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SOIL REMEDIAL ACTION
SVE OPERATIONS AND MAINTENANCE PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Prepared For

Nabisco, Inc.

February 1999

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SOIL REMEDIAL ACTION
SVE OPERATION AND MAINTENANCE PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

1.0 INTRODUCTION

The Rowe Industries Site, located in Sag Harbor, New York, is listed on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or "Superfund". Past activities at the subject site resulted in the release of volatile organic compounds (VOCs) to the site soil and ground water. The three most prevalent VOCs identified in the soil and ground water were tetrachloroethylene (PCE), trichloroethylene (TCE), and trichloroethane (TCA). The VOCs, produced from degreasing wastes generated at the site, were disposed of in the past in five dry wells (dry wells DW-A thru DW-F, with the exception of DW-B) located on the subject property. In addition, soil beneath the former drum storage area (FDSA) was also impacted with VOCs. In order to remediate the impacted soils, two soil-vapor extraction (SVE) systems were constructed in 1998. The first SVE system consists of 10 SVE wells located in the former drum storage area and 5 SVE wells located in the eastern parking lot. The second SVE system consists of horizontal extraction pipes in the soil impoundment. The soil impoundment was constructed to reduce the concentrations of VOCs in soils removed from the FDSA as part of the remedial action. Both of the SVE systems were installed and constructed according to design documents reviewed and approved by the USEPA.

2.0 STATEMENT OF PURPOSES

This plan describes the operation, monitoring and maintenance of the SVE systems installed at the Rowe Industries Site. The objective of this plan is to summarize information needed to assist in understanding the intended operation of the soil remediation system. Managers and technicians often change with time, therefore, this plan will provide quality assurance of adequate operation needed for timely site closure and sufficient monitoring needed to evaluate the system operation. This plan is a working document that can be easily revised by adding or deleting pertinent sections to address changes in operations or facility modifications over time.

3.0 DESCRIPTION OF SYSTEM

Fifteen SVE wells, which are manifolded into five separate groups (Manifolds A through E), six individual extraction points within the soil impoundment, which are manifolded into three separate groups and the two SVE blower packages were installed in the eastern portion of the property. The SVE wells in the FDSA (Manifolds A, B and C) were installed to remediate the contaminated soil within this area. The SVE wells in the eastern parking lot (Manifold D and E) were installed to collect vapors that have migrated to the area beneath the eastern parking lot. The six extraction points within the soil impoundment were installed to treat the excavated offsite soil from the FDSA. Table 1 summarizes the soil-vapor extraction wells connected to each manifold at the site. Figure 1 shows the locations of the vapor extraction points, vacuum monitoring points, and monitor wells on and offsite. Figure 2 shows the below grade manifold piping for the SVE wells and the soil impoundment.

The SVE extraction and treatment systems are contained in a treatment shed and an adjacent fenced in area, located on the eastern side of Sag Harbor Industries. Figure 3 shows the layout of the treatment system.

Two separate extraction systems will be operated to remediate the site. The first system includes the five manifold groups that operate from a 20-horsepower (HP) explosion-proof regenerative blower. The second system includes six individual extraction points that operate from a 3-HP explosion-proof regenerative blower. As shown in figure 4, the SVE blowers used at the site are mounted on a steel skid and are equipped with a moisture separator, air filters, gauges and switches to control the operation. Both the suction and discharge lines are equipped with relief valves to avoid excessive vacuum or pressure loads on the blower.

The extracted vapor from the extraction wells and the impoundment will be plumbed into a common pipe after passing through each respective blower. The vapors will flow through a heat exchanger to reduce the temperature of the airstream which is then treated with two 1,500-pound activated vapor-phase carbon absorbers. After treatment with carbon, the airstream is discharged to the atmosphere. Figure 5 shows the configuration of the carbon units and the heat exchanger.

3.1 Equipment and Controls

Each extraction system is equipped with an in-line filter, an adjustable vacuum relief valve, a dilution valve, an inlet filter silencer, a low pressure switch, a high vacuum switch, pressure gauges and a moisture separator with a liquid level switch. The suction side of each blower is equipped with a filter to remove particulates and a moisture separator to remove excessive moisture. The dilution valves are used for adjustment of the vacuum placed upon the wellhead or impoundment. The silencer devices are used to reduce the level of noise at which each blower operates. Figure 4 shows the location of these controls on the blower system.

Each blower unit is equipped with separate control switches to shut down the blower in the event of an alarm condition. The moisture separators are equipped with a liquid level switch that will shut the unit down when the liquid level within the moisture separator rises to a preset level, triggering the switch to shut the blower down. The low pressure switch will shut down the unit in the event that there is a loss in pressure at the blower outlet. The high vacuum switch will shut down the unit if the vacuum at the blower inlet rises past the alarm setting. Pressure gauges are mounted on the units allowing for identification of operating pressures. Internal thermal overload switches will shut the blower down if there is an overload on the blower. Carbon high back-pressure switches will shut down the blowers if the pressure at the carbon units rises above the switch limit. This switch is located after the blowers, at the common effluent pipe. Control switch logic is shown in the process and instrumentation diagram presented in figure 7. Table 2 is a summary of the system control switches and alarm settings for the SVE system.

In the event of an alarm, an autodialer, programmed with contact phone numbers, will dial the first number for alarm acknowledgment within 60 seconds after the alarm has been detected. The alarm can be acknowledged onsite and offsite by following the autodialer acknowledgment procedure in the manual located in Appendix I.

4.0 SYSTEM OPERATION AND MAINTENANCE

4.1 Start-up Procedure

To start either of the SVE systems, the following procedure should be used:

1. Open all gate valves on the individual extraction lines to be operated. Close all others.
2. Open all ball valves on the manifolds to be operated. Close all others.
3. Close all sample ports.
4. Close drain valve on moisture separator.
5. Turn on heat exchanger motor starter control (located outside of the cargo box).
6. Turn SVE blower on by turning on power control switch, located on the control panel, to the "ON" position.
7. Reset any alarms by pressing the "Alarm Reset" button on the control panel and the "Alarm Cancel" button on the autodialer (located on the outside of the cargo box).
8. Press the green blower "START" button on the corresponding blower control panel.
9. Fine tune the flow rates from the individual extraction wells by adjusting the gate valves on the extraction lines or the ball valves on the manifolds. Fine tune the total flow by adjusting the dilution valve on the blower.
10. Check and record all pressure and temperature gages associated with the system and compare with normal operating ranges.

To stop operation of either of the SVE systems, turn the power off to the SVE blower by pressing the red blower "OFF" button on the blower control panel.

4.2 Routine Operating Procedures

The SVE systems operate by placing a vacuum on the extraction wells and extraction points within the soil impoundment thus inducing ambient air to enter the subsurface or the impoundment. As the air passes through the sediments the contamination volatilizes and is drawn from the sediment through the extraction wells/points and piping and into the blowers. The amount of vacuum at the

extraction wells/points is controlled by the dilution valve located on the blower packages and the flow control valve at each wellhead and extraction point. The options for operation of the systems are as follows:

1. Opening blower dilution valve - will decrease the vacuum on the entire system including the extraction wells/points. Opening the dilution valve increases the exhaust flow rate by adding atmospheric air, but will decrease the concentration of vapors in the exhaust. The flow rate from the extraction wells/points will be decreased due to a decrease in vacuum at the wellhead.

2. Closing blower dilution valve - will increase the vacuum on the entire system including the extraction wells/points. Closing the dilution valve decreases the exhaust flow rate, but increases the concentration of vapors in the exhaust by placing a higher vacuum on the extraction wells/points and it will also increase the extraction rate from the extraction wells/points.

3. Opening the flow control valves on the extraction wells - will increase the vacuum and flow rate from the individual wells/points.

4. Closing the flow control valves on the extraction wells - will decrease the vacuum and flow rate from the individual wells/points.

5. Opening the flow control valve on the manifolds - will increase the vacuum and flow rate from the wells connected to the manifold.

6. Closing the flow control valve on the manifolds - will decrease the vacuum and flow rate from the wells connected to the manifold.

7. Opening the valve separating the blowers - will alter the blower drawing on the manifolds. This will increase or decrease the flow rate depending on the configuration. Operating just the 3 HP blower on the SVE wells will decrease the flow from the wells. Operating just the 20 HP blower will increase the flow from the soil impoundment. Closing the dilution valve on the blower that will not be operating is required in order to prevent short circuiting the treatment air flow.

4.3 Maintenance

4.3.1 Extraction Blower Maintenance

The extraction blowers require little or no maintenance to perform as designed. Maintenance activities should involve keeping the filters clean and the moisture separators empty. The blowers are difficult to disassemble and reassemble; therefore, prior to any attempts to repair the blowers, Ametek Rotron should be consulted.

4.3.2 Heat Exchanger

Maintenance activities should consist of keeping the area surrounding the unit free of debris which may clog the heat exchanger unit.

4.4 Trouble Shooting

4.4.1 Extraction Blowers

Table 3 identifies possible problems, symptoms and potential solutions that may occur while operating the extraction blowers.

4.4.2 Heat Exchanger

The manufacturer should be contacted before any troubleshooting activities are conducted.

5.0 MONITORING /SYSTEM MAINTENANCE

5.1 Inspections

The treatment system will be inspected according to the schedule presented in Appendix II. Any failures, faults or unusual observations will be investigated fully. Any equipment that is found to be out of adjustment, or in disrepair will be repaired or serviced. Manufacturer's information for the major pieces of equipment is provided in Appendix I of the manual.

5.1.1 System Observations

The inspection items that will be observed and recorded on the O&M Data Sheets in Appendix III are listed in the Sampling and Monitoring Schedule in Appendix II. A general list of observations is listed below.

- Weather Conditions

  The weather will be monitored for parameters including current weather conditions (sunny, raining, etc.), air temperature, wind direction, wind speed, relative humidity and barometric pressure, which can be determined from the onsite weather station located in the office trailer.

- Equipment Operations and System Operating Parameters

  The operating configuration of the blowers, manifolds, and carbon units will be recorded. Blower operations that will be recorded include the vacuum at each SVE well, each monitor well screened above the water table, each vapor point, each manifold and each blower inlet.

  The pressure at each blower outlet and the pre-carbon and mid-carbon location will also be recorded.

  The temperature of the influent airstream at each manifold, pre-heat exchanger, pre-carbon, mid-carbon and post-carbon will be recorded.

Additional Raw Data needed to calculate airflows such as the differential pressure across ventures and vacuums in each manifold, the soil impoundment and the pre-carbon location will be recorded.

Photoionization detector (PID) readings will be made from air samples collected at the pre-mid- and post-carbon and the manifold sample ports.

Ground-water levels from monitor wells within the impacted area will be measured. Moisture levels at each blower moisture separator will be recorded.

- Impoundment Status

  Soil impoundment observations will include the operating configuration. Monitoring the condition of the impoundment blocks, piping, valves and cover for damage will also be completed.

- Wellhead and Gate Valve Condition

  Wellhead and gate valve observations will include checking for and removing any water and/or ice in the wellheads and the gate valve heads.

5.1.2 Air Flow Calculations

The vapor airflow for the extraction system for Manifolds A through E will be measured through ventures mounted at each individual manifold line within the treatment shed. The vapor stream airflow at the soil impoundment extraction system will be measured at the individual extraction manifolds utilizing the manifold ventures and through the soil impoundment manifold venturi mounted within the treatment shed. The vapor airflow will be calculated using recorded differential pressure data, temperature data and vacuum data collected at each venturi. Differential pressure readings are made by connecting the high and low ports of each venturi with the high and low ports of a magnetic pressure gauge. This reading will be recorded in units of inches of water

column (" of W.C.). This value will be substituted into the venturi flow equation along with the vacuum and air stream temperature to obtain the vapor stream flow rate in units of cubic feet per minute (cfm). The summation of the vapor stream flowrate from Manifolds A through E will be the total vapor stream flowrate for the SVE system for the FDSA and the eastern parking lot. The vapor stream flowrate for the soil impoundment will be obtained by measuring the differential pressure across the single venturi within the treatment shed and substituting the reading into the venturi flow equation to obtain the vapor stream flowrate for the soil impoundment.

5.2 Effluent Air Quality

Ambient concentrations of VOCs will be measured downwind from the stack using a photoionization detector (PID) equipped with an 11.8 eV bulb. In addition pre-, mid- and post-carbon and manifold vapor samples will be collected in a Tedlar bag and screened with the PID. Select samples will be analyzed using a gas chromatograph for PCE and/or submitted to a State-certified laboratory and analyzed for the compounds of concern using EPA Methods TO-1 and TO-2. A sampling and analysis schedule is presented in Appendix II.

5.3 Waste Disposal

During the operation of the SVE system there will be times when hazardous waste material is generated. The anticipated sources of waste are: 1) moisture from the moisture separators and possibly the sump in the carbon units and 2) carbon from carbon changeouts. The removal and disposal of waste shall be completed following guidelines defined by OSHA, NYSDOT and the USEPA. A disposal or regeneration facility and waste transporter shall be contacted and scheduled for the removal of the waste. Per the Consent Decree, prior to any off-site shipment of waste material from the site to an out-of-state waste disposal or regeneration facility, written notification to the appropriate state environmental official in the receiving facility's state and to the EPA project coordinator should be completed if the waste exceeds 10 cubic yards. The notification will include 1) name and location of the waste management facility, 2) type and quantity of waste, 3) expected schedule of shipment, and 4) method of transportation.

The collection and generation of waste should be noted on the O&M data sheets provided in Appendix III as well.

6.0 SAMPLING, ANALYSIS AND REPORTING DOCUMENTATION

6.1 Vapor Quality

Sampling results will be continuously reviewed and evaluated for reductions from the previous month's sample results. Based on the results, system modifications may be made as frequently as once a month. Notification of a system modification (i.e., change in SVE wells applied vacuum or adjusting airflow from active wells) will be made to the United States Environmental Protection Agency (USEPA), in monthly progress reports.

6.2 Soil Quality

The SVE post-remedial sampling will include six perimeter borings and six interior borings in the former drum storage area at locations to be approved in advance by the USEPA. Continuous split-spoon samples will be collected from all 12 borings. Each sample will be split into duplicate, individually-jarred samples. The one sample from each boring with the highest PID concentration will be submitted for 24-hour turnaround analysis by Method 8010. If compliance has been achieved based on Method 8010, the duplicate sample will be submitted for CLP analysis. If the samples are non-compliant, the PRP's Representative will use their judgement to determine when to re-sample depending on the concentrations. This procedure will be utilized for any subsequent round of post-remedial sampling that may be needed. A sampling and closure plan will be submitted to the USEPA once vapor VOC concentrations have consistently been reduced or eliminated from the remediation process.

6.3 Reporting Documentation

All data collected during O&M activities shall be recorded into a spreadsheet program following each days activities. Keeping data up to date will allow the operator to monitor system

performance by comparing new data with past operating data. Data that shall be continuously updated during O&M activities includes:

- summary of system operation
- airflow data and calculations
- summary of temperatures
- laboratory data for all sample ports
- PID data for all sample ports
- carbon performance data
- summary of gage readings
- summary of monitor well water levels
- summary of vacuum gage readings at SVE wells, vapor points, and monitor wells
- summary of O&M activities
- summary of SVE system alarms

Any additional data that may provide insight into the operation of the SVE system should also be compiled. For the first six months of the system's operation, performance data will be reported to the USEPA and NYSDEC on a monthly basis. A letter which summarizes the above data and presents conclusions regarding the system's performance shall be submitted to the USEPA and NYSDEC on a quarterly basis.

7.0 EQUIPMENT MANUALS AND OPERATING GUIDES

Copies of the operating manuals for both SVE blowers, heat exchanger, auto dialer, and the treatment shed combustible gas indicator are provided in Appendix I. Cut sheets of system components are also provided in Appendix I.

8.0 OPERATING FORMS

The performance of the extraction systems will be tracked using the monitoring/data sheets provided in Appendix III. Standard Operating Procedures, included in Appendix IV, shall be used while conducting operation and maintenance activities.

9.0 SAMPLING AND MONITORING SCHEDULE

The sampling and monitoring completed during the O&M will follow the schedule in Appendix II. This Appendix shall be updated monthly based on results of vapor stream monitoring completed during system operation.

10.0 HEALTH & SAFETY

The Rowe Industries Site is a Hazardous Waste Site contaminated with F-listed hazardous waste. All site activities associated with O&M of the SVE system shall comply with safe work procedures outlined and presented in Appendix V, Health & Safety Plan.

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Reviewed by:

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President

cmp
February 16, 1999
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TABLES

TABLE 1

SOIL REMEDIAL ACTION
SVE OPERATIONS AND MAINTENANCE PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

SVE Well and Manifold Details

Source	Manifold	SVE Well	Screened Interval (ftbg)
Former Drum Storage Area	A	11	5 - 15
		13	6.5 - 16.5
		15	7 - 17
	B	6	4 - 14
		9	4.5 - 14.5
		12	6 - 16
	C	7	4 - 14
		8	4 - 14
		10	5 - 15
		14	5 - 15
Eastern Parking Lot	D	3	4.5 - 14.5
		4	4 - 14
		5	4.5 - 14.5
	E	1	5 - 15
		2	6 - 16
Soil Impoundment[1/]	SI	North	Top 40 feet
		Middle	Bottom 40 feet
		South	Top 40 feet

1/ horizontal piping

TABLE 2

SOIL REMEDIAL ACTION
SVE OPERATIONS AND MAINTENANCE PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Control Switch Alarm Settings

Number	Operating Control[1/]	Alarm Settings
1	20 HP blower high-high moisture level	13.5 inches on sight glass
2	20 HP blower high inlet vacuum	75 inches of W.C. (2.7 psi)
3	20 HP blower thermal overload	Not Adjustable
4	20 HP blower low outlet pressure	18 inches of W.C. (0.65 psi)
5	High carbon back-pressure	80 inches of W.C. at pre-carbon (2.9 psi)
6	Combustible gas detector	40 % LEL
7	3 HP blower high-high moisture level	13.5 inches on sight glass
8	3 HP blower high inlet vacuum	75 inches of W.C. (2.7 psi)
9	3 HP blower thermal overload	Not Adjustable
10	3 HP blower low outlet pressure	2.5 inches on W.C. (0.09 psi)

1/ Switch locations shown on Figure 7, Process and Instrumentation Diagram.

Autodialer alarms: Alarm 1 - alarm condition on 20 HP blower system exists.
Alarm 2 - alarm condition on 3 HP blower system exists.

TABLE 3

SOIL REMEDIAL ACTION
SVE OPERATIONS AND MAINTENANCE PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Trouble Shooting for Extraction Blowers[1/]

POSSIBLE CAUSE	OUT OF WARRANTY REMEDY[2/]
IMPELLER DOES NOT TURN	
Humming Sound	
1. One phase of power line not connected[3/]	1. Connect
2. One phase of stator winding open[3/]	2. Rewind or buy new motor
3. Bearings defective	3. Change bearings
4. Impeller jammed by foreign material	4. Clean and add filter
5. Impeller jammed against housing or cover	5. Adjust
No Sound	
1. Two phases of power line not connected[3/]	1. Connect
2. Two phases of stator winding open[3/]	2. Rewind or buy new motor
IMPELLER TURNS	
Blown fuse	
1. Insufficient fuse capacity	1. Use time delay fuse of proper rating
2. Short circuit	2. Repair
Motor Overheated or Protector Trips	
1. High or low voltage	1. Check input voltage
2. Operating in single phase condition[3/]	2. Check connections
3. Bearings defective	3. Change bearings
4. Impeller rubbing against housing or cover	4. Adjust
5. Impeller or air passage clogged	5. Clean and add filter
6. Unit operating beyond performance range	6. Reduce system pressure/vacuum
7. Capacitor shorted	7. Change capacitor
8. One phase of stator winding short circuited[3/]	8. Rewind or buy new motor
Abnormal Sound	
1. Impeller rubbing against housing or cover	1. Adjust
2. Impeller or air passage clogged	2. Clean and add filter
3. Bearings defective	3. Change bearings

TABLE 3
(continued)

SOIL REMEDIAL ACTION
SVE OPERATIONS AND MAINTENANCE PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Trouble Shooting for Extraction Blowers[1/]

IMPELLER TURNS	
Performance Below Standard	
1. Leak in piping	1. Tighten
2. Piping and air passage clogged	2. Clean
3. Impeller rotation reversed	3. Check wiring
4. Leak in blower	4. Tighten cover, flange
5. Low voltage	5. Check input voltage

1/ Adapted from Manufacture Operational Catalog.

2/ Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.

3/ Three phase units.

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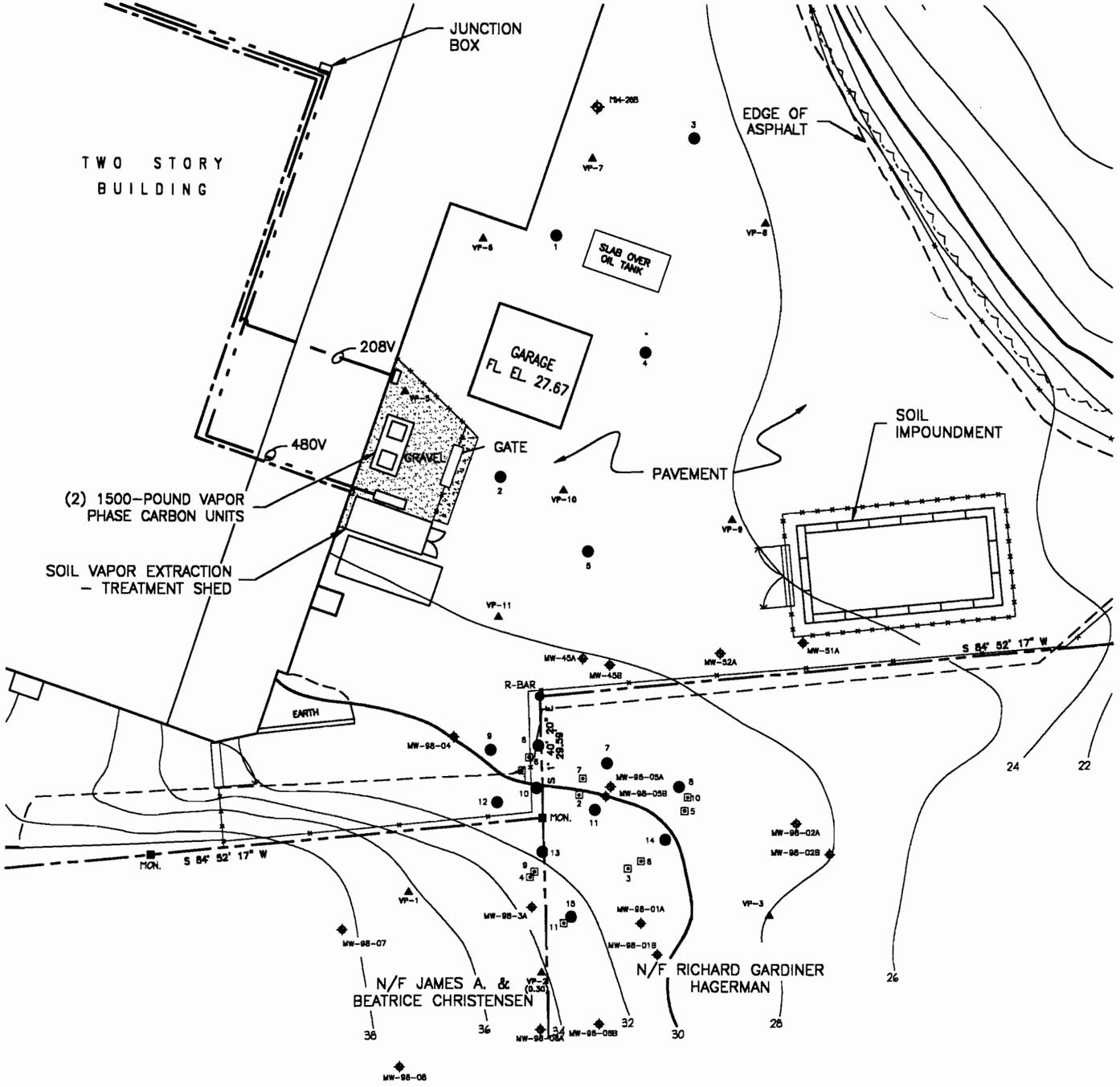
FIGURES



N

LEGEND

- PROPERTY BOUNDARY
- MW-98-02A — MONITOR WELL LOCATION
- 3 — AIR SPARGE WELL LOCATION
- VP-8 — VACUUM MONITOR POINT LOCATION
- 5 — SVE WELL LOCATION

0 30

SCALE IN FEET

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

SITE PLAN

DATE	REVISED

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(203) 452-3100

DRAWN:	TLC	CHECKED:	PJ	DATE:	1/26/99	FIGURE:	1

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LEGEND

- PROPERTY BOUNDARY
- CHAIN LINK FENCE
- UNDERGROUND TELEPHONE
- ABOVEGROUND TELEPHONE
- 208V ELECTRICAL CONDUIT
- 480V ELECTRICAL CONDUIT
- SVE PIPING
- SVE-14 SVE WELL

MANIFOLD	WELLS
A	11, 13, 15
B	6, 9, 12
C	7, 8, 10, 14
D	3, 4, 8
E	1, 2

N

SVE VALVE DETAIL
SCALE: 1" = 1'-6"

4"ø
2"ø TEE

0 20
SCALE IN FEET

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

SVE PIPING - AS-BUILT

DATE	REVISED

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DRAWN:	TLC	CHECKED:	PJ	DATE:	1/26/99	FIGURE:	2

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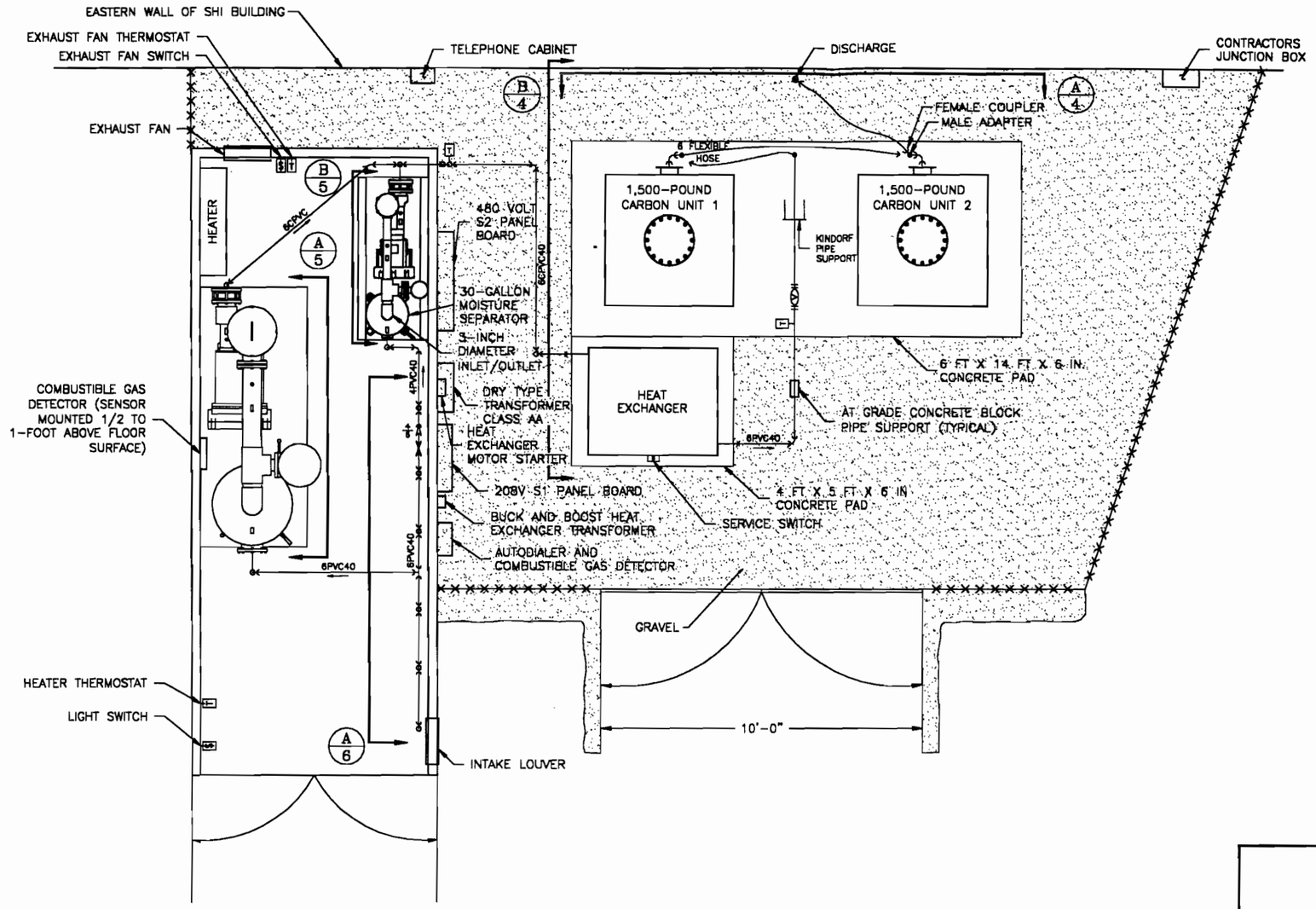

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SCALE IN FEET

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

TREATMENT SHED AND CARBON UNITS - PLAN VIEW

DATE	REVISED

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DRAWN:	TLC	CHECKED:	PJ	DATE:	1/26/99	FIGURE:	3

