optional)

Materials: Fiberglass reinforced plastic w/ Lexan window

Power wiring access: Bottom of enclosure

Intrinsically Safe wiring access: Left side of enclosure

Non-intrinsically safe wiring access: Bottom of enclosure

Modem wiring access: Bottom of enclosure

Site Requirements

Door clearance for full 180° door opening:
20" (50.8cm) wide x 17" (43.2cm) high to left of enclosure

Enclosure footprint for wall mounting:
12-1/4" (31.1cm) wide x 15-1/2" (39.4cm) high

Line Voltage: 115VAC (+/- 20%), 50/60 Hz, 1-phase
230VAC (+/- 20%), 50/60 Hz, 1-phase

Power Consumption: 10 Watts, not including motor power

Modem: Standard dial-pulse or touch-tone (Optional)

Operating Environment

Operating temperature: -40° F (-40° C) to 130° F (54° C)

Humidity: 8% to 85%, non-condensing

Inputs (Available on all panels)

(4) ***Intrinsically safe*** probe inputs for single density probe

(4) ***Intrinsically safe interlock*** inputs

(4) Non-intrinsically safe ***interlock*** inputs

Additional Inputs (Available with telemonitoring)*

(8) ***Intrinsically safe*** inputs for high and low pressure, high sump level and thermal overload

(4) Non-intrinsically safe 0-5 VDC or 4-20 mA ***analog*** inputs with 8 bit measurement resolution

(2) Motor current sensor for monitoring

(1) Voltage sensor for monitoring

(1) Temperature sensor for monitoring

(1) ***Totalizer*** input for water flow measurement; input range 1-120 pulses/gallon w/ 20 gpm maximum. Totalizer must supply a 5-24VDC pulse to the panel

(2) Optically coupled Peripheral Equipment Interface inputs

Outputs

(2) ***Form C dry contact*** outputs capable of handling 100 mA, non-inductive

(2) Optically coupled Peripheral Equipment Interface outputs

(2) Auxilliary outputs to drive small AC powered devices

(1) Pump Motor Output for 2-1/2 HP, 230VAC, 1-phase, 50/60 Hz or 1 HP, 120VAC, 1-phase, 50/60 Hz

(1) Blower Motor Output for 3-1/2 HP, 230VAC, 3-phase 50/60 Hz

Interlock Communication Bus

Type: ***RS-485***

Capacity: Supports up to 16 SITEPRO panels over maximum distance of 3000' (1000 m) using standard 24 AWG, 2-conductor twisted shielded pair wire (Belden # 9841)

Communications: Standard 9-pin ***RS-232*** serial port 300-2400 ***baud*** for data logging *

Certification/Approvals (Pending)

Factory Mutual entity approval on ***intrinsically safe*** inputs

* Hardware for enhanced features built into every panel. Features become operational when panel is equipped with telemonitoring or is networked to a telemonitor equipped SITEPRO panel.

USER INTERFACE

The SITEPRO 2000 can be operated in any of the three modes shown in Figure 1-3 (p. 1-8) and described briefly on the following pages.

SITEPRO™ 2000 USER INTERFACE MODES

Manual Operation:

On site operator control of pump functions using panel controls and indicators

Remote Communication:

Off site monitoring and data acquisition through modem. Telemonitoring option required.

Local Communication:

On site configuration of panel and downloading of data through RS-232 serial port. Telemonitoring option required.

FIGURE 1-3. Three ways of using the SITEPRO™ 2000.

Manual Operation Mode

The panel is equipped with controls and indicators that permit manual operation of the pump and blower. Controls include pump and blower POWER switches that cut off all power to the motors, 3-position pump and blower CONTROL switches and a CONTROL POWER switch to cut off power to the control circuitry. A SYSTEM TEST button activates the panel's self-test feature. Refer to Chapter 4 for details of panel operation.

In SITEPRO 2000 systems without the telemonitoring option, manual operation is the only way the user can interface with the system.

Local Communication Mode

When the SITEPRO 2000 is equipped with the telemonitoring option, the user can use a computer to communicate with the panel either remotely over a telephone line (Remote Communication Mode) or locally via a cable to the ***RS-232*** serial port (Local Communication Mode).

Two basic types of operations are possible using the Local Communication Mode:

1. Set up and configure the data logging and remote monitoring features.
2. Download data from the data logger.

Procedures for using the Local Communication Mode are detailed in the manual that accompanies the SITEPRO Manager software package.

Remote Communication Mode

The modem and associated hardware/software included with the telemonitoring option allows the user to communicate with the SITEPRO 2000 panel from an off-site computer.

Four basic types of operations are possible using the Remote Communication Mode:

1. Set up and configure the data logging and remote monitoring features.

2. Download data from the data logger.

3. Access real time graphical representations of site conditions.

4. Auto dial-out on alarm.

The Remote Communication Mode can also be used to dial out to a Fax machine.

Procedures for using the Remote Communication Mode are detailed in the manual that accompanies the SITEPRO Manager software package.

HOW SITEPRO WORKS

The SITEPRO 2000 uses highly flexible ***microprocessor*** based electronics to provide a wide spectrum of capabilities that range from basic motor control to complex and sophisticated multi-panel networking. This built in versatility allows the SITEPRO 2000 to be configured on site to match the unique requirements of any remediation application.

Basic Motor Control

Figure 1-4 (p. 1-11) shows a simple water treatment system in which a SITEPRO 2000 Blower/Pump panel controls a LO-PRO™ Air Stripper blower and a transfer pump. During normal operation, the blower runs continuously and the pump cycles on and off in response to input from the sump level probe mounted in the air stripper sump.

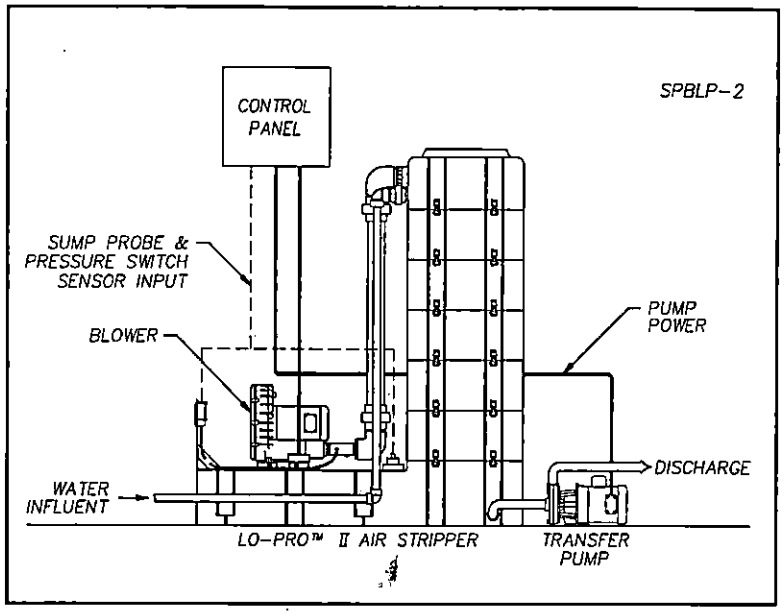


FIGURE 1-4. A SITEPRO™ 2000 Blower/Pump Control Panel with air stripper and transfer pump. Diagram shows basic water treatment application with no interlocks.

Motor Control With Interlocks

In most applications, your SITEPRO 2000 will be integrated into a remediation system that includes additional equipment components. These components (holding tanks, hydrocarbon pumps, oil/water separators, carbon tanks, etc.) often must be interlocked to the control panel to optimize system performance and to prevent permit excursions in the event of a component failure. Figure 1-5 (p. 1-12) shows another simple water treatment system in which contaminated water first passes through an air stripper and then into a carbon tank. Again, the ON/OFF cycling of the transfer pump is controlled by the status of the sump probe. In this application, however, a high pressure switch wired to the control panel shuts off the transfer pump if the carbon tank becomes clogged. Use of such external ***interlock*** devices (high level shutoff switches,

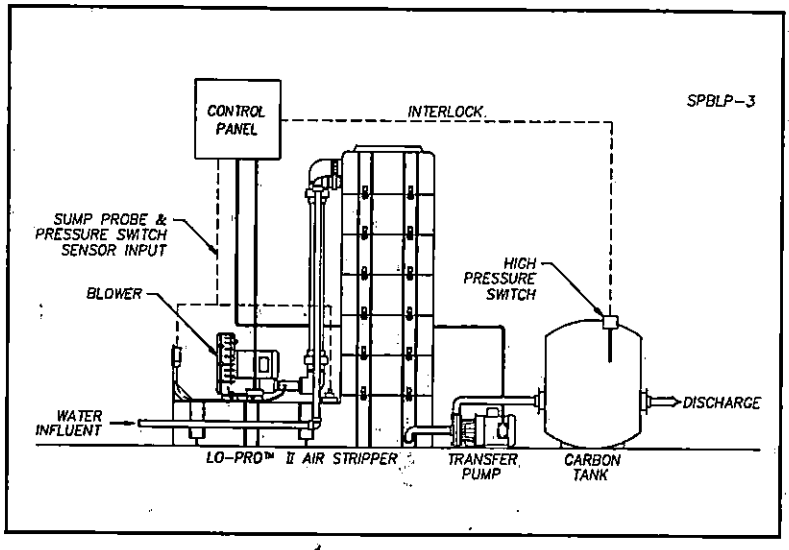


FIGURE 1-5. A SITEPRO™ panel with one ***interlock*** device (high pressure switch) attached.

pressure switches, etc.) is facilitated by a system of internal circuits built into every SITEPRO 2000 panel. These circuits provide four separate ***alarm channels*** for attachment of ***interlock*** devices.

Multi-Panel Networks

When two or more SITEPRO 2000 panels are linked together in a ***network*** as shown in Figure 1-6 (p. 1-13), the individual panel ***microprocessors*** are able to communicate and share information through a system of circuits called the ***Interlock Communication Bus***, or ICB. Each panel in a ***network*** can be configured to send and/or receive alarm signals on any or all of the four ***alarm channels***. In this way, alarms received locally by one panel can be broadcast on the ICB and used to shut off other panels in the ***network***.

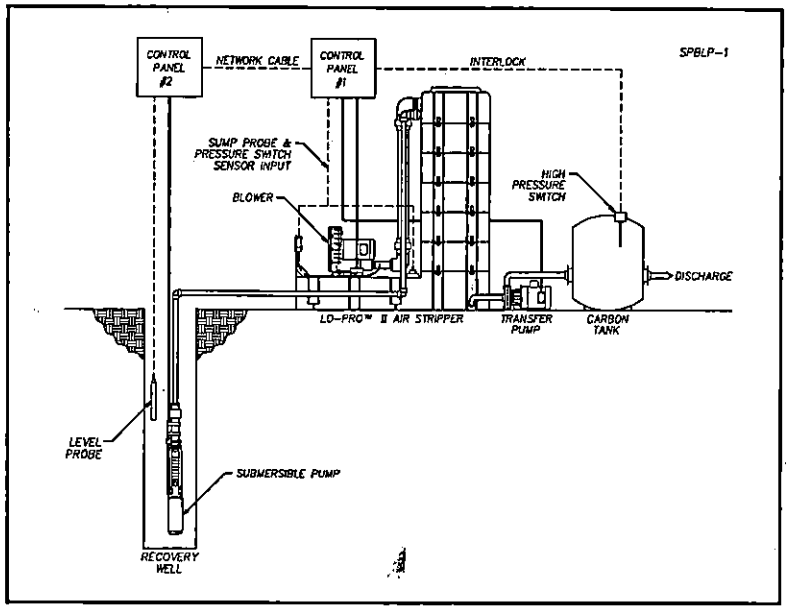


FIGURE 1-6. A two panel SITEPRO™ ***network*** with a single ***interlock*** device attached to Panel #1.

In Figure 1-6 (above), a feed pump and its control panel (Panel #2) have been added to the water treatment system diagrammed in Figure 1-5 (p. 1-12). Panel #2 receives input from its own level sensing probe and from Panel #1 through the ***network*** cable shown in the diagram. The ***network*** connection allows both pumps to be shut off by the carbon tank high pressure switch and also enables the air stripper controls to shut off the feed pump in the event of a sump high level condition or a blower failure.

Network Management

Whenever a multi-panel SITEPRO 2000 ***network*** is configured, one of the panels in the ***network*** must be designated to carry out special ***Interlock Communication Bus*** management functions. This panel, called the Master, controls the

information on the bus, assesses the ***interlock*** status of the other panels, called Slaves, and communicates with the host computer if the telecommunication option is installed. See Figure 1-7 (p. 1-14) for a diagrammatic representation of the relationship between Master and Slave panels.

If the telecommunication option is installed in one of the panels in a ***network***, that panel must be configured as the Master. However, if no remote monitoring is required, any panel in the ***network*** can be the Master. Panels are designated Masters or Slaves by setting dip switches inside each panel. During network operation, the Master continuously polls the Slaves in a set sequence determined by the ***network addresses***

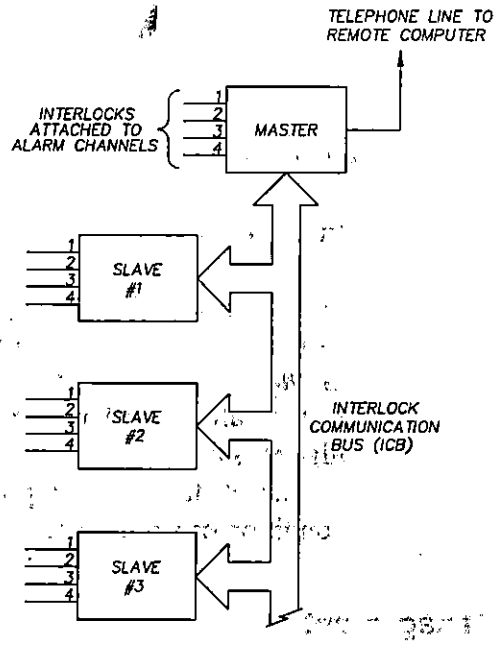


FIGURE 1-7. Diagrammatic representation of the Interlock Communication Bus.

During network operation, the Master continuously polls the Slaves in a set sequence determined by the ***network addresses*** the user chooses for the panels. When a Slave is polled, it is temporarily given control of the ***Interlock Communication Bus***. The Slave then broadcasts any current ***interlock*** alarms that are on ***alarm channels*** configured to send. All other panels in the ***network*** (Slaves and Master) will then respond to the alarms and shut down if they are configured to receive on these same ***alarm channels***.

Step by step procedures for configuring your SITEPRO 2000 Control Panel are provided in Chapter 3 of this manual.

ADDITIONAL APPLICATIONS

The examples in this chapter have shown the SITEPRO 2000 Blower/Pump Control Panel being used to control an air stripper blower and a transfer pump. Additional SITEPRO applications are listed below:

Air Stripper w/ Influent Feed Pump

When used to control an air stripper blower and an influent feed pump, the SITEPRO receives input from the air stripper controls (sump probe & pressure switches) and a water pump level sensing probe. In this application, the normal cycling of the feed pump is controlled by the level sensing probe. When the panel is properly configured, the pump can be shut off by 1) a LOW-OVERRIDE signal from the level sensing probe, 2) a HI or LO PRESSURE signal from the blower, 3) a HI SUMP signal from the air stripper sump level probe or 4) an alarm generated by an external interlock device.

Air Stripper w/ Chemical Feed Pump

When used to control an air stripper blower and a chemical feed pump, the SITEPRO receives input from the air stripper controls (sump probe & pressure switches) and a level sensor mounted in the chemical vat. In this application, operation of the chemical feed pump is controlled by the vat level

sensor. The pump can be shut off by 1) a LOW-OVERRIDE signal from the vat level sensor, 2) a HI or LO PRESSURE signal from the blower, a HI SUMP signal from the air stripper sump level probe or 4) an alarm generated by an external ***interlock*** device.

SVE Blower w/ Knockout Drum

When used to control a soil vapor extraction (SVE) blower with a knockout drum, the SITEPRO receives input from a knockout drum high level switch. In this application, the blower can be shut off by the high level switch or by any external ***interlock*** device wired to one of the panel's ***alarm*** channels.

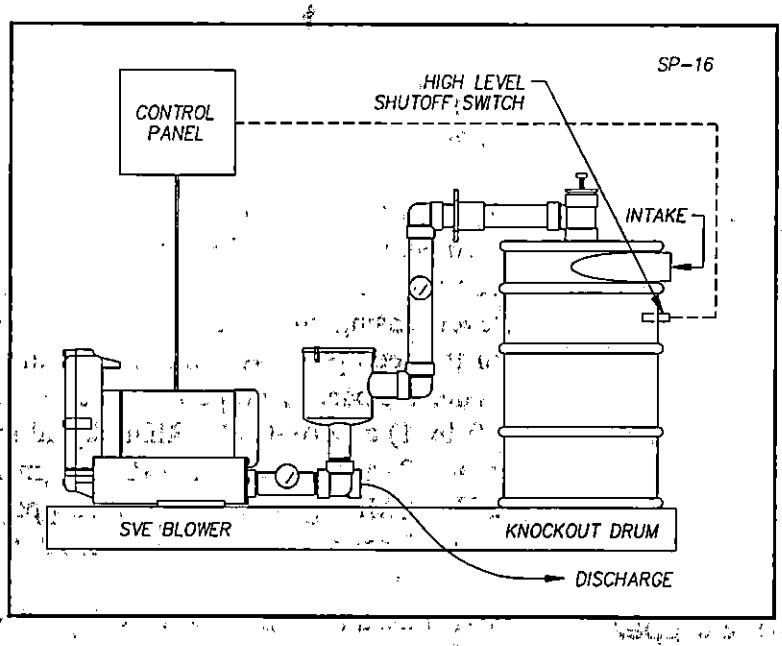


FIGURE 1-8. A SITEPRO™ 2000 panel controlling a soil vapor extraction blower with knockout drum.

CHAPTER 2: SYSTEM INSTALLATION

Chapter Summary
This chapter contains the following SITEPRO™ 2000 installation instructions:

- ***Warnings and Cautions*** *- How to avoid damage to yourself or the panel.*
- ***Inspection*** *- How to determine if you received what you ordered.*
- ***Mounting the Panel*** *- Procedures for mounting the control panel.*
- ***Wiring*** *- Procedures for wiring into and out of the panel.*

The SITEPRO™ 2000 Blower/Pump Controller must be deployed in a non-hazardous location and all conduit runs from the well head to the panel must conform to Article 501-5 of the National Electrical Code (NEC) 1993.

Before deploying the SITEPRO 2000, refer to the System Checklist at the front of this manual and answer the following questions.

1. Is the electrical service at the site properly sized for this panel and does it conform to ***NEC*** and local codes?

2. Are the electrical characteristics of your pump and blower compatible with those of the panel?

INSPECTION

Inspect all equipment upon arrival. Check the contents of the packing crate against the System Specification sheet at the front of this manual. If any items are missing or damaged, make note of this on the shipping papers and immediately notify ORS Environmental Equipment at (800) 228-2310.