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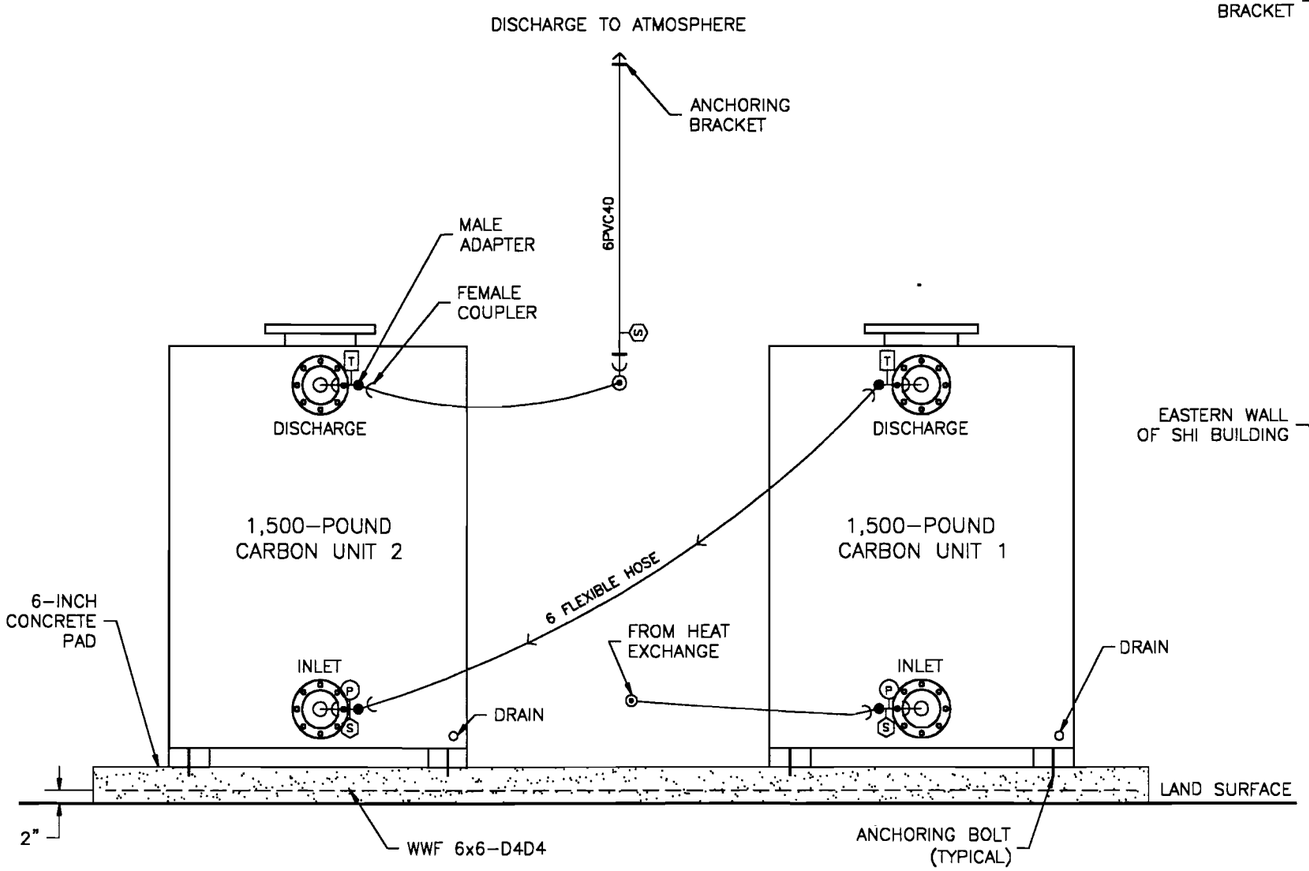
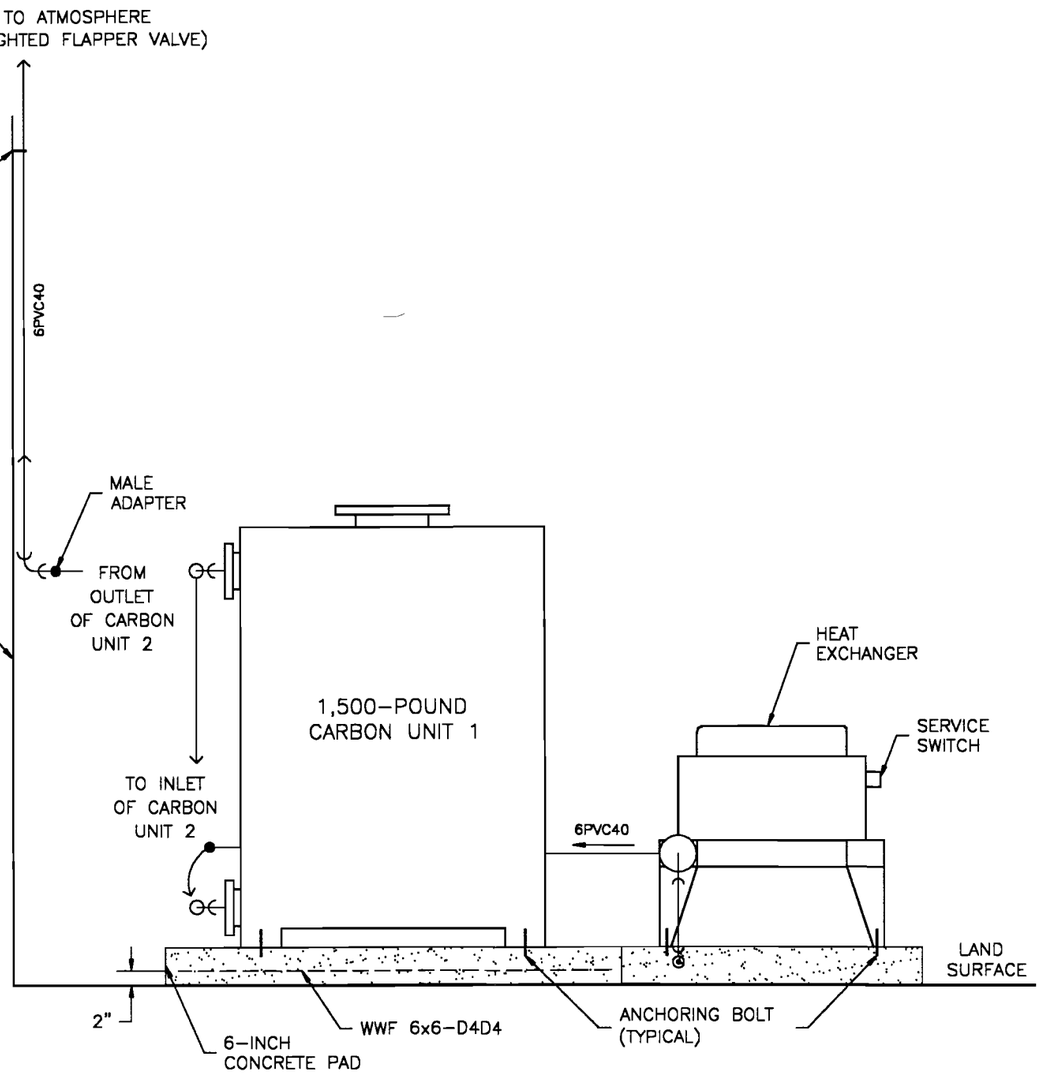


A/4 VAPOR PHASE CARBON ADSORBERS – PROFILE VIEW



B/4 VAPOR PHASE CARBON ADSORBERS AND HEAT EXCHANGER – SIDE VIEW

0 2
SCALE IN FEET

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

VAPOR PHASE CARBON UNITS AND HEAT EXCHANGER

DATE	REVISED

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DRAWN:	TLC	CHECKED:	PJ	DATE:	1/26/99	FIGURE:	4

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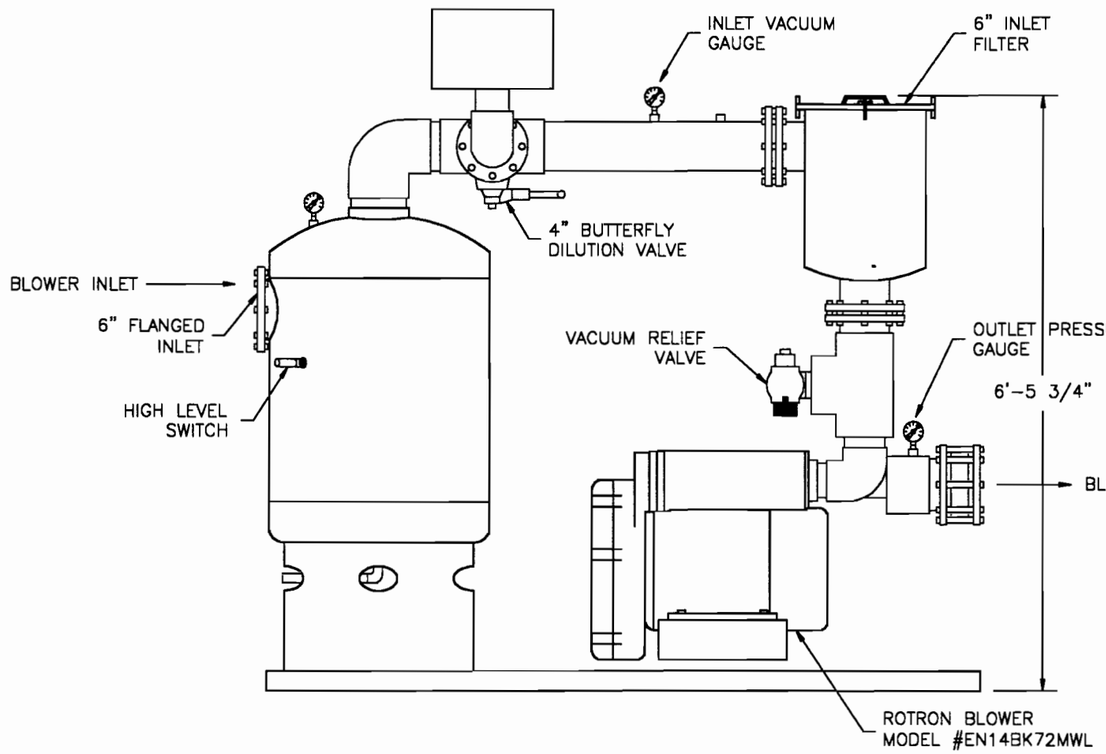
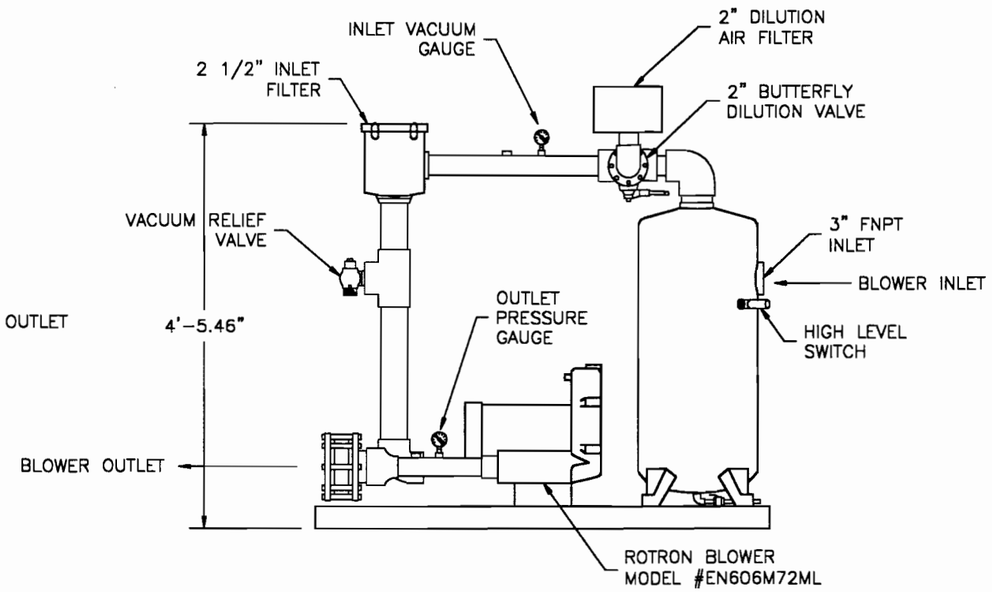


A/5 20HP SVE BLOWER PACKAGE
NOT TO SCALE



B/5 3HP IMPOUNDMENT BLOWER PACKAGE
NOT TO SCALE

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

BLOWER SYSTEMS

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
126 Monroe Turnpike
Trumbull, CT 06611
(203) 452-3100

DRAWN:	TLC	CHECKED:	PJ	DATE:	1/26/99	FIGURE:	5

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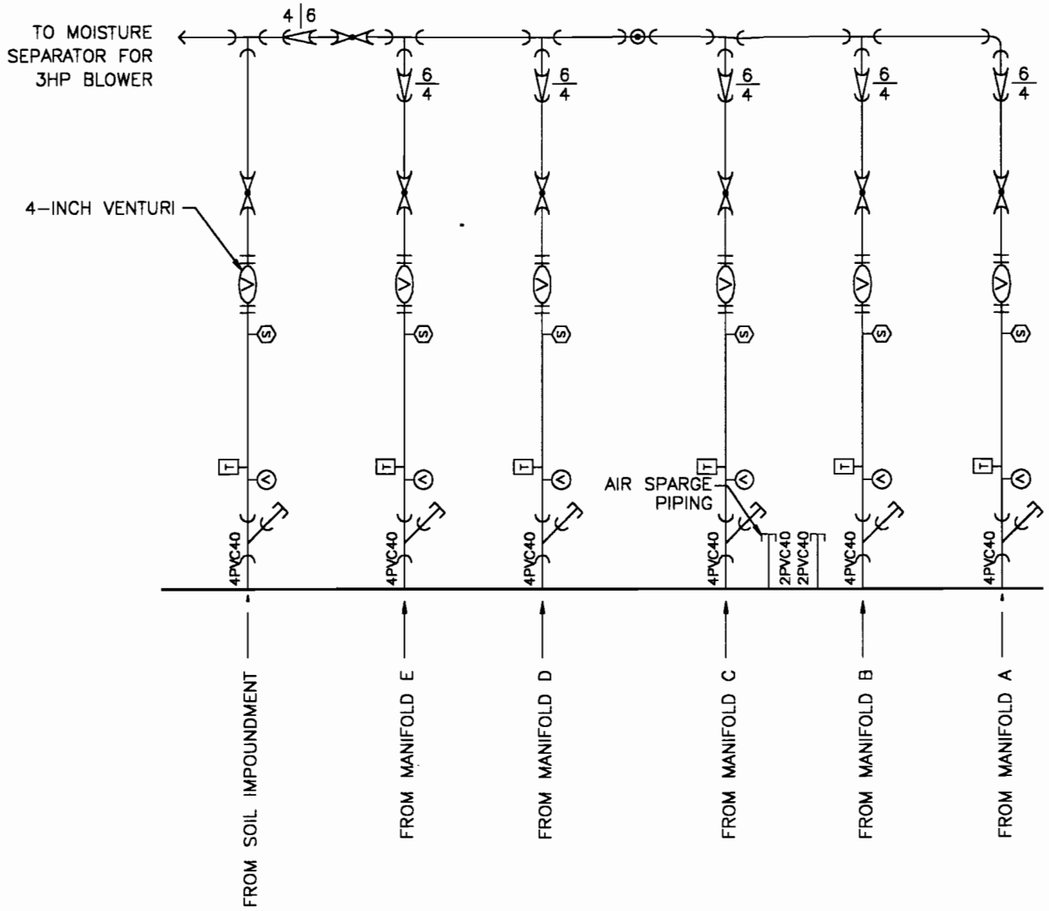

A/6 INFLUENT PIPING – TREATMENT SHED

0 2
SCALE IN FEET

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

INFLUENT PIPING TREATMENT SHED

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
126 Monroe Turnpike
Trumbull, CT 06611
(203) 452-3100

DRAWN:	TLC	CHECKED:	PJ	DATE:	1/26/99	FIGURE:	6

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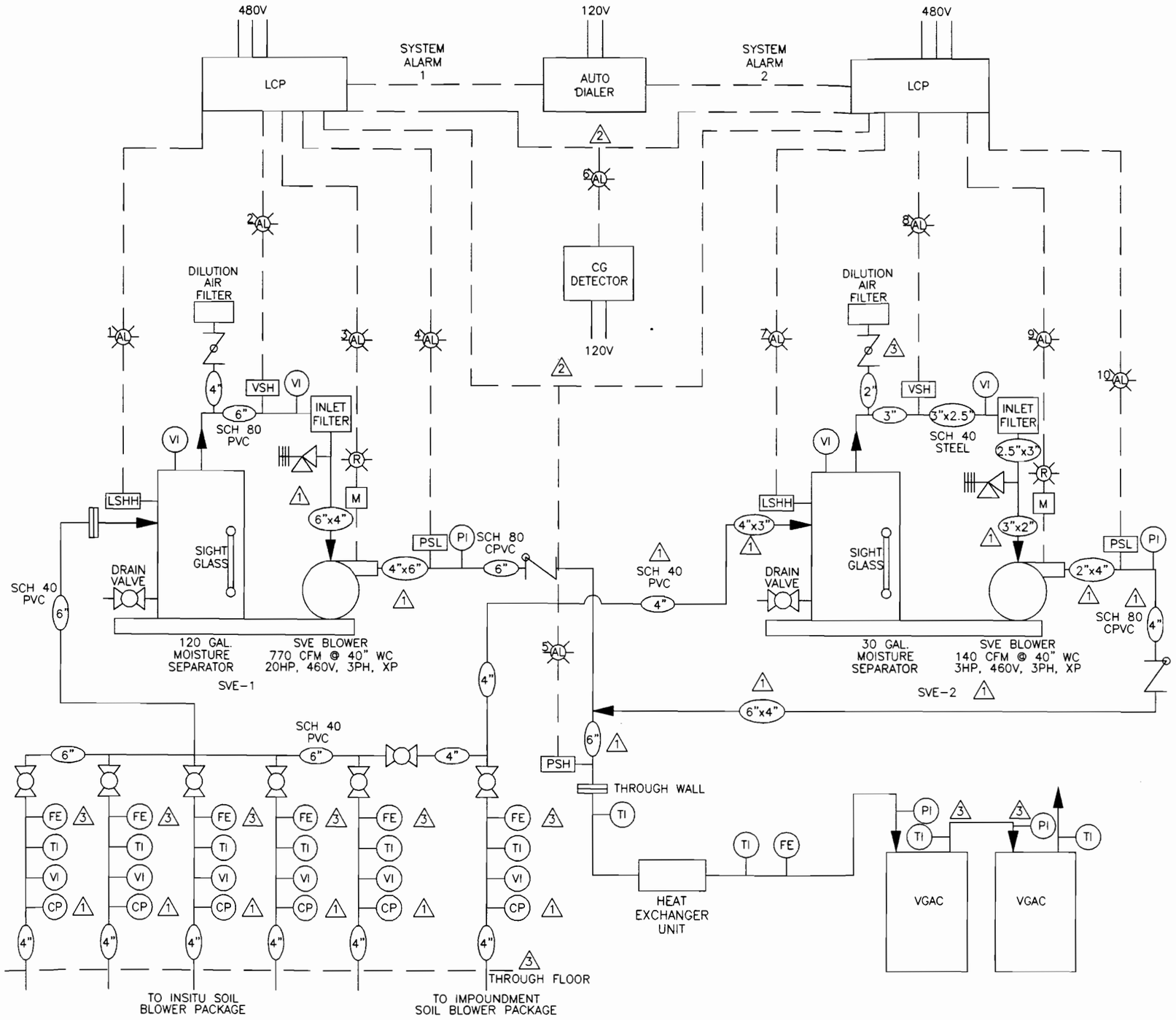

LEGEND

CP	CLEAN-OUT PORT
FE	FLOW ELEMENT
LCP	LOCAL CONTROL PANEL
LSHH	LEVEL SWITCH HIGH HIGH
M	MOTOR
PI	PRESSURE INDICATOR
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
TI	TEMPERATURE INDICATOR
VI	VACUUM INDICATOR
VSH	VACUUM SWITCH HIGH
AL	ALARM LIGHT
R	RUN LIGHT
	AIR CHECK VALVE
	RELIEF VALVE
	BUTTERFLY VALVE
	BALL VALVE
	FLANGE
	CONTROL LINE
	PROCESS LINE

ALARMS

1 SVE-1 MOISTURE SEP. HIGH HIGH LEVEL
2 SVE-1 VACUUM SWITCH HIGH
3 SVE-1 THERMAL OVERLOAD
4 SVE-1 PRESSURE SWITCH LOW
5 VGAC PRESSURE SWITCH HIGH
6 COMBUSTIBLE GAS DETECTOR
7 SVE-2 MOISTURE SEP. HIGH HIGH LEVEL
8 SVE-2 VACUUM SWITCH HIGH
9 SVE-2 THERMAL OVERLOAD
10 SVE-2 PRESSURE SWITCH LOW

Source provided by:

BISCO Environmental
Soil & Groundwater Remediation Equipment

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

PROCESS AND INSTRUMENTATION DIAGRAM

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
126 Monroe Turnpike
Trumbull, CT 06611
(203) 452-3100

DRAWN:	MRV	CHECKED:	PJ	DATE:	2/9/99	FIGURE:	7

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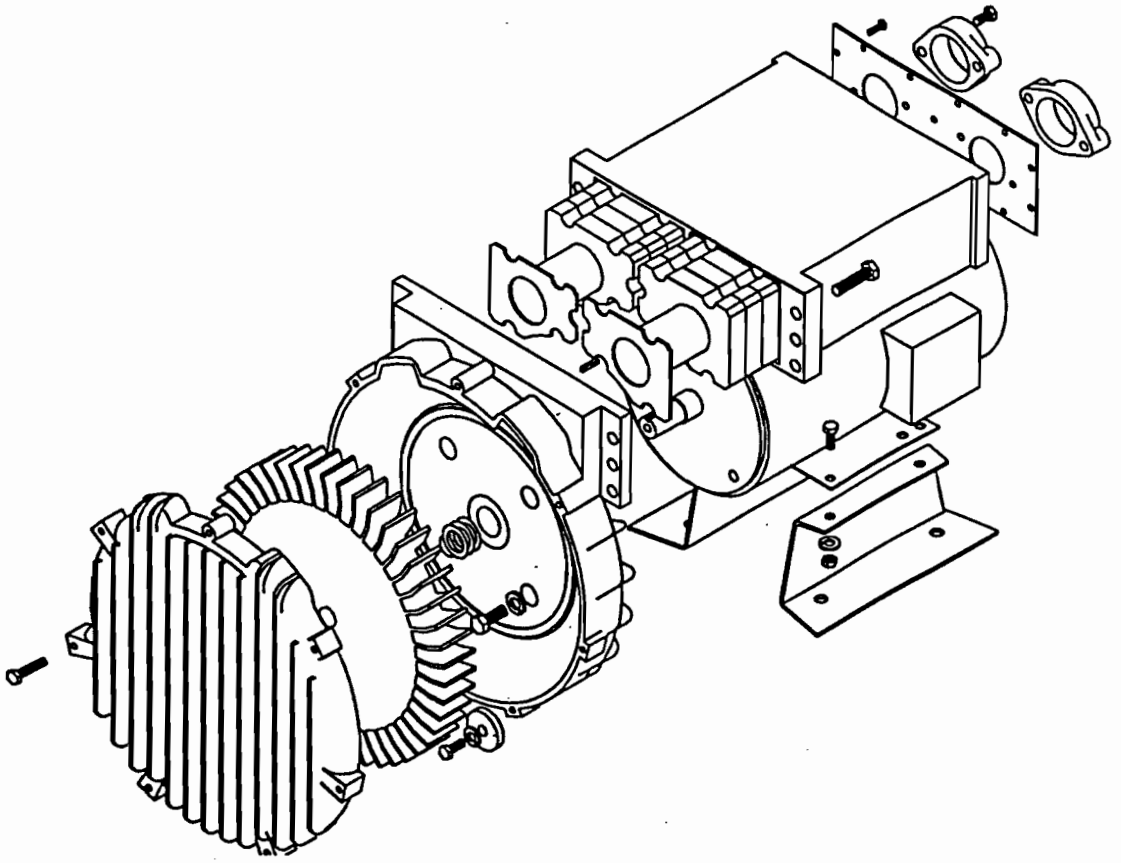
APPENDIX I

MANUFACTURERS OPERATION MANUALS AND CUT SHEETS

APPENDIX I
Contents

20 HP Blower (EN 14) Service and Parts Manual
20 HP Blower System Components Cut Sheets
20 HP Blower Control Panel Wiring Diagram and Cut Sheets
3 HP Blower (EN 606) Service and Parts Manual and Cut Sheets
3 HP Blower System Components Cut Sheets
3 HP Blower Control Panel Wiring Diagram and Cut Sheets
Heat Exchanger Manual
Sensaphone *Express* Autodialer Operator's Manual
Model 1500 Combustable Gas Monitoring System Instruction Manual
Control Switch Cut Sheets
Influent Manifold Components Cut Sheets
Carbon Unit Cut Sheets

Service and Parts Manual for Blower Model EN 6, 858, 909, 14



AMETEK®
ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP
SAUGERTIES, NEW YORK 12477
TEL: (914) 246-3401 FAX: (914) 246-3802

Warranty Information

1. **No-Fault Policy.** AMETEK Rotron regenerative direct drive blowers are guaranteed up to one full year from the date of purchase to the original purchaser only. Should the blower fail, **regardless of the cause of failure**, we will at our option repair or replace the blower.

2. **Standard Policy.** AMETEK Rotron remote drives, Nasty Gas™ models and special built (EO) products are guaranteed up to one full year from date of purchase for workmanship and material defect to the original purchaser only. Should the blower fail, we will evaluate the failure. If determined to be workmanship or material defect, we will at our option repair or replace the blower.

3. **Modified Policy.** AMETEK Rotron packaged units, Vacu-Master models and moisture separators are guaranteed up to one full year from date of purchase for workmanship and material defect to the original purchaser only on all parts excluding maintenance/wear items such as belts and bags. Should the blower fail, we will evaluate the failure. If determined to be workmanship or material defect, we will at our option repair or replace the blower.

4. **Parts Policy.** AMETEK Rotron spare parts and accessories are guaranteed up to three months from date of purchase for workmanship and material defect to the original purchaser only. Should the part fail, we will at our option repair or replace the part.

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

Terms and Conditions. Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Maximum liability will in no case exceed the value of the product purchased. Other terms and conditions of sale are stated on the back of the order acknowledgment.

Installation

1. **Bolt It Down.** Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.

2. **Filtration.** All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

   Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

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

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

4. **Wiring.** Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.

5. **Pressure/Suction Maximums.** The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Application Engineering staff will need to know the operating pressure/suction to properly diagnose the problem.

6. **Excess Air.** Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

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

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all models in the DR, EN, CP, and HiE series have sealed bearings which require no maintenance. Bearings should be changed after 15,000 to 20,000 hours, on average. Shell Dolium R grease is used at the factory. Replacement bearings should contain Shell Dolium R or its equivalent.

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	1. * One phase of power line not connected 2. * One phase of stator winding open 3. Bearings defective 4. Impeller jammed by foreign material 5. Impeller jammed against housing or cover 6. ** Capacitor open	1. Connect 2. Rewind or buy new motor 3. Change bearings 4. Clean and add filter 5. Adjust 6. Change capacitor
	No Sound	1. * Two phases of power line not connected 2. * Two phases of stator winding open	1. Connect 2. Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	1. Insufficient fuse capacity 2. Short circuit	1. Use time delay fuse of proper rating 2. Repair
	Motor Overheated Or Protector Trips	1. High or low voltage 2. * Operating in single phase condition 3. Bearings defective 4. Impeller rubbing against housing or cover 5. Impeller or air passage clogged by foreign material 6. Unit operating beyond performance range 7. Capacitor shorted 8. * One phase of stator winding short circuited	1. Check input voltage 2. Check connections 3. Change bearings 4. Adjust 5. Clean and add filter 6. Reduce system pressure/vacuum 7. Change capacitor 8. Rewind or buy new motor
	Abnormal Sound	1. Impeller rubbing against housing or cover 2. Impeller or air passages clogged by foreign material 3. Bearings defective	1. Adjust 2. Clean and add filter 3. Change bearings
	Performance Below Standard	1. Leak in piping 2. Piping and air passages clogged 3. Impeller rotation reversed 4. Leak in blower 5. Low voltage	1. Tighten 2. Clean 3. Check wiring 4. Tighten cover, flange 5. Check input voltage

* 3 phase units
** 1 phase units
*** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.

Blower Disassembly

WARNING: Attempting to repair or diagnose blower may void Rotron's warranty. This unit can be difficult to successfully disassemble and reassemble.

Refer to assembly diagram (Appendix 2) for referenced part designations. **CAUTION: Be sure power is disconnected before doing any work on units.**

1. Disconnect power leads.
2. Remove or separate piping and/or mufflers from unit.
3. Remove cover bolts (B14) and then cover (B13). **Note:** This unit has seals on it. Opening unit will require mandatory replacement of these seals.
4. Remove impeller bolt (B10) and washers and then remove impeller. **Note:** Never pry on the edges of the impeller. Use puller, if necessary.
5. Carefully note number and location of shims (B8). Remove and set aside. **Note:** If disassembly was for inspection or cleaning purposes, unit may now be reassembled by reversing the above steps. If motor servicing, replacement, or impeller replacement is required, the same shims may not be re-used. It will be necessary to re-shim according to the procedure shown under Assembly.
6. Remove housing bolts (B5) and remove motor assembly.

Muffler Material Replacement

1. Remove manifold cover bolts (B19).
2. Muffler assembly can now be removed and replaced if necessary.
3. Reassemble by reversing procedure.

Bearing Selection

All bearings used in AMETEK Rotron blowers are of the double sealed variety. In addition, high temperature greases are used to prevent loss of lubrication under severe operating conditions. Select the appropriate bearings by referencing the parts list if ordering from AMETEK Rotron, or the parts list and the accompanying chart.

BEARING TYPES AND LUBRICANTS

All Rotron regenerative blowers supplied with direct fitted motors are designed with ABEC1 quality double sealed ball bearings in the motor. The bearing design in all cases is a C3 fit. Below is our recommended chart by bearing part number.

Part No.	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% ± 5% fill	Yes - 325°F
510449 516440 516648	203 202 307	(Buna N)	Shell Dolium "R" 25-40% fill	No
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	(Buna N)	Shell Dolium "R" 30% ± 5% fill	No

Blower Reassembly

1. Place assembled motor against rear of housing (B4) and fasten with bolts (B5) and washer (B17).
2. To ensure impeller is centered within housing cavity, reshim impeller according to the procedure outlined below.
3. Replace seal (B27) (if used).
4. Place impeller onto shaft (be sure key is in place (M3)) and fasten with bolt (B10), washer (B11 & B12), and spacer (B16) if applicable. TORQUE impeller bolt per table below. Once fastened, carefully rotate impeller to be sure it turns freely.
5. Replace cover and fasten with bolts (B14, B14B).
6. Reconnect power leads per motor nameplate.

Bolt Size	Torque
1/4 - 20	6.25 +/- .25
5/16 - 18	11.50 +/- .25
3/8 - 16	20.0 +/- .5
1/2 - 13	49.0 +/- 1
5/8 - 11	90.0 +/- 2

Impeller Shimming Procedure

WARNING: This unit is difficult to shim. Care must be exercised.

Tools needed: Machinist's Parallel Bar
Vernier Caliper with depth measuring capability
Feeler Gauges or Depth Gauge

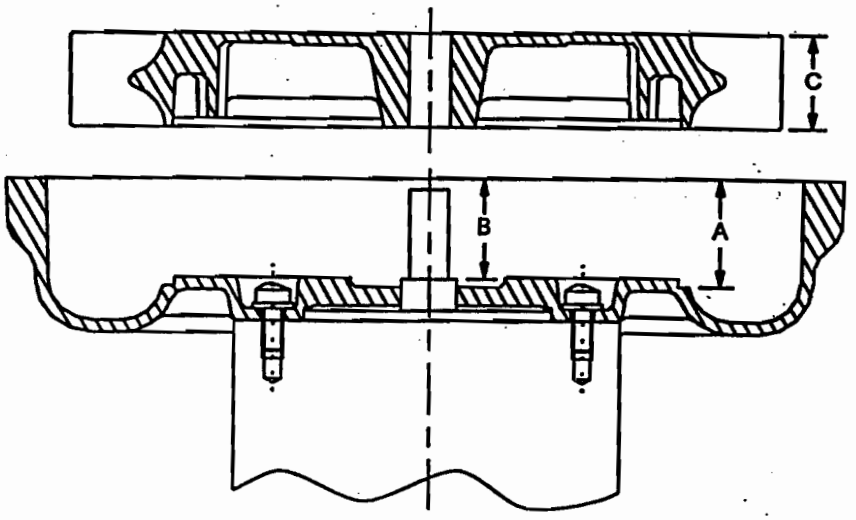
Measure the following:

- Distance from the flange face to the housing (A)
- Distance from the flange face to the motor shaft shoulder (B)
- Impeller thickness (C)

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

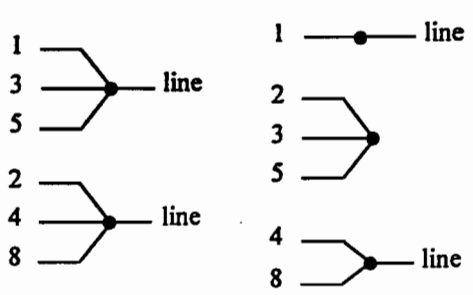
$$Shim\ Thickness = B - \left(\frac{A+C}{2}\right)$$

After impeller installation (step 3 above), the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be $\left(\frac{A-C}{2}\right)$.