PANEL INSTALLATION

Mount Panel

1. Remove the panel from its packing crate and hold it against the intended mounting surface.

2. Refer to Figure 1-2 (p. 1-4) and position the panel so that the access door will open at least 12-1/2" without obstruction.

3. If the mounting surface is wood, use wood screws to attach the panel mounting feet to the wall. If the surface is metal, use the panel as a template and mark the locations of the mounting holes. Then drill and tap the holes and use self-tapping screws to mount the panel.

Do not use nails to attach the panel, as a misdirected hammer blow could damage the enclosure.

WIRING

All wiring must be carried out by a qualified electrician and be in accordance with state and local codes. Proper grounding of the panel is necessary to maintain the ***intrinsically safe*** rating of the SITEPRO 2000. See the following sections for panel grounding procedures.

Install Chassis Ground

Before beginning panel hookup procedures, run a wire from the panel chassis ground lug to a good earth ground such as the circuit breaker panel enclosure. The ground lug is located on the chassis behind the panel faceplate (See the SITEPRO 2000 wiring diagram in Figure 2-1, p. 2-3).

Before installing wires, setting configuration dip switches or touching exposed portions of the panel circuit board, safely discharge any static electricity from your body by touching or otherwise grounding yourself to the panel chassis.

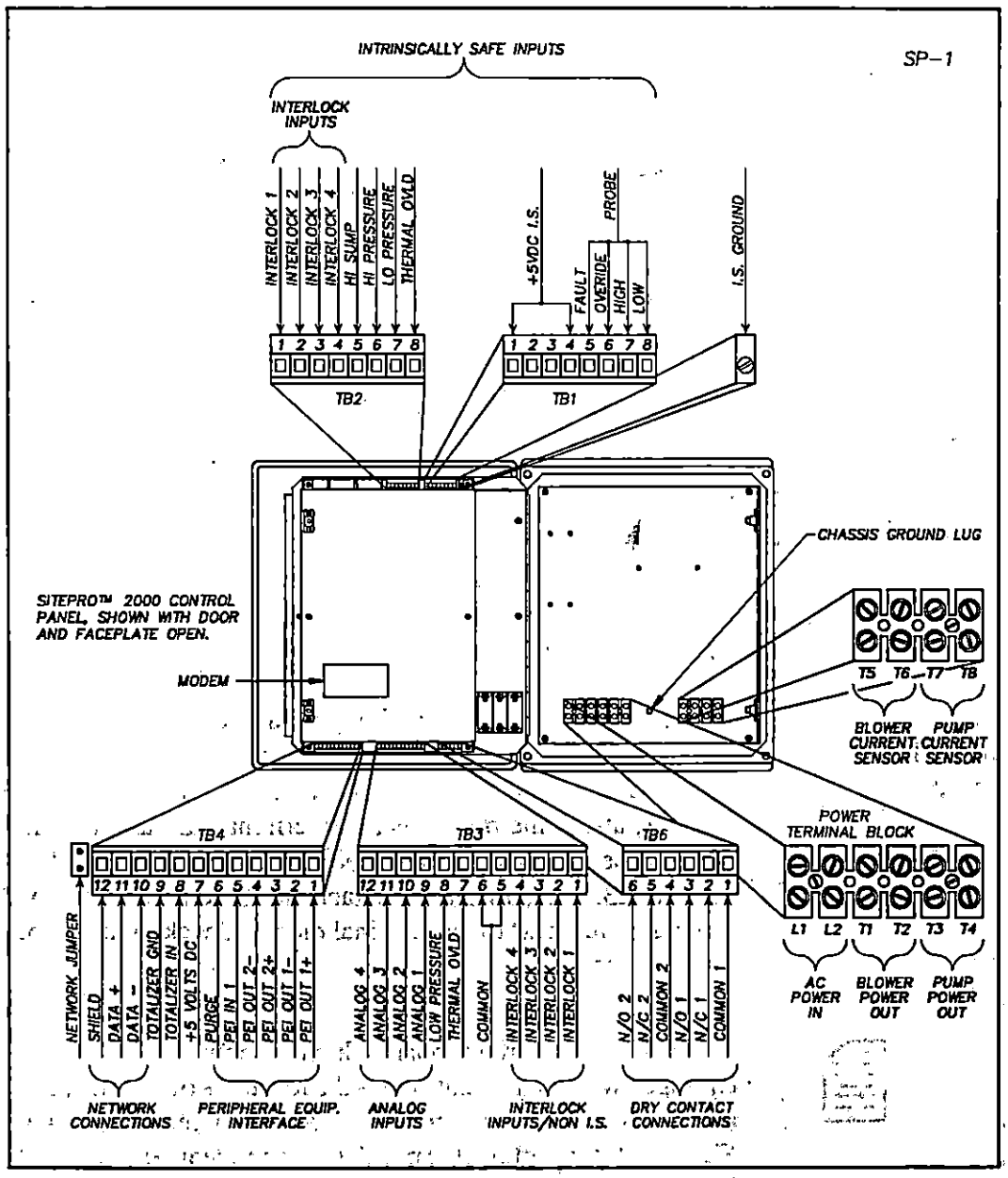


FIGURE 2-1. SITEPRO™ 2000 Blower/Pump Control Panel Wiring Diagram.

CHAPTER 2: SYSTEM INSTALLATION

Install Intrinsically Safe Ground

Run a separate ground wire from the intrinsically safe ground lug to a good earth ground. The I.S. grounding lug is located next to TB1 on the back of the panel faceplate.

The ***intrinsically safe*** ground wire must be kept separate from the chassis ground.

The SITEPRO 2000 panel enclosure is equipped with access ports to facilitate wiring. See Figure 1-2 (p. 1-4 in Chapter 1) for locations of access ports. The port on the side of the enclosure is for all ***intrinsically safe*** wiring. All other wiring, including incoming power and pump connections must be routed through the access port in the bottom of the enclosure.

To maintain the NEMA 4 weatherproof characteristics of your panel after wiring has been completed, seal all wiring access ports with weatherproof conduit hubs.

Wire Incoming Power

Run power wires through the port at the bottom of the enclosure and attach to the terminal block on the chassis behind the faceplate (Figure 2-1, p. 2-3). In single phase systems, attach the power leads to terminals L1 and L2. In three phase systems, attach the power leads to terminals L1, L2 and L3. In either case, attach the ground wire to the grounding lug next to the terminal block. Check tightness of terminal screws.

The SITEPRO circuit board shield (behind faceplate) is equipped with a label that shows the locations of all terminals and configuration dip switches. Refer to this label (and Figure 2-1) throughout the panel wiring procedures described in this chapter.

Do not run power wires within 2 inches of ***intrinsically safe*** (IS) wires or terminals. Refer to Figure 2-1 (p. 2-3) for location of IS terminals (at top of panel), and reference ***NEC*** Article 508 for relevant codes.

Wire Pump

Run the pump power wires through the port at the bottom of the enclosure and attach to the PUMP POWER OUT terminals (Figure 2-1, p. 2-3). Attach the ground wire to the chassis grounding lug next to the terminal block. Check tightness of terminal screws. For wiring instructions specific to your pump and blower, refer to the blueprint sized Field Wiring Diagram provided with these items.

Refer to your pump manual and heed all relevant Warnings and Cautions.

Wire Blower

Run the blower power wires through the port at the bottom of the enclosure and attach to the BLOWER POWER OUT terminals (Figure 2-1, p. 2-3). Attach the ground wire to the chassis grounding lug next to the terminal block. Check tightness of terminal screws. For wiring instructions specific to your pump and blower, refer to the blueprint sized Field Wiring Diagram provided with these items.

Refer to your air stripper or SVE manual and heed all relevant Warnings and Cautions.

Wire WTDP Probe

The SITEPRO 2000 Blower/Pump Control Panel is designed for use with either a standard ORS density actuated WTDP probe or a LO-PRO Air Stripper sump level probe. When the SITEPRO is being used to control a blower and an influent feed pump, the WTDP probe is wired to the panel as shown in Figure 2-2 (p. 2-6). This probe uses three separate switches (HI, LO & LO-OVERRIDE) to monitor the water level in the

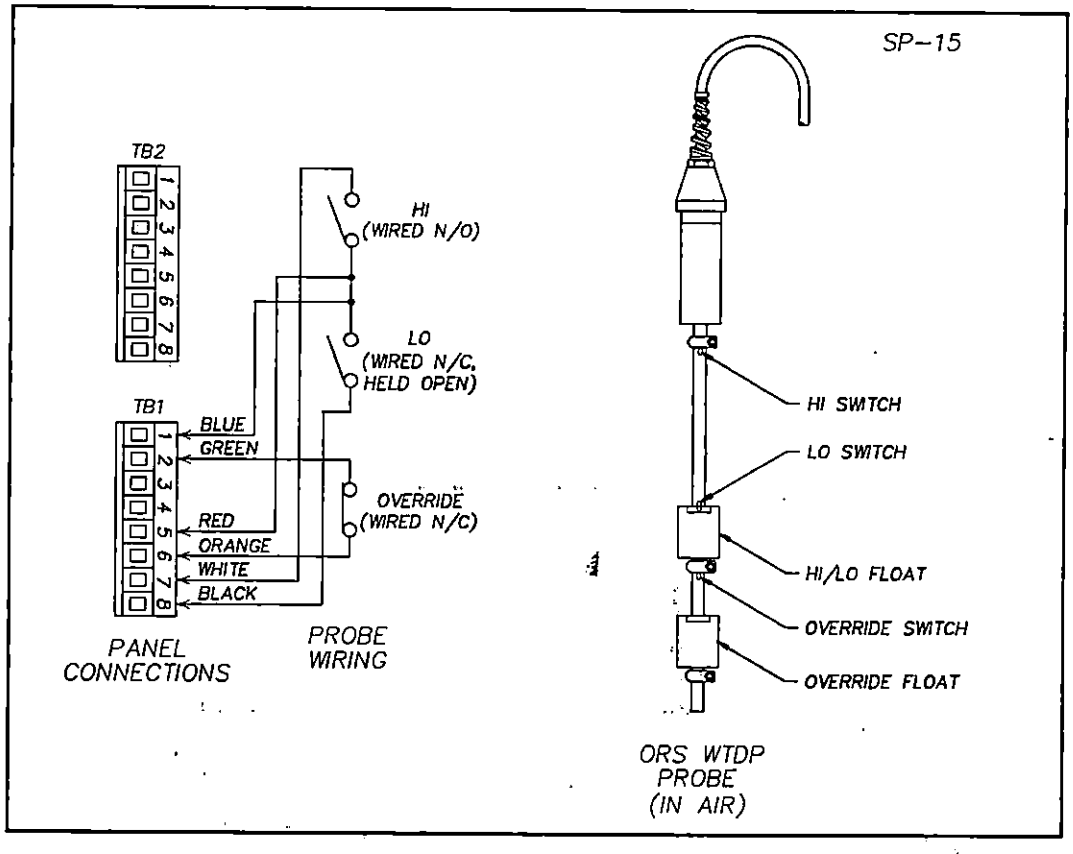


FIGURE 2-2. Wiring a standard ORS Water Table Depression Pump (WTDP) probe to the SITEPRO™ 2000 Control Panel. Switch wiring is shown to facilitate hookup of non-standard probes.

well. The HI and LO switches control the normal ON/OFF cycling of the pump while the LO-OVERRIDE switch shuts off the pump in the event of a control system failure.

Run the probe cable through the access port on the side of the enclosure and attach its leads to IS terminal strips TB1 & TB2 as shown in Figure 2-2 (above).

Conductivity actuated probes can be used only with the addition of a relay. Call ORS for further information.

Before wiring an older ORS probe to the SITEPRO panel, it will be necessary to cut the connector from the probe cable. After wiring the probe to the panel as shown in Figure 2-2 (p. 2-6), attach a jumper wire from terminal #5 on TB2 (red wire) to any of the +5VDC I.S. terminals on TB1.

Wire Sump Probe & Pressure Switches

When the SITEPRO is being used to control an air stripper blower and a transfer pump, the ON/OFF cycling of the pump is controlled by a sump level probe mounted in the air stripper sump. The probe also has a HI-OVERRIDE sensor that can shut off an optional feed pump if the water level in the air stripper sump rises too high and threatens to flood the blower.

If your SITEPRO™ 2000 Blower/Pump Control Panel is being used with an ORS LO-PRO™ II Air Stripper, the sump probe and the pressure switches are pre-wired into a junction box as shown in Figure 2-3 (p. 2-8). Wire from the junction box to TB1 and TB2 inside the SITEPRO panel as shown in Figure 2-3 (p. 2-8).

To shut off an optional feed pump in the event of a High Sump Level or High/Low Pressure condition, the inputs for each of these functions must be jumpered to an ***alarm channel*** as explained in Appendix D: Application Notes.

Wire Interlocks

The SITEPRO 2000 has four ***intrinsically safe*** and four non-intrinsically safe ***interlock*** inputs available for attachment of external ***interlock*** devices to the panel ***alarm channels***. ORS suggests that a maximum of two interlocks be wired to a channel.

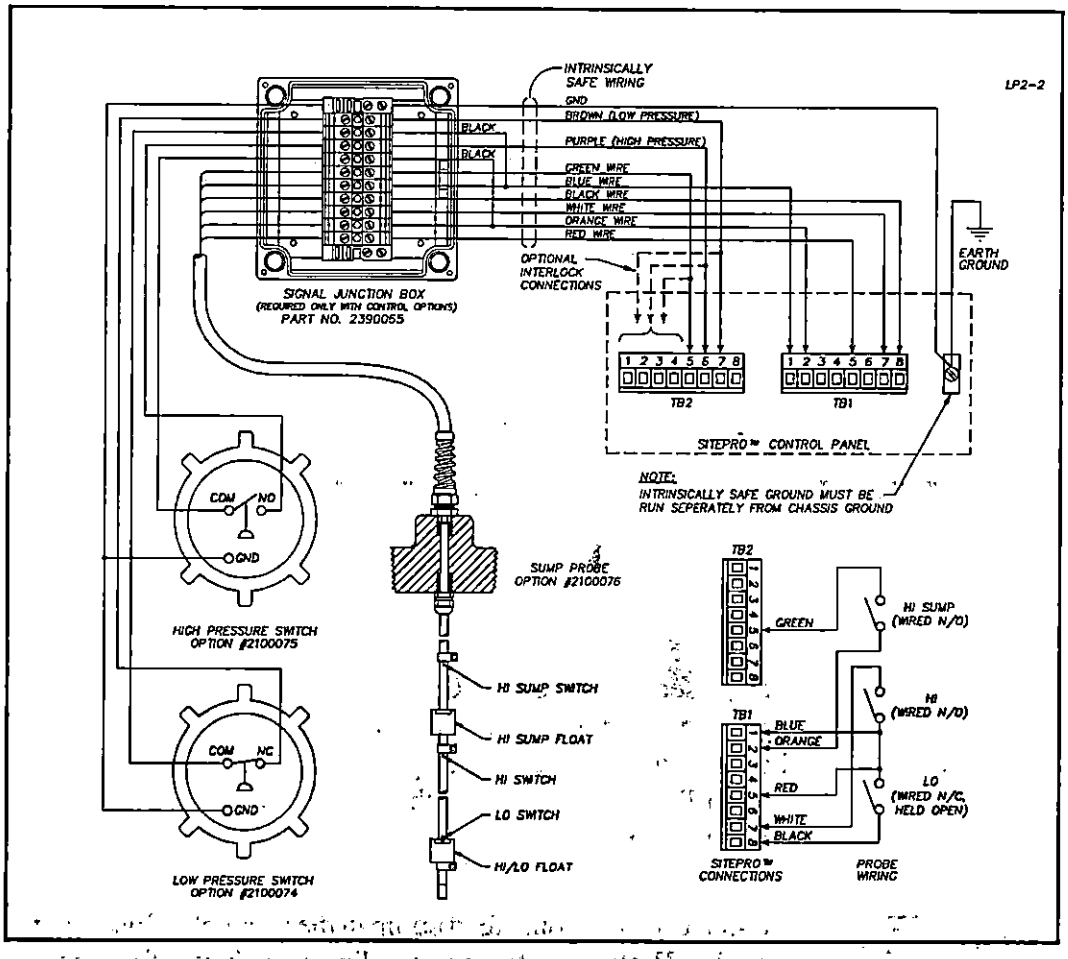


FIGURE 2-3. Wiring the LO-PRO™ sump level probe and pressure switches to a SITEPRO™ 2000 Blower/Pump Control Panel.

Never wire both a ***Normally Open*** and a ***Normally Closed interlock*** device to the same channel. Doing so could cause the panel to either lock in alarm or be unable to read an alarm.

Wire each ***interlock*** device to the SITEPRO panel as follows:

1. Run the ***intrinsically safe interlock*** wires through the access port on the side of the SITEPRO enclosure. Run non-intrinsically safe ***interlock*** wires through the port at the bottom of the enclosure. Use 20-25 AWG wire in all cases.

2. For ***intrinsically safe interlocks***, attach one wire to terminal 1, 2, 3 or 4 of TB2 and the other to one of the +5VDC ***intrinsically safe*** terminals on TB1. For non-intrinsically safe ***interlocks***, attach one wire to terminal 1, 2, 3 or 4 of TB3 and the other to one of the COMMON terminals on TB3.

Refer to Figure 2-4 (below) for an example of ***interlock*** wiring.

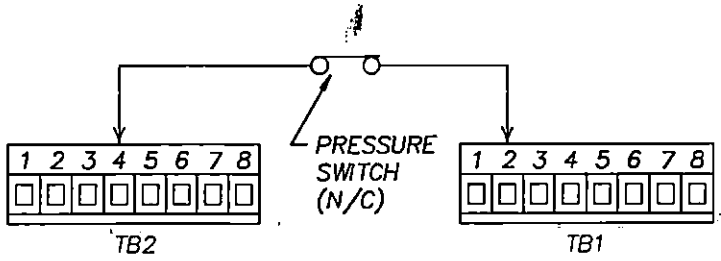


FIGURE 2-4. An ***intrinsically safe Normally Closed*** pressure switch wired to Alarm Channel 4.

In this example, a ***Normally Closed*** pressure switch is wired to ***intrinsically safe*** terminal strips TB1 and TB2. Because the switch is wired to terminal 4 on TB2, an alarm will be generated on Channel 4 when the switch opens. The second wire from the switch could be attached to any of the +5VDC ***intrinsically safe*** terminals on TB1.

As your interlocks are installed, keep track of which ones are wired ***Normally Open*** and which are ***Normally Closed***. This information will be required for completion of the system configuration procedures described in Chapter 3.

Wire Network Connections

To wire two or more SITEPRO panels together into a ***network***, use a high quality shielded twisted pair cable and wire as shown below. Wire the conductors from terminals 10 & 11 of TB4 on one panel to the same terminals on the next. On all but the last panel in the network, connect the sheild to terminal 12 on TB4. Do not splice shield segments together.

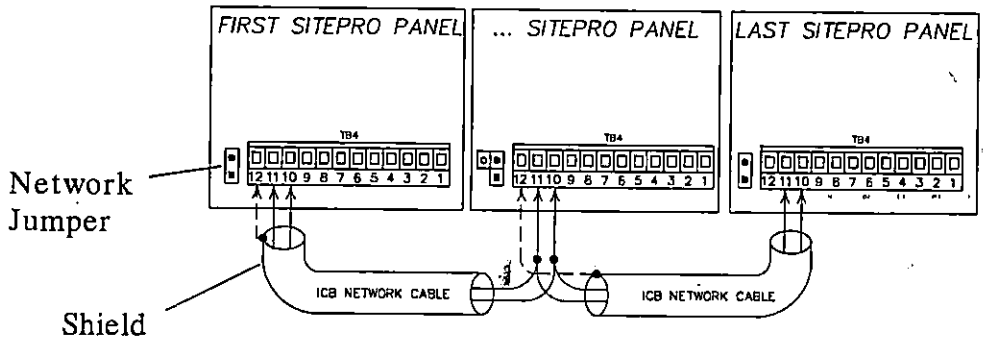


FIGURE 2-5. Three SITEPRO™ 2000 panels wired together into a ***network***.

Always wire number to number (color to color) when establishing ***network*** connections between panels. The maximum ***network*** wire run cannot exceed 3000' (1000M).

After the ***network*** wiring connections have been made, the start and termination of the ***network*** must be designated by installing jumpers on the first and last panel in the ***network***. Each SITEPRO panel is equipped with a 2-pin jumper located next to TB4 (See Figure 2-5, above). On the first and last panel in the ***network***, lift the jumper cap from the pins and reinstall it so that both pins fit into the cap.

Wire Dry Contact Outputs

The SITEPRO 2000 features ***Normally Open*** and ***Normally Closed*** 100 mA ***dry contact*** outputs that can be used to trigger a wide variety of external devices including relays, visual

indicators, buzzers, and security system alarms. Two sets of ***Form C dry contact*** outputs are provided on TB6. The example in Figure 2-6 (below) shows a security system alarm panel wired in a ***Normally Closed*** configuration to TB6 of the SITEPRO. The ***Form C*** outputs are shown schematically (dashed box).

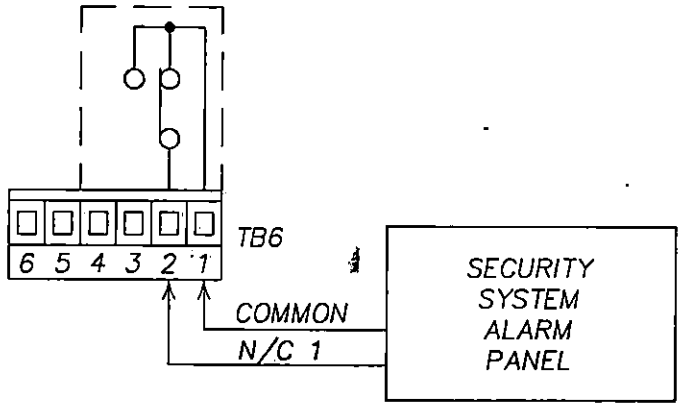


FIGURE 2-6. Using the SITEPRO™ 2000 ***dry contact*** outputs to switch an external security alarm.

Wire Analog Inputs

Analog input devices (pressure transducers, thermocouples, etc.) can be interfaced with the telemonitor equipped SITEPRO 2000 if they are wired into the ***analog*** input connections on TB3 (See Figure 2-1, p. 2-3). Figure 2-7 (p. 2-12) shows how a pressure transducer might be wired to the SITEPRO. Note that the transducer's power supply must be provided by the customer or purchases from ORS.

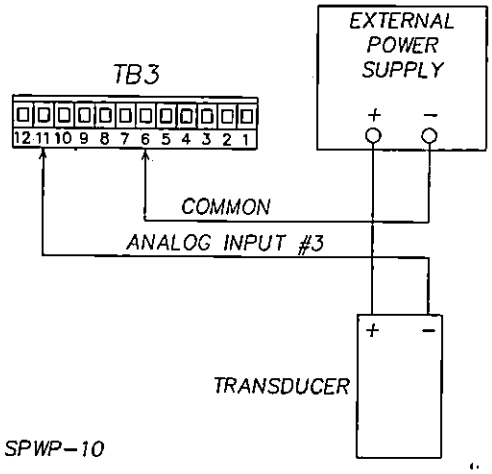


FIGURE 2-7. Wiring a pressure transducer or other analog input device to the SITEPRO™ 2000 analog input connections.

Wire Totalizer

Terminals 8 & 9 on TB4 are available for wiring a totalizer to a SITEPRO that is equipped with the telemonitoring option. Totalizers must supply a 5-24VDC pulse to the control panel. The pulse should be generated by a solid state device (i.e. an open collector output). The pulse should be 1 msec wide minimum. The maximum rate of pulses accepted by the panel is 120 pulses/gallon at 20 gpm. This corresponds to 40Hz.

Connect Modem

If your SITEPRO 2000 is equipped with the telemonitoring option, plug your phone jack into the receptacle on the panel modem. Refer to Figure 2-1 (p. 2-3) for location of modem connections.

In lightning prone areas, have your electrician install a phone line lightning arrestor. Contact your telephone company for further information.

Wire Current Sensors

To provide current sensing for 3-phase blowers or pumps, install the current sensors included with the control panel. Each sensor must be installed around one leg of the blower

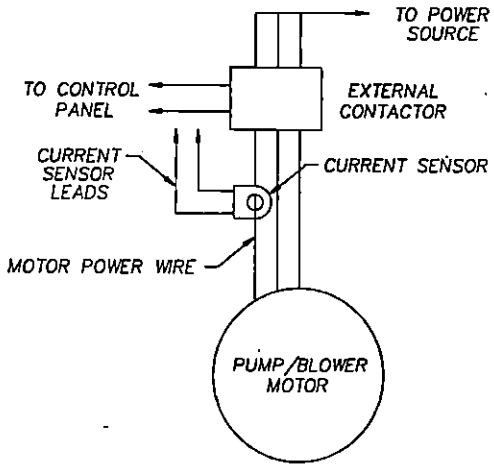


FIGURE 2-8. Detail of current sensor installation for 3-phase moter.

or pump motor power wiring as shown in Figure 2-8, p. 2-13. Then run the sensor leads into the SITEPRO control panel and wire to the terminal block provided. Secure the current sensor with a nylon tie wrap.

A sensor for single phase pumps is already mounted inside the control panel. When wiring the pump to the panel, run one leg of the pump power wiring through the current sensor as shown in the Field Wiring Diagram.

These current sensors will shut down the pump or blower motor in the event that insufficient current is sensed. The panel indication will be a flashing PUMP RUNNING or BLOWER RUNNING indicator.

Wire Thermal Overloads

Additional thermal overload protection for your blower can be obtained by wiring from the ***Normally Closed*** thermal overload contacts of your blower external motor starter to the SITEPRO panel. Wire to input terminals 5 and 7 on TB3 after removing the existing jumper.

When a blower thermal overload is sensed (blower thermal overload contacts open), the blower will shut down and the THERMAL OVERLOAD indicator on the panel will be illuminated.

Set Blower Time Delay

As delivered from the factory, the panel is wired to shut down the blower immediatedly after a Low Pressure condition is detected and 3 minutes after a High Pressure condition is detected. The High Pressure time delay can be reduced to 1 second by installing a jumper between term inals TB4-5 and TB4-7.

CHAPTER 3: SYSTEM CONFIGURATION

Chapter Summary
This chapter contains the following information on system configuration:

- ***Introduction*** *- Explains how to use the Site and Panel Configuration sheets provided in Appendix A and in the Quick Start envelope.*
- ***Configuration Switches*** *- Describes each of the switches used to configure the SITEPRO™ 2000.*
- ***Configuration Procedures*** *- Explains how to set the configuration switches for single panel or network applications.*

INTRODUCTION

The SITEPRO™2000 has a wide range of capabilities and can be configured on site to match your specific remediation requirements. As you will see as you work through this chapter, the panel configuration procedure is quite straightforward and simple. However, before configuring panels that are part of a complex multi-panel ***network***, it will be necessary to carry out a certain amount of planning and site organization.

Site Configuration Worksheet

To aid you in the design and configuration of multi-panel networks, ORS provides a Site Configuration Worksheet (See Quick Start envelope). This sheet allows the user to specify ***network addresses***, ***interlock*** hookups and ***network*** connections for up to 16 SITEPRO 2000 control panels.

Panel Configuration Guide

Once the Site Configuration Worksheet has been filled out, use the Panel Configuration Guide (also in Quick Start envelope), and the procedures in this chapter, to help you configure the individual panels in the network.

CONFIGURATION

Panel Configuration Sheet

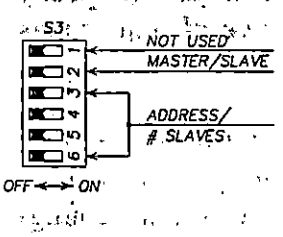
During the panel configuration procedures described in this chapter, you will be changing the settings of some of the dip switches shown in Figure 3-1 (p. 3-3). ORS recommends that you carefully document the final configuration of each of your SITEPRO 2000 panels by using the blank Panel Configuration Sheet provided in Appendix A at the back of this manual. Once filled out, this sheet will be a permanent record of your configuration and can be used as a check against inadvertent or unauthorized configuration changes. Be sure to update this sheet whenever configuration changes are made. An up to date Panel Configuration Sheet is an essential troubleshooting tool and must be available for reference whenever you call ORS for technical assistance.

CONFIGURATION SWITCHES

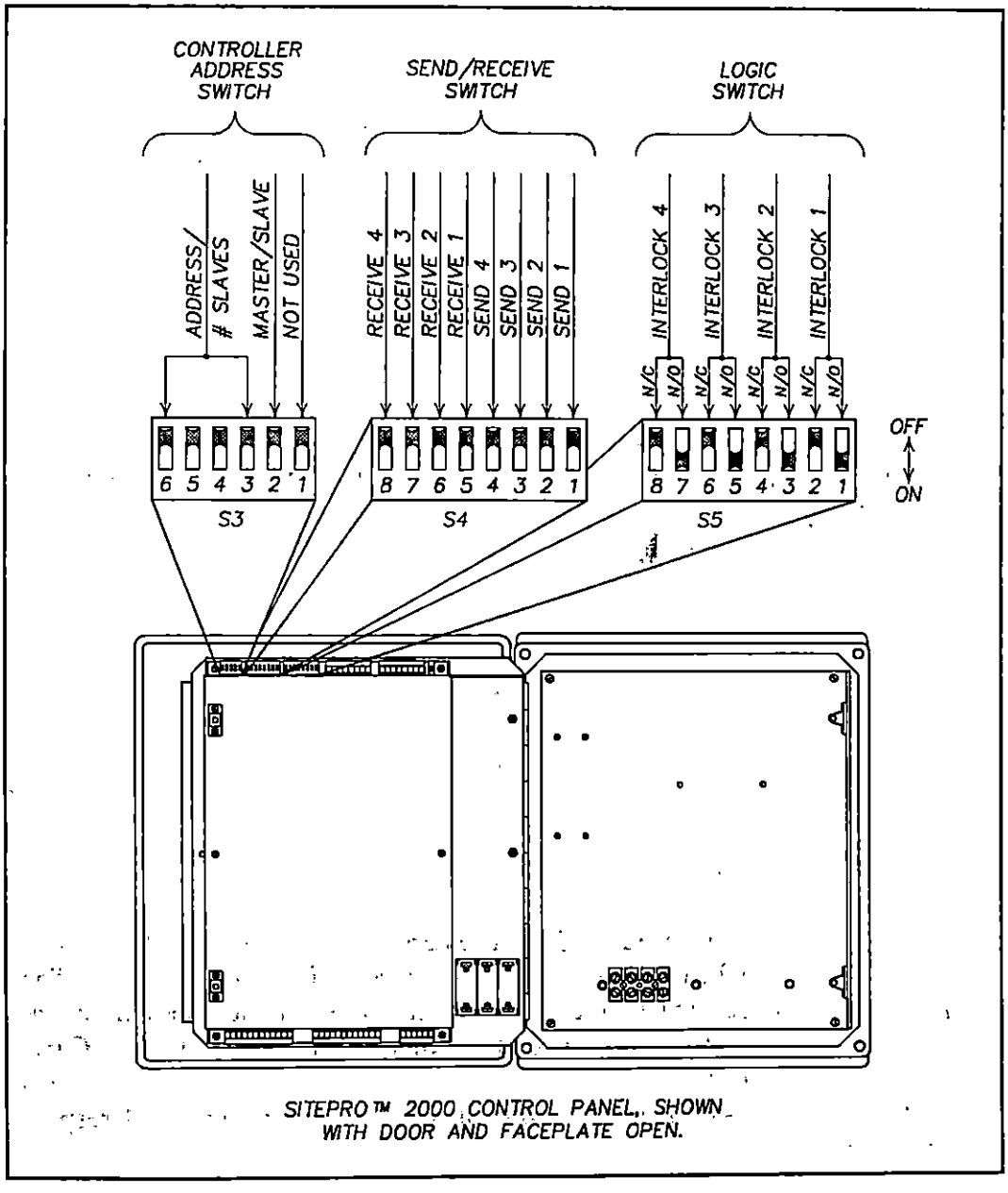
The configuration process is a simple matter of setting the CONTROLLER ADDRESS, LOGIC and SEND/RECEIVE dip switches mounted on the back side of the panel faceplate. See Figure 3-1 (p. 3-3) for switch locations.

CONTROLLER ADDRESS Switches

Function:



The CONTROLLER ADDRESS switches (mounted on switch S3) are used to 1) configure the panel as either a Master or a Slave, and 2) provide a ***network address*** for each panel in the ***network***. The six individual dip switches are labeled 1-6. Switch 2 is used to configure the panel as a Master (switch set to ON) or as a Slave (switch left in OFF position). Dip switches 3-6 are used to set the ***network address*** of each Slave panel or, if the panel is a Master, to indicate the total number of Slave panels in the network. Switch 1 is not used.



SITEPRO™ 2000 CONTROL PANEL, SHOWN WITH DOOR AND FACEPLATE OPEN.

FIGURE 3-1. Locations of configuration switches inside the SITEPRO™ 2000 control panel enclosure.

CHAPTER 3: SYSTEM CONFIGURATION

simultaneous broadcast of multiple alarms. This is done by designating one panel as ***network*** Master and by assigning a unique ***network address*** to each of the remaining Slave panels. The Master then polls the Slaves in a set sequence determined by the numerical order of the ***network addresses*** and allows each Slave to broadcast any alarms it has received from external ***interlock*** devices.

Configure the CONTROLLER ADDRESS switches according to the flowchart in Figure 3-5 (below).

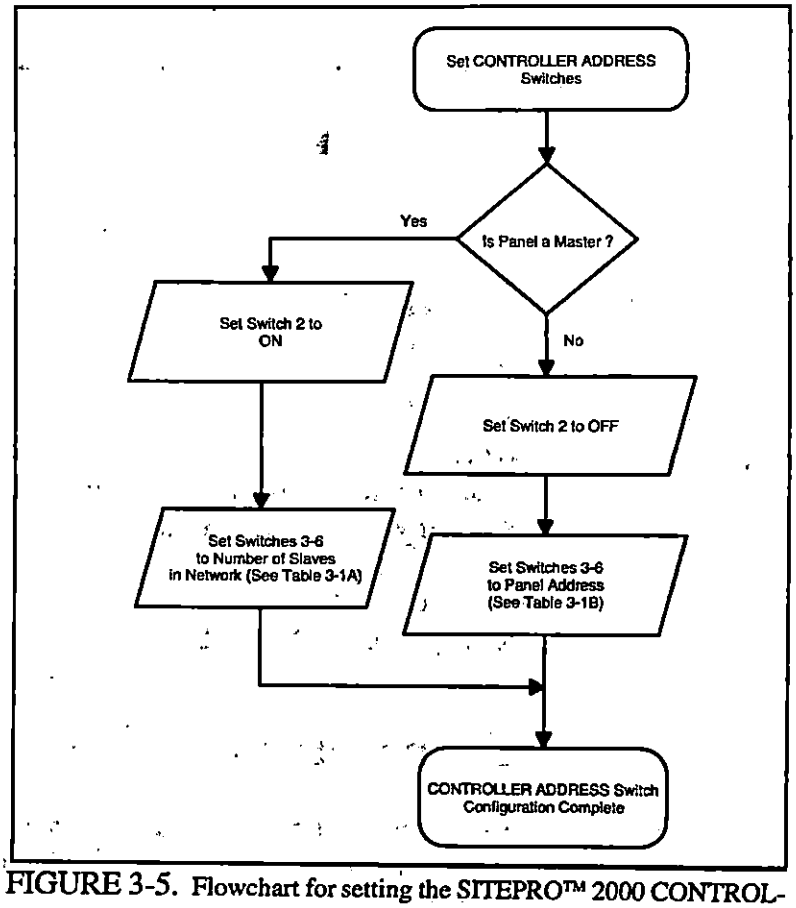
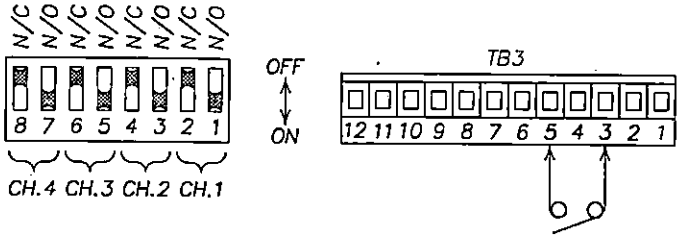


FIGURE 3-5. Flowchart for setting the SITEPRO™ 2000 CONTROLLER ADDRESS Switches.

(dip switches 5 & 6) and set the N/O switch (dip switch 5) to the ON position as shown below. Turn the N/C switch (dip switch 6) OFF.



If possible, wire external ***interlock*** devices ***Normally Closed*** so that they open on alarm.. Such circuits are fail safe in that an alarm will be generated if a wire is broken.

When configuring the LOGIC switch for a channel, never set both the *Normally Open* and *Normally Closed* switches to the ON or OFF position. Doing this could cause the panel either to lock in alarm or be unable to read an alarm.

Network Applications

When multiple pumps or blowers are used together at a remediation site, it is often desirable to tie the control panels together into a coordinated ***network***. The SITEPRO embedded software will support networks of up to 16 control panels.

Configure the SITEPRO 2000 for ***network*** operation by setting the CONTROLLER ADDRESS, LOGIC and SEND/RECEIVE switches.

Set CONTROLLER ADDRESS Switches

An important step in configuring a SITEPRO 2000 ***network*** is to organize the flow of information on the ***Interlink Communication Bus*** to prevent lost signals resulting from the

simultaneous broadcast of multiple alarms. This is done by designating one panel as ***network*** Master and by assigning a unique ***network address*** to each of the remaining Slave panels. The Master then polls the Slaves in a set sequence determined by the numerical order of the ***network addresses*** and allows each Slave to broadcast any alarms it has received from external ***interlock*** devices.