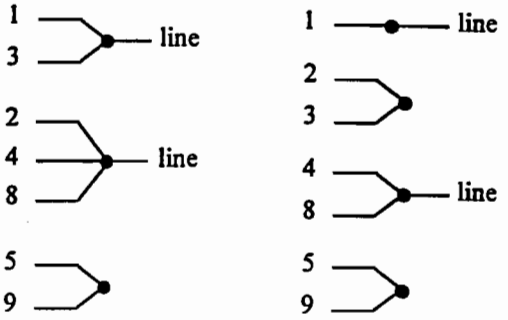
Wiring Diagrams, XP Motors

H. 1ø, 6 wire



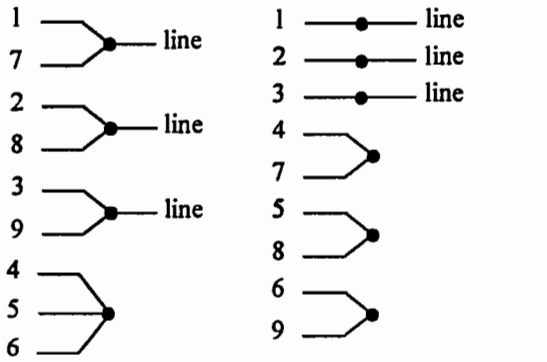
Interchange leadwires 5 & 8 to reverse rotation

I. 1ø, 7 wire



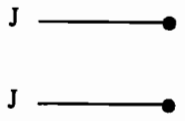
Interchange leadwires 5 & 8 to reverse rotation

K. 3ø, 9 wire



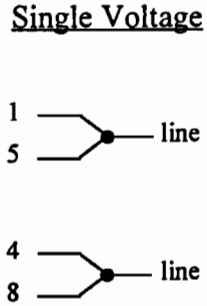
Interchange any two line leads to reverse rotation

L. Pilot Duty Thermal Overload Leads



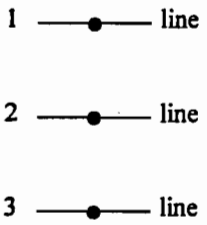
Hook J leads to control circuitry

M. 1ø, 230 VAC



Interchange leadwires 5 & 8 to reverse rotation

N. 3ø, 575 VAC

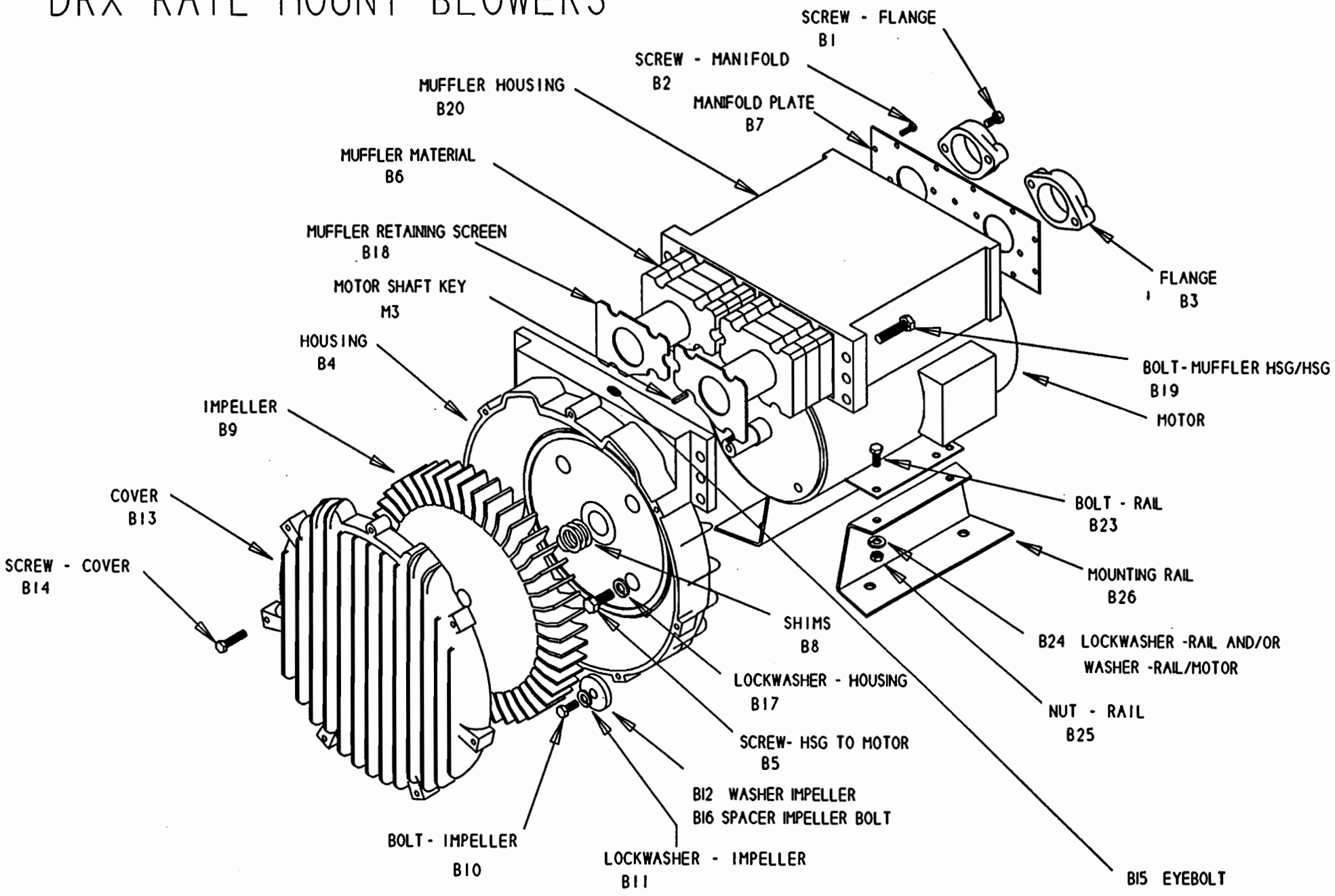


Interchange any two line leads to reverse rotation

NOTE: Wiring diagram on motor takes precedence over those printed here. Wiring diagram typically found under T-box cover.

2/28/96 Rev. -

ASSEMBLY DIAGRAM
DRX RAIL MOUNT BLOWERS



Parts Breakdown

Item No.	Qty Req'd	Description	EN6	EN858	EN909	EN14	EN14
		Model:	EN6	EN858	EN909	EN14	EN14
		Part No.:	038361 038180 038438	038744 038745	038629 038634	038762 038761	038760
M3	1	Key Motor Shaft	510212	511532	511532	155066	511532
B1	6	Screw, Flange	(4 pcs) 120255	(4 pcs) 155067	140016	140016	140016
B2		Screw, Manifold	Not Used	Not Used	Not Used	Not Used	Not Used
B3	2	Flange	See Next Page	511614	529912	529912	529912
	2	O-ring	Not Used	Not Used	155377	155377	155377
		Elbow 90°	See Next Page	Not Used	Not Used	Not Used	Not Used
B4	1	Housing	516747	516764	515356	516799	516797
B5	4	Screw, Hsg /Motor	251792	155034	140014	120205	120205
B6	54	Muffler Material	Not Used	(28) 550020	(40 pcs) 529943	550073	550073
	2	Matting, Fiberglass	Not Used	550075	550077	550116	550116
B7		Manifold Plate	Not Used	Not Used	Not Used	Not Used	Not Used
B8	*	Shim .002"	272703	511547	511547	515991	511547
	*	Shim .005"	272704	511548	511548	515992	511548
	*	Shim .010"	272705	511549	511549	515993	511549
	*	Shim .020"	272706	511550	511550	515994	511550
	*	Shim .030"	Not Used	Not Used	Not Used	Not Used	Not Used
B9	1	Impeller	515484	515249	515270	515509	515683
B10	1	Bolt, Impeller	251791	120210	140015	155068	120251
B11	1	Lockwasher, Impeller	251787	251788	251788	251788	251788
B12	1	Washer, Impeller	Not Used	511529	Not Used	Not Used	Not Used
B13	1	Cover	515488	515247	515359	515910	515910
B14	8	Screw, Cover	251790	140016	140016	155069	155069
B15	1	Eye Bolt	Not Used	140019	140019	140019	140019
B16	1	Spacer, Impeller Bolt	478336	515555	511529	515990	515990
		Shaft Sleeve	Not Used	Not Used	Not Used	Not Used	Not Used
B17		Lockwasher, Housing	Not Used	Not Used	Not Used	Not Used	Not Used
B18	1	Screen, Muffler Retaining, Right (**)	Not Used	515407	529939	550040	550040
	1	Screen, Muffler Retaining, Left (**)	Not Used	515408	529940	550042	550042
B19	6	Bolt, Muffler Hsg/Hsg	Not Used	155025	155025	155067	155067
B19A	4	Bolt, Muffler/Housing	Not Used	120214	120214	120214	120214

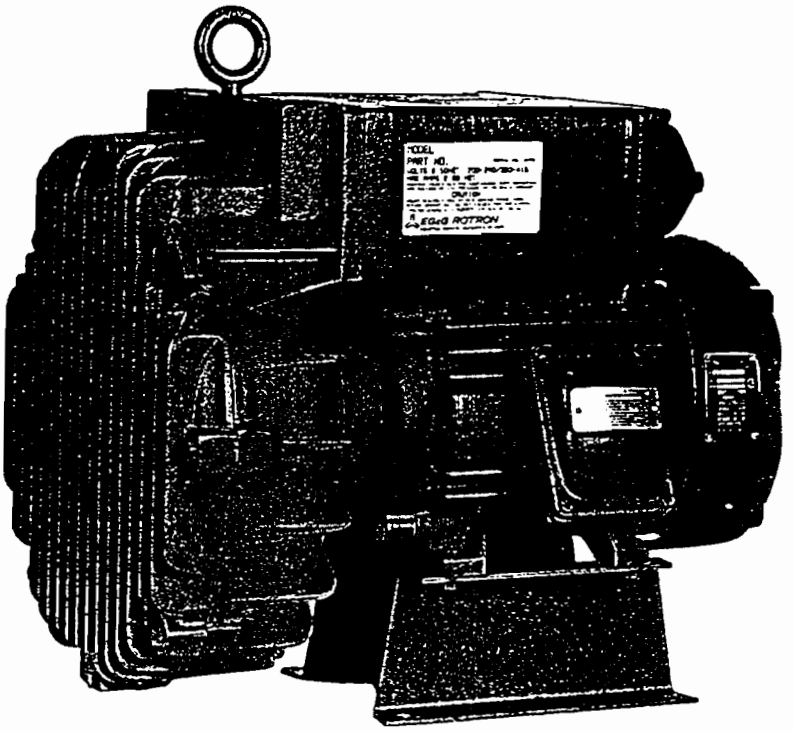
* As needed ** Viewed looking at inlet/outlet ports

Item No.	Qty Req'd	Description	EN6 038361 038180 038438	EN858 038744 038745	EN909 038629 038634	EN14 038762 038761	EN14 038760
B20	1	Muffler Housing	Not Used	550019	529932	550039	550039
	1	Muffler Discrete	522948	Not Used	Not Used	Not Used	Not Used
		Bolt, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used
		Lockwasher, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used
		Washer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used
		Spacer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used
B21		Heat Slinger	Not Used	Not Used	Not Used	Not Used	Not Used
B22		Guard Heat slinger	Not Used	Not Used	Not Used	Not Used	Not Used
B23	4	Bolt, Rail	251791	120007	155095	120256	155025
B24	4	Lockwasher Rail	251787	251787	251787	251788	251788
B24A	8	Washer, Rail/Motor	Not Used	Not Used	155091	Not Used	Not Used
B25	4	Nut, Rail	251789	251789	251789	155070	155070
B26	2	Rail Mounting	478338	595301	515286	516242	516242
	1	Lip Seal	516691	516693	516693	516694	516693

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

EN/CP 14
Explosion-Proof Regenerative Blower

FEATURES
- Manufactured in the USA
- Maximum flow: 920 SCFM
- Maximum pressure: 144 IWG
- Maximum vacuum: 115 IWG
- Standard motor: 30 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

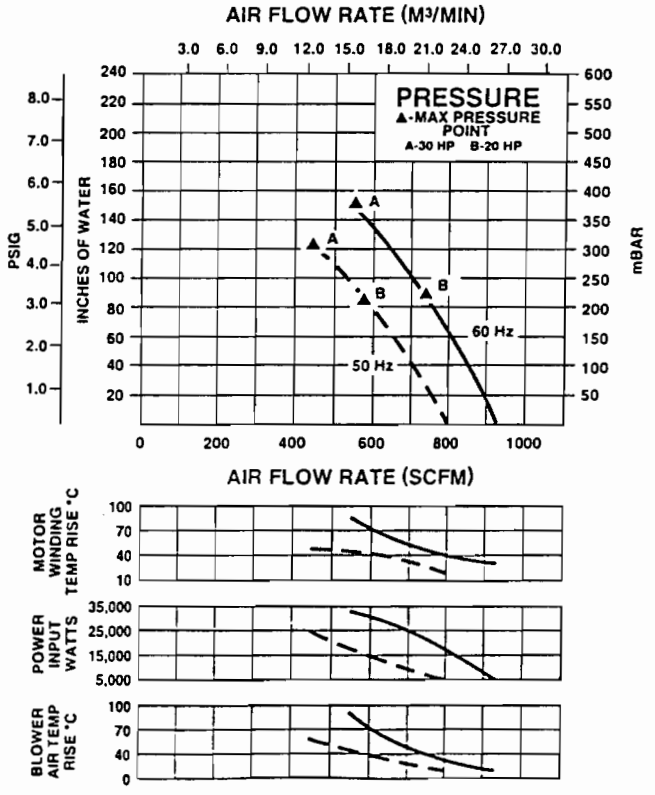


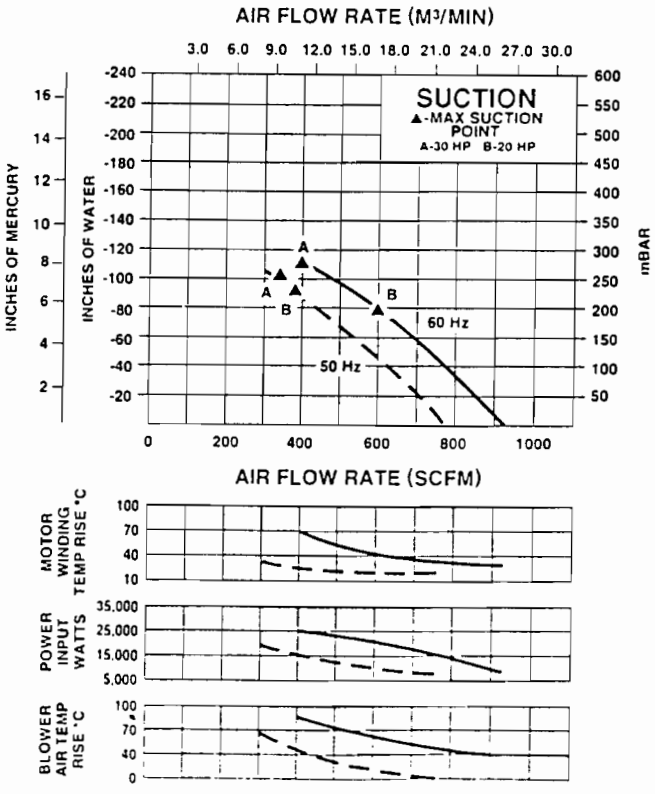
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

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

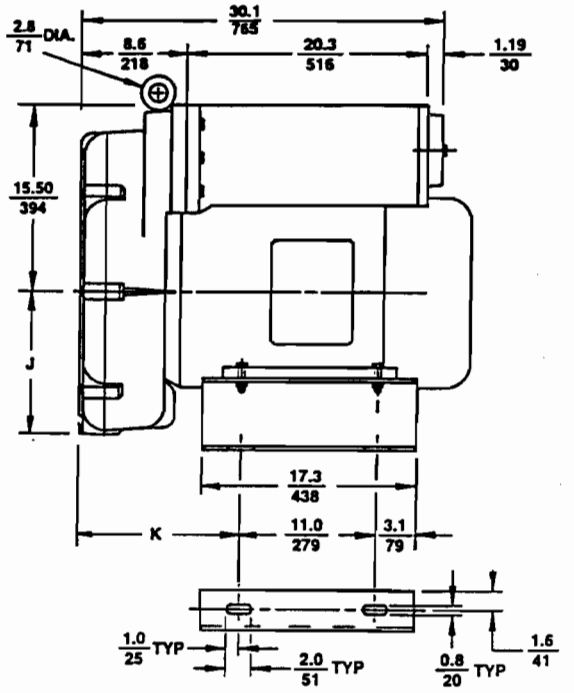
ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)

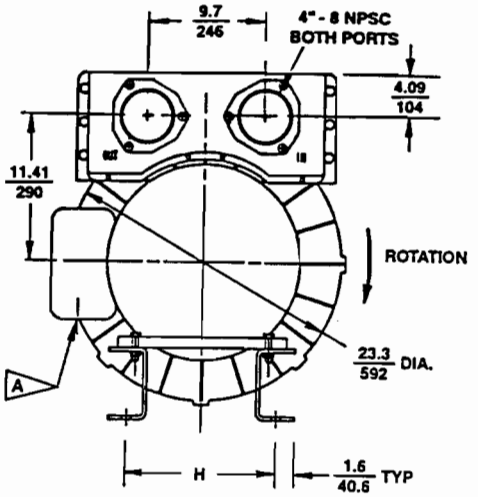
BLOWER PERFORMANCE AT STANDARD CONDITIONS





EN/CP 14
Explosion-Proof Regenerative Blower





A 1.25" NPT CONDUIT CONNECTION AT 6 O'CLOCK POSITION

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

MODEL	K (IN/MM)	J (IN/MM)	H (IN/MM)
EN/CP14DX72WL	13.3/338	12.9/328	12.38/314
EN/CP14BK72WL	12.3/312	12.1/307	8.62/219

SPECIFICATIONS

MODEL	EN14BK72MWL		EN14DX72MWL		EN14DX86MWL	CP14GB72MWLR	CP14GC72MWL
Part No.	038760		038761		038762	–	038984
Motor Enclosure – Shaft Material	Explosion-proof – CS		Explosion-proof – CS		Explosion-proof – CS	Chem XP – SS	Chem XP – SS
Horsepower	20		30		30	Same as EN14BK72MWL – 038760 except add Chemical Processing (CP) features from catalog inside front cover	Same as EN14DX72MWL – 038761 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency [1]	Three - 60 Hz		Three - 60 Hz		Three - 60 Hz		
Voltage [1]	~~230~~	460	200-230	460	575		
Motor Nameplate Amps	~~46~~	23	75-66	33	26.5		
Max. Blower Amps [3]	~~60~~	30	82	41	33		
Inrush Amps	~~294~~	147	448	224	226		
Starter Size	~~3~~	2	3	3	3		
Service Factor	1.0		1.0		1.0		
Thermal Protection [2]	Class B - Pilot Duty		Class B - Pilot Duty		Class B - Pilot Duty		
XP Motor Class – Group	I-D, II-F&G		I-D, II-F&G		I-D, II-F&G		
Shipping Weight	680 lb (309 kg)		816 lb (370 kg)		816 lb (370 kg)		

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **200-220/400-440 VAC-3 ph-50 Hz.** Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz.** All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

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

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and ambient temperature reaches the maximum operating temperature.

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

AMETEK®
.OTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP

75 North Street
Saugerties, New York 12477
Phone: (914) 246-3401
Fax: (914) 246-3802

GENERAL INSTALLATION INSTRUCTIONS

Rotron Regenerative Blowers

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

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.

2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

   Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

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

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

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.

5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Application Engineering staff will need to know the operating pressure/suction to properly diagnose the problem.

6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

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

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearings should be changed after 15,000 to 20,000 hours, on average. Shell Dolium R grease is used at the factory. Replacement bearings should contain Shell Dolium R or its equivalent.

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOE NOT TURN	Humming Sound	1. * One phase of power line not connected	1. Connect
		2. * One phase of stator winding open	2. Rewind or buy new motor
		3. Bearings defective	3. Change bearings
		4. Impeller jammed by foreign material	4. Clean and add filter
		5. Impeller jammed against housing or cover	5. Adjust
		6. ** Capacitor open	6. Change capacitor
	No Sound	1. * Two phases of power line not connected	1. Connect
		2. * Two phases of stator winding open	2. Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	1. Insufficient fuse capacity	1. Use time delay fuse of proper rating
		2. Short circuit	2. Repair
	Motor Overheated Or Protector Trips	1. High or low voltage	1. Check input voltage
		2. * Operating in single phase condition	2. Check connections
		3. Bearings defective	3. Check bearings
		4. Impeller rubbing against housing or cover	4. Adjust
		5. Impeller or air passage clogged by foreign material	5. Clean and add filter
		6. Unit operating beyond performance range	6. Reduce system pressure/vacuum
		7. Capacitor shorted	7. Change capacitor
		8. * One phase of stator winding short circuited	8. Rewind or buy new motor
	Abnormal Sound	1. Impeller rubbing against housing or cover	1. Adjust
		2. Impeller or air passages clogged by foreign material	2. Clean and add filter
		3. Bearings defective	3. Change bearings
	Performance Below Standard	1. Leak in piping	1. Tighten
		2. Piping and air passages clogged	2. Clean
		3. Impeller rotation reversed	3. Check wiring
		4. Leak in blower	4. Tighten cover, flange
		5. Low voltage	5. Check input voltage

* 3 phase units

** 1 phase units

*** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.

For further information regarding Rotron regenerative blowers (including service & parts manuals), please contact our local field sales representative.

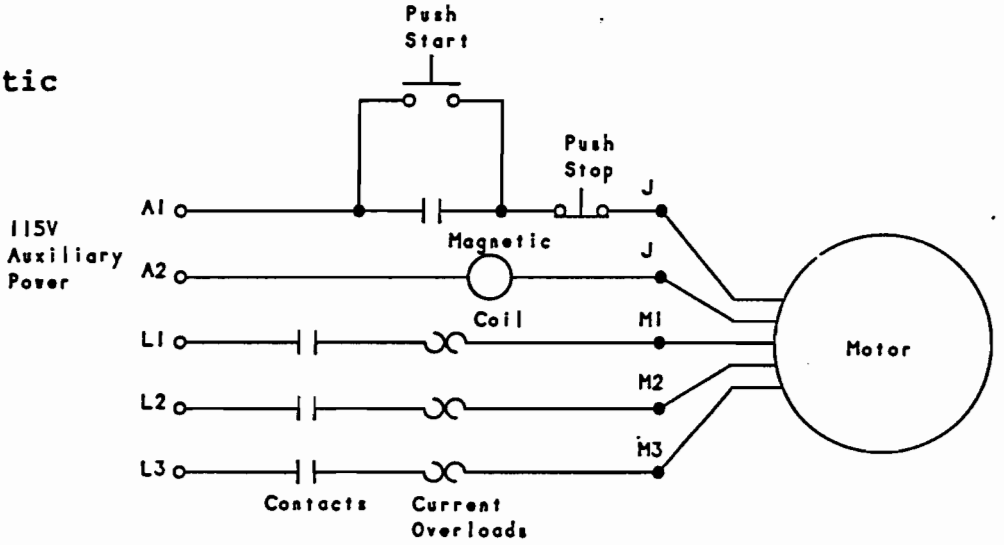
EG&G ROTRON
Industrial Division
North Street, Saugerties, NY 12477
TEL. (914) 246-3401 FAX: (914) 246-3802

IMPORTANT: Read Before Wiring this Explosion-proof Blower

This EG&G Rotron Explosion-proff Regenerative blower may be equipped with Pilot Duty Thermal Overload protection. When properly wired to a motor starter, this protection limits the motor winding temperature rise per the National Electric Code (NEC) article 500. Failure to properly wire this blower is a NEC violation and could cause an explosion. EG&G takes no responsibilities for damages incurred by negligent use of this product, and may not warranty a blower on which the P.D.T.O. is not properly connected. Some blowers 1HP and under do not have P.D.T.O. Consult the factory if you are uncertain.

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

Schematic



J - Pilot Duty Thermal Overload Protection wires
L - Power leads from circut breaker box.
M - Motor leads (refer to wiring diagram inside T'box or on motor nameplate).

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

If you have any questions, EG&G Rotron Application Engineers are available at (914) 246-3401 for your assistance.

POLICY REGARDING INSTALLATION OF EG&G ROTRON

REGENERATIVE BLOWERS IN HAZARDOUS LOCATIONS

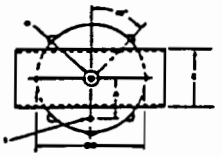
EG&G Rotron will not knowingly specify, design or build any regenerative blower for installation in a hazardous, explosive location without the proper NEMA motor enclosure. EG&G Rotron does not recognize sealed blowers as a substitute for explosion proof motors. Sealed units with standard TEFC motors should never be utilized where local, state, and/or federal codes specify the use of explosion proof equipment. EG&G Rotron has a complete line of regenerative blowers with explosion-proof motors. Division I & II, Class 1, Group D; Class 2, Groups F & G requirements are met with these standard explosion-proof blowers.

EG&G Rotron offers general application guidance; however, suitability of the particular blower selection is ultimately the responsibility of the user, not the manufacturer of the blower.

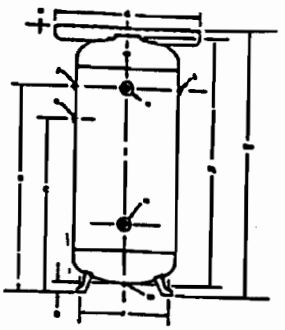
AIR RECEIVERS

THE BRUNNER DIFFERENCE. Leakproof. Vibration resistant. Accurately positioned openings. Slotted and drilling to most intricate requirements.

Superior design and precision fabrication of Brunner air receivers ensures quality performance and long life. Attention to details - the slotting and drilling of tank attachments and accurately positioned vessel openings - have made Brunner the favored choice. With a wide selection of standard configurations from 6" to 12' diameters, we can quickly supply the tanks you need. Brunner will also custom engineer, design and produce air receivers for your specific needs and space requirements. Fast delivery on special orders is a Brunner specialty.



VERTICAL With Platform

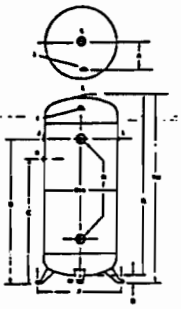


DESIGN PRESSURE 200 PSI

DESCRIPTION				DIMENSIONS								OPENINGS						
Gallons	Diameter	Length (TL)	Height (TH)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
30	16	38	41¼	6½	30¼	24¼	1¾	9	18	23	3/16	1/4	3/4	3/4	3/4	1/2	1½	3/4
60	20	48	52	8½	40	34	2½	13	23	30	3/16	1/4	3/4	3/4	3/4	1/2	2	3/4
80	24	48	52¾	10	39⅞	33⅞	3¼	13	26	30	1/4	1/4	1¼	1¼	1¼	1/2	2	1¼
*120	30	46	55½	10	41	35	8	15	26	39	1/4	1/4	2	2	2	1/2	2	2

*BASE RING used on 120 gallon
*NEMA slotting standard

VERTICAL



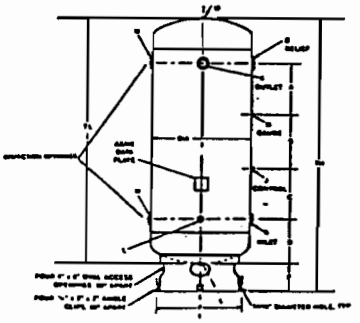
VERTICAL Without Platform

DESIGN PRESSURE 200 PSI

PLATFORMS NOT AVAILABLE ON THESE RECEIVERS

DESCRIPTION				DIMENSIONS					OPENINGS					
Gallons	Diameter	Length (TL)	Height (TH)	A	B	C	D	F	I	J	K	L	M	N
10	10	30	32⅜	3	24⅜	—	2⅜	13½	1/4	3/4	—	3/4	1/4	N/A
15	12	33	35⅜	4	27⅜	—	2⅜	15¾	1/4	3/4	—	3/4	1/4	N/A
20	14	33	35¼	5	27¼	—	2¼	17¾	1/4	3/4	—	3/4	1/4	1½
30	16	38	39¾	6½	30¼	24½	1¾	18	1/4	3/4	3/4	3/4	1/2	1½
60	20	48	50½	8½	40	34	2½	23	1/4	3/4	3/4	3/4	1/2	2
80	20	63	65½	8½	55	49	2½	23	1/4	1¼	1¼	1¼	1/2	2
80	24	48	51¼	10	39⅞	33⅞	3¼	26	1/4	1¼	1¼	1¼	1/2	2

All Brunner air receivers are built to ASME code, National Board registered. USCG, ABS, CSA and California UG 22 approvals also available. Standard design temperature is 450° F. All openings are NPT threaded. Standard outside finish is red oxide primer. Other finishes available on request. In addition to sizes listed in this catalog, Brunner can fabricate alternate sizes up to 144" diameter, 15 tons maximum weight and 1500 psi.



VERTICAL Industrial

DESIGN PRESSURE 125 PSI to 600 PSI

DESCRIPTION				DIMENSIONS (INCHES)						OPENINGS						
Gallons	Diameter (OD)	Length (TL)	Height (TH)	A	B	C	D	E	F	G	H	J	K	L	M	N
120	24	69	81	13	14	13	13	12	20	1½	1/4	1/2	2	1	1/2	2
→ 120	30	46	58	~~7~~	~~7~~	~~7~~	~~12½~~	~~12~~	~~26~~	~~2~~	~~1/4~~	~~1/2~~	~~2~~	~~1~~	~~1/2~~	~~2~~
200	30	72	84	15	16	15	13	12	26	2	1/4	1/2	2	1	1/2	2
240	30	84	96	19	20	19	13	12	26	2	1/4	1/2	2	1	1/2	2
400	36	96	108	21	22	21	15	12	32	2½	1/4	1/2	3	1	1/2	2

INLET VACUUM AIR FILTERS

CSL Series
(Closed System "L")
1/2" FPT to 12" Flange
Up to 4950 CFM

Since 1968 Solberg has been manufacturing quality OEM and industrial filters for air compressor, blower and vacuum applications. By pioneering many filter manufacturing techniques and building their own production machinery, Solberg is fulfilling their commitment of continual product improvement and prompt response to customer needs.

The Solberg line includes most all sizes of inlet, inline, and exhaust system filters and elements, filter silencers, oil mist filters, high temperature filters and more. There is a choice of media to suit specific duty requirements. As the filter specialist, Solberg can also provide reliable products for individual needs and unique filter applications. Ask for an engineering evaluation of your requirements.

APPLICATIONS

- Soil Venting
- Soil Remediation
- Vacuum Pumps & Systems
- Intake Suction Filters
- Blowers
- Pneumatic Conveying Systems
- Air Compressors
- Remote Installations

FEATURES

- Use as an elbow in a package without removing for service
- Rugged all steel construction
- Low pressure drop
- Positive sealing - Vacuum tested
- Large dirt holding capacity and easy field cleaning, especially when mounted horizontally or inverted
- 1/4" FPT tap holes on inlet & outlet for differential pressure gauge (3" & larger)

OPTIONS
(Inquiries Encouraged)

- Larger sizes available
- Support stands
- Stainless steel housings
- Epoxy coated housings
- Hot dipped galvanized housings
- Unique centrifugal 2-stage filtering system/baffle plates
- Special fittings available for volume orders
- Various elements available - see Element bulletin
- Activated carbon pad or prefilter to reduce odor

Inline filters with optional baffle plates provides centrifugal flow to knock down large particulates

CSL-235P-400F

- Connection size: 400 = 4"; F at the end of model # denotes flange connection.
- Element part #; Odd #'s = Polyester, Even #'s = Paper, Even #'s + 5 = Wire Mesh P = Polyurethane foam pre-filter included.
- CSL denotes Closed System "L" design.

SMI MODEL NUMBERS - CSL Series		EFFECTIVE SURFACE AREA OF ELEMENT IN SQUARE FEET		CONNECTION		Flow SCFM	Approx. Shipping Wt. Lbs.	DIMENSIONS					
W/Polyester Element	W/Paper Element	Polyester	Paper	Size	Type			A	B	C	D	E	F
THREADED CONNECTIONS													
CSS-05-025	CSS-04-025	.2	.2	1/4"	MPT	6	.5	3-5/8"	5/8"	2-1/2"	1-13/16"	5/8"	—
CSS-05-038	CSS-04-038	.2	.2	3/8"	MPT	6	.5	3-5/8"	5/8"	2-1/2"	1-13/16"	5/8"	—
CSS-07-038	CSS-06-038	.58	.58	3/8"	MPT	6	1	4-1/4"	5/8"	3-1/4"	2-1/8"	5/8"	—
CSS-07-050/050HC	CSS-06-050/050HC	.58	.58	1/2"	FPT	10	1	4"	1/2"	3-1/4"	2-1/8"	1/2"	—
CSL-843-050HC	CSL-842-050HC	.6	1.75	1/2"	FPT	10	3	4-3/8"	3/8"	5-7/8"	2-5/8"	9/16"	5"
CSL-843-075HC	CSL-842-075HC	.6	1.75	3/4"	FPT	20	3	4-3/8"	3/8"	5-7/8"	2-5/8"	9/16"	5"
CSL-843-100HC	CSL-842-100HC	.6	1.75	1"	FPT	25	3	4-3/8"	5/8"	5-7/8"	2-5/8"	3/4"	5"
CSL-849-100HC	CSL-848-100HC	2.0	4.5	1"	FPT	40	5	6-1/2"	3/4"	7-5/16"	4-1/2"	3/4"	6-13/16"
CSL-843-125HC	CSL-842-125HC	.6	1.75	1-1/4"	FPT	45	3	4-3/8"	5/8"	5-7/8"	2-5/8"	3/4"	5"
CSL-849-125HC	CSL-848-125HC	2.0	4.5	1-1/4"	FPT	60	5	6-1/2"	3/4"	7-5/16"	4-1/2"	3/4"	6-13/16"
CSL-849-150HC	CSL-848-150HC	2.0	4.5	1-1/2"	FPT	80	5	6-1/2"	3/4"	7-5/16"	4-1/2"	3/4"	6-13/16"
CSL-851-200HC	CSL-850-200HC	4.5	13.75	2"	FPT	150	15	10-1/4"	3/4"	8-3/4"	5"	3/4"	7-5/8"
CSL-851-250HC	CSL-850-250HC	4.5	13.75	2-1/2"	FPT	195	15	10-1/2"	1"	8-3/4"	5-1/2"	1-1/4"	7-5/8"
CSL-235P-300	CSL-234P-300	8.3	22.8	3"	MPT	300	47	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-335P-300	CSL-334P-300	12.0	34.0	3"	MPT	300	50	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-235P-400	CSL-234P-400	8.3	22.8	4"	MPT	520	52	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-335P-400	CSL-334P-400	12.0	34.0	4"	MPT	520	55	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-245P-500	CSL-244P-500	14.0	35.5	5"	MPT	800	82	28-1/8"	3"	18-1/2"	19-1/2"	3"	16"
CSL-345P-500	CSL-344P-500	22.1	57.0	5"	MPT	800	88	28-1/2"	3"	18-1/2"	19-1/2"	3"	16"
CSL-275P-600	CSL-274P-600	19.0	45.4	6"	MPT	1100	95	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
CSL-375P-600	CSL-374P-600	28.0	68.1	6"	MPT	1100	97	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
FLANGED CONNECTIONS													
CSL-235P-400F	CSL-234P-400F	8.3	22.8	4"	FLG	520	62	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-335P-400F	CSL-334P-400F	12.0	34.0	4"	FLG	520	64	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-245P-500F	CSL-244P-500F	14.0	35.5	5"	FLG	800	90	28-1/8"	3"	18-1/2"	19-1/2"	3"	16"
CSL-345P-500F	CSL-344P-500F	22.1	57.0	5"	FLG	800	88	28-1/2"	3"	18-1/2"	19-1/2"	3"	16"
CSL-275P-600F	~~CSL-274P-600F~~	19.0	45.4	6"	FLG	1100	110	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
CSL-375P-600F	CSL-374P-600F	28.0	68.1	6"	FLG	1100	113	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
CSL-377P-800F	CSL-376P-800F	50.0	125.0	8"	FLG	1800	185	38"	4"	22-1/2"	25-1/2"	4"	20"
CSL-685P-1000F	CSL-384P(2)-1000F	100.0	280.0	10"	FLG	2900	380	57-1/2"	4"	28-13/32"	45"	4"	24"
CSL-485P(2)-1200F	CSL-484P(2)-1200F	150.0	400.0	12"	FLG	4950	465	70"	4"	28-13/32"	57"	4"	24"

BIG BOY FILTER SILENCERS

FS Series
3" to 6" MPT
4" to 14" Flange
Up to 6000 CFM
Complete Assemblies

Since 1968 Solberg has been manufacturing quality OEM and industrial filters for air compressor, blower and vacuum applications. By pioneering many filter manufacturing techniques and building their own production machinery, Solberg is fulfilling their commitment of continual product improvement and prompt response to customer needs.