Configure the CONTROLLER ADDRESS switches according to the flowchart in Figure 3-5 (below).

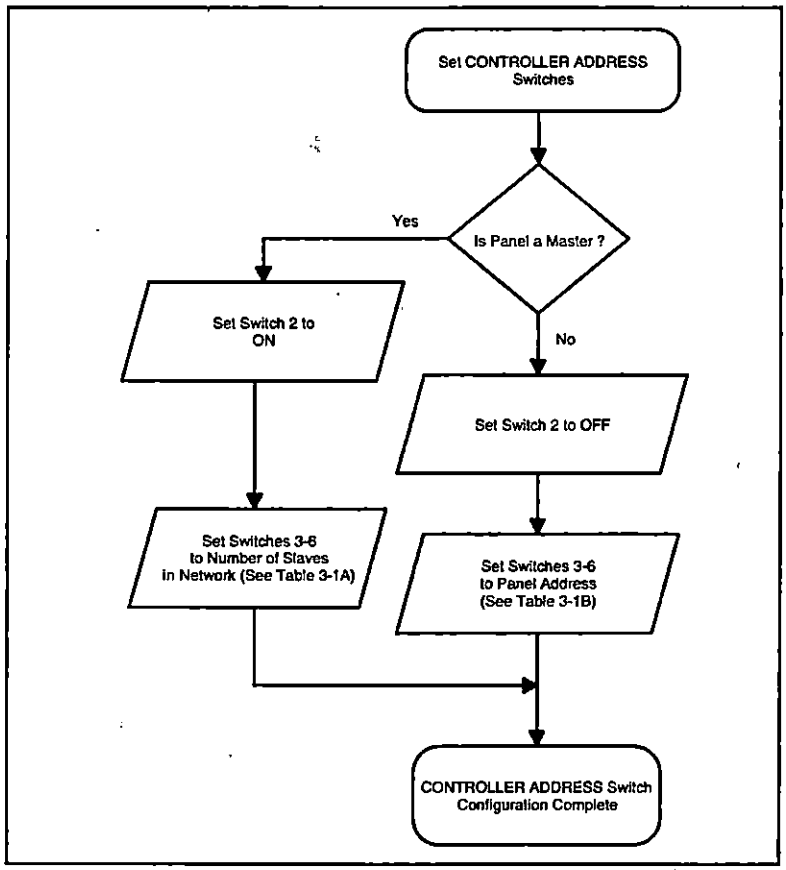


FIGURE 3-5. Flowchart for setting the SITEPRO™ 2000 CONTROLLER ADDRESS Switches.

The settings of dip switches 3-6 are determined by using the tables below. Use Table 3-1A for Master panels and Table 3-1B for Slave panels.

If the panel is to be configured as a Master, set dip switch 2 to ON and set dip switches 3-6 to indicate the total number of Slaves in the ***network*** (maximum of 15). Table 3-1A provides dip switch settings for each of the possible numbers of Slaves in the ***network***.

If the panel is to be configured as a Slave, set dip switch 2 to OFF and set dip switches 3-6 to indicate the ***address*** of the panel on the ***network***. Use Table 3-1B to determine the settings of dip switches 3-6 on Slave panels.

MASTER PANELS

NUMBER OF SLAVE PANELS IN NETWORK	SETTINGS FOR DIP SWITCHES 3–6			
	6	5	4	3
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

A.

SLAVE PANELS

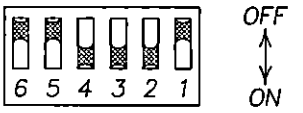
SLAVE NETWORK ADDRESS	SETTINGS FOR DIP SWITCHES 3–6			
	6	5	4	3
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

B.

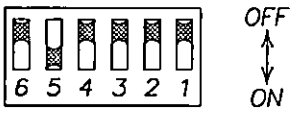
TABLE 3-1. Dip switch settings for CONTROLLER ADDRESS dip switches 3-6 in Master (A) and Slave (B) panels.

Start at the lowest ***address*** (1) and work up (top to bottom in Table 3-1B) with each Slave panel configured.

In Example #1 (below), the CONTROLLER ADDRESS switch settings indicate that the panel is a Master and that there are 12 Slave panels in the ***network***.



In Example #2 (below), the switch settings indicate that the panel is a Slave and that it has been allocated the ***network address*** of 2.



Set LOGIC Switches

Configure the LOGIC dip switches exactly as you would for single panel systems. For each external ***interlock*** device wired to the SITEPRO panel, the corresponding LOGIC switches must be set for either ***Normally Open*** or ***Normally Closed*** status.

As mentioned in the section on single panel configuration, wire external ***interlock*** devices ***Normally Closed*** so that they open on alarm. Such circuits are fail safe in that an alarm will be generated if a wire is accidentally broken.

Set RECEIVE Switches

In multi-panel ***networks***, the procedure for setting the RECEIVE dip switches is exactly the same as that used for single panel applications. However, it should be emphasized that in ***network*** applications, alarms can be generated either by local external ***interlock*** devices wired directly to the panel or by alarms broadcast by other panels on the ***Interlock Communication Bus***. For example, if the Channel 1 dip switch (dip switch 5) is set to ON, the panel will be shut down if, 1) a local ***interlock*** device wired to Channel 1 generates an alarm, or 2) one of the other panels in the ***network*** broadcasts an alarm on Channel 1. Therefore, the question that must be asked when setting a panel's RECEIVE dip switches is, "Under what conditions do I want this panel to shut down?" Refer to your Site Configuration Worksheet and set the RECEIVE dip switches according to the flowchart in Figure 3-3 (p. 3-8).

Set SEND Switches

The settings of the SEND switches determine which panels in the ***network*** can be shut down by alarms present on the ***alarm channels*** of the panel being configured. These four dip switches are labeled 1-4 to correspond with the four ***alarm channels***. Refer to your Network Configuration Sheet and set the SEND dip switches according to the flowchart in Figure 3-6 (p. 3-16).

When a SEND dip switch is set to the ON position, any alarm on that channel will be broadcast on the ***Interlock Communication Bus***. However, only those panels on the ***network*** whose RECEIVE switches are configured to "listen" to that channel will react to the alarm.

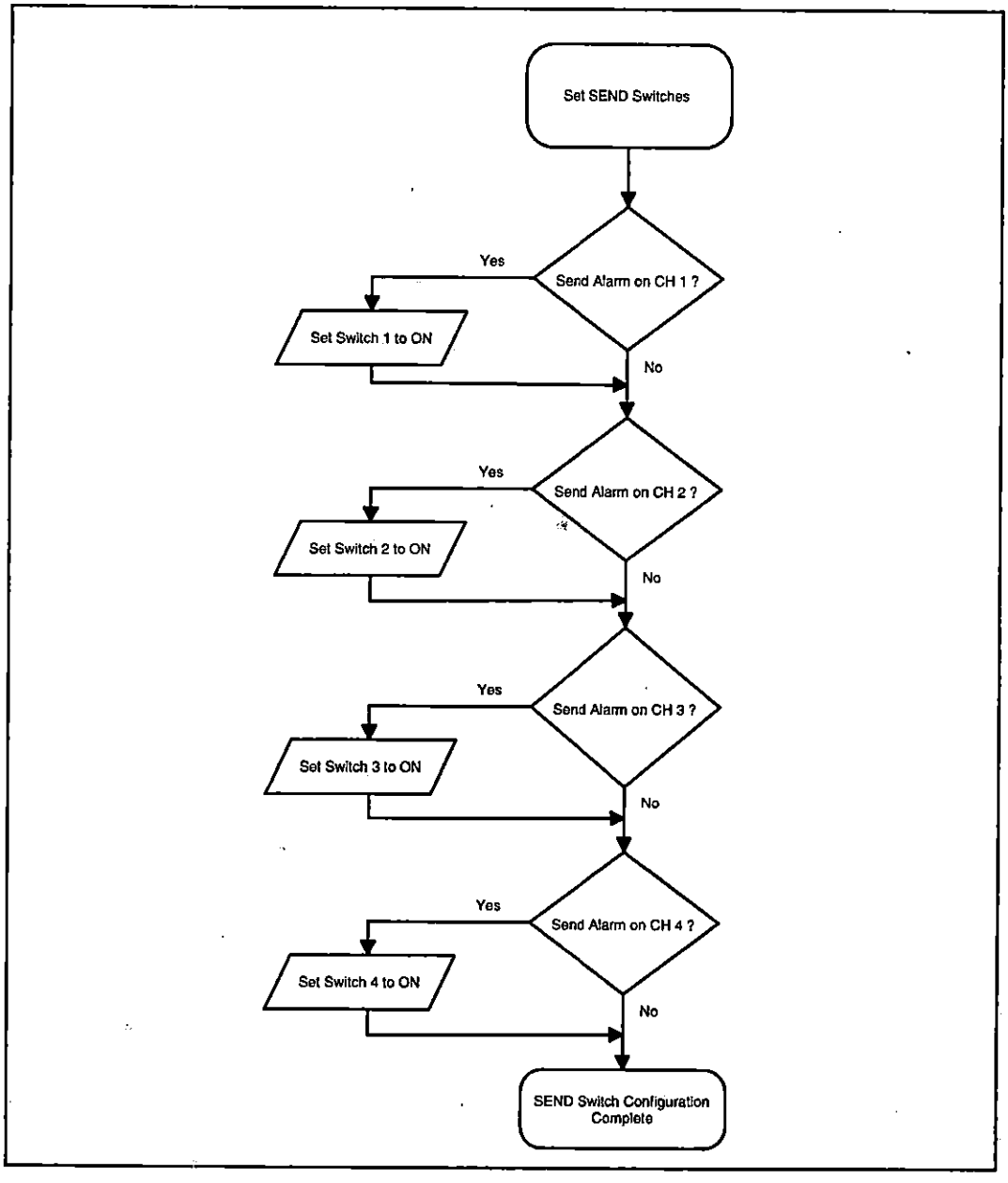


FIGURE 3-6. Flowchart for setting the SITEPRO™ 2000 SEND Switches.

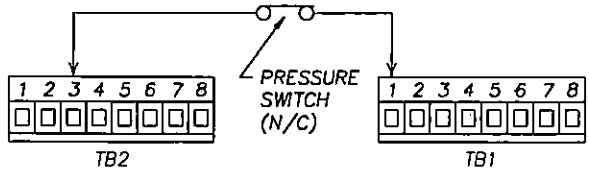
Network Configuration Example

The following example describes a simple SITEPRO ***network*** and shows how the CONTROLLER ADDRESS, LOGIC and SEND/RECEIVE switches are configured to achieve the desired system behavior.

This example refers to the simple two panel ***network*** shown in Figure 1-6 (p. 1-13 in Chapter 1). In the example, a water pump controlled by a SITEPRO 2000 Water Table Depression Pump Control Panel delivers contaminated water to a LO-PRO air stripper. After passing through the air stripper, the water is delivered by a transfer pump to a carbon tank. The air stripper blower and the transfer pump are controlled by a SITEPRO Blower/Pump Control Panel. A high pressure shut-off switch is mounted in the tank and wired to Panel #1 (the Master). This panel is then linked to Panel #2 (the Slave) so that a high pressure condition can shut off both panels.

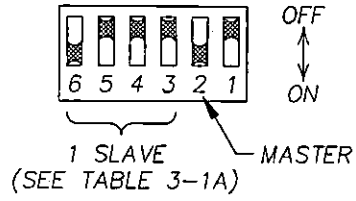
Interlock & Network Wiring

The high pressure switch is wired to ***intrinsically safe interlock*** input 3 on TB2 and to terminal 2 on TB1 of Panel #1 as shown below. The ***network*** connection is made between terminals 10, 11 & 12 on TB4 of Panel #1 to the corresponding terminals on Panel #2.

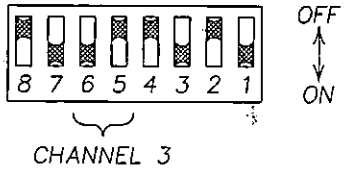


Panel #1 Configuration

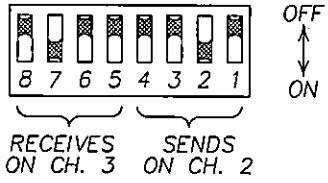
CONTROLLER ADDRESS Switch:



LOGIC Switch:

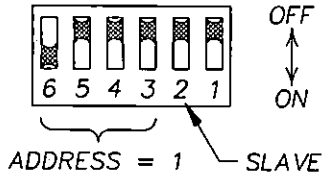


SEND/RECEIVE Switch:

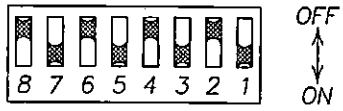


Panel #2 Configuration

CONTROLLER ADDRESS Switch

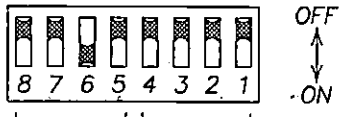


LOGIC Switch:



NO INTERLOCKS
ON PANEL 2

SEND/RECEIVE Switch:



RECEIVES ON CH. 2 | DOES NOT SEND

System Operation Sequence

1. The ***Normally Closed*** high pressure switch wired to Channel 3 of Panel #1 opens.

2. Because Panel #1 is configured to receive on Channel 3, Panel #1 shuts off.

3. Because Panel #1 is configured to send on Channel 2, an alarm is broadcast on Channel 2 of the ICB.

4. Because Panel #2 is configured to receive on Channel 2, Panel #2 shuts off.

As demonstrated above, an individual SITEPRO panel is easy to configure. Although the example used in this chapter referred to a very simple SITEPRO 2000 ***network***, the switch setting procedures described are exactly those used to configure more complex ***networks***.

Remember To Document Your Configuration

Whenever you configure a SITEPRO 2000 panel, always record the switch settings on the Panel Configuration Sheet provided in Appendix A at the back of this manual. Good housekeeping habits are especially critical when you are configuring a complicated multi-panel ***network***.

CHAPTER 4: SYSTEM OPERATION

Chapter Summary
This chapter contains the following information on SITEPRO™ 2000 operation:

- ***Controls & Indicators*** *- Description of panel controls and indicators.*
- ***System Precheck*** *- Panel and probe checkout procedures.*
- ***Startup*** *- Startup procedures for single and networked panels.*
- ***Operation*** *- Tracing and clearing alarms.*

As is explained in Chapter 1 of this manual (see Figure 1-3, p. 1-8), the SITEPRO 2000 can be operated in any one of the following three user interface modes:

1. Manual Operation Mode

2. Local Communication Mode

3. Remote Communication Mode

This chapter provides all the information required to manually operate the SITEPRO 2000 Blower/Pump Controller in either single panel or ***network*** environments. If your system includes the optional telemonitoring features, refer to the SITEPRO Manager software manual for information on operating in the Local Communication or Remote Communication modes.

PANEL CONTROLS & INDICATORS

The following sections describe the functions of all the controls and indicators used by the SITEPRO 2000. Refer to Figure 4-1 (p. 4-2) for locations of controls and indicators on the panel faceplate.

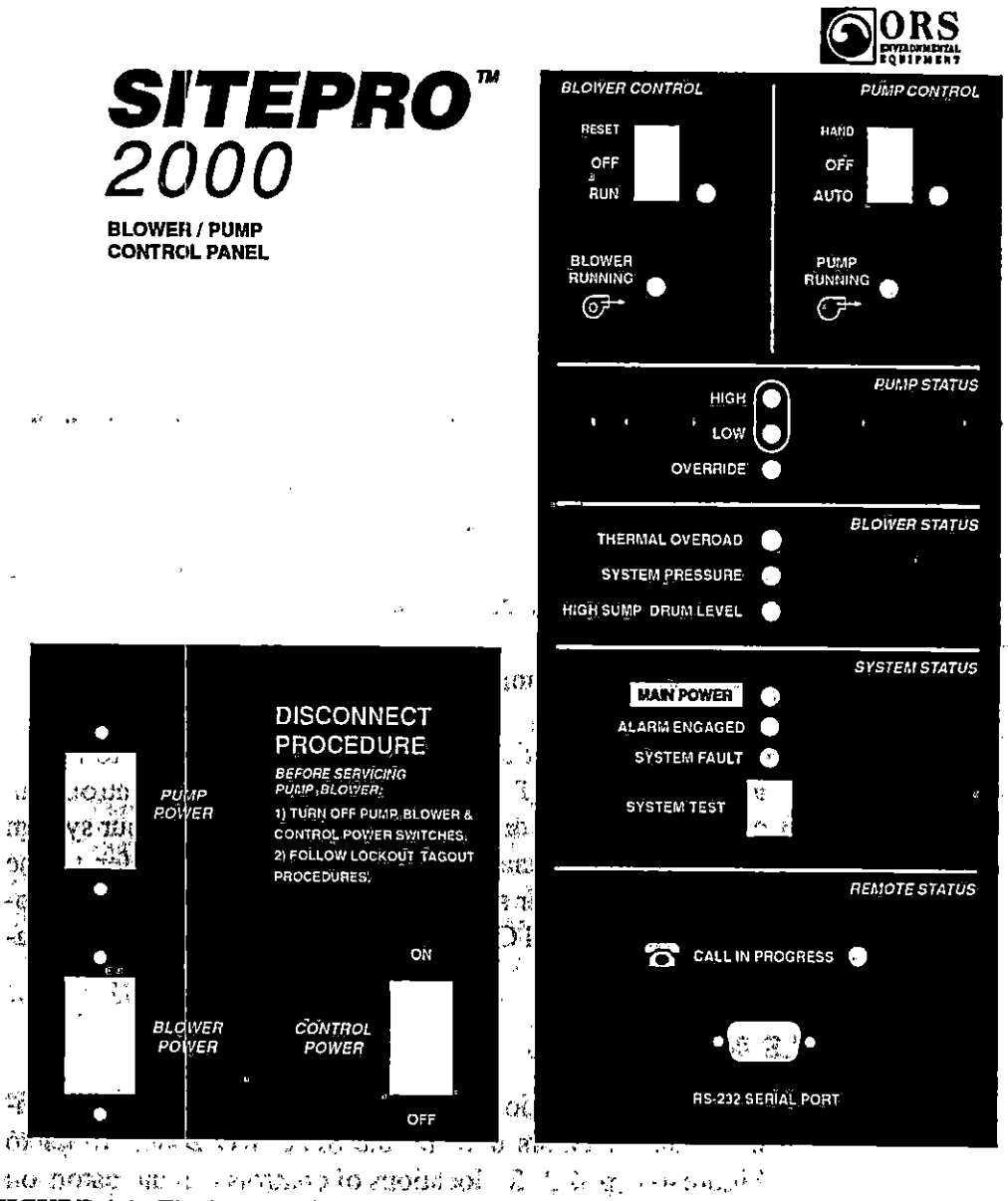


FIGURE 4-1. The SITEPRO™ 2000 Blower/Pump Control Panel faceplate showing controls and indicators.

Because the SITEPRO 2000 Blower/Pump Control Panel combines the functions of two panels in one, the descriptions of controls and indicators presented below are organized into separate Pump and Blower sections. Controls and indicators associated with general panel functions (System Test, etc.) are described in a separate section under the heading General Panel Functions.

GENERAL PANEL FUNCTIONS

CONTROL POWER Switch

The CONTROL POWER switch controls distribution of power to the panel's ***microprocessor***. When this switch is in the OFF position, no power can reach the system control circuitry, switches or indicators.

SYSTEM TEST Button

Single Panel Applications

In single panel applications, the SYSTEM TEST button activates the SITEPRO 2000 self-test routine. Self-test is automatically activated each time the panel is powered up or is manually activated whenever the SYSTEM TEST button is pushed. Self-test consists of the following checks.

- Check all indicators. (SYSTEM FAULT indicator blinks if problem found).
- Perform ***RAM*** test. (Checks all memory locations for proper function; SYSTEM FAULT indicator blinks if problem found).
- Perform ***ROM*** test. (Checks program memory; SYSTEM FAULT indicator blinks if problem found).

- Perform *A/D* test. (Checks *A/D* converter; SYSTEM FAULT indicator blinks if problem found).

- Performs Clock test. (Checks accuracy of system clock; SYSTEM FAULT indicator blinks if problem found).

- Perform Purge test. (Checks panel purge pressure in purged panels; SYSTEM FAULT indicator blinks five times if pressure low).

Network Applications

When your SITEPRO panel is part of a ***network***, the SYSTEM TEST button provides an additional ***alarm*** diagnostic feature. The first time the button is pressed, the ALARM ENGAGED indicator blinks the ***alarm channels*** of all the ***alarms*** present on the ***Interlock Communication Bus*** in the order in which they occurred. When the button is pressed again, the self-test routine is run as described on p. 4-3.

SYSTEM STATUS Indicators

The SYSTEM STATUS indicators provide information on the ***Interlock Communication Bus*** (ICB), aid in the diagnosis of system errors and display the power status of the panel. Indicator functions are described below:

MAIN POWER

When illuminated, power is reaching the system ***microprocessor.*** When blinking, the panel is waiting to get on the ICB.

ALARM ENGAGED

This indicator provides information on the status of the panel's ***alarm channels.*** During routine panel operation

(SYSTEM TEST button not pressed), the indicator can be in any one of three states;

- **Off** - No alarms are being received by the panel either from local ***interlock*** devices or from the ***Interlock Communication Bus***.

- **Steadily Illuminated** - The panel has been shut down by an alarm broadcast on the ***Interlock Communication Bus***.

- **Blinking** - The panel has received an ***alarm*** from an ***interlock*** connected directly to the panel. The panel may or may not be shut down depending upon the setting of its RECEIVE switch. The indicator will fast blink after a manual RESET until all alarms are cleared.

In ***network*** applications, the ALARM ENGAGED indicator can be used to detect and trace ***alarms*** on the ***Interlock Communication Bus***. If the SYSTEM TEST button is pressed once, the ALARM ENGAGED indicator will blink to indicate which ***alarm channels*** have been activated. The ***alarm channel*** codes (one blink = channel 1, etc.) will be displayed in the order in which they originally occurred. For example, if a tank high level ***alarm*** on Channel 1 shut down a pump that caused a subsequent high level ***alarm*** on Channel 2, the ALARM ENGAGED indicator would blink once, pause, and then blink twice. This sequence will be repeated three times.

If no alarms are present on the ***Interlock Communication Bus***, the panel will go into its self-test routine when the SYSTEM TEST button is pushed.

SYSTEM FAULT

When flashing, the panel self-test procedure has detected an error. Refer to "PROBLEM SOLVING" (Chapter 6) for error code interpretation.

REMOTE STATUS Indicators

This section of the panel faceplate is dedicated to functions related to the telemonitoring option.

CALL IN PROGRESS

This indicator is steadily illuminated whenever the modem is in use for either an incoming or outgoing call. Do not use the *RS-232* Serial Port while the CALL IN PROGRESS indicator is illuminated. Doing so will terminate any ongoing call. When blinking, the CALL IN PROGRESS indicator alerts the user to a fault in the telemonitoring electronics. Call ORS for assistance.

PUMP CONTROL FUNCTIONS

PUMP POWER Switch

The PUMP POWER switch operates the circuit breaker for the pump. When this switch is turned to the ON position, power is applied to the pump whenever the control relay is closed. When the PUMP POWER switch is turned to the OFF position, power cannot be applied to the pump regardless of the settings of any other panel controls.

Before working on the pump, the operator must (1) turn the PUMP POWER switch to OFF (2) turn the CONTROL POWER switch to OFF and (3) secure the panel door according to standard lockout/tagout procedures.

PUMP CONTROL Switch

This is a three position switch with HAND, OFF and AUTO positions.

HAND

In the HAND position, the PUMP CONTROL switch overrides sensor input and applies power directly to the pump.

AUTO

In the AUTO position, ON/OFF switching of the pump is controlled by sensor input. The pump starts when the probe's HI/LO float is in the HI position. The pump will continue to run until the float falls to the LO position. If a probe fault prevents the pump from shutting off, the OVERRIDE float (if used) drops and de-energizes the control relay.

OFF

In the OFF position, the pump will not run and the PROBE STATUS indicators are nonfunctional.

PUMP CONTROL Indicators

These indicators monitor the setting of the PUMP CONTROL switch and provide information on the status of the pump.

AUTO

The yellow AUTO indicator is illuminated whenever the PUMP CONTROL switch is in the AUTO position. If the PUMP CONTROL switch fails, the AUTO indicator will blink.

WATER PUMP RUNNING

When steadily illuminated, the pump is running. When blinking, the pump motor has been shut down by a thermal overload or a tripped circuit breaker.

PUMP STATUS Indicators

These three indicators allow the user to monitor the status of the downwell probe (feed pump applications) or sump/drum probe (transfer pump applications). These indicators are not functional if either the PUMP CONTROL or CONTROL POWER switch is in the OFF position. Indicator functions are described below:

HIGH

When illuminated, the HI/LO float is at the top of its travel or is on its way down. The pump should be running.

LOW

When illuminated, the HI/LO float is at the bottom of its travel or is moving up. The pump should be off.

OVERRIDE

When steadily illuminated, the OVERRIDE float has dropped and shut off the pump. Reset the panel by turning the PUMP STATUS switch to OFF and then back to AUTO.

If the PUMP STATUS switch is in either the HAND or AUTO position, the AUTO, PUMP RUNNING and PUMP STATUS indicators are functional even if the PUMP POWER switch is in the OFF position. This feature facilitates probe placement during system deployment.

BLOWER CONTROL FUNCTIONS

BLOWER POWER Switch

The BLOWER POWER switch operates the circuit breaker for the blower. When this switch is turned to the ON position, power is applied to the blower whenever the control relay is closed. When the BLOWER POWER switch is turned to the OFF position, power cannot be applied to the blower regardless of the settings of any other panel controls.

Before working on the blower, the operator must (1) turn the BLOWER POWER switch to OFF (2) turn the CONTROL POWER switch to OFF and (3) secure the panel door according to standard lockout/tagout procedures.

BLOWER CONTROL Switch

This is a three position switch with RESET, OFF and RUN positions.

RUN

In the RUN position, the blower runs continuously but can be shut off by a SYSTEM PRESSURE (High or Low) condition or by a THERMAL OVERLOAD. HIGH SUMP/DRUM LEVEL is monitored and can be used to shut down the blower if configured as an interlock (see Chapter 3).

OFF

In the OFF position, the blower will not run. HIGH SUMP/DRUM LEVEL is monitored.

RESET

The RESET position is used to reset the panel after a THERMAL OVERLOAD, HIGH SUMP/DRUM LEVEL or SYSTEM PRESSURE condition has occurred.

BLOWER CONTROL Indicators

These indicators monitor the setting of the BLOWER CONTROL switch and provide information on the status of the blower.

RUN

The green RUN indicator is illuminated whenever the BLOWER CONTROL switch is in the RUN position. If the BLOWER CONTROL switch fails, the RUN indicator will blink.

BLOWER RUNNING

When steadily illuminated, the blower is running. When blinking, current sensors in the panel have monitored a current fault (thermal overload or tripped circuit breaker) and have shut down the blower.

BLOWER STATUS Indicators

These three indicators allow the user to monitor the status of the blower and the sump/drum probe. The indicators are not functional if the CONTROL POWER switch is in the OFF position. Indicator functions are described below:

THERMAL OVERLOAD

If the blower motor thermals have been wired directly to the panel as explained in Chapter 2, the THERMAL OVERLOAD indicator will be illuminated in the event the blower shuts down because of a thermal overload. This condition is cleared by turning the BLOWER CONTROL switch to RESET and then back to RUN.

Before restarting the blower, determine and rectify the cause of the thermal overload.

SYSTEM PRESSURE

If either a High or Low Pressure signal is received by the panel, the SYSTEM PRESSURE indicator will be illuminated, the blower will shut down and the feed pump will shut down (if tied to an interlock). If the shutdown was caused by a Low Pressure condition, the indicator will blink and the blower will stop immediately. If the shutdown was caused by a High Pressure condition, the indicator will be steadily illuminated and the blower will stop after a time delay of 3 minutes. **NOTE: if a jumper is installed between terminals TB4-5 and TB4-7, the blower will stop after 1 second.** A second time delay prevents the SYSTEM PRESSURE feature from shutting down the blower during the first 5 seconds of operation. This permits the blower to build normal pressure during startup. The SYSTEM PRESSURE condition is cleared by turning the BLOWER CONTROL switch to RESET and then back to RUN.

HIGH SUMP/DRUM LEVEL

In air stripper/transfer pump applications, this indicator is illuminated if the air stripper sump fills and lifts the OVERRIDE float on the sump level probe. In SVE/knockout drum pump applications, the indicator is illuminated if the knockout drum becomes full and activates the high level switch.

In air stripper/transfer pump applications, neither blower nor transfer pump is shut down by a HIGH SUMP signal. However, both can be shut down if the signal is tied to an interlock.

SYSTEM PRECHECK PROCEDURES

Before starting the system, carry out the following precheck procedures to familiarize yourself with the controls and confirm correct operation.

1. Refer to the wiring diagrams in Chapter 2 and check all wiring connections to the panel.

2. With the PUMP CONTROL and BLOWER CONTROL switches in the OFF position, turn the PUMP POWER, BLOWER POWER and CONTROL POWER switches to ON.

3. Press the SYSTEM TEST button. All the panel indicators should be illuminated briefly as the microprocessor goes through its self-test routine.

If the SYSTEM FAULT indicator comes on after the SYSTEM TEST button has been pushed, the self-test routine has detected a fault in the panel electronics. Document the problem as instructed in Chapter 6, and call ORS for assistance.

4. Briefly turn the PUMP CONTROL switch to HAND. The pump should start and the PUMP RUNNING indicator should be illuminated.

5. Return the PUMP CONTROL switch to OFF and completely submerge the probe in the bucket of water.

6. Turn the PUMP CONTROL switch to AUTO. The pump should start and both PUMP RUNNING and AUTO indicators should be illuminated. The HIGH PUMP STATUS indicator should also be illuminated.

7. Stop the pump by lifting the probe out of the bucket.

8. Once it has been established that the probe will shut off the pump, disconnect the pump by turning the PUMP POWER switch to the OFF position. Since all indicators will continue to function normally as long as the CONTROL POWER switch is ON, disconnecting the

pump will permit further testing of the probe without the risk of damaging the pump by running it dry. Complete the probe precheck procedure as follows:

9. Completely submerge the probe in water. The HIGH probe indicator will be illuminated as will the PUMP RUNNING indicator. Slowly withdraw the probe from the bucket. The PUMP STATUS indicators will follow the water level as it drops on the probe. The PUMP RUNNING indicator will remain illuminated until the HI/LO float drops to the LO sensor. When this happens, the LOW probe indicator will be illuminated and the PUMP RUNNING indicator will turn off.

10. Raise and lower the probe in the bucket so that the HI and LO sensors on the probe alternately switch the PUMP RUNNING indicator on and off. This sequence simulates the normal ON/OFF cycling of the pump as the water level rises and falls in the well.

11. With the PUMP CONTROL switch still in the AUTO position, check the OVERRIDE function as follows. Remove the probe from the bucket. Obtain a thin piece of wire and insert it through the probe shell to hold the OVERRIDE float in the DOWN position. Turn the probe upside down in air. After a time delay of 4-7 seconds, the PUMP RUNNING indicator should go out. Reset the OVERRIDE function by turning the PUMP CONTROL switch to OFF and then back to AUTO.

12. Test the PROBE FAULT feature by disconnecting the TB2 plug from its board connector while the PUMP RUNNING indicator is illuminated. The PUMP RUNNING indicator should go out and the SYSTEM FAULT indicator will blink six times.

Use similar procedures to test the sump level probe or knock-out drum high level switch.

Once precheck procedures have been completed, the SITEPRO 2000 control panel is ready for operation.

If your panel is running a feed pump, the pump intake should be positioned at least 5' (1.5 m) below the level of drawdown. This will minimize intake of contaminated water. To prevent false OVERRIDE signals, suspend the probe at least 3' (1 m) above the pump intake.

SINGLE PANEL STARTUP

1. With the PUMP and BLOWER CONTROL switches in the OFF position, turn on the PUMP POWER, BLOWER POWER and CONTROL POWER switches.

2. After the panel has gone through its self-test procedure, turn the BLOWER CONTROL switch to RUN. The blower should start.

3. Once the blower is running, turn the PUMP CONTROL switch to AUTO. The pump will cycle on and off as the water level rises and falls in the well, sump or knockout drum.

Downwell feed pumps should be purged if free hydrocarbon is present in the well. To do this, place the output hose in a suitable container and run the pump on HAND until the water runs clear. Dispose of hydrocarbon according to local codes.

4. With the pump running on AUTO, reduce the rate of cycling to a minimum by adjusting the pumping rate.

Refer to the specifications provided with your pump and confirm that the volume of water passing through it is sufficient for adequate cooling.

NETWORK STARTUP

1. On each Slave panel in the ***network***, turn the PUMP and BLOWER CONTROL and POWER switches to OFF while turning the CONTROL POWER switch to ON. Each Slave will then go through its own self-test routine and will begin blinking its MAIN POWER indicator.

2. Make the same switch settings on the Master panel. After going through its self-test routine, the Master will begin blinking its MAIN POWER indicator. The Master will then:

   a. Check the number of Slaves on the ***network*** against the setting on its CONTROLLER ADDRESS switch. See Chapter 3 for switch configuration procedures.

   b. Poll Slaves at their pre-programmed ***network addresses*** until each is accounted for and connected to the ***network***. The Slaves are polled in ascending numerical order as determined by their ***network addresses***.

As each Slave comes on the ***network***, its MAIN POWER indicator stops blinking and remains steadily illuminated. If a Slave cannot be located by the Master or suffers a fault that prevents it from coming on the ***network***, the Master's MAIN POWER indicator will continue blinking until the problem is eliminated and polling can be completed.

When all the Slaves have been connected to the network, the Master's MAIN POWER indicator will stop blinking and remain steadily illuminated. The network is now ready for operation.

3. Turn each panel's PUMP and BLOWER POWER switches to ON.

4. Turn each panel's PUMP CONTROL switch to AUTO and BLOWER CONTROL switch to RUN.

The pumps and blowers will begin functioning according to the configuration of the ***network*** as documented on the Configuration Sheet at the front of this manual.

ROUTINE OPERATION

During normal operation, the blower(s) will run continuously while the pump(s) will cycle on and off in response to input from its downwell or sump level sensing probe.

If difficulties are encountered during or after startup, refer to the troubleshooting procedures in Chapter 6 of this manual.

TRACING AND CLEARING ALARMS

Single Panel Applications

In single panel applications, ***alarms*** can be generated only by ***interlock*** devices wired directly to the panel. In such cases, the ALARM ENGAGED indicator will blink the number of the ***alarm channel*** that carried the ***alarm*** (e.g., one blink = channel 1, two blinks = channel 2). Proceed as follows to restore panel operation;

1. Refer to the ALARM ENGAGED indicator to isolate the ***interlock*** device that generated the alarm.

2. Correct the condition that caused the ***alarm***.

3. Clear the ***alarm*** by turning the PUMP CONTROL switch to OFF and then back to AUTO.

Network Applications

In ***network*** applications, ***alarms*** can be generated by ***interlock*** devices wired to any panel in the ***network***. Depending upon the configuration of the panels' SEND/RECEIVE switches, any number of panels in the ***network*** can be shut down by a single ***alarm***. Also, because a panel shutdown can trigger site conditions that lead to additional ***alarms***, it may not be immediately clear which ***interlock*** device initiated the shutdown "cascade." Proceed as follows to restore ***network*** operation;

1. Locate the one panel in the ***network*** whose ALARM ENGAGED indicator is blinking. This is the panel to which the alarming ***interlock*** device is attached. The ***interlock*** device can then be isolated by interpreting the channel code being blinked by the indicator.

In large multi-panel ***networks***, some footwork can be eliminated by using the SYSTEM TEST button (pp. 4-4 and 4-7) to isolate the ***alarm channel***. Once the ***alarm channel*** has been isolated, refer to your Network Configuration Sheet (p. A-4, Appendix A) to determine which ***interlock*** devices are attached to that channel.

2. Correct the condition that caused the ***alarm***.

3. Clear the ***alarm*** by turning the PUMP CONTROL switch to OFF and then back to AUTO.

If the ALARM ENGAGED indicator goes out when the PUMP CONTROL switch is reset, then the ***network*** is free of

interlocks. Normal operation can resume. However, if the indicator blinks an ***alarm channel*** code, additional ***alarms*** must be cleared. Repeat steps 1-3 above until all ***alarms*** have been cleared from the ***network***.

In SITEPRO panels without the telemonitoring option, all ***alarms*** are of the ***latching*** type and must be manually cleared as described in the section above. When the telemonitoring option is installed, ***alarms*** can be remotely configured to be either ***latching*** or non-latching. Non-latching ***alarms*** will automatically clear when the condition that caused the ***alarm*** is corrected.

CHAPTER 5: SYSTEM MAINTENANCE

Chapter Summary
This chapter contains maintenance procedures for the following components:

- ***SITEPRO™ 2000 Enclosure***
- ***Level Sensing Probe***

The SITEPRO 2000 is designed for trouble free operation with minimal maintenance required. The following simple maintenance tasks should be carried out at the specified intervals.

Vacuum Enclosure

At yearly intervals, the insides of the enclosure should be vacuumed to remove accumulated dust.

Clean Window

As needed, clean the enclosure window using a solution of soap and warm water.

Glass cleaners containing ammonia will damage the enclosure's Lexan window. Also prevent hydrocarbons from contacting the window.

Change Desiccant

If desiccant is being used to control moisture accumulation inside the enclosure, this material should be renewed on a monthly basis or at the intervals recommended by the desiccant manufacturer.

ORS does not supply desiccant.