The Solberg line includes most all sizes of inlet, inline, and exhaust system filters and elements, filter silencers, oil mist filters, high temperature filters and more. There is a choice of media to suit specific duty requirements. As the filter specialist, Solberg can also provide reliable products for individual needs and unique filter applications. Ask for an engineering evaluation of your requirements.

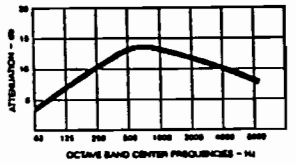
APPLICATIONS

- Blowers
- Air Compressors
- Fans
- Hydraulic breathers
- Engines

FEATURES

- Durable Heavy Gauge base with low pressure drop yoke and pipe design
- Tubular silencing design - maximizing noise attenuation and air flow
- Larger units reinforced with gussets for machines with extreme vibration

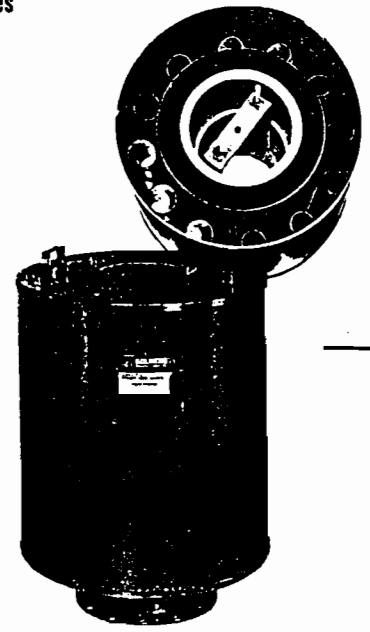
TYPICAL NOISE ATTENUATION - FS SERIES



- Interchangeable elements
- Several element sizes available at a given connection size providing a choice according to the severity of your application

OPTIONS
(Inquiries Encouraged)

- Larger sizes available
- Various elements available - See Element Bulletin
- 1/8" & 1/4" FPT tap holes for differential pressure gueges
- Support stands
- Epoxy coated housings
- Hot dipped galvanized housings
- Special connections



FS-685P-1000F

- Connection size; 1000 = 10"; F at end of model # denotes flange connection.
- Element part #; Odd #'s = Polyester, Even #'s = Paper, Even #'s + 8 = Wire Mesh. P = Polyurethane foam pre-filter included.
- FS denotes Filter Silencer.

SMI MODEL NUMBERS - FS Series

W/Polyester Element	W/Paper Element	W/Wire Mesh Element	EFFECTIVE SURFACE AREA OF ELEMENT IN SQUARE FEET		APPLICATION CFM PULSATING FLOW	APPLICATION CFM CONTINUOUS FLOW	MPT or Flange Connection	Approx. Shipping Wt. Lbs.	DIMENSIONS		
			Polyester	Paper	Reciprocating Compressors	Fans, Blowers, Compressors (Rotary, Centrifugal, Screw)			A	B	C
Male Pipe Thread Connection											
FS-235P-300	FS-234P-300	FS-234S-300	8.3	22.8	200	300	3"	29	13"	3"	16"
FS-245P-300	FS-244P-300	FS-244S-300	14.0	35.5	200	300	3"	30	13"	3"	16"
FS-275P-300	FS-274P-300	FS-274S-300	19.0	45.4	200	300	3"	33	13"	3"	16"
FS-235P-400	~~FS-234P-400~~	FS-234S-400	6.3	22.8	300	520	4"	30	14"	4"	16"
FS-245P-400	FS-244P-400	FS-244S-400	14.0	35.5	450	520	4"	31	14"	4"	16"
FS-275P-400	FS-274P-400	FS-274S-400	19.0	45.4	450	520	4"	34	14"	4"	16"
FS-245P-500	FS-244P-500	FS-244S-500	14.0	35.5	500	800	5"	33	14"	4"	16"
FS-275P-500	FS-274P-500	FS-274S-500	19.0	45.4	650	800	5"	36	14"	4"	16"
FS-375P-500	FS-374P-500	FS-374S-500	28.0	68.1	650	800	5"	44	20"	4"	16"
FS-275P-600	FS-274P-600	FS-274S-600	19.0	45.4	650	1100	6"	38	15-1/2"	5-1/4"	16"
FS-375P-600	FS-374P-600	FS-374S-600	28.0	68.1	800	1100	6"	46	20"	5"	16"
FS-377P-600	FS-376P-600	FS-376S-600	50.0	125.0	1100	1100	6"	95	22"	5"	22-1/2"
Flanged Connections Class 150											
FS-235P-400F	FS-234P-400F	FS-234S-400F	8.3	22.8	300	520	4"	33	14"	4"	16"
FS-245P-400F	FS-244P-400F	FS-244S-400F	14.0	35.5	450	520	4"	35	14"	4"	16"
FS-275P-400F	FS-274P-400F	FS-274S-400F	19.0	45.4	450	520	4"	39	14"	4"	16"
FS-245P-500F	FS-244P-500F	FS-244S-500F	14.0	35.5	500	800	5"	38	14"	4"	16"
FS-275P-500F	FS-274P-500F	FS-274S-500F	19.0	45.4	650	800	5"	41	14"	4"	16"
FS-375P-500F	FS-374P-500F	FS-374S-500F	28.0	68.1	650	800	5"	49	20"	4"	16"
FS-275P-600F	FS-274P-600F	FS-274S 600F	19.0	45.4	650	1100	6"	42	15-1/2"	5-1/4"	16"
FS-375P-600F	FS-374P-600F	FS-374S-600F	28.0	68.1	800	1100	6"	51	20"	5"	16"
FS-377P-600F	FS-376P-600F	FS-376S-600F	50.0	125.0	1100	1100	6"	100	22"	5"	22-1/2"
FS-377P-800F	FS-376P-800F	FS-376S-800F	50.0	125.0	1440	1800	8"	105	23"	6"	22-1/2"
FS-385P-800F	FS-384P-800F	FS-384S-800F	50.0	140.0	1440	1800	8"	145	23"	8"	28-1/2"
FS-485P-800F	FS-484P-800F	FS-484S-800F	75.0	200.0	1800	1800	8"	180	31"	6"	28-1/2"
FS-385P-1000F	FS-384P-1000F	FS-384S-1000F	50.0	140.0	1800	3300	10"	152	23"	8"	28-1/2"
FS-485P-1000F	FS-484P-1000F	FS-484S-1000F	75.0	200.0	2600	3300	10"	166	31"	8"	28-1/2"
FS-685P-1000F	FS-384P(2)-1000F	FS-384S(2)-1000F	100.0	280.0	2880	3300	10"	185	38"	8"	28-1/2"
FS-385P-1200F	FS-384P-1200F	FS-384S-1200F	50.0	140.0	2600	4700	12"	160	23"	8"	28-1/2"
FS-485P-1200F	FS-484P-1200F	FS-484S-1200F	75.0	200.0	2600	4700	12"	176	31"	8"	28-1/2"
FS-685P-1200F	FS-384P(2)-1200F	FS-384S(2)-1200F	100.0	280.0	3500	4700	12"	198	38"	8"	28-1/2"
FS-485P(2)-1200F	FS-484P(2)-1200F	FS-484S(2)-1200F	150.0	400.0	4320	4700	12"	221	53"	8"	28-1/2"
FS-485P(2)-1400F	FS484P(2)-1400F	FS-484S(2)-1400F	150.0	400.0	5400	6000	14"	245	53"	8"	28-1/2"

KUNKLE Valve Division

IRON SAFETY AND VACUUM VALVES

MODELS 215V 337

PRESSURE LIMITS 337 — 60 PSIG-300°F.

VACUUM LIMITS 215V — 22" HG.-300°F.

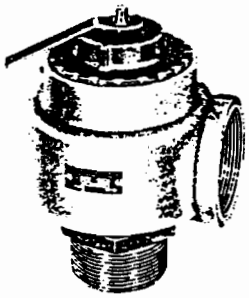
ASME Standard

UV

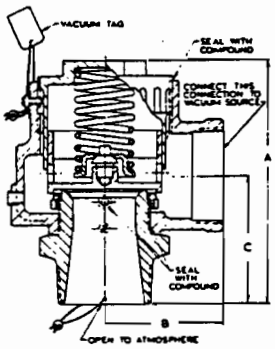
N.B. Certified

APPLICATIONS

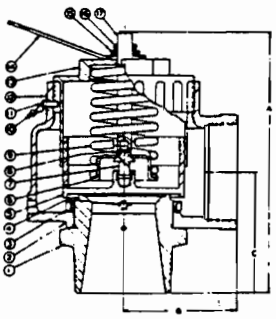
- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.



MODEL 337



MODEL 215V



MODEL 337

FEATURES

High capacity full nozzle design. Bronze nozzle, disc and guide with cast iron housing. Flat bronze valve seats are lapped for optimum performance. Warn ring offers easy adjustability for precise opening with minimum preopen or simmer and exact blowdown control. Pivot between disc and spring corrects mis-alignment and compensates for spring side thrust. Model 337 has reversible lift lever for "pull-up" or "pull-down" manual testing. Every valve 100% tested/inspected for pressure setting, blowdown and leakage. All adjustments are factory sealed to prevent tampering or dis-assembly.

SPECIFICATIONS

SIZE IN & OUT	A 337	A 215V	B	C	WGHT LBS.
2"	7¼	6¾	3¼	3¼	8
2½"	8	7½	3¾	3¾	12
→ 3"	9½	9	4¼	4¼	19

CAPACITIES

SCFM Air, 60°F., 10% Accumulation

Set Pressure PSIG	MODEL 337 2"	MODEL 337 2½"	MODEL 337 3"	Set Inches Mercury	MODEL 215V 2"	MODEL 215V 2½"	MODEL 215V 3"
5	527	799	1157	1	140	213	308
10	743	1127	1632	2	217	329	477
15	903	1368	1982	3	264	400	579
20	1062	1609	2331	4	299	453	657
25	1221	1850	2680	5	331	501	726
30	1380	2091	3029	6	352	533	772
35	1539	2332	3379	7	372	564	817
40	1698	2573	3728	8	391	592	858
45	1857	2814	4076	9	403	610	884
50	2017	3055	4428	10	413	625	906
60	2335	3537	5125	12	424	642	930
				12.8+	426	646	935

MODEL NUMBER/ORDER GUIDE

MODEL NO. POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EXAMPLE	2	1	5	V	—	K	0	1	—	Q	E	0	0	0	6
	0	3	3	7											

INLET SIZE
H — 2"
J — 2½"
K — 3"

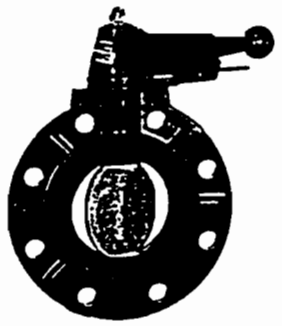
VARIATION (01 thru 99)
Number Provided Only by Manufacturer to Cover Specific Feature or Option.

DESIGN REVISION
Indicates Non-Interchangeable Revision. Dash (-) If Original Design.

VALVE SERVICE
K-Air ASME Sec VIII (Model 337 Only)
Q-Vacuum (Model 215V Only)

SPRING MATERIAL
E-Stainless (302)

SET PRESSURE
Models 337 2 PSIG (0002) thru 60 PSIG (0060)
Model 215V 1" HG (Inches of Mercury) (0001) thru 22" HG (0022) Vacuum



FEATURES

- Standard model has PVC body and polypropylene disc for better chemical resistance at temperatures higher than can be achieved with PVC
- Can be fitted with a variety of elastomeric seat materials to provide bubble-tight seating for a wide range of chemicals
- Stainless steel shaft has full engagement with disc and is a non-wetted part isolated from the media by double O-ring seals on top and bottom trunnions of disc
- Only disc and liner are wetted parts

SPECIFICATIONS

SIZES: 1½"–24"
Lever: 1½"–8", Gear: 8"–24"
MODELS: Wafer style (for ANSI flanges)
OPERATORS: Lever, ~~Gear~~
BODIES: PVC, ~~PP, PVDF~~
DISCS: PP, ~~PVDF, PVC (optional)~~
SEATS: ~~EPDM or~~ Viton, ~~Nitrile (Buna N), Butyl, Hypalon, Natural Rubber, Neoprene, Chlorinated Polyethylene (CPE)~~
SEALS: Same as seating material

OPTIONS

- Stem extensions
- Gear operators for 1½"–6"
- Handle locking devices
- 2" square operating nut
- Lug style butterfly valves
- Tandem arrangements (patented)
- PVDF disc for better temperature range and chemical resistance
- PP body
- 316 stainless steel or titanium stem

PARTS

No.	Parts	Pcs.	Materials
1	Body	1	PVC, PP, PVDF
1a	Ring *	2	Steel (SS400 / Epoxy Coated)
2	Disc	1	PP, PVDF
3	Seat	1	EPDM, Viton, Nitrile (Buna N), Neoprene, Hypalon, Butyl, Natural Rubber
4	Disc Seal O-Ring (A)***	2	Same material as seat
5	Disc Seal O-Ring (B)	2	Same material as seat
6	Stem Seal O-Ring (C)	1	Same material as seat
7	Stem	1	403 SS
8	Stem Holder	1	304 SS
9	Retaining Nut	1	PVC
10	Handle	1	PP
10a	Insert	1	Steel (SS400/Galvanized)
11	Handle Lever	1	304 SS
12	Pin	1	304 SS
13	Spring	1	304 SS
14	Washer	1	304 SS
15	Nut	1	304 SS
16	Locking Plate	1	304 SS
17	Screw	3	304 SS
18	Bolt	4	304 SS
19	Gasket	1	Nonas Sheet
20	Gear Box **	1	See Note

* Used for PP body for 6"-24" and for PDVF body for 12"-24".
** 1"-6": Cast aluminum with epoxy coat.
8"-16": Cast iron (FC200) with epoxy coat.
18"-24": Cast aluminum alloy (AC3A) with epoxy coat.
*** Used for sizes 2"-24".

SAMPLE SPECIFICATION

All solid thermoplastic butterfly valves shall be of the lined body design and bubble-tight seal with only the liner and disc as wetted parts. The disc shall have double O-ring seals on top and bottom trunnions of the same material as the valve liner. Liner shall be molded and formed around the body, functioning as a gasket on each side of the valve. Stem shall be of stainless steel and have engagement over the full length of the disc. Butterfly valves shall be wafer style, as manufactured by Asahi/America, Inc.

VACUUM SERVICE

Size (inches)	Vacuum (inches of mercury)
1½–5	-29.92
6–10	-27.56
12–16	-23.62
18–24	-19.69

Cv VALUES

(AT VARIOUS DEGREES OF OPENING)

Size (in)	30°	60°	90°
1½	2.9	43.3	71
2	3.9	56.1	92
2½	5.9	85.4	140
3	9.3	134.2	220
4	15.1	231	380
5	30.9	445	730
6	46.6	671	1100
8	106	1425	2500
10	270	1476	3600
12	408	2140	5160
14	535	2770	6440
16	750	3760	8340
18	1100	5020	10890
20	1448	6620	14060
24	2130	9180	18500

PRESSURE* VS TEMPERATURE (PSI, WATER, NON-SHOCK)

Body	PVC / PP			~~PP / PP~~		~~PVDF / PVDF~~			
Disc									
Size (inches)	30° F 120° F	121° F 140° F	141° F 180° F	-5° F 140° F	141° F 175° F	-5° F 140° F	141° F 175° F	176° F 212° F	213° F 250° F
1½–3	150	70	30	150	100	150	100	85	75
4–6	150	45	30	150	100	150	100	85	75
8–10	150	40	20	150	85	150	85	75	60
12	100	30	15	100	60	100	60	45	30
14	100	30	7	100	45	100	45	30	15
16	NA	NA	NA	85	45	85	45	30	15
18	NA	NA	NA	70	45	75	45	30	15
20–24	NA	NA	NA	50	30	50	30	25	15

* Consult factory for pressure ratings for lug style

P.O. Box 653 • 35 Green Street, Malden, MA 02148 • Tel: (800) 343-3618, (617) 321-5409
Fax: (800) 426-7058 • Internet: http://www.asahi-america.com • Email: asahi@asahi-america.com

TECHNO CORPORATION

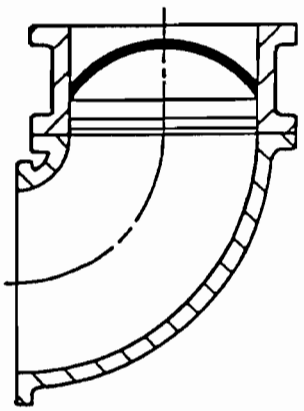
METAL CHECK VALVE INSTALLATION INSTRUCTIONS

GENERAL

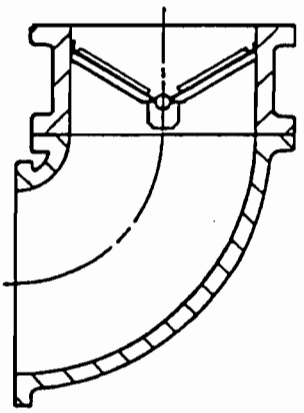
The internal assembly of the Technocheck should move freely from the open to closed position without binding. Even in the largest valves, the internals should operate easily by hand. The Technocheck may appear not to close tightly when so operated, but this simply means that the sealing member has not assumed its "set" and in no way should be interpreted as a failure of the valve to close easily or to seat tightly. This condition, if it exists, will be rectified by a few flexings in service. All Technocheck valve assemblies are treated with a locking solution during assembly and no loose fasteners should be found.

PRECAUTIONS

- **Positive Displacement and Rotary Lobe Blowers**—When used in this application, a Technocheck should always be mounted on the downstream side of a Silencer.
- **Reciprocating Pumps and Compressors**—Technocheck Valves **should not** used in these applications.
- **Pipe Fittings, Expansions, Reductions and Swages**—A **minimum** of 5 to 7 pipe diameters should be maintained between the Valve and Pipe Fittings (Tees, Elbows, etc.), Expansions, Reductions, and Swages.
- **Male Threaded, Plain or Grooved End Valves**—These valves may be held stationary in vises or with special wrenches, but should **never** be turned with a pipe wrench of any kind since serious risk of body distortion would be incurred. The use of a strap wrench is acceptable.
- **Adjacent to Vertical Elbows**—When installing Technocheck Valves in vertical lines downstream from an elbow, it is necessary to orient the hinge post to prevent unequal loading of the two valve plates.



CORRECT



INCORRECT

NOTE: Frequently the discharge of pumps and compressors simulates the above elbow configuration which causes higher velocity at the outer circumference. Care should be taken to position valves as shown above for these applications.

VALVE STORAGE

Valves should be stored indoors and in their original containers to keep them clean and to avoid damage.

REFER TO OPPOSITE SIDE FOR ADDITIONAL INSTRUCTIONS ON METAL CHECK VALVES.

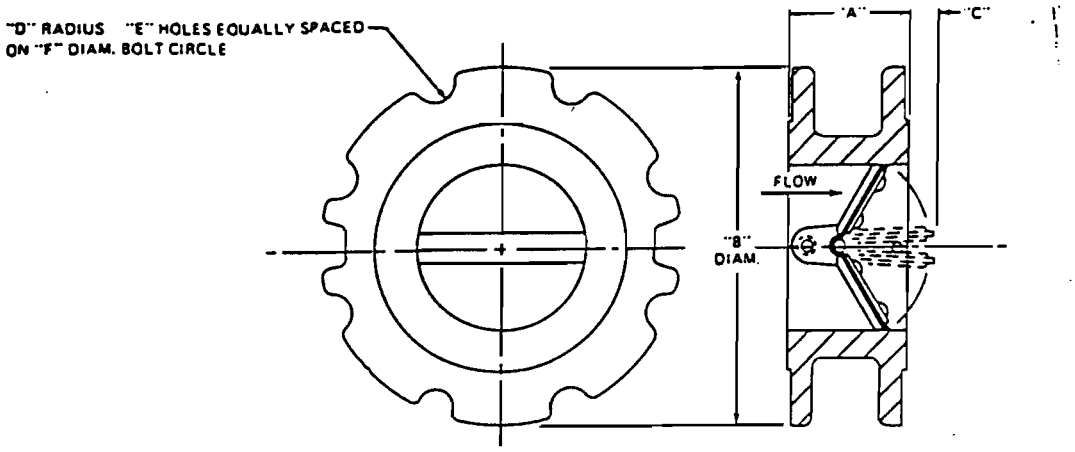
2709 WEST 10TH ST. P.O. BOX 1416 ERIE, PA 16512 PHONE 814-838-4561 FAX 814-838-6963

TECHNOCHECK

SF [SHORT FORM]

WAFER TYPE 125 # AND 150 # CLASS

STYLE
5412, 5118
5831-F 5831-R
5355
5355-304
5355-316



GENERAL DIMENSIONS FOR STYLES 5412, 5118, 5831-F, 5831-R, 5355, 5355-304 AND 5355-316

VALVE SIZE	"A"	"B"	"C"	"D"	"E"	"F"	VALVE SIZE	"A"	"B"	"C"	"D"	"E"	"F"
2	1-3/8	4-3/4	1/2	3/8	4	4-3/4	18	9-3/8	22-3/4	4-1/4	5/8	16	22-3/4
2-1/2	1-5/8	5-1/2	9/16	3/8	4	5-1/2	20	10-3/8	25	4-3/4	5/8	20	25
3	1-7/8	6	11/16	3/8	4	6	24	12-3/8	29-1/2	5-3/4	11/16	20	29-1/2
4	2-3/8	7-1/2	7/8	3/8	8	7-1/2	30	15-3/8	36	7-3/4	11/16	28	36
5	2-7/8	8-1/2	1-1/8	7/16	8	8-1/2	36	18-3/8	42-3/4	8-1/2	13/16	32	42-3/4
6	3-3/8	9-1/2	1-1/2	7/16	8	9-1/2	42	21-3/8	49-1/2	9-1/2	13/16	36	49-1/2
8	4-3/8	11-3/4	2-1/4	7/16	8	11-3/4	48	24-3/8	56	11-1/2	13/16	44	56
10	5-3/8	14-1/4	2-1/2	1/2	12	14-1/4	54	27-3/8	62-3/4	13	15/16	44	62-3/4
12	6-3/8	17	3	1/2	12	17	60	30-3/8	69-1/4	14	15/16	52	69-1/4
14	7-3/8	18-3/4	3-1/4	9/16	12	18-3/4	66	33-3/8	76	15	15/16	52	76
16	8-3/8	21-1/4	3-3/4	9/16	16	21-1/4	72	36-3/8	82-1/2	16-1/2	15/16	60	82-1/2

ALL DIMENSIONS IN INCHES

STANDARD MODELS & MATERIALS

STYLE	BODY	INTERNALS	FLANGE CLASS	PSI C.W.P.
5412	ALUMINUM	ALUMINUM	125*	125
5118	CAST IRON	ALUMINUM	125*	125
5831-F	BRONZE	BRONZE	125*	150
5831-R	BRONZE	BRONZE	150†	150
5355	STEEL	CADMIUM PLATED STEEL	150†	150
5355-304	304 STAINLESS STEEL	304 STAINLESS STEEL	150†	150
5355-316	316 STAINLESS STEEL	316 STAINLESS STEEL	150†	150

→ STANDARD ELASTOMER: BUNA-N

*FLAT FACE
†RAISED FACE

OPTIONAL MATERIAL SELECTION

INTERNAL MATERIALS

- Aluminum
- Bronze
- 304 Stainless Steel
- 316 Stainless Steel
- Cadmium Plated Steel
- Electroless Nickel Plated Steel or Aluminum*
- Monel*
- Titanium*
- Hastelloy*

*Non stock item – Available upon request.

SPRING MATERIALS

- 304 Stainless Steel
- 316 Stainless Steel

Monel and Inconel springs available upon request.

SEALING MEMBER MATERIALS

MATERIAL	*TEMPERATURE RANGE
• Buna-N	–60 to 225° F
• Neoprene	–40 to 225° F
• Butyl	–65 to 300° F
• Hypalon	–20 to 300° F
• EPDM	–40 to 300° F
• Viton	–20 to 400° F
• Teflon	–20 to 450° F
• Silicone	–100 to 500° F
• FDA Approved White Neoprene	–40 to 225° F

*This temperature range is for general guidance. The figures may vary with application

CONSULT FACTORY FOR MATERIALS, SIZES AND PRESSURE RATINGS NOT SHOWN.

Motor Current Ratings

Single & Three Phase

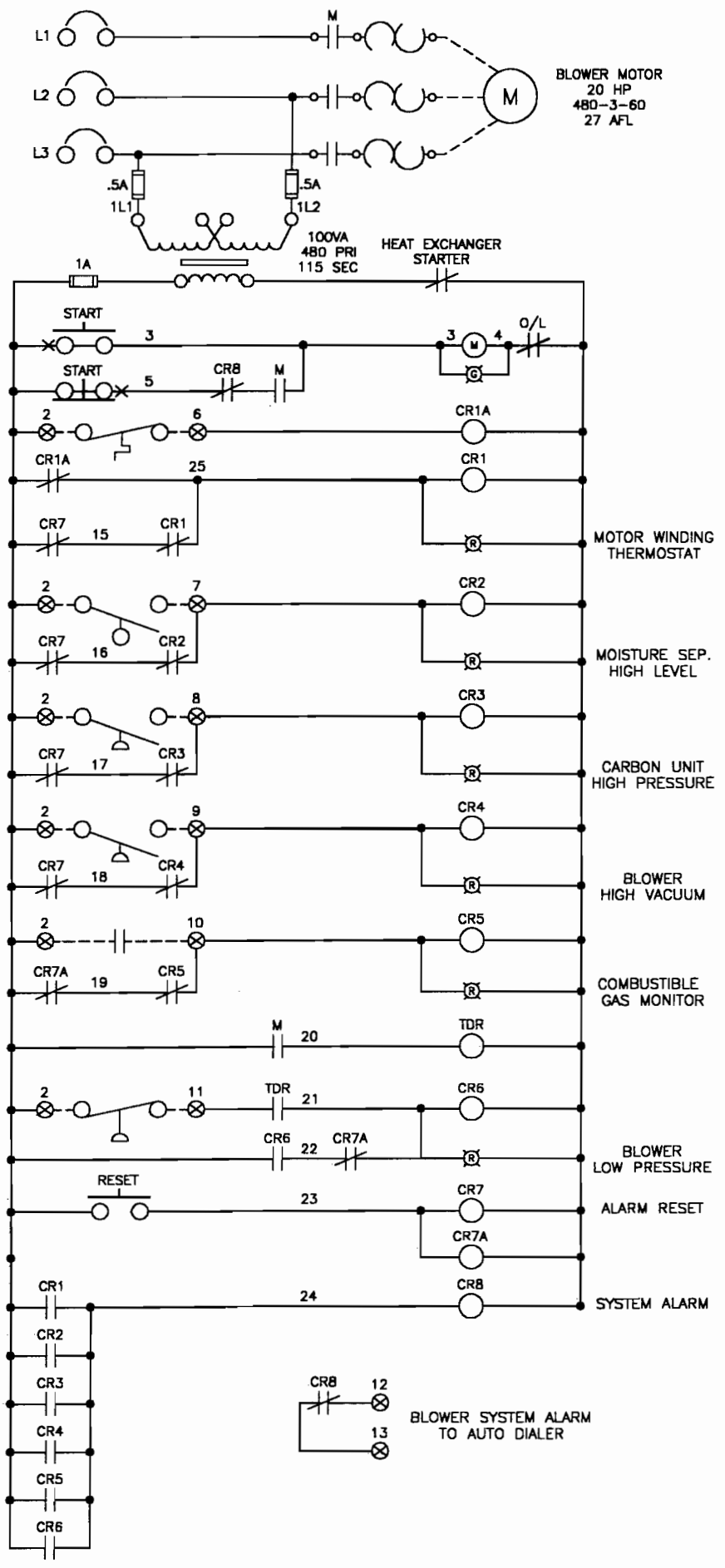
A

Horsepower	60Hz AC Induction Motor					
	Single Phase		Three Phase			
	115 Volt	230 Volt	200 Volt	230 Volt	460 Volt	575 Volt
1/6	4.4	2.2	~	~	~	~
1/4	5.8	2.9	~	~	~	~
1/3	7.2	3.6	~	~	~	~
1/2	9.8	4.9	2.3	2.0	1.0	0.8
3/4	13.8	6.9	3.2	2.8	1.4	1.1
1	16.0	8.0	4.1	3.6	1.8	1.4
1 1/2	20.0	10.0	6.0	5.2	2.6	2.1
2	24.0	12.0	7.8	6.8	3.4	2.7
3	34.0	17.0	11.0	9.6	4.8	3.9
5	56.0	28.0	17.5	15.2	7.6	6.1
7 1/2	80.0	40.0	25.0	22.0	11.0	9.0
10	100	50.0	32.0	28.0	14.0	11.0
15	135	68.0	48.0	42.0	21.0	17.0
20	~	88.0	62.0	54.0	27.0	22.0
25	~	110	78.0	68.0	34.0	27.0
30	~	136	92.0	80.0	40.0	32.0
40	~	176	120	104	52.0	41.0
50	~	216	150	130	65.0	52.0
60	~	~	177	154	77.0	62.0
75	~	~	221	192	96.0	77.0
100	~	~	285	248	124	99.0
125	~	~	359	312	156	125
150	~	~	414	360	180	144
200	~	~	552	480	240	192
250	~	~	692	602	302	242
300	~	~	~	~	361	289
350	~	~	~	~	414	336
400	~	~	~	~	477	382
500	~	~	~	~	590	472

The information in this chart was derived from Table 430–148 & 430–150 of the NEC and Table 52.2 of UL standard 508. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110–120, 220–240, 440–480 and 550–600 volts.

The full-load current values are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents, and multi-speed motors will have full-load currents varying with speed. In these cases, the nameplate current ratings shall be used.