Clean Probe

It is essential that the probe shaft and floats be cleaned on a regular basis. Use Alconox detergent, warm water and a soft brush. The required frequency of cleanings is highly site specific and must be determined by the user.

Failure to clean the probe will result in fouling that could cause system malfunction.

CHAPTER 6: PROBLEM SOLVING

Chapter Summary

This chapter contains the following troubleshooting information:

- ***Getting Help*** *- What to do before calling ORS for assistance.*
- ***Service Locations*** *- A list of ORS service center locations.*
- ***Troubleshooting Procedures*** *- How to determine if your SITEPRO™ 2000 is functioning properly, and what to do if a problem is detected.*

Do not attempt any troubleshooting procedures other than those listed in this chapter.

GETTING HELP

There are no field replaceable components inside the SITEPRO enclosure. If the troubleshooting procedures in this chapter indicate a component failure, call ORS Environmental Equipment after documenting the problem as outlined below.

- Read the entire manual and become thoroughly familiar with all system components and troubleshooting procedures.
- Prepare a written list of all problems encountered while operating the equipment.
- Prepare an up to date copy of your Panel Configuration Sheet and have it available while conferring with ORS personnel.

SERVICE LOCATIONS

ORS Field Service personnel are trained on all aspects of ORS equipment and are dedicated to helping you maximize the efficiency and cost effectiveness of your SITEPRO 2000 Control Panel. For technical support of ORS products, call one of the ORS Field Service offices listed below:

Southern California
ORS Environmental Equipment
20000/200 Mariner Ave.
Torrance, CA 90510
(310) 542-1782 FAX: 310 371-4782

New England Area
ORS Environmental Equipment
32 Mill St.
Greenville, NH 03048
(800) 228-2310 FAX: (603) 878-3866

BASIC TROUBLESHOOTING PROCEDURES

The SITEPRO 2000 is equipped as standard with online self-diagnostic features and can be ordered with optional telemonitoring capabilities. These features make the SITEPRO 2000 significantly easier to troubleshoot than are conventional control panels. Whenever the SITEPRO 2000 is in operation, its microprocessor "brain" monitors the function of all critical system components. When an operational fault is detected, the user is alerted through a system of error messages communicated locally by one or more of the panel's indicator lights. When the telemonitoring package is installed, the panel will dial out and relay error messages to a computer, Fax machine or other remote receiving device.

ERROR MESSAGES

In the sections below, all possible local error messages are listed and described. If your SITEPRO 2000 is equipped with the telemonitoring option, refer to the SITEPRO Manager software manual for remote monitoring protocol and procedures.

Before beginning troubleshooting procedures, press the SELF TEST button to confirm that all panel indicators are functional.

- **Error Message: Pump Control Switch AUTO Indicator Blinking**

Cause: The PUMP CONTROL switch is faulty.

Remedy: Call ORS for assistance.

- **Error Message: Blower Control Switch RUN Indicator Blinking**

Cause: The BLOWER CONTROL switch is faulty.

Remedy: Call ORS for assistance.

- **Error Message: PUMP RUNNING Indicator Blinking**

Cause: The motor current has deviated from specifications and has shut down the pump.

Remedy:

1. Refer to your pump O & M manual and remedy the cause of the problem.

2. When the pump has cooled, restart the system by turning the PUMP CONTROL switch OFF and then back to AUTO.

Before working on the pump, carry out the DISCONNECT PROCEDURE printed on the front of the SITEPRO 2000 faceplate.

- **Error Message: BLOWER RUNNING Indicator Blinking**

Cause: The motor current has dropped below 3 Amps and has shut down the blower.

Remedy:

1. Refer to your blower O & M manual and remedy the cause of the problem.

2. When the blower has cooled, restart the system by turning the BLOWER CONTROL switch to RESET and then back to RUN.

Before working on the blower, carry out the DISCONNECT PROCEDURE printed on the front of the SITEPRO 2000 faceplate.

- **Error Message: MAIN POWER Indicator Blinking (Network Applications Only)**

Cause: The panel is no longer connected to the network.

Remedy: Check the ***network*** connections on TB4. If no loose connections are found, confirm than none of the other panels has fallen off the network.

- **Error Message: SYSTEM FAULT Indicator Blinks Once**

Cause: The panel has failed the Self Test routine.

Remedy: Call ORS for assistance.

- **Error Message: SYSTEM FAULT Indicator Blinks Twice**

Cause: An Interlink Communication Bus failure has occurred. The panel will shut down.

Remedy: Call ORS for assistance.

- **Error Message: SYSTEM FAULT Indicator Blinks Three Times**

Cause: Line voltage has deviated more than 20% from specified value.

Remedy: Check power at service and restore to specifications.

- **Error Message: SYSTEM FAULT Indicator Blinks Four Times**

Cause: The temperature inside the panel has risen over the specified maximum.

Remedy: Determine cause of problem and correct.

- **Error Message: SYSTEM FAULT Indicator Blinks Five Times**

Cause: The panel purge pressure has dropped below the specified minimum. The panel will shut down.

Remedy:
1. Check for loose or disconnected purge air hose.
2. Check function of purge air compressor.

- **Error Message: SYSTEM FAULT Indicator Blinks Six Times**

Cause: This error message indicates a probe fault caused by one of the following conditions.

1. The probe has become disconnected from the panel.
2. The probe has a stuck float or faulty reed switch.

Remedy:
1. Check all connections between the probe and the panel.
2. Clean the probe and free all floats on the shaft.

If the error message persists, call ORS for assistance.

- **Error Message: CALL IN PROGRESS Indicator Blinking (Telemonitoring Applications Only)**

Cause: A communications fault has been detected.

Remedy: Clear the error message by turning the CONTROL POWER switch OFF, waiting 5 seconds, and then turning the switch to ON. If the error message persists, call ORS for assistance.

ADDITIONAL TROUBLESHOOTING PROCEDURES

In addition to the error conditions described above, the following problems could cause an interruption in system operation.

- **Problem: PUMP Or BLOWER POWER Switch Tripped OFF**

Cause:

A tripped circuit breaker could be caused by:

1. Breaker too small for motor.
2. Short in wiring between panel and motor
3. Faulty motor drawing excessive current.

Remedy:

1. Refer to the trip amps specification printed on the side of the breaker. Confirm that the breaker is properly sized for the motor being used.
2. Use an Ohm meter to check for shorts in the motor wiring.
3. Check the motor for damage.

Before working on the pump or blower, carry out the DISCONNECT PROCEDURE printed on the front of the SITEPRO 2000 faceplate.

- **Problem: No Panel Indicators Illuminated**

Cause: Either a fuse is blown or no power is reaching the panel.

Remedy:

1. Use a voltmeter to check for power at the terminal block on the panel chassis.
2. If power is present, the problem is a blown fuse behind the circuit board shield. Call ORS for assistance.
3. If no power is present at the terminal block, problem is a power failure at the service. Restore power and re-start the system by repeating the panel startup procedure described in Chapter 4.

APPENDIX A: PANEL CONFIGURATION SHEET

This Appendix consists of a SITEPRO™ 2000 Panel Configuration Sheet to be used to record the final configuration of your SITEPRO panel.

During the panel configuration procedures described in Chapter 3 of this manual, you will be changing the settings of some of the dip switches shown in Figure 3-1 (p. 3-3). ORS recommends that you carefully record the final configuration of your SITEPRO 2000 panel by penciling in the appropriate dip switch settings on the blank Panel Configuration Sheet provided in this Appendix. Once filled out, this sheet will be a permanent record of your configuration and can be used as a check against inadvertent or unauthorized configuration changes. Be sure to update this sheet whenever configuration changes are made. An up to date Panel Configuration Sheet is an essential troubleshooting tool and must be available for reference whenever you call ORS for technical assistance.

Network Configuration

Before configuring any SITEPRO panel that is part of a complex multi-panel ***network***, basic decisions must be made about the design of the network as a whole. Although remediation site design is beyond the intended scope of this manual, a Site Configuration Guide has been included in your Quick Start Installation envelope. The Site Configuration Guide is designed to help you specify panel ***network addresses***, ***interlock*** hookups and alarm ***interlock*** assignments for up to 16 SITEPRO 2000 control panels. Fill out the blank Site Configuration Worksheet **BEFORE** configuring individual panels.

SITEPRO™ 2000 PANEL CONFIGURATION SHEET

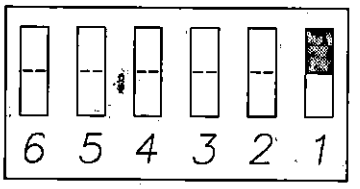
Date _____

Panel Type _____

Panel Network Address _____

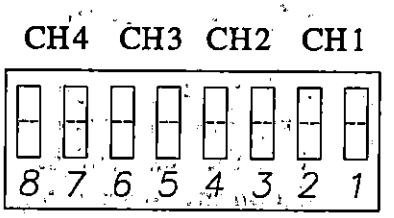
CONTROLLER ADDRESS Switch SW3

MASTER ☐
SLAVE ☐



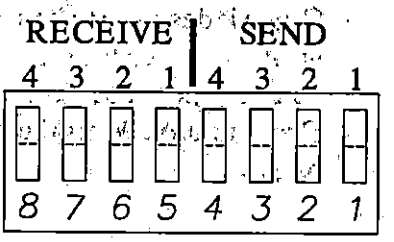
OFF
ON

LOGIC Switch SW5



OFF
ON

SEND/RECEIVE Switch SW4



OFF
ON

APPENDIX B: GLOSSARY

Address

An identifying number assigned to each panel in a network. The Master panel always receives the address "0". Slaves are numbered from "1" to a maximum value of "15". During network operation, the Master panel polls the Slaves in ascending numerical order.

Alarm

A shutoff signal generated by an interlock device wired to a SITEPRO panel.

Alarm Channel

One of four circuits in the SITEPRO that can carry an alarm signal. Alarms are carried from panel to panel on the Interlock Communication Bus.

A/D Converter

A device that converts analog signals to digital signals

Analog Input

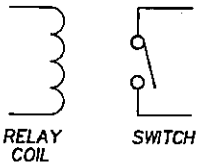
An input that accepts signals from pressure transducers or other analog devices. Analog signals are continuous functions and must be converted to discrete digital data before they can be manipulated by the microprocessor. This conversion is carried out by the SITEPRO's analog to digital (A/D) converter.

Baud Rate

Rate of data transfer in bits/second. A measure of how fast information is transferred over a serial communications network.

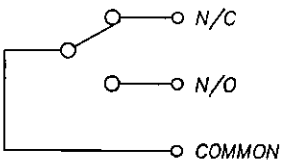
Dry Contact

An electrical switch that is isolated from any source of electrical energy. In the diagram below, the dry contacts are acted upon by a relay coil that is isolated from the switch.



Form C Contacts

A set of electrical contacts that has both Normally Open and Normally Closed poles as shown in the diagram below. See definitions of Normally Open and Normally Closed also included in this Glossary.



Interlock Communication Bus

An RS-485 network that allows the SITEPRO to exchange information with other panels.

Interlock

A signal or alarm generated by a switching device attached to a SITEPRO panel.

Intrinsically Safe

Incapable of carrying enough electrical current to cause an explosion.

IP 66

Enclosure intended for outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure. The International Electrotechnical Commission (IEC) equivalent to a rating of NEMA 4.

Latching

An alarm that, once engaged, requires a manual reset to clear. A non-latching alarm will clear automatically when the condition that caused the alarm either corrects itself spontaneously or is corrected by operator intervention.

Microprocessor

A computer chip that is capable of executing programmed instructions; the SITEPRO's "brain".

NEC

The NEC (National Electrical Code) is a collection of electrical safety standards compiled by the National Fire Protection Association.

NEMA 4

Enclosure intended for outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure. (See IP 66).

Network

A series of SITEPRO panels connected by the Interlock Communication Bus.

Normally Closed

A switch that is closed when not acted upon. See Figure 2-2 (p. 2-6) for an example of a Normally Closed switch that is held open by a magnet embedded in a probe float. When the magnet is moved, the switch closes.

Normally Open

A switch that is open when not acted upon.

RAM

RAM (Random Access Memory) is computer memory that can be both read and written to. RAM is used for temporary data storage.

ROM

ROM (Read Only Memory) is computer memory that can be read but not written to. ROM is used to store permanent programmed instructions.

RS-232

A serial communications network capable of transmitting over short distances only.

RS-485

A serial communications network capable of transmitting over long distances.

Totalizer

A device that counts electrical pulses generated by a flowmeter.

APPENDIX C: INDEX

APPENDIX D: APPLICATION NOTES

The SITEPRO 2000 Blower/Pump Control Panel is highly flexible and can be adapted for many different site remediation functions. The examples in this appendix explain how to wire and configure your SITEPRO panel for the most commonly encountered field applications.

APPLICATION #1

SITEPRO Blower/Pump Control Panel controlling air stripper blower and transfer pump. High Sump Level or High/Low Pressure condition must shut down feed pump controlled by separate SITEPRO WTDP panel.

In order to shut down the WTDP panel in the event of a High Sump Level or High/Low Pressure alarm received by the Blower/Pump panel, the High Sump Level, High Pressure and Low Pressure inputs must each be jumpered to an alarm channel in the Blower/Pump panel. Both panels must then be configured to communicate through the Interlock Communication Bus. Proceed as follows:

Wiring

1. Wire the sump level probe and pressure switches to the SITEPRO Blower/Pump control panel as shown in Figure 2-3 (p. 2-8).
2. Install a wire jumper between terminal 5 on TB2 (High Sump Level) and one of the interlock terminals (1-4) also on TB2.
3. Install a jumper between terminal 6 on TB2 (High Pressure) and one of the other interlock terminals on TB2.

4. Install a wire jumper between terminal 7 on TB2 (Low Pressure) and one of the interlock terminals on TB2.

Refer to Figure 2-3 or to the Field Wiring Diagram for locations of jumpers.

Configure Blower/Pump Panel

1. Set the RECEIVE switches for the interlock channels to which jumpers were attached above. For example, if the High Sump Level input was jumpered to terminal 4 (interlock 4) on TB2, set RECEIVE dip switch 8 to ON.

2. Set the SEND switches for the Interlock Communication Bus channels on which the High Sump Level and High Pressure alarms will be sent to the WTDP panel. Any of the four ICB channels can be used for this purpose.

3. Configure the CONTROLLER ADDRESS Switch and LOGIC switch as explained in Chapter 3.

Configure WTDP Panel

1. Set the RECEIVE switches to correspond to the SEND switch settings chosen for Panel #1. For example, if the Blower/Pump panel SEND switches 1, 2 and 3 were set to ON, set the WTDP panel RECEIVE switches 5, 6 and 7 to ON.

2. Configure the CONTROLLER ADDRESS switch and LOGIC switch as explained in Chapter 3.

APPLICATION #2 **SITEPRO Blower/Pump Control Panel controlling air stripper blower and feed pump. The feed pump must be shut down in the event of a High Sump Level or High/Low Pressure condition at the air stripper.**

Wiring

1. Wire the downwell WTDP probe and pressure switches into the SITEPRO Blower/Pump Control Panel as shown in Figure 2-2 (p. 2-6).

2. Jumper the High and Low Pressure inputs to interlocks as explained in Application #1, above.

3. Run the High Sump Level leads (green and orange) from the air stripper sump level probe to the SITEPRO Blower/Pump Control Panel and wire the High Sump Level switch as an interlock. Refer to Chapter 3 for a discussion of interlock wiring.

Configure Panel

1. Set RECEIVE switches for the interlock channels to which the High and Low Pressure jumpers were attached.

2. Set the RECEIVE switch for the interlock channel to which the High Sump Level switch was attached.

3. Configure the CONTROLLER ADDRESS and LOGIC switches as explained in Chapter 3.

Standard Equipment Limited Warranty

All references to the Customer herein shall mean the Customer or the Lessee as applicable.

(a) ORS Environmental Equipment, a Division of Groundwater Technology, Inc. (ORS), warrants that any Equipment which it manufactures will be free from substantial defects in material and workmanship for a period of one (1) year from the date such goods are delivered to a carrier by ORS for shipment to the Customer.

(b) The Customer agrees that the liability of ORS hereunder shall be limited to replacing, repairing or issuing credit for, at ORS's discretion, any Equipment which is returned F.O.B. ORS's plant within the applicable term of the warranty, provided that (i) upon examination of the Equipment ORS determines that the alleged defect constitutes a substantial defect, and (ii) the warranty made herein is not invalid pursuant to Section (d) hereof. The Customer agrees that such replacement, repair or credit shall be its sole and exclusive remedies hereunder. For purposes hereof, a substantial defect shall mean any defect which prevents the Equipment from operating in accordance with ORS's published specifications. In the event that ORS determines that Equipment which is no longer manufactured by it contains a substantial defect and the warranty covering the defective equipment is not invalid pursuant to Section (d) hereof, the Purchaser's sole and exclusive remedy hereunder shall be the repair of such Equipment or the replacement of such Equipment with new equipment at ORS's discretion. In no case is Equipment to be returned by the Customer without first submitting a warranty claim in writing to ORS and obtaining a return authorization number from ORS. Equipment which is repaired or replaced pursuant to this warranty shall continue to be warranted for the unexpired portion of the warranty term applicable to the Equipment so repaired or replaced. ORS shall make the final determination as to the existence or cause of any alleged defect.

(c) The foregoing warranty shall not be valid (i) if the alleged defect is the result of abuse, misuse, accident, alteration, neglect or unauthorized repair; (ii) if ORS requires installation of Equipment by specifically approved ORS employee and such installation is not effected, or the Equipment is otherwise installed improperly; or (iii) if the Equipment is resold by the Customer. Any repair shall be deemed unauthorized unless it is made (i) by ORS or a duly authorized agent of ORS or (ii) with the written consent of ORS.

(d) The operating efficiency of treatment, abatement, and recovery Equipment and systems is affected by factors extrinsic to their manufacture, including operating environment and such conditions of use as contaminant and related substance build-up, the frequency and type of operator maintenance and other external variables. For these reasons, specific levels of performance cannot be guaranteed for such Equipment and systems.

(e) **THIS WARRANTY IS THE SOLE WARRANTY MADE BY ORS TO THE CUSTOMER AND IS IN LIEU OF ALL OTHER WARRANTIES OR OBLIGATIONS, EXPRESS OR IMPLIED. ORS EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

(f) **THE CUSTOMER AGREES THAT IN NO EVENT SHALL ORS BE LIABLE FOR SPECIAL, INCIDENTAL, INDIRECT, EXEMPLARY OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS OF LOSS OF USE OR ANY OTHER ECONOMIC LOSS, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.**

(g) **THE REMEDIES PROVIDED HEREIN ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES.**

ORS ENVIRONMENTAL EQUIPMENT
RETURN POLICY

Permission is required to return equipment to the ORS Environmental Equipment factory in Greenville, NH. A Return Authorization Number will be issued upon receipt of your request to return, which should include reasons for the return. Your return shipment to us must have this R.A.# clearly marked on the outside of each package.

Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN AUTHORIZATION, PLEASE CALL OUR SERVICE DEPARTMENT AT 800-228-2310 or 603-878-2500.

Equipment Decontamination

Prior to return, all equipment must be thoroughly cleaned and decontaminated. During decontamination, personnel should wear protective clothing and observe the cautions outlined below.

ORS reserves the right to refuse any equipment not properly decontaminated. ORS may also choose to decontaminate equipment at a fee which will be applied to the repair invoice.

Decontamination Solutions

The determination of what decontamination solution to use should be based on the types of contaminants present and the materials to be decontaminated. The fabrics of protective clothing are made of organic polymers which may be dissolved or destroyed by organic solvents. The metals and gaskets of tools may be damaged by overly acidic or basic compounds. Some decontamination solvents should be entirely avoided. The toxicity or physical hazards associated with using some once commonly used decontamination solutions can be as potentially dangerous as the site contaminants.

It is important to be certain that the decon solution, the contaminant, and the material to be cleaned are all compatible with each other. If they are not, it is possible to produce toxic or flammable gases, heat, splattering, bubbling, fire, or explosion. If an uncommonly used method and/or chemical solution is being considered for decontamination, it is important to consult with an experienced chemist to ensure chemical compatibility.

be placed on a slight angle so that the spent decontamination solutions drain into a collection basin or drum.

Recommended Supplies for Decontamination of Personnel, Clothing, and Equipment

The list below contains recommendations for supplies which should be on hand for the decontamination of personnel, clothing and equipment. Depending on the site activities, not all of these items may be needed. Alternatively, some additional items not listed here may be required.

- Drop cloths of plastic or other suitable material, such as visqueen, for heavily contaminated equipment.
- Disposal collection containers, such as drums or suitably lined trash cans for disposable clothing and heavily contaminated personal protective clothing or equipment to be discarded.
- Lined box with adsorbents for wiping or rinsing off gross contaminants and liquid contaminants.
- Wash tubs of sufficient size to enable workers to place booted foot in and wash off contaminants (without a drain or with a drain connected to a collection tank or appropriate treatment system).
- Rinse tubs of sufficient size to enable workers to place booted foot in and hold the solution used to rinse the wash solutions and contaminants after washing (without a drain or with a drain connected to a collection tank or appropriate treatment system)
- Wash solutions selected to wash off and reduce the hazards associated with the contaminated wash and rinse solutions.
- Rinse solution (usually water) to remove contaminants and contaminated wash solutions.
- Long-handled, soft-bristled brushes to help wash and rinse off contaminants.
- Lockers and cabinets for storage of decontaminated clothing and equipment.
- Storage containers for contaminated wash and rinse solutions.
- Plastic sheeting, sealed pads with drains, or other appropriate method for containing and collecting contaminated wash and rinse water spilled during decontamination.
- Shower facilities for full body wash or, at a minimum, personal wash sinks (with drains connected to collection tank or appropriate treatment system).
- Soap or wash solution, wash cloths and towels.
- Clean clothing and personal item storage lockers and/or closets.

APPENDIX D

SOIL VAPOR EXTRACTION AND AIR SPARGING START-UP TESTING AND ANALYSIS

TEST NO. START-UP
EXTRACTION WELL NO. VP2

TEST DATE: 09/08/94

DESCRIPTION OF FLOW REGIME DESIGN

TIME AT START OF TEST 15:37

MONITORING POINT		VMP-2	MW-9	VMP-1	VACUUM AT MANI-FOLD IN.W.C.	INLET AIR FLOW RATE FT^3/MIN	INLET VOC CONC. PPMV
DISTANCE TO EXTRACTION WELL		13.4	25.9	44.1			
TIME	MINUTES AFTER START	MEASURED VACUUM (IN.W.C.)					
15:37	0	NR	NR	NR	6.0	49	NR
16:16	39	0.21	0.34	0.03	6.0	49	NR
16:36	59	0.23	0.33	0.03	6.0	49	2.2

NR: NOT RECORDED
NA: NOT APPLICABLE

GROUNDWATER TECHNOLOGY

ANALYSIS OF VACUUM DISSIPATION DATA FROM PILOT TEST

6 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
VMP-2	13.4	.23	-.638
MW-9	25.9	.34	-.469
VMP-1	44.1	.03	-1.523

Additional data point based on applied vacuum:
1.2 inches of water column at 0 feet from SVE well

Slope	= -.033 per foot
Intercept	= 1.114 inches of water column
R squared	= .858

AIR SPARGING PILOT TEST DATA SHEET

SITE NAME: BULOVA START-UP
TEST DATE: 09/09/94
TESTER(S): M.SOWA, T.PAINTER

TIME	PARAMETER	LOCATION	VALUE	UNITS	DISTANCE(FT)	PARAM. CHANGE
BACKGROUND (PRE-OPERATION)						
09:45	DTW	MW11	10.09	FT		
09:51	DTW	MW12	10.46	FT		
09:55	DTW	MW4	12.56	FT		
10:23	DTW	MW9	15.30	FT		
10:27	DTW	VMP1	16.05	FT		
10:31	DTW	VMP2	16.44	FT		
09:45	DO	MW11	6.80	mg/L		
09:51	DO	MW12	1.00	mg/L		
09:55	DO	MW4	7.00	mg/L		
10:23	DO	MW9	1.20	mg/L		
10:27	DO	VMP1	0.80	mg/L		
10:31	DO	VMP2	0.90	mg/L		
VP/SP-1 TEST						
10:35	FLOW	VP1	52.00	SCFM	0.0	
10:35	PRESS	VP1	-7.00	IN. WATER	0.0	
10:48	FLOW	SP1	12.00	SCFM	0.0	
10:48	SPARGE PRESS	SP1	8.40	PSIG	0.0	
11:33	PRESS	VMP1	-0.07	IN. WATER	19.8	-0.07
11:33	PRESS	VMP2	-0.14	IN. WATER	21.3	-0.14
11:34	FLOW	SP1	11.50	SCFM	0.0	
11:34	SPARGE PRESS	SP1	8.25	PSIG	0.0	
11:36	FLOW	VP1	49.00	SCFM	0.0	
11:36	PRESS	VP1	-7.00	IN. WATER	0.0	
11:36	PRESS	MW9	-1.00	IN. WATER	9.9	-1
11:38	DTW	VMP1	16.02	FT	19.8	-0.03
11:39	DTW	MW9	15.25	FT	9.9	-0.05
11:39	DTW	VMP2	16.40	FT	21.3	-0.04
11:40	DO	VMP1	0.80	mg/L	19.8	0
11:41	DO	VMP2	0.80	mg/L	21.3	-0.1
11:42	DO	MW9	0.70	mg/L	9.9	-0.5
11:50	VOC	VP1	70.00	PPMV	0.0	
VP/SP-5 TEST						
11:56	FLOW	VP5	50.00	SCFM	0.0	
11:56	PRESS	VP5	-3.50	IN. WATER	0.0	
12:00	FLOW	SP5	12.00	SCFM	0.0	
12:00	SPARGE PRESS	SP5	9.40	PSIG	0.0	
12:45	DTW	MW4	12.42	FT	41.6	-0.14
12:45	DTW	MW12	10.02	FT	17.9	-0.44
12:46	DO	MW11	6.80	mg/L	16.1	0
12:46	DTW	MW11	9.21	FT	16.1	-0.88
12:47	DO	MW12	0.80	mg/L	17.9	-0.2
12:48	DO	MW4	7.00	mg/L	41.6	0
12:49	PRESS	MW11	0.02	IN. WATER	16.1	0.02
12:49	PRESS	MW12	0.00	IN. WATER	17.9	0
12:50	PRESS	MW4	0.00	IN. WATER	41.6	0
12:50	SPARGE PRESS	SP5	9.00	PSIG	0.0	
12:51	FLOW	SP5	12.00	SCFM	0.0	
12:51	FLOW	VP5	50.00	SCFM	0.0	
12:51	PRESS	VP5	-0.35	IN. WATER	0.0	
12:52	VOC	VP5	240.00	PPMV	0.0	
VP/SP-2 TEST						
12:59	FLOW	VP2	52.00	SCFM	0.0	
12:59	PRESS	VP2	-6.50	IN. WATER	0.0	
13:00	FLOW	SP2	12.00	SCFM	0.0	
13:00	SPARGE PRESS	SP2	9.25	PSIG	0.0	
13:40	FLOW	SP2	11.50	SCFM	0.0	
13:40	SPARGE PRESS	SP2	9.25	PSIG	0.0	
13:42	FLOW	VP2	53.00	SCFM	0.0	
13:42	PRESS	VP2	-7.10	IN. WATER	0.0	
13:44	DTW	VMP1	15.94	FT	44.1	-0.11
13:45	DTW	VMP2	16.35	FT	13.4	-0.09
13:46	DTW	MW9	15.17	FT	25.9	-0.13
13:48	DO	VMP1	0.03	mg/L	44.1	-0.77
13:50	DO	VMP2	8.80	mg/L	13.4	7.9
13:53	DO	MW9	0.80	mg/L	25.9	-0.4
13:58	PRESS	VMP1	-0.03	IN. WATER	44.1	-0.03
13:59	PRESS	VMP2	-0.16	IN. WATER	13.4	-0.16
13:59	PRESS	MW9	-0.33	IN. WATER	25.9	-0.33
14:05	VOC	VP2	46.00	PPMV	0.0	

GROUNDWATER TECHNOLOGY ®

APPENDIX E

VOLATILE ORGANIC COMPOUND REMOVAL RATE CALCULATION

VOC REMOVAL CALCULATION

The estimated mass removal rate for individual constituents by the remediation system requires the measurement of the air flow rate and constituent concentration in the SVE system at the same sampling location in the SVE system. Additionally, the molecular weight of the constituent must be known, or estimated, in order to perform the calculation. The calculations assume that the temperature of the gas is 68°F and the pressure is 1 atmosphere. While the actual values do vary from these estimates, the resulting error is negligible (<1%).

Calculation

Objective: To calculate the mass of constituent per unit time. To do so, first convert the constituent concentration (vol. const./vol. air) to its mass concentration (i.e. to convert ppmv to mg/m^3). Then combine this result with the measured air flow rate in volume per unit time which results in mass of constituent per unit time.

p	=	absolute pressure of gas (atm)	=	1 atm
v	=	volume of gas (l)		
n	=	number of moles of gas		
T	=	absolute temperature (°K)	=	273.15°K
t	=	actual temperature (°K)	=	293.15°K (68°F)
R	=	Universal Gas Constant		
r	=	specific gas constant		
w	=	mass of constituent (g)		
m	=	molecular weight of constituent (g/mole)		
ppmv	=	parts per million (by volume)		

Converting ppmv to mg/m^3

pv = nrT (Ideal Gas Law)
n = w/m
r = pv/nT = (1 atm x 22.414 l)/(1 mole x 273.15°K) = 0.082056 atm l/mole°K
ppmv = number of moles of constituent per 10^6 moles of air
= n(constituent) / n(air)
ppmv = wrt/(vpm)
mg/m^3 = w/v = (ppmv x p x m x 10^6) / r x t
= ppmv x m /24.05

Mass Removal Rate:

lb/hour = Concentration (? mg/m^3) x (1 lb/4.54x10^5 mg) x (1 m^3/35.31 ft^3) x
Flow Rate (? ft^3/min) x (60 min/hour)

GROUNDWATER TECHNOLOGY

APPENDIX F

LABORATORY REPORTS

GTEL
ENVIRONMENTAL
LABORATORIES, INC.

Northeast Region
Meadowbrook Industrial Park
Milford, NH 03055
(603) 672-4835
(603) 673-8105 (FAX)

September 20, 1994

Al Tonn
Groundwater Technology, Inc.
101-1 Colin Drive
Holbrook, NH 11741

RE: GTEL Client ID: 011137013
Login Number: M4090293
Project ID (number): 011137013
Project ID (name): BULOVA SAG HARBOR, NY

Dear Al Tonn:

Enclosed please find the analytical results for the samples received by GTEL Environmental Laboratories, Inc. on 09/14/94 under Chain-of-Custody Number(s) 58169.

A formal Quality Assurance/Quality Control (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria unless otherwise stated in the footnotes.

GTEL is certified by the State of New York under Lab ID #10599.

If you have any questions regarding this analysis; or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,
GTEL Environmental Laboratories, Inc.

Susan C. Umler
Laboratory Director

Client Number: 011137013
Project ID: BULOVA SAG HARBOR, NY
Login Number: M4-09-0293

ANALYTICAL RESULTS

Aromatic Volatile Organics in Air
Modified EPA Method TO3[a]

GTEL Sample Number		090293-01	090293-02	--	--
Client Identification		PROCESS 200 INFLUENT	PROCESS 400 INFLUENT	--	--
Date Sampled		09/13/94	09/13/94	--	--
Date Analyzed		09/14/94	09/14/94	--	--
Analyte	Reporting Limit, ppmv	Concentration, ppmv			
Benzene	1.0	< 1.0	< 1.0	--	--
Toluene	1.0	< 1.0	< 1.0	--	--
Ethylbenzene	1.0	< 1.0	< 1.0	--	--
Xylenes (total)	3.0	< 3.0	< 3.0	--	--
Misc. Aliphatics (C_1-C_{10})[b]	15	19	45	--	--
Misc. Aromatics (C_9-C_{10})[c]	10	< 10	< 10	--	--
1,1-Dichloroethene	2.0	< 2.0	< 2.0	--	--
trans-1,2-Dichloroethene	2.0	< 2.0	< 2.0	--	--
cis-1,2-Dichloroethene	2.0	< 2.0	< 2.0	--	--
1,1-Dichloroethane	2.0	< 2.0	< 2.0	--	--
1,2-Dichloroethane	2.0	< 2.0	< 2.0	--	--
Methylene Chloride	2.0	< 2.0	< 2.0	--	--
Chlorobenzene	2.0	< 2.0	< 2.0	--	--
1,1,1-Trichloroethane	2.0	12	95	--	--
Trichloroethene	2.0	13	67	--	--
Tetrachloroethene	2.0	< 2.0	< 2.0	--	--
Dilution Factor[d]		1	1	--	--

a "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Cryogenic Preconcentration Techniques," Revision 1.0, US EPA April 1984.
b Misc. Aliphatics (C_1-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of Hexane.
c Misc. Aromatics (C_9-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of o-Xylene.
d The dilution factor indicates the adjustments made to the data and reporting limits for sample dilutions.

GTEL ENVIRONMENTAL LABORATORIES, INC.

MEADOWBROOK INDUSTRIAL PARK
MIL[illegible]D, [illegible]3055
(603) 672-4835
(800) LAB-GTEL

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

00169

Company Name: GROUNDWATER TECHNOLOGY INC
Phone #: 516-472-4000
FAX #: 516-472-4077

Company Address: 511 COMMACK RD. HAUPPAUGE NY
Site location: SAG HARBOR, NY

Project Manager: AL TONN
Client Project ID: (#) 01113-7013
(NAME) BULOVA SAG HARBOR

I certify that the proper field sampling procedures were used during the collection of these samples. Todd Painter
Sampler Name (Print): TODD PAINTER

Field Sample ID	GTEL Lab # (Lab use only)	# Containers	Matrix: WATER	SOIL	AIR	SLUDGE	PRODUCT	OTHER	Method Preserved: HCl	HNO_3	H_2SO_4	ICE	UNPRESERVED	OTHER (SPECIFY)	Sampling: DATE	TIME	BTEX/602 ☐ 8020 ☐ with MTBE ☐	BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐	Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screen ☐	Hydrocarbon Profile (SIMDIS) ☐	Oil and Grease 413.1 ☐ 413.2 ☐ SM 503 ☐	TPH/IR 418.1 ☐ SM 503 ☐	EDB by 504 ☐ DBCP by 504 ☐	EPA 503.1 ☐ EPA 502.2 ☐	EPA 601 ☐ EPA 8010 ☐	EPA 602 ☐ EPA 8020 ☐	EPA 608 ☐ 8080 ☐ PCB only ☐	EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐	EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐	EPA 610 ☐ 8310 ☐	EP TOX Metals ☐ Pesticides ☐ Herbicides ☐	TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐	EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐	CAM Metals TTLC ☐ STLC ☐	Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐	Organic Lead ☐	Corrosivity ☐ Flash Point ☐ Reactivity ☐	XX TO3 VOLATILES
BESS 200 INFLUENT	1	1			X								X		9-13-94	1510																				X
BESS 400 INFLUENT	2	1			X								X		9-13-94	1515																				X

TAT
☐ y (24 hr)
☐ ited (48 hr)
☐ ness Days STANDARD
☐ ss Days

Special Handling
GTEL Contact
Quote/Contract #
Confirmation #
PO #

QA / QC LEVEL
☐ ☐ CLP ☐
OTHER

SPECIAL DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS
FAX ☐

REMARKS

Lab Use Only Lot #
Storage Location: Login
Work Order # M4090293

JSTODY ECORD

Relinquished by Sampler: Todd Painter — Date 9-13-94 — Time 5:30
Relinquished by: — Date — Time
Relinquished by: — Date 9/14/94 — Time 0930

Received by: FED EX
Received by:
Received by Laboratory:
Waybill # 618148426 0

GTEL
ENVIRONMENTAL
LABORATORIES, INC.

Meadowbrook Industrial Park
Milford, N.H. 03055
(603) 672-4835
(800) 441-4835
FAX (603) 673-8105

October 3, 1994

OCT 0 6 1994

Al Tonn
Groundwater Technology, Inc.
101-1 Colin Drive
Holbrook, NH 11741

RE: GTEL Client ID: 011137013
Login Number: M4090681
Project ID (number): 011137013
Project ID (name): BULOVA SAG HARBOR, NY

Dear Al Tonn:

Enclosed please find the analytical results for the samples received by GTEL Environmental Laboratories, Inc. on 09/27/94 under Chain-of-Custody Number(s) 58163.

A formal Quality Assurance/Quality Control (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria unless otherwise stated in the footnotes.

GTEL is certified by the State of New York under Lab ID #10599.

If you have any questions regarding this analysis, or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,
GTEL Environmental Laboratories, Inc.