Caution: The actual motor amps may be higher or lower than the average values listed above. For more reliable motor protection, use the actual motor current as listed on the motor nameplate. Use this table as a guide only



SOIL REMEDIAL ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

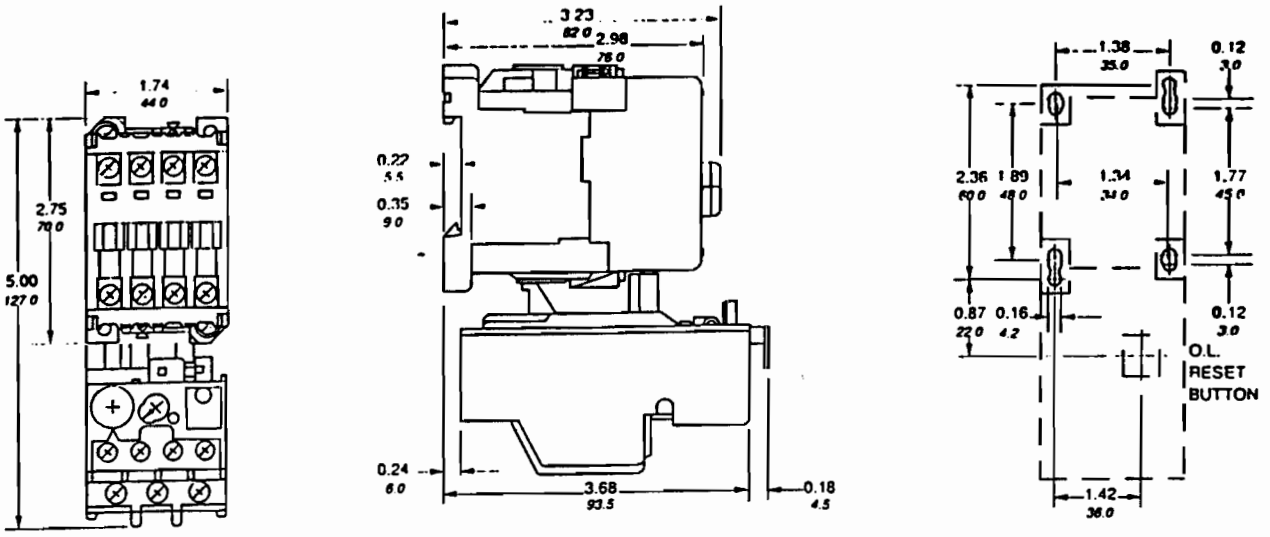
20 HP BLOWER CONTROL PANEL WIRING DIAGRAM

DRAWN:	DATE	REVISED	PREPARED BY:
YDN			LEGGETTE, BRASHEARS & GRAHAM, INC.
CHECKED:			Professional Ground-Water and Environmental Engineering Services
PJ			126 Monroe Turnpike
DATE:			Trumbull, CT 06611
1/28/99			(203) 452-3100
FIGURE:			

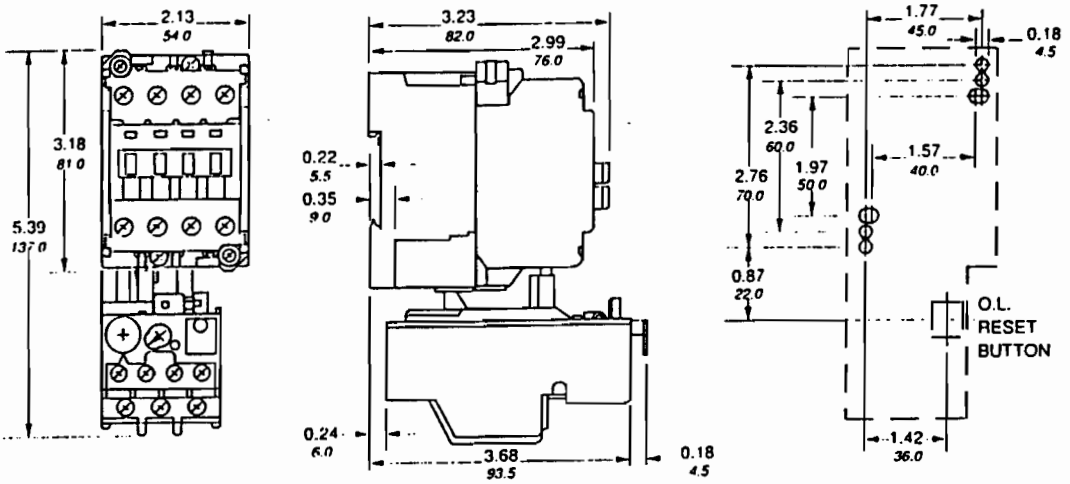
Dimensions

00.00 Inches
00.00 Millimeters

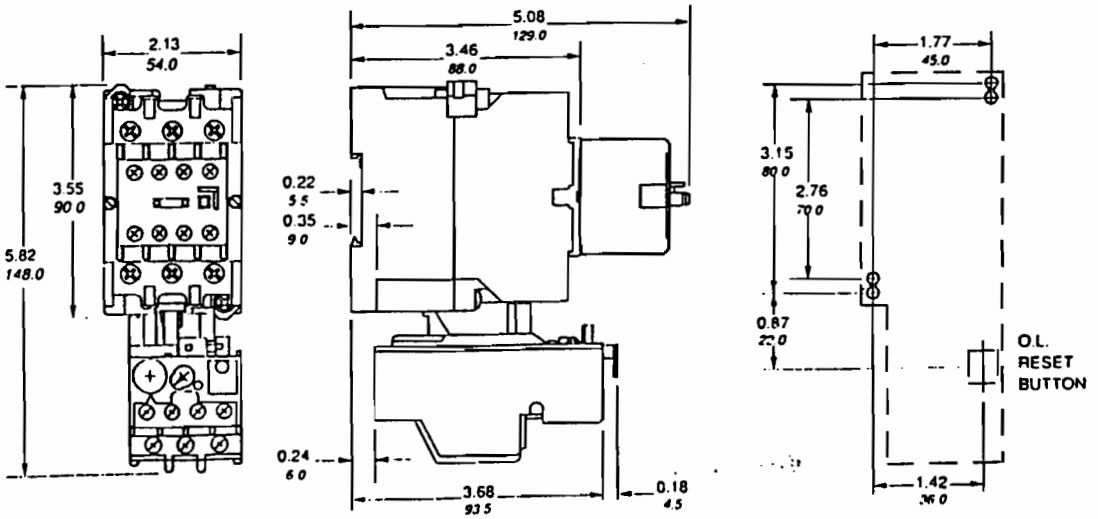
B9, B12, & B16



B25



B30



Contact Ratings

Voltage	Rating	Resistive				Inductive			
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
28V DC	UL	10A	10A	10A	10A	7.5A			7.5A
30V DC	UL	10A	10A	10A	10A	7A	7A		
	CSA						7.5A		
	Nominal							7.5A	7.5A
120V AC	UL	10A	10A	10A	10A	7.5A			7.5A
	CSA						7.5A	7.5A	
	Nominal					7A			
240V AC	UL	10A	10A		7.5A	7A	7A	•	5A
	CSA							7A	
	Nominal	7A	7.5A	7.5A	4.5A	5A	5A	5A	

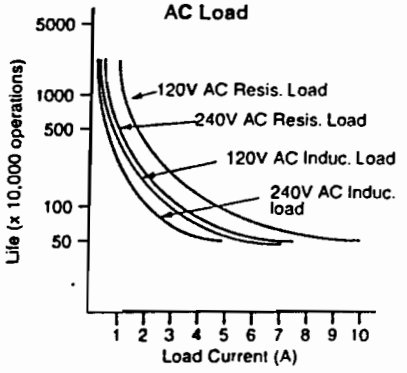
*Note: 6.5A/pole, 20A total.
Note: Inductive load cos ø = 0.3, L/R = 7 msec

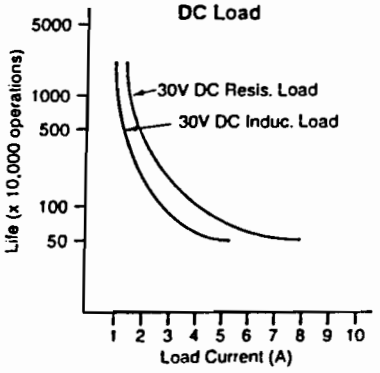
Sockets

Relay	Sockets					Spring (Optional)
	DIN Rail Mount		Surface Mount	Panel Mount	PCB Mount	
	Standard	Fingersafe				
RH1B	SH1B-05	SH1B-05C		SH1B-51	SH1B-62	SY2S-02F1 SFA-101 SFA-202 SY4S-51F1 SFA-301 SFA-302
RH2B	SH2B-05	SH2B-05C	SH2B-02	SH2B-51	SH2B-62	SY2S-02F1 SFA-101 SFA-202 SY4S-51F1
RH3B	SH3B-05	SH3B-05C		SH3B-51	SH3B-62	SH3B-05F1 SFA-101, -202 SY4S-51F1
RH4B	SH4B-05	SH4B-05C		SH4B-51	SH4B-62	SH4B-02F1 SFA-101, -202 SY4S-51F1

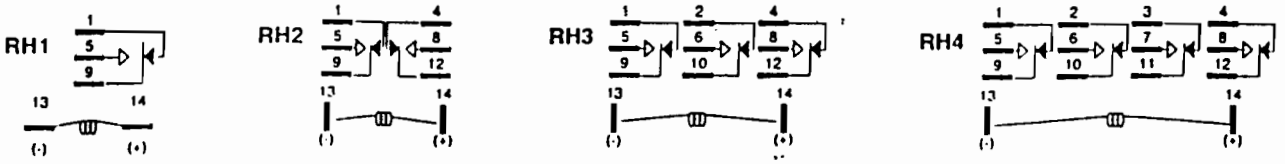
Note: See section F for details on sockets. All DIN rail mount sockets shown above can be mounted using DIN Rail BND-1000 or BAM-1000.

Electrical Life Curves





Internal Circuit



Specifications

Contact Material	Silver cadmium oxide (AgCdO)
Contact Res.	50mΩ max. (Initial value)
Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
Operating Time	SPDT(RH1), DPDT (RH2): 20ms max. 3PDT (RH3), 4PDT (RH4): 25ms max.
Release Time	SPDT(RH1), DPDT (RH2): 20ms max. 3PDT (RH3), 4PDT (RH4): 25ms max.
Power Consumption	SPDT (RH1): DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) DPDT (RH2): DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) 3PDT (RH3): DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) 4PDT (RH4): DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
Insulation Resistance	100MΩ min (measured with a 500V DC megger)
Dielectric Strength	SPDT (RH1) Betw. live and dead parts: 2000V AC, 1 minute; Betw. contact circuit and operating coil: 2000V AC, 1 minute; Between contacts of the same pole: 1000V AC, 1 minute
	DPDT (RH2), 3PDT (RH3), 4PDT (RH4) Betw. live and dead parts: 2000V AC, 1 minute; Betw. contact circuit and operating coil: 2000V AC, 1 minute; Between contact circuits: 2000V AC, 1 minute; Between contacts of the same pole: 1000V AC, 1 minute
Freq. Response	1800 operations/hr
Temperature Rise	Coil: 85°C max. Contact: 65°C max.
Vibration Resistance	0 to 6G (55Hz max.)
Shock Resistance	SPDT/DPDT: 200N (approx. 20G) 3PDT/4PDT: 100N (approx. 10G)
Life Expectancy	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT (RH1), 3PDT (RH3), 4PDT (RH4). Mechanical: 50,000,000 operations
Operating Temp.	-30° to +70°C
Weight	SPDT: 24g, DPDT: 37g (approx.) 3PDT: 50g, 4PDT: 74g (approx.)

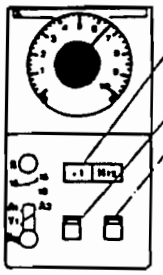
Syrelec

CHRONOS INSTRUCTION SHEET

Setting the time delay - All models: Power should be disconnected before changing the switch settings.

Setting the time delay - LRU/LR2U, ASU/ARU/AR2U, BRU/BR2U, CRU/CR2U Series:

1. Select Hours, Minutes, or Seconds with the Time Base Selection switch on the front, using a small screwdriver or pen.
2. Select desired multiplier (x0.1 or x1) by moving the Scale Selection Switch, located to the left of the time base switch.
3. Rotate the knob to desired setting between 0 and 10.



Six Time Ranges can be selected with two front panel switches.
- X 0.1 s _ 0.1 to 1 second
- X 1 s _ 1 to 10 seconds
- X 0.1 mn _ 0.1 to 1 minute
- X 1 mn _ 1 to 10 minutes
- X 0.1 hrs _ 0.1 to 1 hour
- X 1 hrs _ 1 to 10 hours

Examples:

Required setting - 2 minutes.
1. Select "Minutes"
2. Select "x1"
3. Rotate knob to 2.

Required setting - 30 minutes.
1. Select "Hours"
2. Select "x0.1"
3. Rotate knob to 5.

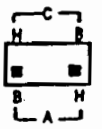
Setting the Time Delay - DRU/DR2U Series Repeat Cycle:

The DRU Repeat Cycle offers two different time settings, one for "off" time and one for "on" time - both in the U time range (.1 seconds to 10 hours). Six dipswitches are located on the underside of the case. Switches 1,2, & 3 set the "off" time range; switches 4,5, & 6 set the "on" range. The chart defines the switch settings. Once you have selected your time range, you can set the dials on the front. Top dial is "ON", bottom dial is "OFF" and they are labeled as such. Refer to the examples above.

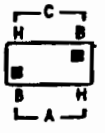
SWITCHES 1/4	2/5	3/6	TIME RANGE
Down	Down	Down	.1 to 1 second
Down	Down	Up	1 to 10 seconds
Down	Up	Down	.1 to 1 minute
Down	Up	Up	1 to 10 minutes
Up	Down	Down	.1 to 1 hour
Up	Down	Up	1 to 10 hours

Selecting the desired function - LRU/LR2U Series Multifunction Timer:

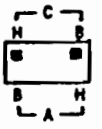
Two dipswitches are located on the under-side of the LRU to select between Delay on Make (A), Delay on Break (C), Single Shot (B), or Interval Timer (H). Select your function using a small screwdriver or a pen. See diagram for switch settings. Function descriptions and wiring diagrams are on the reverse side of this sheet.



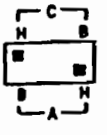
FUNCTION A
Delay on Make



FUNCTION B
Single Shot



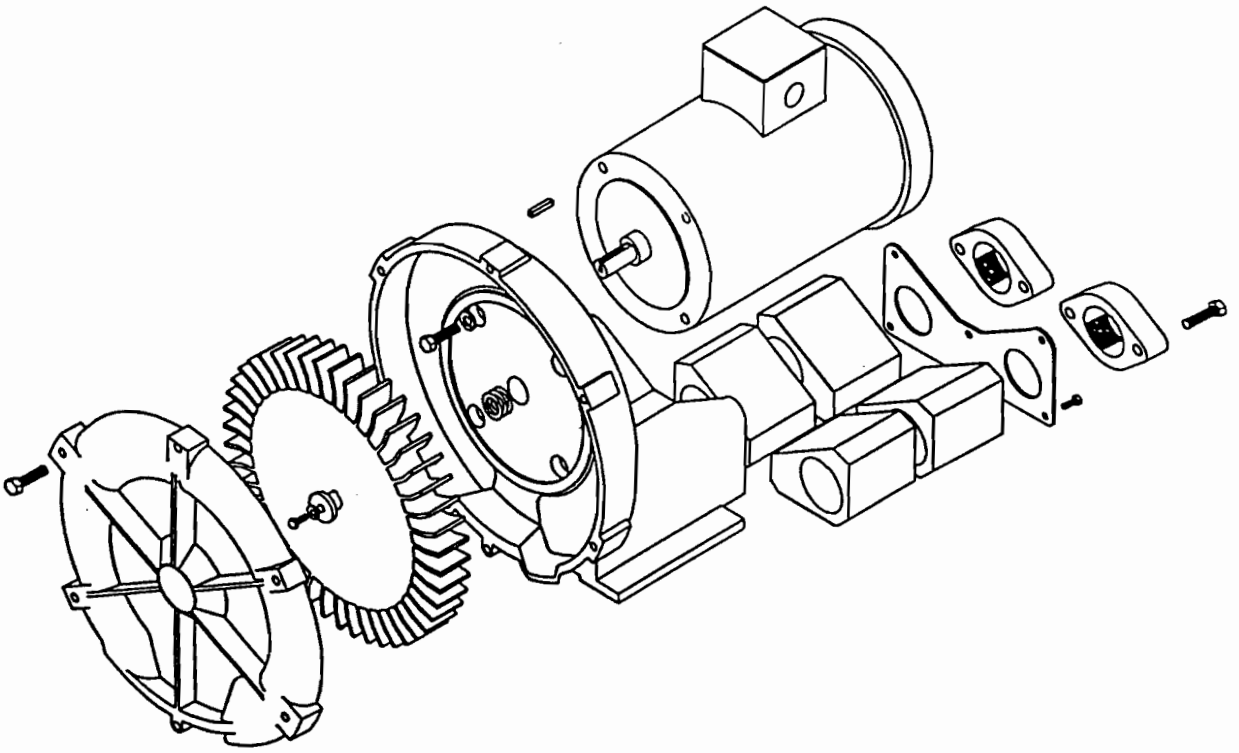
FUNCTION C
Delay on Break



FUNCTION H
Interval Timer

3237 Commander Dr. • Carrollton, TX 75006-2506 • (800) 677-5311 • Fax (214) 250-3865

Service and Parts Manual for Blower Model EN454 - EN606



AMETEK®
ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP
SAUGERTIES, NEW YORK 12477
TEL: (914) 246-3401 FAX: (914) 246-3802

Warranty Information

1. **No-Fault Policy.** AMETEK Rotron regenerative direct drive blowers are guaranteed up to one full year from the date of purchase to the original purchaser only. Should the blower fail, **regardless of the cause of failure**, we will at our option repair or replace the blower.

2. **Standard Policy.** AMETEK Rotron remote drives, Nasty Gas™ models and special built (EO) products are guaranteed up to one full year from date of purchase for workmanship and material defect to the original purchaser only. Should the blower fail, we will evaluate the failure. If determined to be workmanship or material defect, we will at our option repair or replace the blower.

3. **Modified Policy.** AMETEK Rotron packaged units, Vacu-Master models and moisture separators are guaranteed up to one full year from date of purchase for workmanship and material defect to the original purchaser only on all parts excluding maintenance/wear items such as belts and bags. Should the blower fail, we will evaluate the failure. If determined to be workmanship or material defect, we will at our option repair or replace the blower.

4. **Parts Policy.** AMETEK Rotron spare parts and accessories are guaranteed up to three months from date of purchase for workmanship and material defect to the original purchaser only. Should the part fail, we will at our option repair or replace the part.

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

Terms and Conditions. Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Maximum liability will in no case exceed the value of the product purchased. Other terms and conditions of sale are stated on the back of the order acknowledgment.

Installation

1. **Bolt It Down.** Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.

2. **Filtration.** All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

   Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

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

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

4. **Wiring.** Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.

5. **Pressure/Suction Maximums.** The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Application Engineering staff will need to know the operating pressure/suction to properly diagnose the problem.

6. **Excess Air.** Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

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

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all models in the DR, EN, CP, and HiE series have sealed bearings which require no maintenance. Bearings should be changed after 15,000 to 20,000 hours, on average. Shell Dolium R grease is used at the factory. Replacement bearings should contain Shell Dolium R or its equivalent.

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	1. * One phase of power line not connected 2. * One phase of stator winding open 3. Bearings defective 4. Impeller jammed by foreign material 5. Impeller jammed against housing or cover 6. ** Capacitor open	1. Connect 2. Rewind or buy new motor 3. Change bearings 4. Clean and add filter 5. Adjust 6. Change capacitor
	No Sound	1. * Two phases of power line not connected 2. * Two phases of stator winding open	1. Connect 2. Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	1. Insufficient fuse capacity 2. Short circuit	1. Use time delay fuse of proper rating 2. Repair
	Motor Overheated Or Protector Trips	1. High or low voltage 2. * Operating in single phase condition 3. Bearings defective 4. Impeller rubbing against housing or cover 5. Impeller or air passage clogged by foreign material 6. Unit operating beyond performance range 7. Capacitor shorted 8. * One phase of stator winding short circuited	1. Check input voltage 2. Check connections 3. Change bearings 4. Adjust 5. Clean and add filter 6. Reduce system pressure/vacuum 7. Change capacitor 8. Rewind or buy new motor
	Abnormal Sound	1. Impeller rubbing against housing or cover 2. Impeller or air passages clogged by foreign material 3. Bearings defective	1. Adjust 2. Clean and add filter 3. Change bearings
	Performance Below Standard	1. Leak in piping 2. Piping and air passages clogged 3. Impeller rotation reversed 4. Leak in blower 5. Low voltage	1. Tighten 2. Clean 3. Check wiring 4. Tighten cover, flange 5. Check input voltage

* 3 phase units
** 1 phase units
*** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.

Blower Disassembly

WARNING: Attempting to repair or diagnose blower may void Rotron's warranty. This unit can be difficult to successfully disassemble and reassemble.

Refer to assembly diagram (Appendix 2) for referenced part designations. **CAUTION: Be sure power is disconnected before doing any work on units.**

1. Disconnect power leads.
2. Remove or separate piping and/or mufflers from unit.
3. Remove cover bolts (B14) and then cover (B13). **Note:** This unit has seals on it. Opening unit will require mandatory replacement of these seals.
4. Remove impeller bolt (B10) and washers and then remove impeller. **Note:** Never pry on the edges of the impeller. Use puller, if necessary.
5. Carefully note number and location of shims (B8). Remove and set aside. **Note:** If disassembly was for inspection or cleaning purposes, unit may now be reassembled by reversing the above steps. If motor servicing, replacement, or impeller replacement is required, the same shims may not be re-used. It will be necessary to re-shim according to the procedure shown under Assembly.
6. Remove housing bolts (B5) and remove motor assembly.

Muffler Material Replacement

1. Remove manifold cover bolts (B19).
2. Muffler assembly can now be removed and replaced if necessary.
3. Reassemble by reversing procedure.

Bearing Selection

All bearings used in AMETEK Rotron blowers are of the double sealed variety. In addition, high temperature greases are used to prevent loss of lubrication under severe operating conditions. Select the appropriate bearings by referencing the parts list if ordering from AMETEK Rotron, or the parts list and the accompanying chart.

BEARING TYPES AND LUBRICANTS

All Rotron regenerative blowers supplied with direct fitted motors are designed with ABEC1 quality double sealed ball bearings in the motor. The bearing design in all cases is a C3 fit. Below is our recommended chart by bearing part number.

Part No.	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% ± 5% fill	Yes - 325°F
510449 516440 516648	203 202 307	(Buna N)	Shell Dolium "R" 25-40% fill	No
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	(Buna N)	Shell Dolium "R" 30% ± 5% fill	No

Blower Reassembly

1. Place assembled motor against rear of housing (B4) and fasten with bolts (B5) and washer (B17).
2. To ensure impeller is centered within housing cavity, reshim impeller according to the procedure outlined below.
3. Replace seal (B27) (if used).
4. Place impeller onto shaft (be sure key is in place (M3)) and fasten with bolt (B10), washer (B11 & B12), and spacer (B16) if applicable. TORQUE impeller bolt per table below. Once fastened, carefully rotate impeller to be sure it turns freely.
5. Replace cover and fasten with bolts (B14, B14B).
6. Reconnect power leads per motor nameplate.

Bolt Size	Torque
1/4 - 20	6.25 +/- .25
5/16 - 18	11.50 +/- .25
3/8 - 16	20.0 +/- .5
1/2 - 13	49.0 +/- 1
5/8 - 11	90.0 +/- 2

Impeller Shimming Procedure

WARNING: This unit is difficult to shim. Care must be exercised.

Tools needed: Machinist's Parallel Bar
Vernier Caliper with depth measuring capability
Feeler Gauges or Depth Gauge

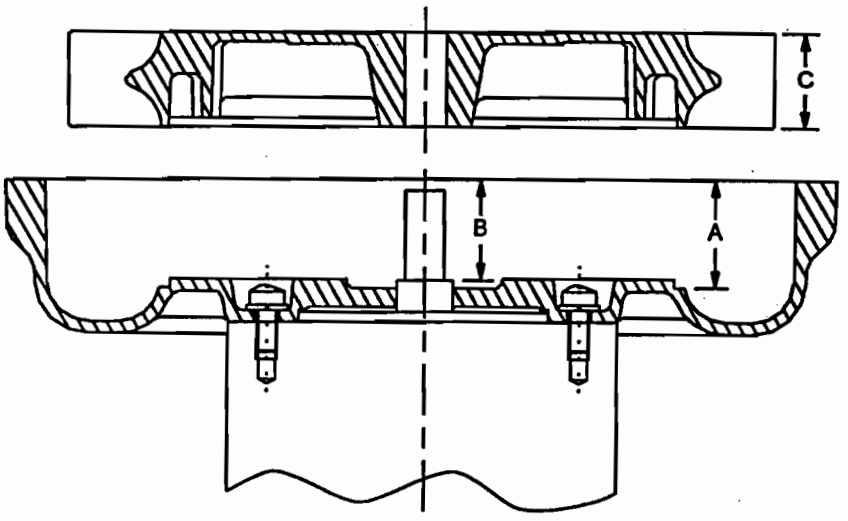
Measure the following:

- Distance from the flange face to the housing (A)
- Distance from the flange face to the motor shaft shoulder (B)
- Impeller thickness (C)

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

$$Shim\ Thickness = B - \left(\frac{A+C}{2}\right)$$

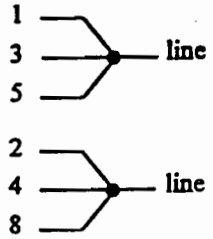
After impeller installation (step 3 above), the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be $\left(\frac{A-C}{2}\right)$.



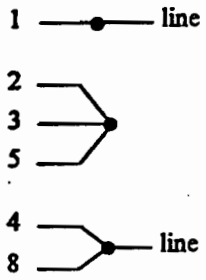
Wiring Diagrams, XP Motors

H. 1ø, 6 wire

115 VAC



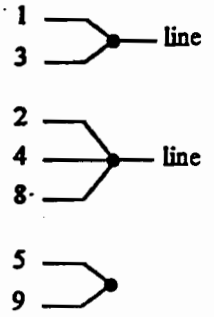
230 VAC



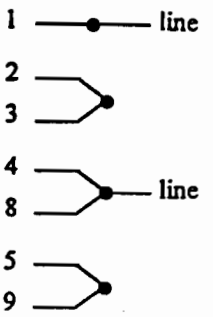
Interchange leadwires 5 & 8 to reverse rotation

I. 1ø, 7 wire

115 VAC



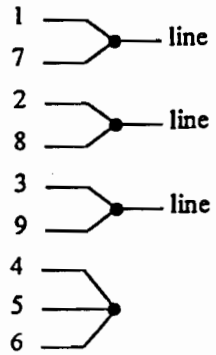
230 VAC



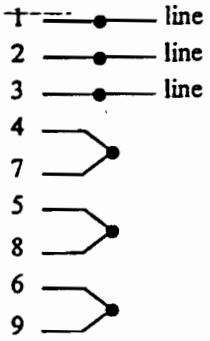
Interchange leadwires 5 & 8 to reverse rotation

K. 3ø, 9 wire

230 VAC

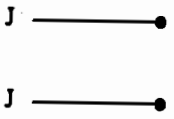


460 VAC



Interchange any two line leads to reverse rotation

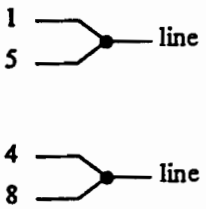
L. Pilot Duty Thermal Overload Leads



Hook J leads to control circuitry

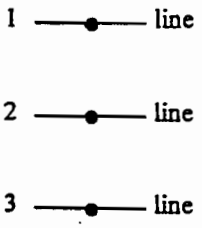
M. 1ø, 230 VAC

Single Voltage



Interchange leadwires 5 & 8 to reverse rotation

N. 3ø, 575 VAC

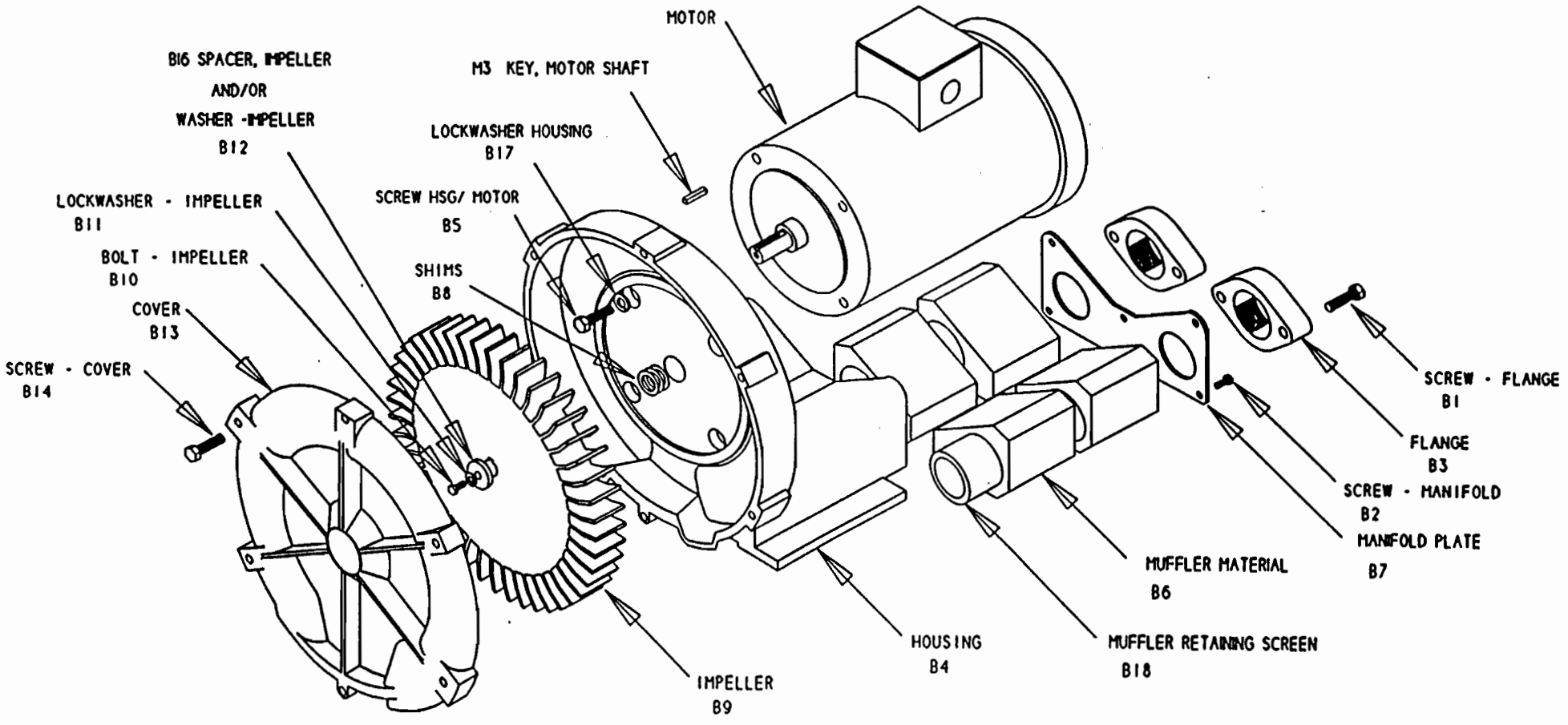


Interchange any two line leads to reverse rotation

NOTE: Wiring diagram on motor takes precedence over those printed here. Wiring diagram typically found under T-box cover.

2/28/96 Rev. -

ASSEMBLY DIAGRAM
DR XOX



EN 454/513/523/505/555/606
Service and Parts Manual

Parts Breakdown

Item No.	Qty Req'd	Description	EN454 038175 038176	EN513 038183 038037	EN523 038223 038184	EN505 038177 038178 038445	EN555 038045	EN606 038179 038222 038437 038536 038538
M3	1	Key Motor Shaft	510629	510629	155099	510629	510629	510629
B1	4	Screw, Flange	120162	120162	120162	120162	120162	155095
B2	6	Screw, Manifold	120216	(10 pcs) 120214	(10 pcs) 120214	155170	120216	120216
B3	2	Flange	510354	510354	510354	510354	510354	511480
B4	1	Housing	515737	523419	523420	See Next Page	516721	See Next Page
B5	4	Screw, Hsg /Motor	251791	251791	251791	155128	251791	251791
B6	4	Muffler Material	515743	516560	516560	(6 pcs) 515743	515743	See Next Page
B7	1	Manifold Plate	516410	529868	529868	517460	515482	516392
B8	*	Shim .002"	510356	510356	500664	510356	510356	510356
	*	Shim .005"	510357	510357	500665	510357	510357	510357
	*	Shim .010"	510358	510358	500666	510358	510358	510358
	*	Shim .020"	510359	510359	500667	510359	510359	510359
	*	Shim .030"	Not Used	Not Used	510292	Not Used	Not Used	Not Used
B9	1	Impeller	515675	516557	(2 pcs) 516562	517433	516678	511272
B10	1	Bolt, Impeller	120214	120325	120214	120214	120262	120325
B11	1	Lockwasher, Impeller	120203	120203	120203	120203	120203	120203
B12		Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1	Cover	517807	516559	516559	517808	516675	511274
B14	6	Screw, Cover	120215	(8 pcs) 120255	(8 pcs) 155098	155236	(7 pcs) 120215	120215
B16		Spacer, Impeller Bolt	510355	510355	510355	510355	510355	510355
B17		Lockwasher, Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B18		Screen, Muffler Retaining, Right (**)	510362	511718	511718	See Next Page	510362	See Next Page
		Screen, Muffler Retaining, Left (**)	510362	511718	511718	See Next Page	510362	See Next Page
B19		Bolt, Muffler Hsg/Hsg	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B20		Muffler Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Bolt, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Lockwasher, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Washer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Spacer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B23		Bolt, Mounting Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B24		Lockwasher, Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B25		Nut, Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B26		Rail Mounting	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Lip Seal	516587	516587	516587	516587	516587	516587

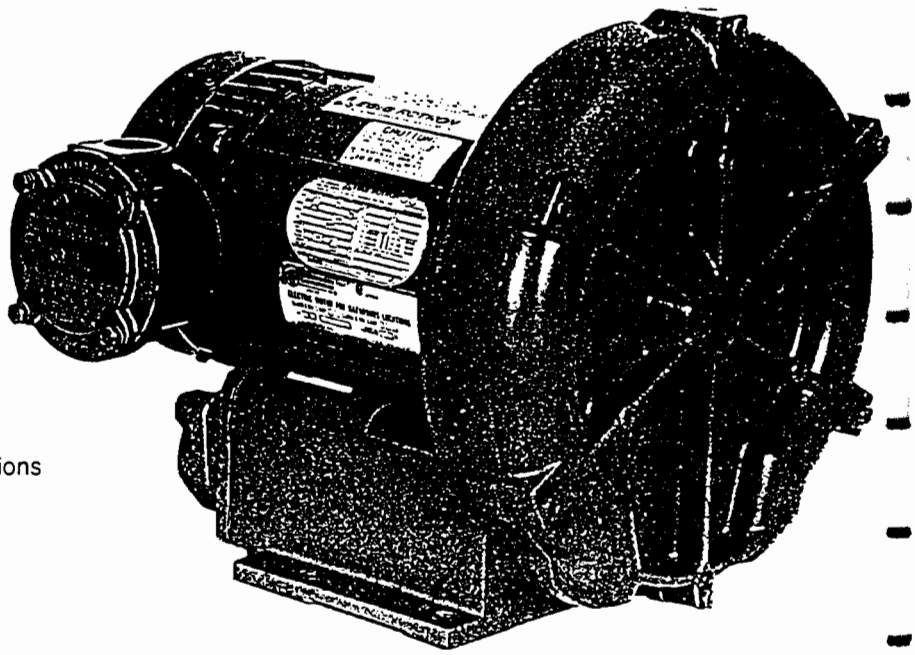
As n[illegible] *[illegible] wed [illegible] g at inlet/outlet ports *** Not currently in production; superseded by model listed below

Model	Part #	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
EN454W58L	038175	515747	H + L		510449	510217
EN454W72L	038176	515746	K + L			
EN513W58L	038183	515747	H + L			
EN513W72L	038037	515746	K + L			
EN523M72L	038184	517675	K + L	B13A 516555 1 pc Center Annulus		
EN523M5L	038223	529392	M + L			
EN505AX58ML	038177	510326	H + L	B4 517419 B18 517435 2 pcs		
EN505AX72ML	038178	510325	K + L			
EN505CJ5ML	038445	529622	M + L	B4 529654 B18 517436 2 pcs		
EN555M72L	038045	516687	K + L			
EN606M72L	038179 ***	516687	K + L	B4 511276 1 pc B6 511285 4 pcs		
EN606M5L	038222 ***	529373	M + L			
EN606M86L	038437	529630	N + L	B4 529790 1 pc B6 529781 4 pcs B18 529782 2 pcs		
EN606M72ML	038536	516687	K + L			
EN606M5ML	038538	529373	M + L			

* As needed ** Viewed looking at inlet/outlet ports *** Not currently in production; superseded by model listed below

EN/CP 606
Explosion-Proof Regenerative Blower

FEATURES
- Manufactured in the USA
- Maximum flow: 200 SCFM
- Maximum pressure: 75 IWG
- Maximum vacuum: 75 IWG
- Standard motor: 3.0 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

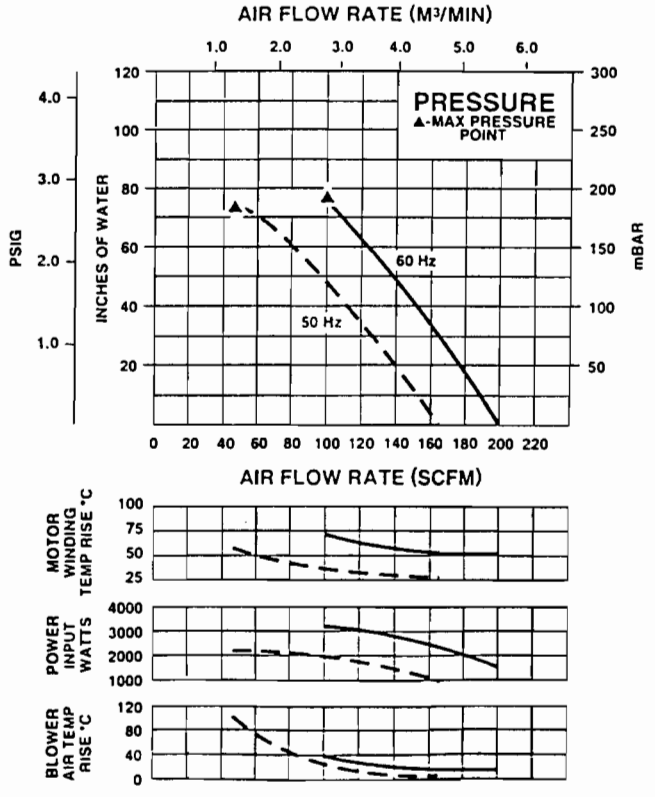


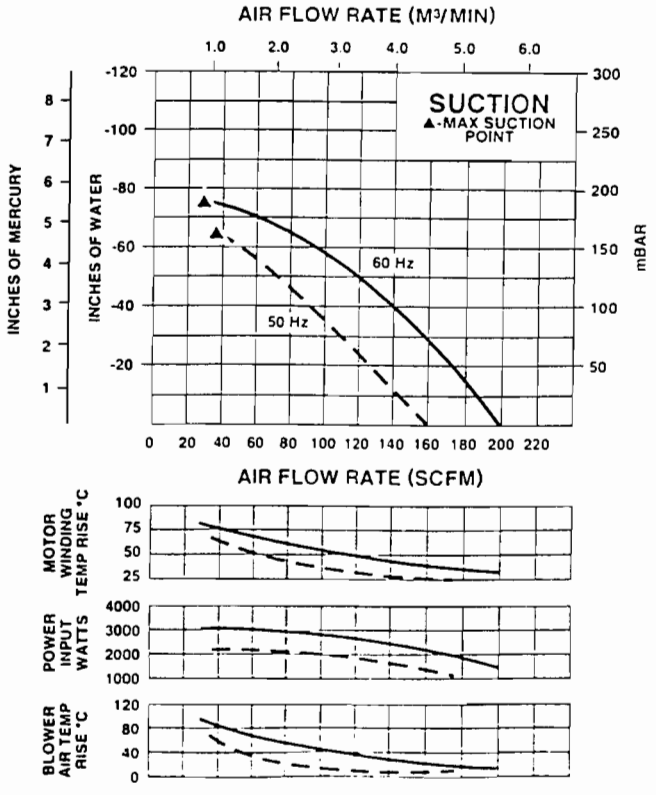
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

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

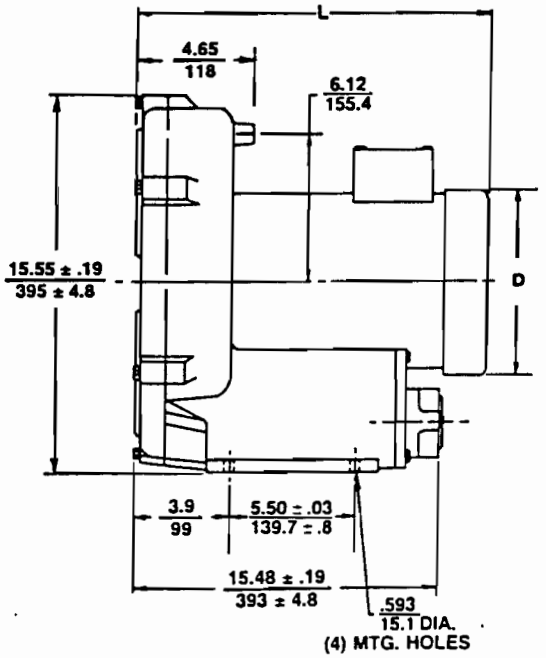
ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)

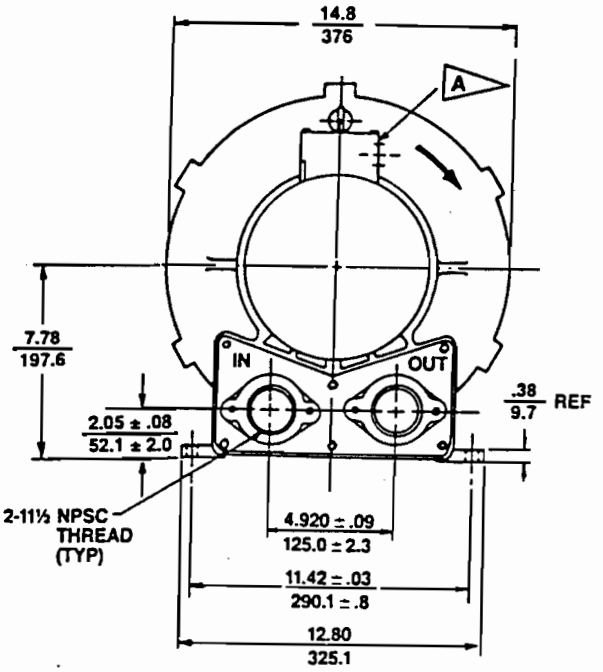
BLOWER PERFORMANCE AT STANDARD CONDITIONS





EN/CP 606
Explosion-Proof Regenerative Blower





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

MODEL	L (IN) ± .3	L (MM) ± 8	D (IN) ± .1	D(MM) ±3
EN/CP606M72ML	17.89	454	7.2	182
EN/CP606M5ML	19.9	505	8.5	216

A — 0.75" NPT CONDUIT CONNECTION

SPECIFICATIONS

MODEL	EN606M5ML	EN606M72ML		EN606M86ML	CP606FU5MLR	CP606FU72MLR
Part No.	038538	038536		038437	–	038972
Motor Enclosure – Shaft Material	Explosion-proof – CS	Explosion-proof – CS		Explosion-proof – CS	Chem XP – SS	Chem XP – SS
Horsepower	3.0	3.0		3.0	Same as EN606M5ML – 038538 except add Chemical Processing (CP) features from catalog inside front cover	Same as EN606M72ML – 038536 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency [1]	Single - 60 Hz	Three - 60 Hz		Three - 60 Hz		
Voltage [1]	208-230	~~200-230~~	460	575		
Motor Nameplate Amps	15.5-14.5	~~7.8-7.4~~	3.7	3.0		
Max. Blower Amps [3]	19	~~7.8~~	3.8	3.1		
Inrush Amps	94-88	~~60-54~~	27	26		
Starter Size	1	~~0~~	0	0		
Service Factor	1.0	1.0		1.0		
Thermal Protection [2]	Class B - Pilot Duty	Class B - Pilot Duty		Class B - Pilot Duty		
XP Motor Class – Group	I-D, II-F&G	I-D, II-F&G		I-D, II-F&G		
Shipping Weight	130 lb (59 kg)	106 lb (48 kg)		106 lb (48 kg)		

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **200-220/400-440 VAC-3 ph-50 Hz.** Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz.** All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

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

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

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

AMETEK®
ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP

75 North Street
Saugerties, New York 12477
Phone: (914) 246-3401
Fax: (914) 246-3802

GENERAL INSTALLATION INSTRUCTIONS

Rotron Regenerative Blowers

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

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.

2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

   Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

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

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

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.

5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Application Engineering staff will need to know the operating pressure/suction to properly diagnose the problem.

6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

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

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearings should be changed after 15,000 to 20,000 hours, on average. Shell Dolium R grease is used at the factory. Replacement bearings should contain Shell Dolium R or its equivalent.

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOE NOT TURN	Humming Sound	1. * One phase of power line not connected 2. * One phase of stator winding open 3. Bearings defective 4. Impeller jammed by foreign material 5. Impeller jammed against housing or cover 6. ** Capacitor open	1. Connect 2. Rewind or buy new motor 3. Change bearings 4. Clean and add filter 5. Adjust 6. Change capacitor
	No Sound	1. * Two phases of power line not connected 2. * Two phases of stator winding open	1. Connect 2. Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	1. Insufficient fuse capacity 2. Short circuit	1. Use time delay fuse of proper rating 2. Repair
	Motor Overheated Or Protector Trips	1. High or low voltage 2. * Operating in single phase condition 3. Bearings defective 4. Impeller rubbing against housing or cover 5. Impeller or air passage clogged by foreign material 6. Unit operating beyond performance range 7. Capacitor shorted 8. * One phase of stator winding short circuited	1. Check input voltage 2. Check connections 3. Check bearings 4. Adjust 5. Clean and add filter 6. Reduce system pressure/vacuum 7. Change capacitor 8. Rewind or buy new motor
	Abnormal Sound	1. Impeller rubbing against housing or cover 2. Impeller or air passages clogged by foreign material 3. Bearings defective	1. Adjust 2. Clean and add filter 3. Change bearings
	Performance Below Standard	1. Leak in piping 2. Piping and air passages clogged 3. Impeller rotation reversed 4. Leak in blower 5. Low voltage	1. Tighten 2. Clean 3. Check wiring 4. Tighten cover, flange 5. Check input voltage

* 3 phase units

** 1 phase units

*** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.

For further information regarding Rotron regenerative blowers (including service & parts manuals), please contact our local field sales representative.

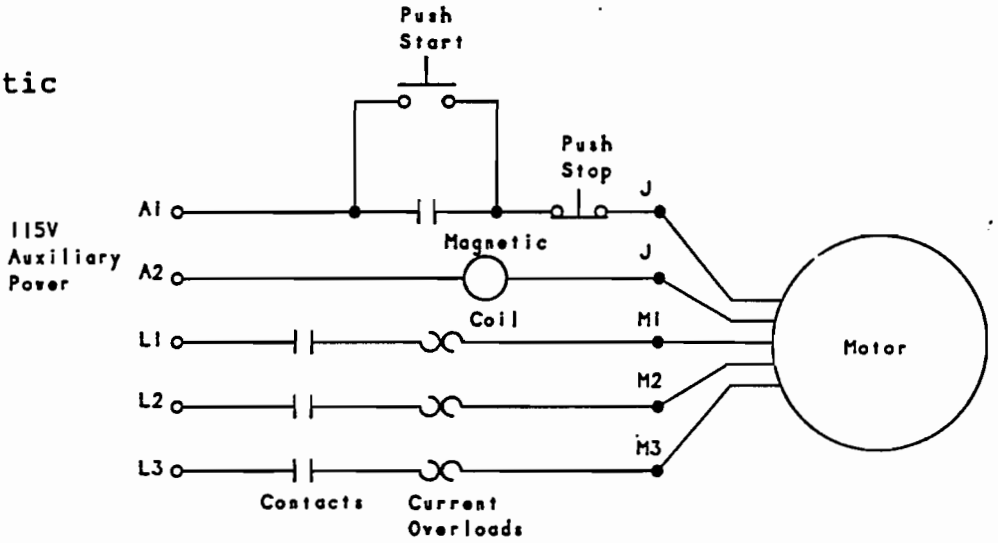
EG&G ROTRON
Industrial Division
North Street, Saugerties, NY 12477
TEL. (914) 246-3401 FAX: (914) 246-3802

IMPORTANT: Read Before Wiring this Explosion-proof Blower

This EG&G Rotron Explosion-proff Regenerative blower may be equipped with Pilot Duty Thermal Overload protection. When properly wired to a motor starter, this protection limits the motor winding temperature rise per the National Electric Code (NEC) article 500. Failure to properly wire this blower is a NEC violation and could cause an explosion. EG&G takes no responsibilities for damages incurred by negligent use of this product, and may not warranty a blower on which the P.D.T.O. is not properly connected. Some blowers 1HP and under do not have P.D.T.O. Consult the factory if you are uncertain.

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

Schematic



J - Pilot Duty Thermal Overload Protection wires
L - Power leads from circut breaker box.
M - Motor leads (refer to wiring diagram inside T'box or on motor nameplate).

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

If you have any questions, EG&G Rotron Application Engineers are available at (914) 246-3401 for your assistance.

POLICY REGARDING INSTALLATION OF EG&G ROTRON

REGENERATIVE BLOWERS IN HAZARDOUS LOCATIONS

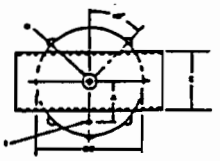
EG&G Rotron will not knowingly specify, design or build any regenerative blower for installation in a hazardous, explosive location without the proper NEMA motor enclosure. EG&G Rotron does not recognize sealed blowers as a substitute for explosion proof motors. Sealed units with standard TEFC motors should never be utilized where local, state, and/or federal codes specify the use of explosion proof equipment. EG&G Rotron has a complete line of regenerative blowers with explosion-proof motors. Division I & II, Class 1, Group D; Class 2, Groups F & G requirements are met with these standard explosion-proof blowers.

EG&G Rotron offers general application guidance; however, suitability of the particular blower selection is ultimately the responsibility of the user, not the manufacturer of the blower.

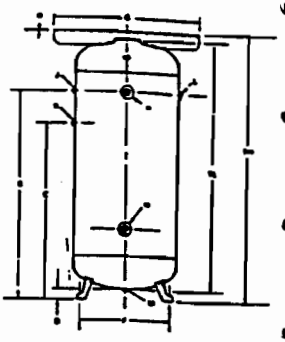
AIR RECEIVERS

THE BRUNNER DIFFERENCE. Leakproof. Vibration resistant. Accurately positioned openings. Slotted and drilling to most intricate requirements.

Superior design and precision fabrication of Brunner air receivers ensures quality performance and long life. Attention to details - the slotting and drilling of tank attachments and accurately positioned vessel openings - have made Brunner the favored choice. With a wide selection of standard configurations from 6" to 12' diameters, we can quickly supply the tanks you need. Brunner will also custom engineer, design and produce air receivers for your specific needs and space requirements. Fast delivery on special orders is a Brunner specialty.



VERTICAL
With Platform

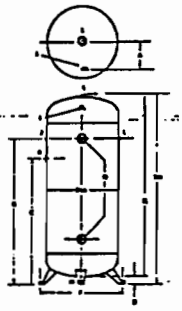


DESIGN PRESSURE 200 PSI

DESCRIPTION				DIMENSIONS								OPENINGS						
Gallons	Diameter	Length (TL)	Height (TH)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
30	16	38	41¼	6½	30¼	24¼	1¾	9	18	23	3/16	1/4	3/4	3/4	3/4	1/2	1½	3/4
60	20	48	52	8½	40	34	2½	13	23	30	3/16	1/4	3/4	3/4	3/4	1/2	2	3/4
80	24	48	52¾	10	39⅞	33⅞	3¼	13	26	30	1/4	1/4	1¼	1¼	1¼	1/2	2	1¼
*120	30	46	55½	10	41	35	8	15	26	39	1/4	1/4	2	2	2	1/2	2	2

*BASE RING used on 120 gallon
*NEMA slotting standard

VERTICAL



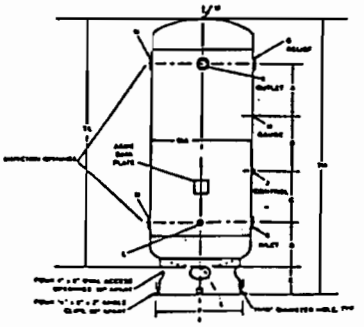
VERTICAL Without Platform

DESIGN PRESSURE 200 PSI

PLATFORMS NOT AVAILABLE
ON THESE RECEIVERS

DESCRIPTION				DIMENSIONS					OPENINGS					
Gallons	Diameter	Length (TL)	Height (TH)	A	B	C	D	F	I	J	K	L	M	N
10	10	30	32⅜	3	24⅜	—	2⅜	13½	1/4	3/4	—	3/4	1/4	N/A
15	12	33	35⅜	4	27⅜	—	2⅜	15¾	1/4	3/4	—	3/4	1/4	N/A
20	14	33	35¼	5	27¼	—	2¼	17¾	1/4	3/4	—	3/4	1/4	1½
30	16	38	39¾	6½	30¼	24½	1¾	18	1/4	3/4	3/4	3/4	1/2	1½
60	20	48	50½	8½	40	34	2½	23	1/4	3/4	3/4	3/4	1/2	2
80	20	63	65½	8½	55	49	2½	23	1/4	1¼	1¼	1¼	1/2	2
80	24	48	51¼	10	39⅞	33⅞	3¼	26	1/4	1¼	1¼	1¼	1/2	2

All Brunner air receivers are built to ASME code, National Board registered. USCG, ABS, CSA and California UG 22 approvals also available. Standard design temperature is 450° F. All openings are NPT threaded. Standard outside finish is red oxide primer. Other finishes available on request. In addition to sizes listed in this catalog, Brunner can fabricate alternate sizes up to 144" diameter, 15 tons maximum weight and 1500 psi.



VERTICAL Industrial

DESIGN PRESSURE 125 PSI to 600 PSI

DESCRIPTION				DIMENSIONS (INCHES)						OPENINGS						
Gallons	Diameter (OD)	Length (TL)	Height (TH)	A	B	C	D	E	F	G	H	J	K	L	M	N
120	24	69	81	13	14	13	13	12	20	1½	1/4	1/2	2	1	1/2	2
120	30	46	58	7	7	7	12½	12	26	2	1/4	1/2	2	1	1/2	2
200	30	72	84	15	16	15	13	12	26	2	1/4	1/2	2	1	1/2	2
240	30	84	96	19	20	19	13	12	26	2	1/4	1/2	2	1	1/2	2
400	36	96	108	21	22	21	15	12	32	2½	1/4	1/2	3	1	1/2	2

INLET VACUUM AIR FILTERS

CSL Series (Closed System "L")

1/2" FPT to 12" Flange

Up to 4950 CFM

Since 1968 Solberg has been manufacturing quality OEM and industrial filters for air compressor, blower and vacuum applications. By pioneering many filter manufacturing techniques and building their own production machinery, Solberg is fulfilling their commitment of continual product improvement and prompt response to customer needs.

The Solberg line includes most all sizes of inlet, inline, and exhaust system filters and elements, filter silencers, oil mist filters, high temperature filters and more. There is a choice of media to suit specific duty requirements. As the filter specialist, Solberg can also provide reliable products for individual needs and unique filter applications. Ask for an engineering evaluation of your requirements.

APPLICATIONS

- Soil Venting
- Soil Remediation
- Vacuum Pumps & Systems
- Intake Suction Filters
- Blowers
- Pneumatic Conveying Systems
- Air Compressors
- Remote Installations

FEATURES

- Use as an elbow in a package without removing for service
- Rugged all steel construction
- Low pressure drop
- Positive sealing - Vacuum tested
- Large dirt holding capacity and easy field cleaning, especially when mounted horizontally or inverted
- 1/4" FPT tap holes on inlet & outlet for differential pressure gauge (3" & larger)

OPTIONS (Inquiries Encouraged)

- Larger sizes available
- Support stands
- Stainless steel housings
- Epoxy coated housings
- Hot dipped galvanized housings
- Unique centrifugal 2-stage filtering system/baffle plates
- Special fittings available for volume orders
- Various elements available - see Element bulletin
- Activated carbon pad or prefilter to reduce odor

Inline filters with optional baffle plates provides centrifugal flow to knock down large particulates

SMI MODEL NUMBERS - CSL Series		EFFECTIVE SURFACE AREA OF ELEMENT IN SQUARE FEET		CONNECTION		Flow SCFM	Approx. Shipping Wt. Lbs.	DIMENSIONS					
W/Polyester Element	W/Paper Element	Polyester	Paper	Size	Type			A	B	C	D	E	F
THREADED CONNECTIONS													
CSS-05-025	CSS-04-025	.2	.2	1/4"	MPT	6	.5	3-5/8"	5/8"	2-1/2"	1-13/16"	5/8"	—
CSS-05-038	CSS-04-038	.2	.2	3/8"	MPT	6	.5	3-5/8"	5/8"	2-1/2"	1-13/16"	5/8"	—
CSS-07-038	CSS-06-038	.58	.58	3/8"	MPT	8	1	4-1/4"	5/8"	3-1/4"	2-1/8"	5/8"	—
CSS-07-050/050HC	CSS-06-050/050HC	.58	.58	1/2"	FPT	10	1	4"	1/2"	3-1/4"	2-1/8"	1/2"	—
CSL-843-050HC	CSL-842-050HC	.6	1.75	1/2"	FPT	10	3	4-3/8"	3/8"	5-7/8"	2-5/8"	9/16"	5"
CSL-843-075HC	CSL-842-075HC	.6	1.75	3/4"	FPT	20	3	4-3/8"	3/8"	5-7/8"	2-5/8"	9/16"	5"
CSL-843-100HC	CSL-842-100HC	.6	1.75	1"	FPT	25	3	4-3/8"	5/8"	5-7/8"	2-5/8"	3/4"	5"
CSL-849-100HC	CSL-848-100HC	2.0	4.5	1"	FPT	40	5	8-1/2"	3/4"	7-5/16"	4-1/2"	3/4"	8-13/16"
CSL-843-125HC	CSL-842-125HC	.8	1.75	1-1/4"	FPT	45	3	4-3/8"	5/8"	5-7/8"	2-5/8"	3/4"	5"
CSL-849-125HC	CSL-848-125HC	2.0	4.5	1-1/4"	FPT	60	5	8-1/2"	3/4"	7-5/16"	4-1/2"	3/4"	8-13/16"
CSL-849-150HC	CSL-848-150HC	2.0	4.5	1-1/2"	FPT	80	5	8-1/2"	3/4"	7-5/16"	4-1/2"	3/4"	8-13/16"
CSL-851-200HC	CSL-850-200HC	4.5	13.75	2"	FPT	150	15	10-1/4"	3/4"	8-3/4"	5"	3/4"	7-5/8"
CSL-851-250HC	CSL-850-250HC	4.5	13.75	2-1/2"	FPT	195	15	10-1/2"	1"	8-3/4"	5-1/2"	1-1/4"	7-5/8"
CSL-235P-300	CSL-234P-300	8.3	22.8	3"	MPT	300	47	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-335P-300	CSL-334P-300	12.0	34.0	3"	MPT	300	50	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-235P-400	CSL-234P-400	8.3	22.8	4"	MPT	520	52	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-335P-400	CSL-334P-400	12.0	34.0	4"	MPT	520	55	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-245P-500	CSL-244P-500	14.0	35.5	5"	MPT	800	82	28-1/8"	3"	18-1/2"	19-1/2"	3"	16"
CSL-345P-500	CSL-344P-500	22.1	57.0	5"	MPT	800	88	28-1/2"	3"	18-1/2"	19-1/2"	3"	16"
CSL-275P-600	CSL-274P-600	19.0	45.4	6"	MPT	1100	95	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
CSL-375P-600	CSL-374P-600	28.0	68.1	6"	MPT	1100	97	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
FLANGED CONNECTIONS													
CSL-235P-400F	CSL-234P-400F	8.3	22.8	4"	FLG	520	62	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-335P-400F	CSL-334P-400F	12.0	34.0	4"	FLG	520	64	27-1/8"	3"	14"	18-1/2"	3"	12"
CSL-245P-500F	CSL-244P-500F	14.0	35.5	5"	FLG	800	90	28-1/8"	3"	18-1/2"	19-1/2"	3"	16"
CSL-345P-500F	CSL-344P-500F	22.1	57.0	5"	FLG	800	88	28-1/2"	3"	18-1/2"	19-1/2"	3"	16"
CSL-275P-600F	CSL-274P-600F	19.0	45.4	6"	FLG	1100	110	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
CSL-375P-600F	CSL-374P-600F	28.0	68.1	6"	FLG	1100	113	28-1/8"	4"	18-1/2"	20-1/2"	4"	16"
CSL-377P-800F	CSL-376P-800F	50.0	125.0	8"	FLG	1800	185	38"	4"	22-1/2"	25-1/2"	4"	20"
CSL-685P-1000F	CSL-384P(2)-1000F	100.0	280.0	10"	FLG	2900	380	57-1/2"	4"	26-13/32"	45"	4"	24"
CSL-485P(2)-1200F	CSL-484P(2)-1200F	150.0	400.0	12"	FLG	4950	465	70"	4"	26-13/32"	57"	4"	24"

CSL-235P-400F

- Connection size: 400 = 4"; F at the end of model # denotes flange connection.
- Element part #: Odd #'s = Polyester, Even #'s = Paper, Even #'s + 8 = Wire Mesh P = Polyurethane foam pre-filter included.
- CSL denotes Closed System "L" design.

SMALL FILTER SILENCERS

FS Series
1/4" to 3" MPT
Up to 300 CFM
Complete Assemblies

SOLBERG

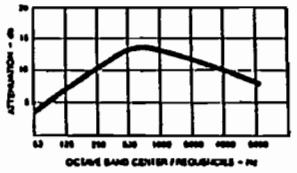
Since 1968 Solberg has been manufacturing quality OEM and industrial filters for air compressor, blower and vacuum applications. By pioneering many filter manufacturing techniques and building their own production machinery, Solberg is fulfilling their commitment of continual product improvement and prompt response to customer needs.

The Solberg line includes most all sizes of inlet, inline, and exhaust system filters and elements, filter silencers, oil mist filters, high temperature filters and more. There is a choice of media to suit specific duty requirements. As the filter specialist, Solberg can also provide reliable products for individual needs and unique filter applications. Ask for an engineering evaluation of your requirements.