Robert C. Boisclair for SO

Susan C. Uhler
Laboratory Director

Client Number: 011137013
Project ID: BULOVA SAG HARBOR, NY
Login Number: M4-09-0681 REISSUE

ANALYTICAL RESULTS

Aromatic Volatile Organics in Air
Modified EPA Method TO3[a]

GTEL Sample Number		090681-01	090681-02	090681-03	–
Client Identification		INTERIOR COURT-YARD EFFLUENT AFTER CARBON	INTERIOR COURT-YARD EFFLUENT BEFORE CARBON	EXTERIOR COURT-YARD EFFLUENT	–
Date Sampled		09/26/94	09/26/94	09/26/94	–
Date Analyzed		09/28/94	09/28/94	09/28/94	–
Analyte	Reporting Limit, ppmv	Concentration, ppmv			
Benzene	1.0	< 1.0	< 1.0	< 1.0	–
Toluene	1.0	< 1.0	< 1.0	< 1.0	–
Ethylbenzene	1.0	< 1.0	< 1.0	< 1.0	–
Xylenes (total)	3.0	< 3.0	< 3.0	< 3.0	–
Misc. Aliphatics (C_1-C_{10})[b]	15	< 15	32	< 15	–
Misc. Aromatics (C_9-C_{10})[c]	10	< 10	< 10	< 10	–
1,1-Dichloroethene	2.0	< 2.0	< 2.0	< 2.0	–
trans-1,2-Dichloroethene	2.0	< 2.0	< 2.0	< 2.0	–
cis-1,2-Dichloroethene	2.0	< 2.0	< 2.0	< 2.0	–
1,1-Dichloroethane	2.0	< 2.0	< 2.0	< 2.0	–
1,2-Dichloroethane	2.0	< 2.0	< 2.0	< 2.0	–
Methylene Chloride	2.0	< 2.0	< 2.0	< 2.0	–
Chlorobenzene	2.0	< 2.0	< 2.0	< 2.0	–
1,1,1-Trichloroethane	2.0	< 2.0	70	< 2.0	–
Trichloroethene	2.0	< 2.0	48	< 2.0	–
Tetrachloroethene	2.0	< 2.0	< 2.0	< 2.0	–
Dilution Factor[d]		1	1	1	–

a "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Cryogenic Preconcentration Techniques," Revision 1.0, US EPA April 1984.
b Misc. Aliphatics (C_1-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of Hexane.
c Misc. Aromatics (C_9-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of o-Xylene.
d The dilution factor indicates the adjustments made to the data and reporting limits for sample dilutions.

GTEL ENVIRONMENTAL LABORATORIES, INC.

MEADOWBROOK INDUSTRIAL PARK
MI[illegible] D, [illegible] 305[illegible]
(603) 672-4835
(800) LAB-GTEL

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUE[redacted]T [illegible]18[redacted]

[Com]pany Name: [Gr]OUNDWATER TECHNOLOGY INC
Phone #: 516-472-4000
FAX #: 516-472-4077
[Com]pany Address: [10]1-1 COLIN DR, HOLBROOK NY 11741
Site location: SAG HARBOR, NY
[Proj]ect Manager: [illegible]L TONN
Client Project ID: (#) 01113-7013
(NAME) BULOVA SAG HARBOR
[I att]est that the proper field sampling [proc]edures were used during the collection [of th]ese samples. [signature]
Sampler Name (Print): TODD PAINTER

Field Sample ID	GTEL Lab # (Lab use only)	# Containers	Matrix: WATER	SOIL	AIR	SLUDGE	PRODUCT	OTHER	Method Preserved: HCl	HNO_3	H_2SO_4	ICE	UNPRESERVED	OTHER (SPECIFY)	Sampling: DATE	TIME	OTHER: TO3 (HAV)
[INT]ERIOR COURTYARD [INFL]UENT AFTER CARBON	1	1			X								X		9-26-94	4:00	X
[INT]ERIOR COURTYARD [INFL]UENT BEFORE CARBON	2	1			X								X		9-26-94	4:20	X
[INT]ERIOR COURTYARD EFFLUENT	3	1			X								X		9-26-94	4:10	X

ANALYSIS REQUEST (not checked): BTEX/602 ☐ 8020 ☐ with MTBE ☐; BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐; Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screen ☐; Hydrocarbon Profile (SIMDIS) ☐; Oil and Grease 413.1 ☐ 413.2 ☐ SM 503 ☐; TPH/IR 418.1 ☐ SM 503 ☐; EDB by 504 ☐ DBCP by 504 ☐; EPA 503.1 ☐ EPA 502.2 ☐; EPA 601 ☐ EPA 8010 ☐; EPA 602 ☐ EPA 8020 ☐; EPA 608 ☐ 8080 ☐ PCB only ☐; EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐; EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐; EPA 610 ☐ 8310 ☐; EP TOX Metals ☐ Pesticides ☐ Herbicides ☐; TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐; EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐; CAM Metals TTLC ☐ STLC ☐; Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐; Organic Lead ☐; Corrosivity ☐ Flash Point ☐ Reactivity ☐

TAT
[Pri]ority (24 hr) ☐
[Exp]edited (48 hr) ☐
[ ] Business Days ☐
[Oth]er STANDARD
[ ] Business Days ☐

Special Handling
GTEL Contact ____
Quote/Contract # ____
Confirmation # ____
PO # ____

QA / QC LEVEL
[BLU]E ☐ CLP ☐ OTHER ____

SPECIAL DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS
FAX ☐

REMARKS

Lab Use Only Lot #
Storage Location: Logan
Work Order #: M4090681

[CHAIN-OF-C]USTODY RECORD

Relinquished by	Date	Time	Received by
Relinquished by Sampler: [signature]	9-26-94	6:00	Received by: AIRBORNE EXP.
Relinquished by:			Received by:
Relinquished by:	9/27/94	1040	Received by Laboratory: Bethany Johnson

Waybill #: 618 147 9065

7/91

GTEL
ENVIRONMENTAL
LABORATORIES, INC.
Northeast Region
Meadowbrook Industrial Park
Milford, NH 03055
(603) 672-4835
(603) 673-8105 (FAX)

October 14, 1994

Al Tonn
Groundwater Technology, Inc.
101-1 Colin Drive
Holbrook, NY 11741

RE: GTEL Client ID: 011137013
Login Number: M4100091
Project ID (number): 011137013
Project ID (name): BULOVA SAG HARBOR, NY

Dear Al Tonn:

Enclosed please find the analytical results for the samples received by GTEL Environmental Laboratories, Inc. on 10/05/94 under Chain-of-Custody Number(s) 58958.

A formal Quality Assurance/Quality Control (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria unless otherwise stated in the footnotes.

GTEL is certified by the State of New York under Lab ID #10599.

If you have any questions regarding this analysis, or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,
GTEL Environmental Laboratories, Inc.

Susan C. Uhler
Laboratory Director

Client Number: 011137013
Project ID: BULOVA SAG HARBOR, NY
Login Number: M4-10-0091

ANALYTICAL RESULTS

Aromatic Volatile Organics in Air
Modified EPA Method TO3[a]

GTEL Sample Number		100091-01	100091-02	–	–
Client Identification		PROCESS 300,400 AFTER CARBON	PROCESS 300,400 BEFORE CARBON	–	–
Date Sampled		10/04/94	10/04/94	–	–
Date Analyzed		10/05/94	10/05/94	–	–
Analyte	Reporting Limit, ppmv	Concentration, ppmv			
Benzene	1.0	< 1.0	< 1.0	–	–
Toluene	1.0	< 1.0	< 1.0	–	–
Ethylbenzene	1.0	< 1.0	< 1.0	–	–
Xylenes (total)	3.0	< 3.0	< 3.0	–	–
Misc. Aliphatics (C_1-C_{10})[b]	15	< 15	66	–	–
Misc. Aromatics (C_9-C_{10})[c]	10	< 10	< 10	–	–
1,1-Dichloroethene	2.0	< 2.0	< 2.0	–	–
trans-1,2-Dichloroethene	2.0	< 2.0	< 2.0	–	–
cis-1,2-Dichloroethene	2.0	< 2.0	< 2.0	–	–
1,1-Dichloroethane	2.0	< 2.0	< 2.0	–	–
1,2-Dichloroethane	2.0	< 2.0	< 2.0	–	–
Methylene Chloride	2.0	< 2.0	< 2.0	–	–
Chlorobenzene	2.0	< 2.0	< 2.0	–	–
1,1,1-Trichloroethane	2.0	< 2.0	39	–	–
Trichloroethene	2.0	< 2.0	59	–	–
Tetrachloroethene	2.0	< 2.0	< 2.0	–	–
Dilution Factor[d]		1	1	–	–

a "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Cryogenic Preconcentration Techniques," Revision 1.0, US EPA April 1984.
b Misc. Aliphatics (C_1-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of Hexane.
c Misc. Aromatics (C_9-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of o-Xylene.
d The dilution factor indicates the adjustments made to the data and reporting limits for sample dilutions.

GTEL ENVIRONMENTAL LABORATORIES, INC.

MEADOWBROOK I[illegible]STR[illegible]AR
MILFORD, NH 03055
(603) 672-4835
(800) LAB-GTEL

CH[illegible]OF-CUSTOD[illegible]CO[illegible]
AND ANALYSIS REQUEST [illegible]89[illegible]

[Com]pany Name: GROUNDWATER TECHNOLOGY INC
Phone #: 516-472-4000
FAX #: 516-472-4077
[Com]pany Address: 1-1 COLIN DR HOLBROOK NY 11741
Site location: SAG HARBOR, NY
[Proj]ect Manager: AL TOWN
Client Project ID: (#) 01113-7013
(NAME) BULOVA SAG HARBOR
[I att]est that the proper field sampling [pro]cedures were used during the collection [of t]hese samples. Todd Painter
Sampler Name (Print): TODD PAINTER

Field Sample ID	GTEL Lab # (Lab use only)	# Containers	Matrix: WATER	SOIL	AIR	SLUDGE	PRODUCT	OTHER	Method Preserved: HCl	HNO_3	H_2SO_4	ICE	UNPRESERVED	OTHER (SPECIFY)	Sampling: DATE	TIME
[illegible]S 300,400 AFTER CARBON	1	1			X				·				X		10-4-94	4:20
[illegible]S 300,400 BEFORE CARBON	✓	1			X								X		10-4-94	4:30

ANALYSIS REQUEST

Field Sample ID	BTEX/602 ☐ 8020 ☐ with MTBE ☐	BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐	Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screen ☐	Hydrocarbon Profile (SIMDIS) ☐	Oil and Grease 413.1 ☐ 413.2 ☐ SM 503 ☐	TPH/IR 418.1 ☐ SM 503 ☐	EDB by 504 ☐ DBCP by 504 ☐	EPA 503.1 ☐ EPA 502.2 ☐	EPA 601 ☐ EPA 8010 ☐	EPA 602 ☐ EPA 8020 ☐	EPA 608 ☐ 8080 ☐ PCB only ☐	EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐	EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐	EPA 610 ☐ 8310 ☐	EP TOX Metals ☐ Pesticides ☐ Herbicides ☐	TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐	EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐	CAM Metals TTLC ☐ STLC ☐	Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐	Organic Lead ☐	Corrosivity ☐ Flash Point ☐ Reactivity ☐	OTHER: TO3 (VAH)
[illegible]S 300,400 AFTER CARBON																						X
[illegible]S 300,400 BEFORE CARBON																						X

TAT
[Pri]ority (24 hr) ☐
[Exp]edited (48 hr) ☐
[ ] Business Days ☐
[Oth]er STANDARD
[ ] Business Days ☐

Special Handling
GTEL Contact ______
Quote/Contract # ______
Confirmation # ______
PO # ______

QA / QC LEVEL
[BL]UE ☐ CLP ☐ OTHER ______

SPECIAL DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS

FAX ☐

REMARKS

Lab Use Only Lot #
Storage Location: Log in
Work Order # M4100091

[C]USTODY [R]ECORD

	Date	Time	
Relinquished by Sampler: Todd Painter	10-4-94	6:30	Received by:
Relinquished by:			Received by:
Relinquished by:	1 [illegible]	10[illegible]	Received by Laboratory: [signature]

Waybill # 618147916[illegible]

7/91

GTEL
ENVIRONMENTAL
LABORATORIES, INC.

Northeast Region
Meadowbrook Industrial Park
Milford, NH 03055
(603) 672-4835
(800) 441-4835
FAX (603) 673-8105

RECEIVED
NOV 2 1 1994

November 15, 1994

Al Tonn
Groundwater Technology, Inc.
101-1 Colin Drive
Holbrook, NY 11741

RE: GTEL Client ID: 011137013
Login Number: M4110201
Project ID (number): 011137013
Project ID (name): BULOVA SAG HARBOR, NY

Dear Al Tonn:

Enclosed please find the analytical results for the samples received by GTEL Environmental Laboratories, Inc. on 11/09/94 under Chain-of-Custody Number(s) 59567.

A formal Quality Assurance/Quality Control (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria unless otherwise stated in the footnotes.

GTEL is certified by the State of New York under Lab ID #10599.

If you have any questions regarding this analysis, or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,
GTEL Environmental Laboratories, Inc.

Susan C. Uhler
Laboratory Director

Client Number: 011137013
Project ID: BULOVA SAG HARBOR, NY
Login Number: M4-11-0201

ANALYTICAL RESULTS

Aromatic Volatile Organics in Air
Modified EPA Method TO3[a]

GTEL Sample Number		110201-01	110201-02	110201-03	--
Client Identification		PROCESS 300, 400 BEFORE CARBON	PROCESS 300, 400 AFTER CARBON	PROCESS 100, 200 EFFLUENT	--
Date Sampled		11/08/94	11/08/94	11/08/94	--
Date Analyzed		11/10/94	11/10/94	11/10/94	--
Analyte	Reporting Limit, ppmv	Concentration, ppmv			
Benzene	1.0	< 1.0	< 1.0	< 1.0	--
Toluene	1.0	< 1.0	< 1.0	< 1.0	--
Ethylbenzene	1.0	< 1.0	< 1.0	< 1.0	--
Xylenes (total)	3.0	< 3.0	< 3.0	< 3.0	--
Misc. Aliphatics (C_1-C_{10})[b]	15	< 15	< 15	< 15	--
Misc. Aromatics (C_9-C_{10})[c]	10	< 10	< 10	< 10	--
1,1-Dichloroethene	2.0	< 2.0	< 2.0	< 2.0	--
trans-1,2-Dichloroethene	2.0	< 2.0	< 2.0	< 2.0	--
cis-1,2-Dichloroethene	2.0	< 2.0	< 2.0	< 2.0	--
1,1-Dichloroethane	2.0	< 2.0	< 2.0	< 2.0	--
1,2-Dichloroethane	2.0	< 2.0	< 2.0	< 2.0	--
Methylene Chloride	2.0	< 2.0	< 2.0	< 2.0	--
Chlorobenzene	2.0	< 2.0	< 2.0	< 2.0	--
1,1,1-Trichloroethane	2.0	**7.4**	**6.9**	< 2.0	--
Trichloroethene	2.0	**11**	**17**	< 2.0	--
Tetrachloroethene	2.0	< 2.0	< 2.0	< 2.0	--
Dilution Factor[d]		1	1	1	--

a "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Cryogenic Preconcentration Techniques," Revision 1.0, US EPA April 1984.
b Misc. Aliphatics (C_1-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of Hexane.
c Misc. Aromatics (C_9-C_{10}) is an estimated concentration based on a derived total area, and calculated using the response factor of o-Xylene.
d The dilution factor indicates the adjustments made to the data and reporting limits for sample dilutions.

GTEL ENVIRONMENTAL LABORATORIES, INC.

MEADOWBROOK INDUSTRIAL PARK
MILFORD, NH 03055
(603) 672-4835
(800) LAB-GTEL

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

59567

Company Name: GROUNDWATER TECHNOLOGY INC
Phone #: 516-472-4000
FAX #: 516-472-4077
Company Address: 101-1 COLIN DR HOLBROOK NY 11741
Site location: ~~Bulo~~ SAG HARBOR, NY
Project Manager: AL TONN
Client Project ID: (#) 01113-7013
(NAME) BULOVA SAG HARBOR
I attest that the proper field sampling procedures were used during the collection of these samples. [signature]
Sampler Name (Print): TODD PAINTER

Field Sample ID	GTEL Lab # (Lab use only)	# Containers	Matrix: AIR	Method Preserved: UNPRESERVED	Sampling DATE	Sampling TIME	Analysis Request: Other — TO3 (VAH)
ESS 300,400 BEFORE CARBON	1	1	X	X	11-8-94	1430	X
ESS 300,400 AFTER CARBON	2	1	X	X	11-8-94	1400	X
ESS 100,200 EFFLUENT	3	1	X	X	11-8-94	1415	X

Matrix: WATER, SOIL, AIR, SLUDGE, PRODUCT, OTHER. Method Preserved: HCl, HNO_3, H_2SO_4, ICE, UNPRESERVED, OTHER (SPECIFY).

ANALYSIS REQUEST: BTEX/602 ☐ 8020 ☐ with MTBE ☐; BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐; Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screen ☐; Hydrocarbon Profile (SIMDIS) ☐; Oil and Grease 413.1 ☐ 413.2 ☐ SM 503 ☐; TPH/IR 418.1 ☐ SM 503 ☐; EDB by 504 ☐ DBCP by 504 ☐; EPA 503.1 ☐ EPA 502.2 ☐; EPA 601 ☐ EPA 8010 ☐; EPA 602 ☐ EPA 8020 ☐; EPA 608 ☐ 8080 ☐ PCB only ☐; EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐; EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐; EPA 610 ☐ 8310 ☐; EP TOX Metals ☐ Pesticides ☐ Herbicides ☐; TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐; EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐; CAM Metals TTLC ☐ STLC ☐; Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐; Organic Lead ☐; Corrosivity ☐ Flash Point ☐ Reactivity ☐; OTHER

TAT
Priority (24 hr) ☐
Expedited (48 hr) ☐
Business Days ☐
Other ___
Business Days ☐

Special Handling
GTEL Contact ___
Quote/Contract # ___
Confirmation # ___
PO # ___

QA / QC LEVEL
☐ CLP ☐ OTHER ___

SPECIAL DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS

FAX ☐

REMARKS

Lab Use Only Lot #
Storage Location: LC C1N
Work Order # 11941163C1

CUSTODY RECORD

Relinquished by	Date	Time	Received by
Relinquished by Sampler: [signature]	11-8-94	1600	Received by: AIRBORNE EXP
Relinquished by:			Received by:
Relinquished by:	11-9-94	[illegible]	Received by Laboratory: [signature]

Waybill #: 6158179261

APPENDIX G

GRANULAR ACTIVATED CARBON CONSUMPTION

GAC-USE

A PROGRAM FOR ESTIMATION OF GRANULAR ACTIVATE CARBON CONSUMPTION RATES

SUMMARY OF VAPOR PHASE GAC CONSUMPTION ANALYSIS

FORMER WATCH CASE FACTORY SITE site in SAG HARBOR, NY

Air flow rate	= 160 cfm
Influent air temperature	= 55 deg F
Temperature increase across blower	= 30 deg F

Influent vapor phase contaminant concentrations:

1,1,1-TCA	= 53 ppmv	TCE	= 68 ppmv

VAPOR PHASE CARBON CONSUMPTION = 11421 lb/year

GROUNDWATER TECHNOLOGY

GAC-USE

A PROGRAM FOR ESTIMATION OF GRANULAR ACTIVATE CARBON CONSUMPTION RATES

SUMMARY OF VAPOR PHASE GAC CONSUMPTION ANALYSIS

WATCH CASE FACTORY SITE site in SAG HARBOR, NY

Air flow rate	= 160 cfm
Influent air temperature	= 55 deg F
Temperature increase across blower	= 30 deg F

Influent vapor phase contaminant concentrations:

1,1,1-TCA	= 7 ppmv	TCE	= 11 ppmv

VAPOR PHASE CARBON CONSUMPTION = 2647 lb/year