APPLICATIONS
- Blowers
- Air Compressors
- Fans
- Hydraulic breathers
- Engines

FEATURES
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tubes positioned to maximize attenuation and air flow while minimizing pressure drop

TYPICAL NOISE ATTENUATION – FS SERIES



- Durable carbon steel construction with baked enamel finish
- Low pressure drop center bracket and pipe design
- Interchangeable elements

OPTIONS
(Inquiries Encouraged)
- Various elements available - See Element Bulletin
- 1/8" & 1/4" tap holes for differential pressure guages
- Epoxy coated housings
- Hot dipped galvanized housings
- Special connections

SMI MODEL NUMBERS - FS Series

 W/Polyester Element	 W/Paper Element	 W/Wire Mesh Element	EFFECTIVE SURFACE AREA OF ELEMENT IN SQUARE FEET		APPLICATION CFM PULSATING FLOW	APPLICATION CFM CONTINUOUS FLOW	MPT Connection	Approx. Shipping Wt. Lbs.	DIMENSIONS 		
			Polyester	Paper	Reciprocating Compressors	Fans, Blowers, Compressors (Rotary, Centrifugal, Screw)			A	B	C
FS-05-025	FS-04-025	—	.2	.2	6	8	1/4"	.5	2-11/16"	5/8"	2-1/2"
FS-05-038	FS-04-038	—	.2	.2	6	8	3/8"	.5	2-11/16"	5/8"	2-1/2"
FS-07-038	FS-06-038	—	.58	.58	8	8	3/8"	1	3-15/16"	5/8"	3-1/4"
FS-07-050	FS-06-050	—	.58	.58	10	10	1/2"	1	4-1/4"	15/16"	3-1/4"
FS-15-050	FS-14-050	FS-14S-050	.5	.9	10	10	1/2"	1.8	4"	1-1/2"	6"
FS-15-075	FS-14-075	FS-14S-075	.5	.9	20	20	3/4"	2	4"	1-1/2"	6"
FS-15-100	FS-14-100	FS-14S-100	.5	.9	20	25	1"	2.1	4"	1-1/2"	6"
FS-19P-100	FS-18P-100	FS-18S-100	1.5	3.0	30	35	1"	3	6-1/2"	1-1/2"	6"
FS-19P-125	FS-18P-125	FS-18S-125	1.5	3.0	60	60	1-1/4"	3.3	6-1/2"	1-1/2"	6"
FS-19P-125-9T	FS-18P-125-9T	FS-18S-125-9T	1.5	3.0	60	60	1-1/4"	3.5	7-7/8"	2-1/8"	6"
FS-19P-125HC	FS-18P-125HC	FS-18S-125-HC	1.5	3.0	60	60	1-1/4" Fem.	3.3	5-7/8"	5/8"	6"
FS-19P-150	FS-18P-150	FS-18S-150	1.5	3.0	60	80	1-1/2"	3.5	6-1/2"	1-1/2"	6"
FS-19P-150-4	FS-18P-150-4	FS-18S-150-4	1.5	3.0	60	80	1-1/2"	3.7	8-5/8"	3-5/8"	6"
FS-19P-150-7T	FS-18P-150-7T	FS-18S-150-7T	1.5	3.0	60	80	1-1/2"	3.7	6-1/2"	1-1/2"	6"
FS-19P-150-9T	FS-18P-150-9T	FS-18S-150-9T	1.5	3.0	60	80	1-1/2"	3.9	7-1/8"	2-1/8"	6"
FS-31P-200	FS-30P-200	FS-30S-200	2.3	5.7	60	135	2"	7.8	7-1/4"	2-1/4"	10"
FS-231P-200	~~FS-230P-200~~	~~FS-230S-200~~	4.5	10.9	135	135	2"	14	12-1/4"	2-1/4"	10"
FS-19P-250-9T	FS-18P-250-9T	FS-18S-250-9T	1.5	3.0	60	100	2-1/2"	4.5	8-1/4"	3-1/4"	6"
FS-31P-250	FS-30P-250	FS-30S-250	2.3	5.7	80	195	2-1/2"	8.2	7-1/4"	2-1/4"	10"
FS-231P-250	FS-230P-250	FS-230S-250	4.5	10.9	105	195	2-1/2"	14.5	12-1/4"	2-1/4"	10"
FS-231P-300	FS-230P-300	FS-230S-300	4.5	10.9	200	300	3"	15	12-1/2"	2-1/2"	10"

FS-19P-125

- Connection size; 125 = 1¼"; 250 = 2½";
- Element part #; Odd #'s = Polyester, Even #'s = Paper, Even #'s + 5 = Wire Mesh, P = Polyurethane foam pre-filter included.
- FS denotes Filter Silencer.

KUNKLE
valve Division

IRON SAFETY AND VACUUM VALVES

MODELS 215V 337

PRESSURE LIMITS 337 — 60 PSIG-300°F.

VACUUM LIMITS 215V — 22" HG.-300°F.

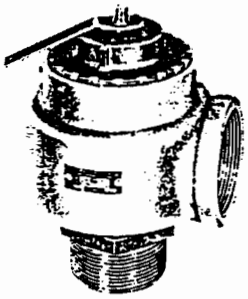
ASME Standard

UV

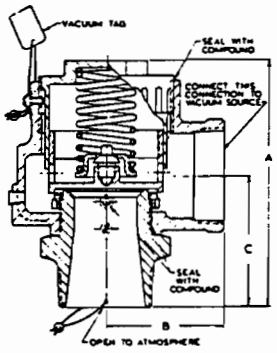
N.B. Certified

APPLICATIONS

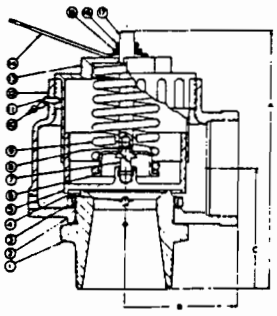
- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.



MODEL 337



MODEL 215V



MODEL 337

FEATURES

High capacity full nozzle design. Bronze nozzle, disc and guide with cast iron housing. Flat bronze valve seats are lapped for optimum performance. Warn ring offers easy adjustability for precise opening with minimum preopen or simmer and exact blowdown control. Pivot between disc and spring corrects mis-alignment and compensates for spring side thrust. Model 337 has reversible lift lever for "pull-up" or "pull-down" manual testing. Every valve 100% tested/inspected for pressure setting, blowdown and leakage. All adjustments are factory sealed to prevent tampering or dis-assembly.

SPECIFICATIONS

SIZE IN & OUT	A 337	A 215V	B	C	WGHT LBS.
2"	7¼	6¾	3¼	3¼	8
2½"	8	7½	3¾	3¾	12
3"	9½	9	4¼	4¼	19

CAPACITIES SCFM Air, 60°F., 10% Accumulation

Set Pressure PSIG	MODEL 337 2"	MODEL 337 2½"	MODEL 337 3"	Set Inches Mercury	MODEL 215V 2"	MODEL 215V 2½"	MODEL 215V 3"
5	527	799	1157	1	140	213	308
10	743	1127	1632	2	217	329	477
15	903	1368	1982	3	264	400	579
20	1062	1609	2331	4	299	453	657
25	1221	1850	2680	5	331	501	726
30	1380	2091	3029	6	352	533	772
35	1539	2332	3379	7	372	564	817
40	1698	2573	3728	8	391	592	858
45	1857	2814	4076	9	403	610	884
50	2017	3055	4428	10	413	625	906
60	2335	3537	5125	12	424	642	930
				12.8+	426	646	935

MODEL NUMBER/ORDER GUIDE

MODEL NO. POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EXAMPLE	2	1	5	V	—	H	0	1	—	Q	E	0	0	0	6
	0	3	3	7											

INLET SIZE
H — 2"
J — 2½"
K — 3"

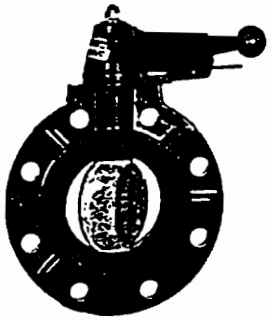
VARIATION (01 thru 99)
Number Provided Only by Manufacturer to Cover Specific Feature or Option.

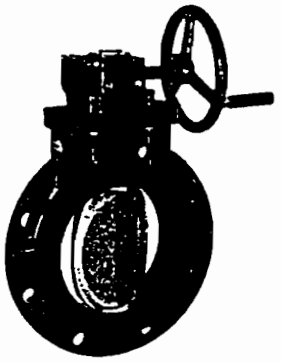
DESIGN REVISION
Indicates Non-Interchangeable Revision. Dash (-) If Original Design.

VALVE SERVICE
K-Air ASME Sec VIII (Model 337 Only)
Q-Vacuum (Model 215V Only)

SPRING MATERIAL
E-Stainless (302)

SET PRESSURE
Models 337 2 PSIG (0002) thru 60 PSIG (0060)
Model 215V 1" HG (Inches of Mercury) (0001) thru 22" HG (0022) Vacuum





FEATURES

- Standard model has PVC body and polypropylene disc for better chemical resistance at temperatures higher than can be achieved with PVC
- Can be fitted with a variety of elastomeric seat materials to provide bubble-tight seating for a wide range of chemicals
- Stainless steel shaft has full engagement with disc and is a non-wetted part isolated from the media by double O-ring seals on top and bottom trunnions of disc
- Only disc and liner are wetted parts

SPECIFICATIONS

SIZES: 1½"–24"
Lever: 1½"–8", Gear: 8"–24"
MODELS: Wafer style (for ANSI flanges)
OPERATORS: Lever, ~~Gear~~
BODIES: PVC, ~~PP, PVDF~~
DISCS: PP, ~~PVDF, PVC (optional)~~
SEATS: ~~EPDM or~~ Viton, ~~Nitrile (Buna N) Butyl, Hypalon, Natural Rubber, Neoprene, Chlorinated Polyethylene (CPE)~~
SEALS: Same as seating material

OPTIONS

- Stem extensions
- Gear operators for 1½"–6"
- Handle locking devices
- 2" square operating nut
- Lug style butterfly valves
- Tandem arrangements (patented)
- PVDF disc for better temperature range and chemical resistance
- PP body
- 316 stainless steel or titanium stem

SAMPLE SPECIFICATION

All solid thermoplastic butterfly valves shall be of the lined body design and bubble-tight seal with only the liner and disc as wetted parts. The disc shall have double O-ring seals on top and bottom trunnions of the same material as the valve liner. Liner shall be molded and formed around the body, functioning as a gasket on each side of the valve. Stem shall be of stainless steel and have engagement over the full length of the disc. Butterfly valves shall be wafer style, as manufactured by Asahi/America, Inc.

PARTS

No.	Parts	Pcs.	Materials
1	Body	1	PVC, PP, PVDF
1a	Ring *	2	Steel (SS400 / Epoxy Coated)
2	Disc	1	PP, PVDF
3	Seat	1	EPDM, Viton, Nitrile (Buna N), Neoprene, Hypalon, Butyl, Natural Rubber
4	Disc Seal O-Ring (A)***	2	Same material as seat
5	Disc Seal O-Ring (B)	2	Same material as seat
6	Stem Seal O-Ring (C)	1	Same material as seat
7	Stem	1	403 SS
8	Stem Holder	1	304 SS
9	Retaining Nut	1	PVC
10	Handle	1	PP
10a	Insert	1	Steel (SS400/Galvanized)
11	Handle Lever	1	304 SS
12	Pin	1	304 SS
13	Spring	1	304 SS
14	Washer	1	304 SS
15	Nut	1	304 SS
16	Locking Plate	1	304 SS
17	Screw	3	304 SS
18	Bolt	4	304 SS
19	Gasket	1	Nonas Sheet
20	Gear Box **	1	See Note

* Used for PP body for 6"-24" and for PDVF body for 12"-24".
** 1"-6": Cast aluminum with epoxy coat.
8"-16": Cast iron (FC200) with epoxy coat.
18"-24": Cast aluminum alloy (AC3A) with epoxy coat.
*** Used for sizes 2"-24".

VACUUM SERVICE

Size (inches)	Vacuum (inches of mercury)
1½–5	-29.92
6–10	-27.56
12–16	-23.62
18–24	-19.69

Cv VALUES

(AT VARIOUS DEGREES OF OPENING)

Size (in)	30°	60°	90°
1½	2.9	43.3	71
2	3.9	56.1	92
2½	5.9	85.4	140
3	9.3	134.2	220
4	15.1	231	380
5	30.9	445	730
6	46.6	671	1100
8	106	1425	2500
10	270	1476	3600
12	408	2140	5160
14	535	2770	6440
16	750	3760	8340
[illegible]	1100	5020	10890
20	1448	6620	14060
24	2130	9180	18500

PRESSURE* VS TEMPERATURE (PSI, WATER, NON-SHOCK)

Body	PVC			PP		PVDF			
Disc	PP			PP		PVDF			
Size (inches)	30° F 120° F	121° F 140° F	141° F 180° F	-5° F 140° F	141° F 175° F	-5° F 140° F	141° F 175° F	176° F 212° F	213° F 250° F
1½–3	150	70	30	150	100	150	100	85	75
4–6	150	45	30	150	100	150	100	85	75
8–10	150	40	20	150	85	150	85	75	60
12	100	30	15	100	60	100	60	45	30
14	100	30	7	100	45	100	45	30	15
16	NA	NA	NA	85	45	85	45	30	15
18	NA	NA	NA	70	45	75	45	30	15
20–24	NA	NA	NA	50	30	50	30	25	15

* Consult factory for pressure ratings for lug style

P.O. Box 653 • 35 Green Street, Malden, MA 02148 • Tel: (800) 343-3618, (617) 321-5409
Fax: (800) 426-7058 • Internet: http://www.asahi-america.com • Email: asahi@asahi-america.com

TECHNO CORPORATION

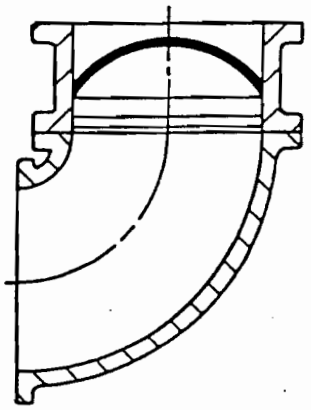
METAL CHECK VALVE INSTALLATION INSTRUCTIONS

GENERAL

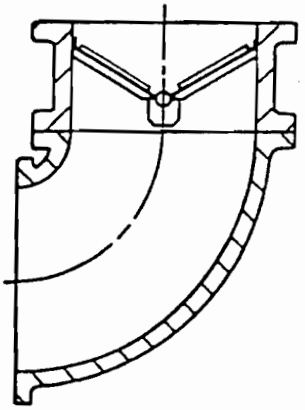
The Internal assembly of the Technocheck should move freely from the open to closed position without binding. Even in the largest valves, the internals should operate easily by hand. The Technocheck may appear not to close tightly when so operated, but this simply means that the sealing member has not assumed its "set" and in no way should be interpreted as a failure of the valve to close easily or to seat tightly. This condition, if it exists, will be rectified by a few flexings in service. All Technocheck valve assemblies are treated with a locking solution during assembly and no loose fasteners should be found.

PRECAUTIONS

- **Positive Displacement and Rotary Lobe Blowers**—When used in this application, a Technocheck should **always** be mounted on the downstream side of a Silencer.
- **Reciprocating Pumps and Compressors**—Technocheck Valves **should not** used in these applications.
- **Pipe Fittings, Expansions, Reductions and Swages**—A **minimum** of 5 to 7 pipe diameters should be maintained between the Valve and Pipe Fittings (Tees, Elbows, etc.), Expansions, Reductions, and Swages.
- **Male Threaded, Plain or Grooved End Valves**—These valves may be held stationary in vises or with special wrenches, but should **never** be turned with a pipe wrench of any kind since serious risk of body distortion would be incurred. The use of a strap wrench is acceptable.
- **Adjacent to Vertical Elbows**—When installing Technocheck Valves in vertical lines downstream from an elbow, it is necessary to orient the hinge post to prevent unequal loading of the two valve plates.



CORRECT



INCORRECT

NOTE: Frequently the discharge of pumps and compressors simulates the above elbow configuration which causes higher velocity at the outer circumference. Care should be taken to position valves as shown above for these applications.

VALVE STORAGE

Valves should be stored indoors and in their original containers to keep them clean and to avoid damage.

REFER TO OPPOSITE SIDE FOR ADDITIONAL INSTRUCTIONS ON METAL CHECK VALVES.

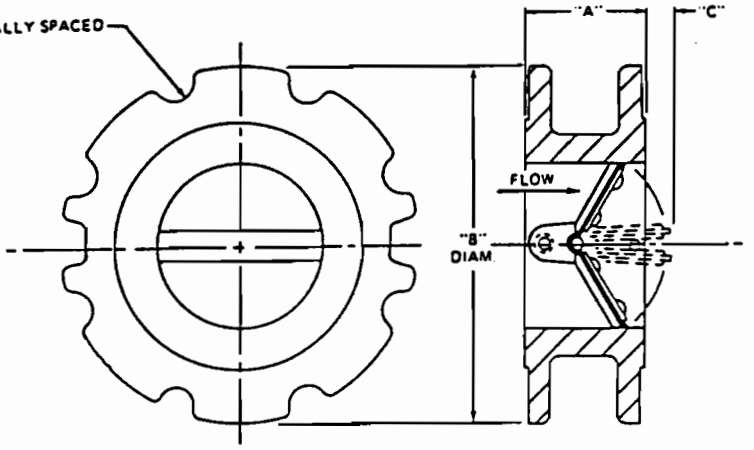
2709 WEST 10TH ST. P.O. BOX 1416 ERIE, PA 16512 PHONE 814-838-4561 FAX 814-838-6963

TECHNOCHECK

SF (SHORT FORM)

WAFER TYPE 125 # AND 150 # CLASS

STYLE
5412, 5118
5831-F 5831-R
5355
5355-304
5355-316



GENERAL DIMENSIONS FOR STYLES 5412, 5118, 5831-F, 5831-R, 5355, 5355-304 AND 5355-316

VALVE SIZE	"A"	"B"	"C"	"D"	"E"	"F"	VALVE SIZE	"A"	"B"	"C"	"D"	"E"	"F"
2	1-3/8	4-3/4	1/2	3/8	4	4-3/4	18	9-3/8	22-3/4	4-1/4	5/8	16	22-3/4
2-1/2	1-5/8	5-1/2	9/16	3/8	4	5-1/2	20	10-3/8	25	4-3/4	5/8	20	25
3	1-7/8	6	11/16	3/8	4	6	24	12-3/8	29-1/2	5-3/4	11/16	20	29-1/2
4	2-3/8	7-1/2	7/8	3/8	8	7-1/2	30	15-3/8	36	7-3/4	11/16	28	36
5	2-7/8	8-1/2	1-1/8	7/16	8	8-1/2	36	18-3/8	42-3/4	8-1/2	13/16	32	42-3/4
6	3-3/8	9-1/2	1-1/2	7/16	8	9-1/2	42	21-3/8	49-1/2	9-1/2	13/16	36	49-1/2
8	4-3/8	11-3/4	2-1/4	7/16	8	11-3/4	48	24-3/8	56	11-1/2	13/16	44	56
10	5-3/8	14-1/4	2-1/2	1/2	12	14-1/4	54	27-3/8	62-3/4	13	15/16	44	62-3/4
12	6-3/8	17	3	1/2	12	17	60	30-3/8	69-1/4	14	15/16	52	69-1/4
14	7-3/8	18-3/4	3-1/4	9/16	12	18-3/4	66	33-3/8	76	15	15/16	52	76
16	8-3/8	21-1/4	3-3/4	9/16	16	21-1/4	72	36-3/8	82-1/2	16-1/2	15/16	60	82-1/2

ALL DIMENSIONS IN INCHES

STANDARD MODELS & MATERIALS

STYLE	BODY	INTERNALS	FLANGE CLASS	PSI C.W.P.
5412	ALUMINUM	ALUMINUM	125*	125
5118	CAST IRON	ALUMINUM	125*	125
5831-F	BRONZE	BRONZE	125*	150
5831-R	BRONZE	BRONZE	150†	150
5355	STEEL	CADMIUM PLATED STEEL	150†	150
5355-304	304 STAINLESS STEEL	304 STAINLESS STEEL	150†	150
5355-316	316 STAINLESS STEEL	316 STAINLESS STEEL	150†	150
→ STANDARD ELASTOMER: BUNA-N				

*FLAT FACE
†RAISED FACE

OPTIONAL MATERIAL SELECTION

INTERNAL MATERIALS

- Aluminum
- Bronze
- 304 Stainless Steel
- 316 Stainless Steel
- Cadmium Plated Steel
- Electroless Nickel Plated Steel or Aluminum
- Monel*
- Titanium*
- Hastelloy*

*Non stock item – Available upon request.

SPRING MATERIALS

- 304 Stainless Steel
- 316 Stainless Steel

Monel and Inconel springs available upon request.

SEALING MEMBER MATERIALS

MATERIAL	*TEMPERATURE RANGE
• Buna-N	– 60 to 225° F
• Neoprene	– 40 to 225° F
• Butyl	– 65 to 300° F
• Hypalon	– 20 to 300° F
• EPDM	– 40 to 300° F
• Viton	– 20 to 400° F
• Teflon	– 20 to 450° F
• Silicone	– 100 to 500° F
• FDA Approved White Neoprene	– 40 to 225° F

*This temperature range is for general guidance. The figures may vary with application

CONSULT FACTORY FOR MATERIALS, SIZES AND PRESSURE RATINGS NOT SHOWN.

Motor Current Ratings

Single & Three Phase

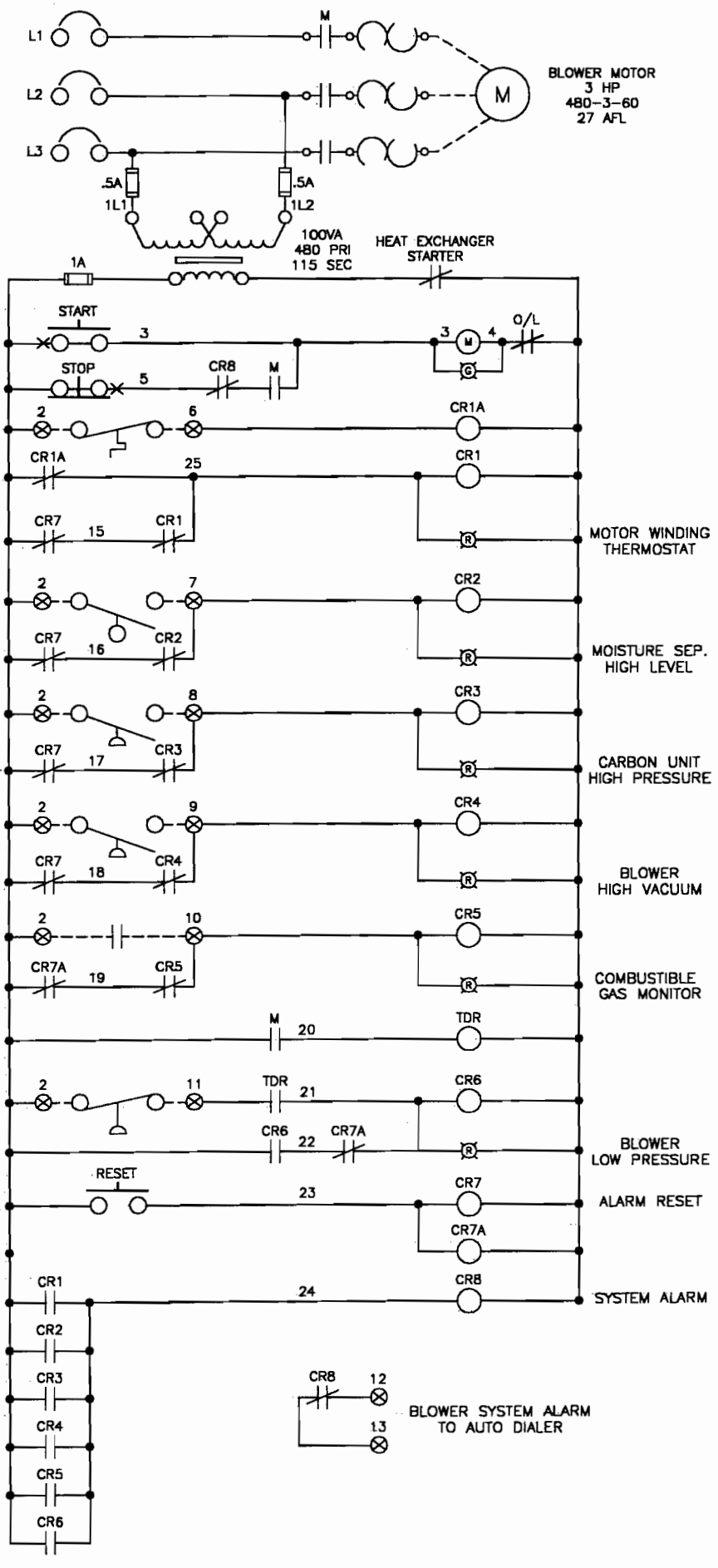
Horsepower	60Hz AC Induction Motor					
	Single Phase		Three Phase			
	115 Volt	230 Volt	200 Volt	230 Volt	460 Volt	575 Volt
1/6	4.4	2.2	~	~	~	~
1/4	5.8	2.9	~	~	~	~
1/3	7.2	3.6	~	~	~	~
1/2	9.8	4.9	2.3	2.0	1.0	0.8
3/4	13.8	6.9	3.2	2.8	1.4	1.1
1	16.0	8.0	4.1	3.6	1.8	1.4
1 1/2	20.0	10.0	6.0	5.2	2.6	2.1
2	24.0	12.0	7.8	6.8	3.4	2.7
3	34.0	17.0	11.0	9.6	4.8	3.9
5	56.0	28.0	17.5	15.2	7.6	6.1
7 1/2	80.0	40.0	25.0	22.0	11.0	9.0
10	100	50.0	32.0	28.0	14.0	11.0
15	135	68.0	48.0	42.0	21.0	17.0
20	~	88.0	62.0	54.0	27.0	22.0
25	~	110	78.0	68.0	34.0	27.0
30	~	136	92.0	80.0	40.0	32.0
40	~	176	120	104	52.0	41.0
50	~	216	150	130	65.0	52.0
60	~	~	177	154	77.0	62.0
75	~	~	221	192	96.0	77.0
100	~	~	285	248	124	99.0
125	~	~	359	312	156	125
150	~	~	414	360	180	144
200	~	~	552	480	240	192
250	~	~	692	602	302	242
300	~	~	~	~	361	289
350	~	~	~	~	414	336
400	~	~	~	~	477	382
500	~	~	~	~	590	472

The information in this chart was derived from Table 430–148 & 430–150 of the NEC and Table 52.2 of UL standard 508. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110–120, 220–240, 440–480 and 550–600 volts.

The full-load current values are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents, and multi-speed motors will have full-load currents varying with speed. In these cases, the nameplate current ratings shall be used.

Caution: The actual motor amps may be higher or lower than the average values listed above. For more reliable motor protection, use the actual motor current as listed on the motor nameplate. Use this table as a guide only

O:\DWG\NABSAG\1999\FIGURE2.DWG



SOIL REMEDIAL ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

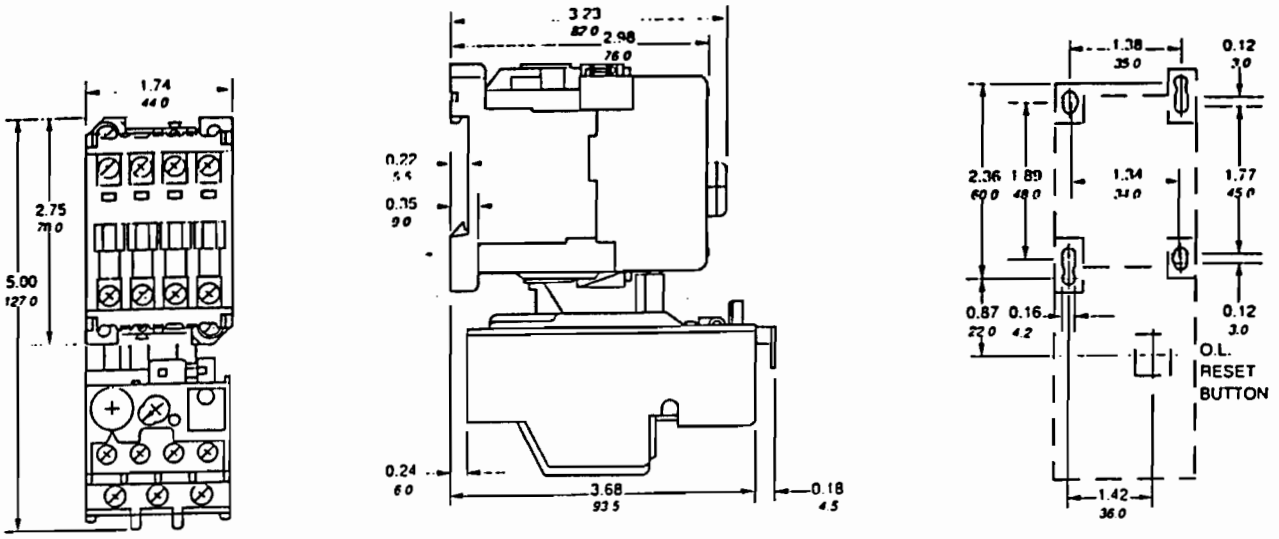
3 HP BLOWER CONTROL PANEL WIRING DIAGRAM

DRAWN:	DATE	REVISED	PREPARED BY:
YDN			LEGGETTE, BRASHEARS & GRAHAM, INC.
CHECKED:	DATE:	FIGURE:	Professional Ground-Water and Environmental Engineering Services
PJ	1/25/99		126 Monroe Turnpike Trumbull, CT 06611 (203) 452-3100

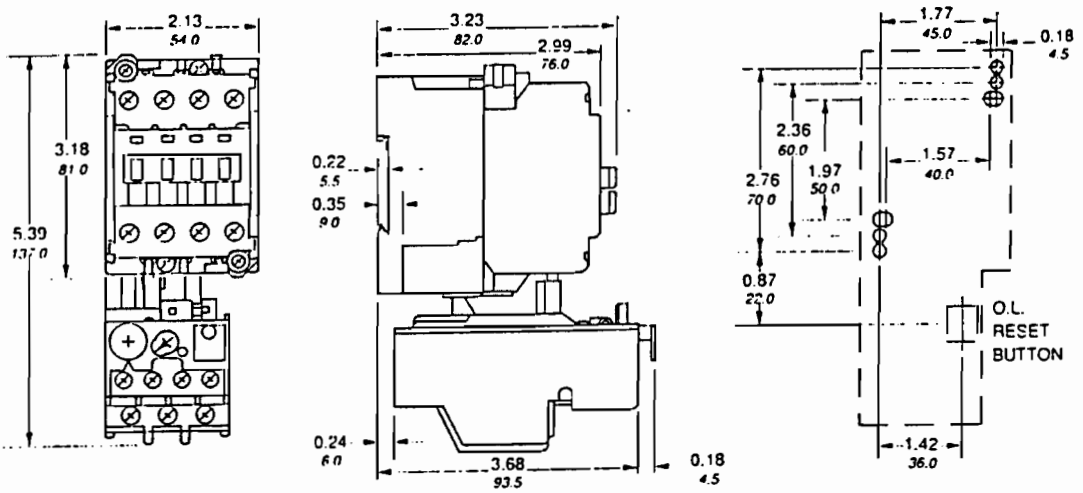
Dimensions

00.00 Inches
00.00 Millimeters

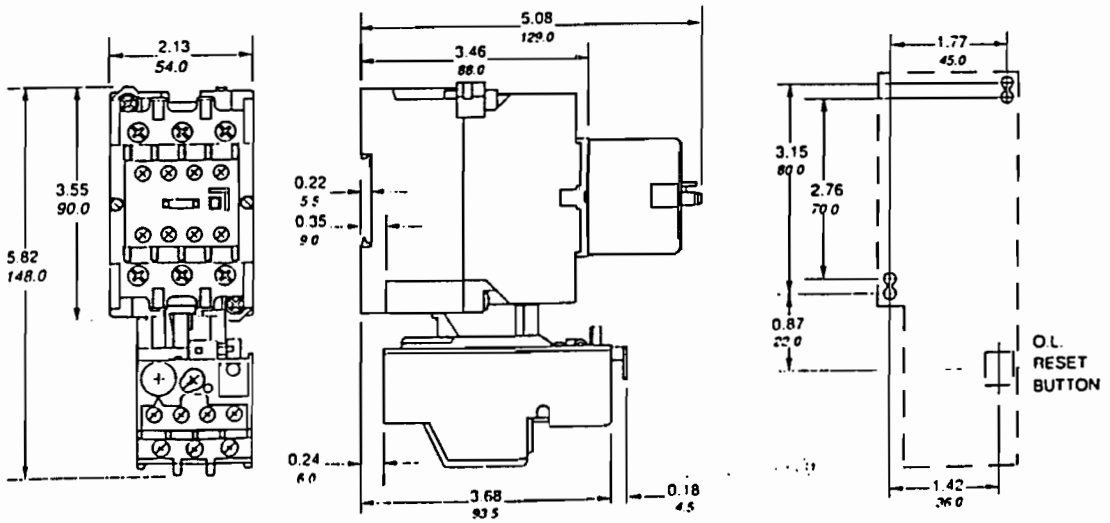
B9, B12, & B16



B25



B30



Contact Ratings

Voltage	Rating	Resistive				Inductive			
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
28V DC	UL	10A	10A	10A	10A	7.5A			7.5A
30V DC	UL	10A	10A	10A		7A	7A		
	CSA				10A	7A	7.5A		
	Nominal							7.5A	7.5A
120V AC	UL	10A	10A	10A	10A	7.5A			7.5A
	CSA						7.5A	7.5A	
	Nominal					7A			
240V AC	UL	10A	10A		7.5A	7A	7A		5A
	CSA							7A	
	Nominal	7A	7.5A	7.5A	4.5A	5A	5A	5A	

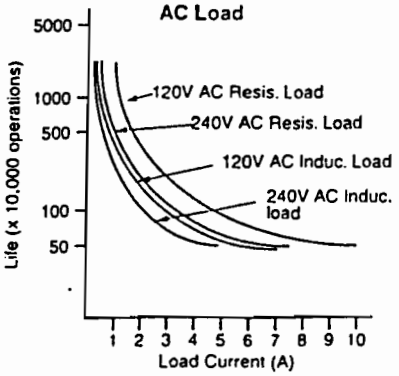
*Note: 6.5A/pole, 20A total.
Note: Inductive load cos ø = 0.3, L/R = 7 msec

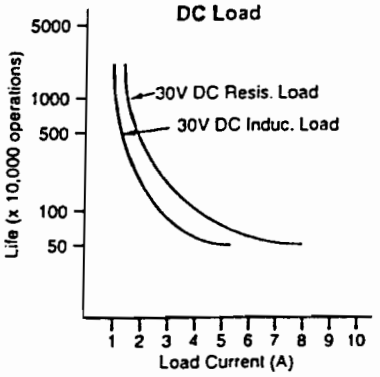
Sockets

Relay	Sockets					Spring (Optional)
	DIN Rail Mount		Surface Mount	Panel Mount	PCB Mount	
	Standard	Fingersafe				
RH1B	SH1B-05	SH1B-05C		SH1B-51	SH1B-62	SY2S-02F1 SFA-101 SFA-202 SY4S-51F1 SFA-301 SFA-302
RH2B	SH2B-05	SH2B-05C	SH2B-02	SH2B-51	SH2B-62	SY2S-02F1 SFA-101 SFA-202 SY4S-51F1
RH3B	SH3B-05	SH3B-05C		SH3B-51	SH3B-62	SH3B-05F1 SFA-101, -202 SY4S-51F1
RH4B	SH4B-05	SH4B-05C		SH4B-51	SH4B-62	SH4B-02F1 SFA-101, -202 SY4S-51F1

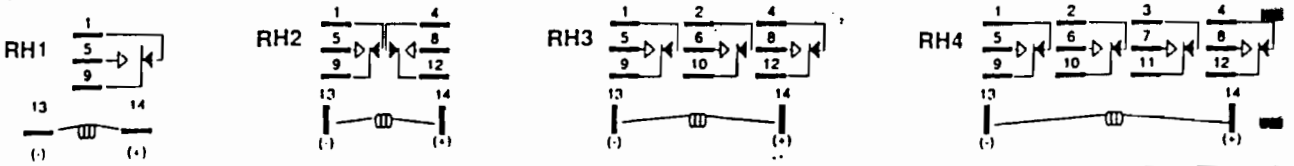
Note: See section F for details on sockets. All DIN rail mount sockets shown above can be mounted using DIN Rail BND-1000 or BAM-1000.

Electrical Life Curves





Internal Circuit



Specifications

Contact Material	Silver cadmium oxide (AgCdO)
Contact Res.	50mΩ max. (Initial value)
Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
Operating Time	SPDT(RH1), DPDT (RH2): 20ms max. 3PDT (RH3), 4PDT (RH4): 25ms max.
Release Time	SPDT(RH1), DPDT (RH2): 20ms m 3PDT (RH3), 4PDT (RH4): 25ms m
Power Consumption	SPDT (RH1): DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) DPDT (RH2): DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) 3PDT (RH3): DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) 4PDT (RH4): DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
Insulation Resistance	100MΩ min (measured with a 500V DC megger)
Dielectric Strength	SPDT (RH1) Betw. live and dead parts: 2000V A 1 minute; Betw. contact circuit and operating coil: 2000V AC, 1 minute Between contacts of the same pol 1000V AC, 1 minute
	DPDT (RH2), 3PDT (RH3), 4PDT (RH4) Betw. live and dead parts: 2000V A 1 minute; Betw. contact circuit and operating coil: 2000V AC, 1 minute Between contact circuits: 2000V AC, 1 minute; Between contacts of the same pole: 1000V AC, 1 minute
Freq. Response	1800 operations/hr
Temperature Rise	Coil: 85°C max. Contact: 65°C max.
Vibration Resistance	0 to 6G (55Hz max.)
Shock Resistance	SPDT/DPDT: 200N (approx. 20G) 3PDT/4PDT: 100N (approx. 10G)
Life Expectancy	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT (RH1), 3PDT (RH3), 4PDT (RH4 Mechanical: 50,000,000 operations
Operating Temp.	-30° to +70°C
Weight	SPDT: 24g, DPDT: 37g (approx.) 3PDT: 50g, 4PDT: 74g (approx.)

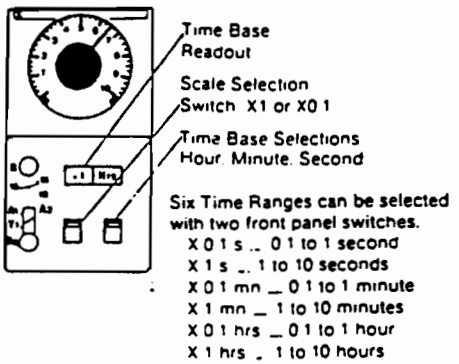
Syrelec

CHRONOS INSTRUCTION SHEET

Setting the time delay - All models: Power should be disconnected before changing the switch settings.

Setting the time delay - LRU/LR2U, ASU/ARU/AR2U, BRU/BR2U, CRU/CR2U Series:

1. Select Hours, Minutes, or Seconds with the Time Base Selection switch on the front, using a small screwdriver or pen.
2. Select desired multiplier (x0.1 or x1) by moving the Scale Selection Switch, located to the left of the time base switch.
3. Rotate the knob to desired setting between 0 and 10.



Examples:

Required setting - 2 minutes.
1. Select "Minutes"
2. Select "x1"
3. Rotate knob to 2.

Required setting - 30 minutes.
1. Select "Hours"
2. Select "x0.1"
3. Rotate knob to 5.

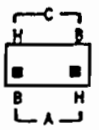
Setting the Time Delay - DRU/DR2U Series Repeat Cycle:

The DRU Repeat Cycle offers two different time settings, one for "off" time and one for "on" time - both in the U time range (.1 seconds to 10 hours). Six dipswitches are located on the underside of the case. Switches 1,2, & 3 set the "off" time range; switches 4,5, & 6 set the "on" range. The chart defines the switch settings. Once you have selected your time range, you can set the dials on the front. Top dial is "ON", bottom dial is "OFF" and they are labeled as such. Refer to the examples above.

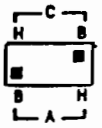
SWITCHES 1/4	2/5	3/6	TIME RANGE
Down	Down	Down	.1 to 1 second
Down	Down	Up	1 to 10 seconds
Down	Up	Down	.1 to 1 minute
Down	Up	Up	1 to 10 minutes
Up	Down	Down	.1 to 1 hour
Up	Down	Up	1 to 10 hours

Selecting the desired function - LRU/LR2U Series Multifunction Timer:

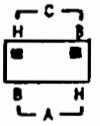
Two dipswitches are located on the under-side of the LRU to select between Delay on Make (A), Delay on Break (C), Single Shot (B), or Interval Timer (H). Select your function using a small screwdriver or a pen. See diagram for switch settings. Function descriptions and wiring diagrams are on the reverse side of this sheet.



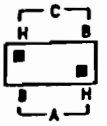
FUNCTION A
Delay on Make



FUNCTION B
Single Shot



FUNCTION C
Delay on Break



FUNCTION H
Interval Timer

3237 Commander Dr. • Carrollton, TX 75006-2506 • (800) 677-5311 • Fax (214) 250-3865

Heat Exchangers

Installation

Operation

Maintenance

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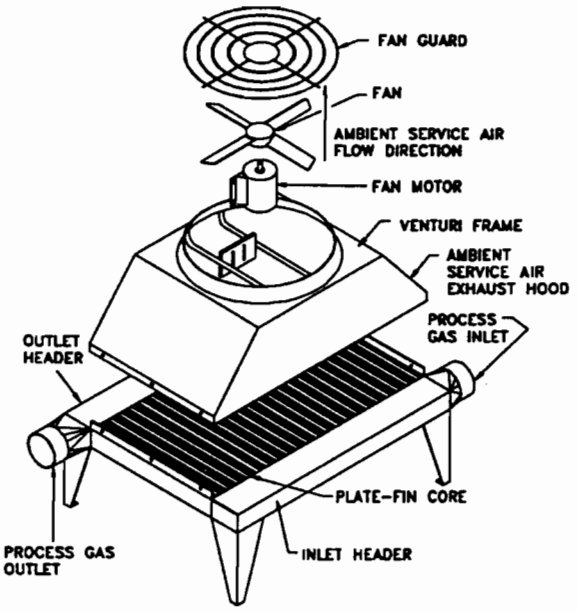
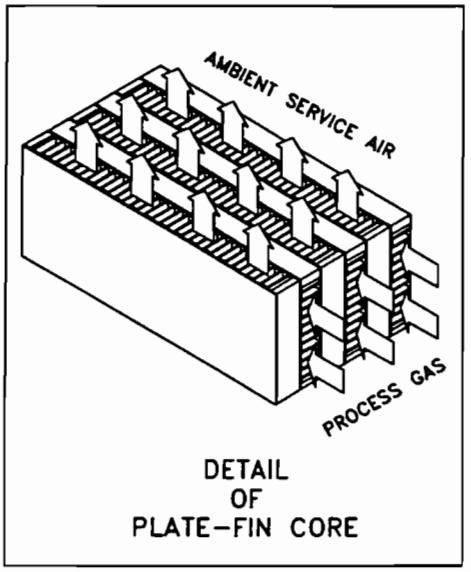
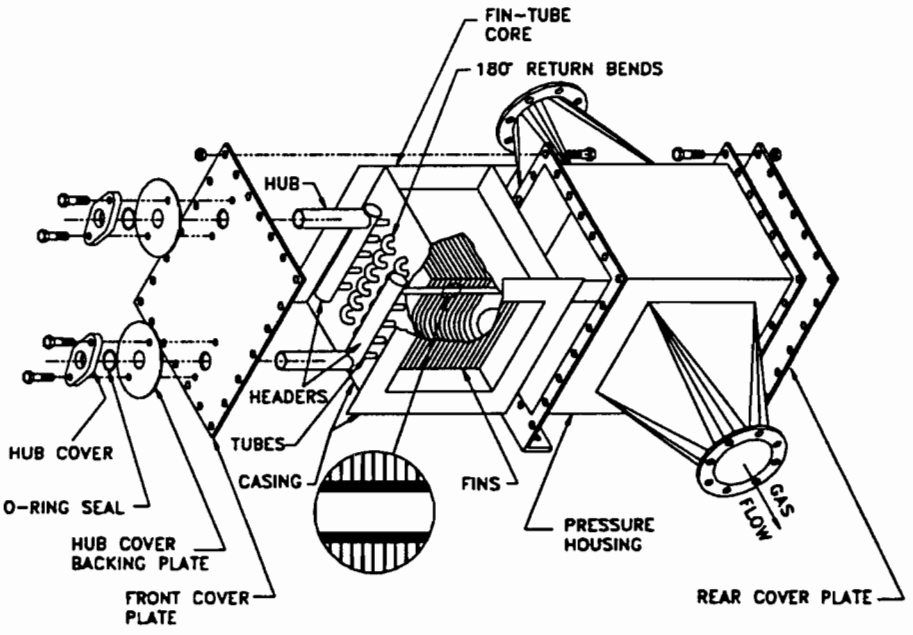
1.0 SCOPE OF THIS MANUAL

AA, C, HP, LC & TV Series heat exchangers are addressed in this manual.

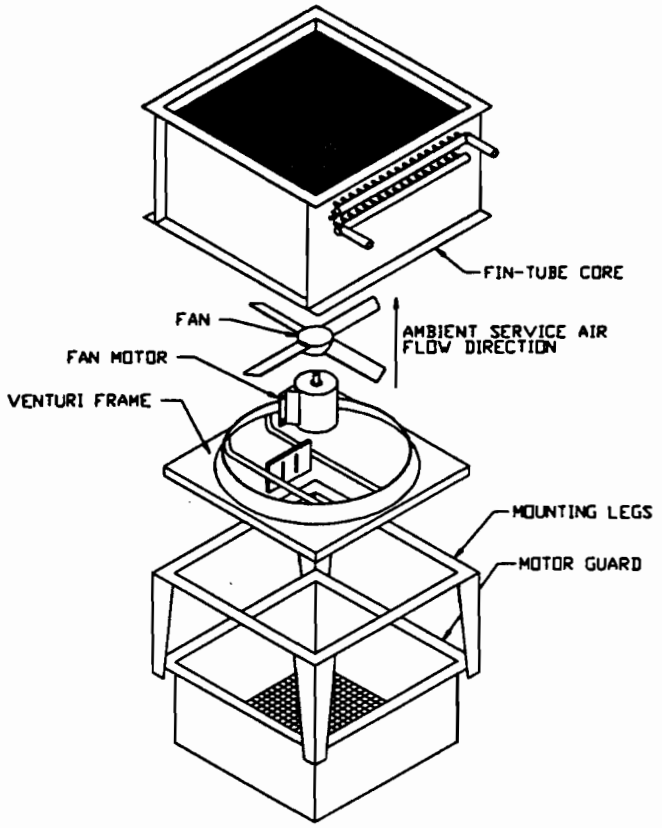




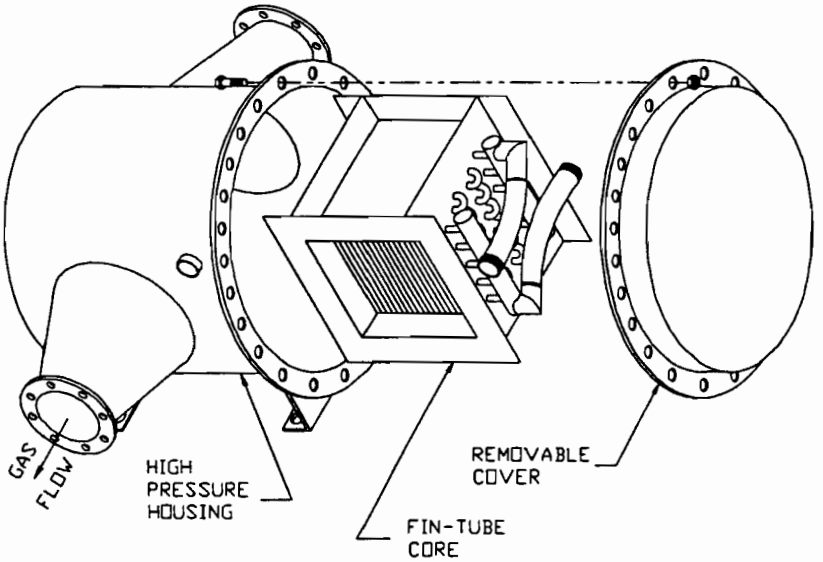
AA Series Heat Exchangers



C/TV Series Heat Exchangers



LC Series Heat Exchangers



HP Series Heat Exchangers

2.0 RECEIVING THE HEAT EXCHANGER

The unit should be examined thoroughly upon receipt. No apparent cracks, dents or deformations should be observed.

Damage to either the unit or its crating should be immediately noted on the freight receipt. If the shipment was made F.O.B. our factory, damage claims should be filed with the responsible carrier.

2.1 Storage

If the unit will not be placed in operation for an extended period of time, it should be left on the shipping skid. Store in a clean, dry protected area. All openings should be covered to protect interior surfaces. Unprotected carbon steel should be coated with a light coating of rust inhibitor.

3.0 MOUNTING LOCATION

If the heat exchanger is located at the inlet or discharge of a pulsating flow air/gas blower (e.g. Roots type - rotary lobe discharge), the heat exchanger must be protected from the pulsation by a chambered silencer.

If vibrating machines are present, the heat exchanger must be isolated from the system piping using flexible connections. Constant vibration can cause work-hardening, and failure of the heat exchanger.

The process air/gas stream should be free of particulate. If there is a possibility of particulate passing through the heat exchanger, a filtration system may be required.

Ample space should be provided on all sides to allow servicing when required.

3.1 C/HP/TV Series

To facilitate servicing a unit with a removable core, provide enough clear space for removing the core through the bolted access panel.

For cooling applications where vapors may condense from the gas stream, a proper drain trap arrangement is necessary (see section C/HP/TV SERIES HOUSING DRAIN TRAP for more information).

If water or steam is used for the service fluid, the water must not be allowed to freeze in the core or damage to the core may result (see section titled FREEZING PROTECTION - C/HP/LC/TV SERIES for more information).

3.2 AA/LC Series

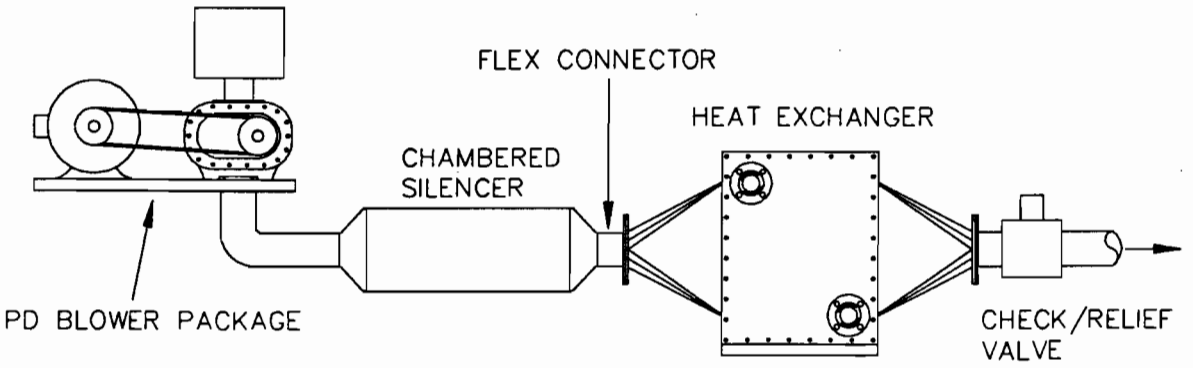
Mount in a well ventilated area, preferably outdoors, as these units dissipate heat to the ambient air. If installed indoors and ducting is required, a boosterfan capable of handling the air flow through the duct will be required.

A minimum clearance of 2 feet around the heat exchanger base is essential for proper cooling air flow.

4.0 INSTALLATION

The unit should be supported and secured by the mounting feet. All piping should be supported independently of the heat exchanger.

The unit is equipped with labels indicating air/gas flow and service fluid inlets and outlets. Connections must be installed as labelled. The certified drawing also indicates flow information, and should be consulted during installation.



Blower Package with Heat Exchanger

If the air or gas flow through the unit is pulsating and/or vibrations in the system piping are present, a chambered silencer and/or flexible connections should be used. Constant pulsation and/or vibration can cause work-hardening, and possible failure of the heat exchanger.

If used in a pneumatic material handling system, a check valve should be placed between the air lock and the heat exchanger. This will help to prevent clogging the heat exchanger with the product being conveyed.

4.1 C/HP/HP SERIES

The orientation for which the heat exchanger is designed is noted on the certified drawing. A unit that is designed for horizontal air/gas flow may not perform to specification if it is installed for vertical flow.

The service connections should be made using industry standard practices. If special valves, controls, traps, etc., are furnished by Xchanger, separate instructions may be attached. If shut off valves are installed on both the water (service fluid) lines, a pressure relief valve should be installed on the heat exchanger side of one of the shut off valves to prevent over pressuring. A pressure relief valve similar to a domestic water heater valve is usually adequate.

On standard heat exchangers, there is a 3/4 inch female NPT drain coupling in the bottom of the housing. Condensate that forms on the outside of the fins can be drained through this coupling to a drain leg, or trap.

4.1.1 Drainable Tube Circuits

These units should be sloped slightly towards the service connection end. The certified drawing indicates if the required slope is built in to the housing, or if it must be accounted for in the mounting platform.

4.1.2 Steam Heater Piping

Proper installation, piping and trapping is necessary to insure satisfactory operation and prevent damage under service conditions. These installation recommendations and piping diagrams must be followed to assure satisfactory, trouble-free operation:

__ General Points

- Provide swing joints or flexible fittings in all piping connections adjacent to the heat exchanger. This absorbs the thermal expansion and contraction of the piping.
- Condensate must flow freely from the heat exchanger at all times to prevent physical damage to the core caused by water hammer, unequal thermal stresses, freeze-up and corrosion.
- Do not pitch the heat exchanger. The mounting position should be level.
- Control each heat exchanger core separately when installing multiple heat exchangers for series airflow.
- Do not modulate systems with overhead or pressurized returns unless the condensate is drained by gravity to a receiver (vented to atmosphere) and returned to steam main by a condensate pump.
- Pitch all supply and return piping down a minimum of 1" per 10' in direction of steam flow.
- Do not drain steam mains or take-offs through the heat exchanger. Drain steam mains ahead of the heat exchanger through a steam trap into the steam return line.
- Do not bush or reduce the steam condensate return piping smaller than the heat exchanger connection. Run return pipe full size to a steam trap (except for short nipple screwed directly into the condensate connection of the steam trap).
- Overhead steam return lines require 1 psig pressure at the steam trap discharge for each 2 feet of elevation to assure continuous condensate removal.

- When a overhead steam return line is installed, provisions should be incorporated into the piping system to allow condensate to drain from the heat exchanger during "down time".

- End-of-steam supply main must be trapped.

- A vacuum breaker must be installed if there is any possibility the heat exchanger will see a vacuum resulting from a fast acting valve operation. The vacuum breaker is to be a 15° swing check valve.

__ Steam Trap Selection

Proper steam trap selection and installation is necessary for satisfactory heat exchanger performance and service life:

- Select a steam trap based on the maximum possible condensate flow rate along with the recommended load factors.

- Locate the steam trap discharge at least 12" below the heat exchanger condensate return connection. This will provide sufficient hydrostatic head pressure to overcome trap losses and assure complete removal of the condensate from the heat exchanger.

- Float and thermostatic type steam traps are preferred because of their gravity drain and continuous discharge operation.

- Use a float and thermostatic type steam trap with gravity condensate return and automatic controls where there is a possibility of a low pressure steam supply.

- Use bucket traps only when supply steam is not modulated and is over 25 PSIG.

- When installed for series airflow, size steam traps for each heat exchanger core using the capacity of first heat exchanger core (in airflow direction).

- Trap each heat exchanger core separately. This will prevent condensate holdup in the heat exchanger cores.

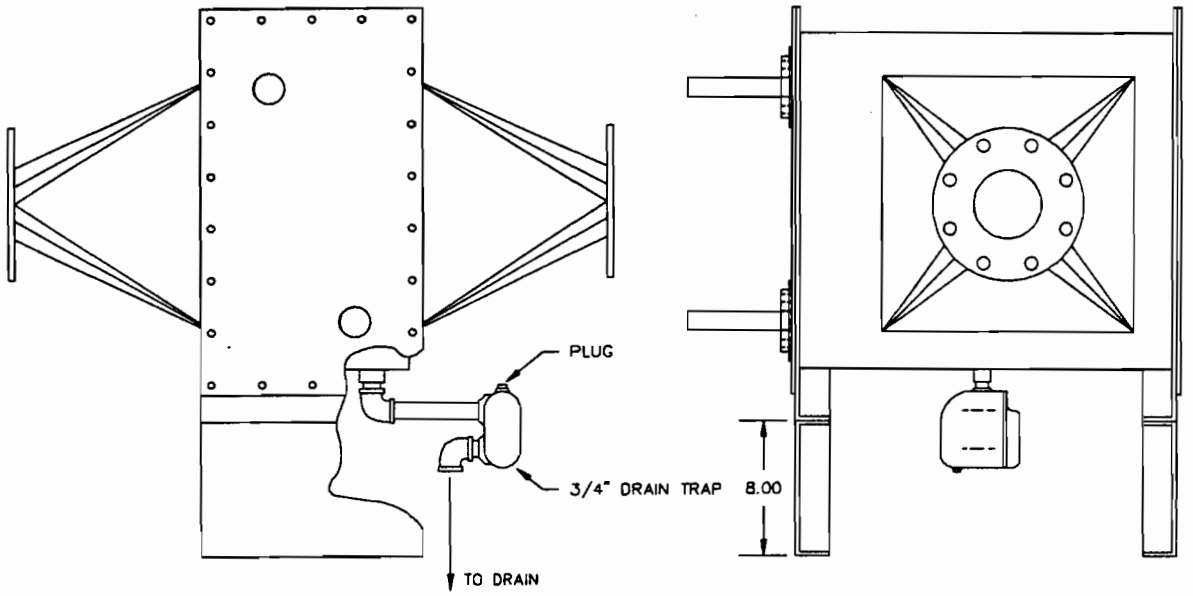
- Install strainers as close as possible to inlet side of a steam trap.

4.1.2 Refrigerant Circuit

Direct expansion refrigerant circuits are shipped open uncharged. They must be evacuated and charged. If you need assistance, contact a local industrial refrigeration contractor.

4.1.3 Housing Drain Trap

In applications where vapors are expected to condense from the air/gas flow, an automatic drain trap should be installed. Approximately 8 inches of clearance below the standard mounting feet is required.



Heat Exchanger with Drain Trap

4.2 AA/LC SERIES

The electric motor must be wired on site. On many air cooled heat exchangers, the electrical service must be brought through the cooling air exhaust hood. Any holes through the exhaust hood should sealed to prevent cooling air from coming in that has not passed over the core (short-circuiting the core). Refer to the motor name plate for power requirements.

5.0 START-UP

After carefully observing all the points listed under INSTALLATION, the unit is ready for start-up. After the process/service fluids have been directed to the unit, check for leaks.

5.1 C/HP/TV SERIES STEAM HEATERS

Steam should be turned on full for at least ten minutes before airflow is started to prevent water hammer, freezing and excessive thermal stresses on the heat exchanger.

5.2 AA/LC SERIES

Before starting the electric fan, the following checklist should be used:

1. The propeller hub should be secure on the motor shaft.
2. The propeller should rotate freely.
3. Electrical wiring should be safely secured.
4. The air flow path should be open (i.e. packing material removed).

After starting the motor, check that the propeller is rotating in the proper direction.

6.0 MAINTENANCE

Depending on the model, and your operating environment, the maintenance requirements will vary.

6.1 LUBRICATION

6.1.1 C/HP/TV Series

No lubrication is required.

6.1.2 AA/LC Series

Refer to the maintenance instructions provided with the heat exchanger motor.

6.2 C/HP/TV CORE REMOVAL AND INSTALLATION

It may be necessary to occasionally remove the fin-tube core from the housing for inspection and/or cleaning.

6.2.1 C/HP/TV Series Core Removal

The following steps describe removing the fin-tube core from the heat exchanger housing on units with removable cores. Units which are all-welded will need to be returned to the factory for service. [see page 1 for reference to terminology]

__ C/TV Series

1. On units with O-ring sealed hubs: Remove the four bolts holding the hub covers, the hub covers, O-ring seals, and hub cover backing plates.
2. Remove the front cover plate and, where applicable, the rear cover plate. Some units have a welded on rear cover.
3. Remove the bolts holding the core casing to the entering air/gas side of the housing.
4. Remove the core from the housing.

__ HP Series

1. Remove the flange bolts around the removable dished head cover.
2. Disconnect the internal service connections from the core and housing.
3. Remove the bolts holding the core to the entering air/gas side of the housing.
4. Remove the core from the housing.

6.2.2 C/HP/TV Series Core Installation

Install the core in the reverse order of disassembly noting the following:

1. Slide the core into the housing.

   Note: For replacement cores, the holes in the casing which hold the core to the entering air side of the housing will need to be drilled as follows:

   a. Slide the core into the housing such that the core face is centered in the transition opening.

   b. Mark the hole locations on the casing.

   c. Remove the core and drill the holes where marked. When drilling the holes, place a wooden block behind the casing to prevent damage to the core's tubing.

   d. Re-install the core into the housing.

2. Clean the sealing surfaces on the covers and housing flanges with solvent to remove any oils or residue.

3. Apply new gasket material to the housing flange. Refer to the data sheet supplied at the time of purchase for proper gasket material selection.

4. Install covers, cover bolts-nuts-washers and hub cover assemblies. To facilitate installing the hub cover assemblies, do not tighten the cover bolts until after the hub cover assemblies are installed. All bolts should be finger tight at this point.

   Note: For C/TV Series replacement cores, the hub locations may not be identical to the original. To check for proper alignment, Install the front cover with the 4 corner bolts. Slide on the hub cover assemblies to check for alignment. If the hub-cover bolt holes in the cover do not match, new holes must drilled and tapped into the cover. The hub covers may be rotated such that the old holes will not interfere with the new holes. Fill in the old holes to prevent air/gas leakage.

7. Tighten the front and, if applicable, rear cover bolts.

8. Tighten the hub cover assembly bolts.

6.3 CLEANING

6.3.1 Air Passages

For dirt/dust contamination, a soap and water wash is usually adequate. If not, the use an appropriate solvent, or compressed air is recommended. Pressure washers can damage the fins, and should not be used.

__ AA Series Process Gas Passages

The internal process gas passages in the AA Series heat exchangers are not cleanable. Filtered air is absolutely necessary for these units. For clogs, core replacement is recommended.

__ AA/LC Series Service Gas Passages

The service side can be cleaned as described above.

__ C/HP/TV Series

C/HP/TV Series heat exchangers may require disassembly for cleaning. See section 6.2 for disassembly instructions.

6.3.2 Fluid Passages

__ C/HP/LC/TV Series

The tube interior can become coated with sediment, this coating will reduce the thermal capacity of the heat exchanger. To restore a fouled heat exchanger to it's original capacity, an appropriate solvent or cleaner compatible with the tube material can be circulated through the tube circuit to clean the tube interior.

6.4 FREEZING PROTECTION - C/HP/LC/TV SERIES

6.4.1 Drainable Circuits

If the heat exchanger is equipped with a drainable tube circuit, the tubes can be drained by simply opening the water inlet & outlet to atmosphere. These units should be sloped slightly towards the water connection end to facilitate in complete drainage.

6.4.2 Non-Drainable Circuits

Non-drainable circuits include two varieties:

A. Non-trapped circuits are circuits that run horizontal and upward, or horizontal and downward. This type of circuit is drainable for the most part, but protection from freezing damage can never be 100%.

B. Trapped circuits run upward and downward (like the trap under a sink).

___ Procedure

1. Open the water inlet and outlet to atmosphere and allow the core to drain as completely as possible.

2. Add antifreeze to the core and circulate the solution through the core for about fifteen minutes.

3. Check the concentration for adequate freeze protection for your area. If concentration is not adequate, repeat steps 1 and 2 as necessary.

7.0 SPARE PARTS

7.1 C/HP/TV SERIES

No spare parts are recommended. However, new gasketing will be required before reassembly during maintenance.

7.2 AA/LC SERIES

A spare electric motor is recommended.

8.0 GUARANTEE

8.1 DURATION

The sooner of either:

- 12 months from date of start-up.
- 18 from date of shipment from Xchanger, Inc.

8.2 TERMS

Xchanger, Inc. will replace or repair any part or parts free of charge, F.O.B. our factory, provided our examination shows the item to be defective by reason of inferior materials or workmanship.

The part or parts must have been used for the purpose as intended and in accordance with our instructions. No allowance will be made for repairs or alterations without our written consent.

8.3 EXCLUSIONS

This Guarantee does not cover damages resulting from misuse, neglect, alteration, or accident, specifically including operating at temperatures or pressures in excess of those for which the equipment was specified and furnished.

Motors, controls and other purchased parts are warranted by their original manufacturers. Such warranties will be carried out in accordance with the usual terms thereof.

9.0 SERVICE

Should assistance in installation, demonstration, or repair of any equipment be required, please contact Xchanger, Inc. at (612) 933-2559.

Xchanger, Inc.

1401 South 7th Street • Hopkins, MN 55343
Phone (612) 933-2559 • Fax (612) 933-5647

CUSTOM DESIGN AND MANUFACTURE OF HEAT EXCHANGERS SINCE 1972

SENSAPHONE® *EXPRESS*

OPERATOR'S MANUAL

v. 1.20

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CHAPTER 1: INTRODUCTION

Welcome to the Sensaphone® Express by Phonetics, Inc. Express is an advanced environmental monitoring system that combines digital speech recording technology with your creativity. With Express, you can enjoy comprehensive monitoring capability and the versatility of recording your own voice for the dial-out alarm and ID messages.

Express features monitoring of up to 4 dry contacts, a built-in temperature sensor, and on-board power monitoring. In addition, Express has a built-in microphone to allow remote monitoring of on-site sounds.

Express can call up to 8 phone numbers using pulse or Touch-Tone dialing. It is able to share a phone line with answering devices such as answering machines and modems. Express's call progress feature detects a busy signal or no answer. The Dialing Pattern option allows you to customize your dial-out sequence.

Express is equipped with a rechargeable Gel Cell battery backup to ensure continued monitoring through power failure. In addition, Express has non-volatile memory to retain programming and voice messages with no power at all.

PROGRAMMING EXPRESS

Reading this instruction manual will help you install and program Express easily. Programming and voice recording are performed locally using the built-in keypad. Some programming and voice messages can also be accessed via touch-tone phone.

If there are any questions or problems that arise upon installation or operation, please contact:

Phonetics, Inc.
901 Tryens Road
Aston, PA 19014
Phone: (610)558-2700
FAX: (610)558-0222

ABOUT THIS MANUAL

This manual is comprised of the instructions and commands necessary to install and program Express. In addition, summary and application chapters are included to help you speed programming and to understand Express's features.

CHAPTER 2: INSTALLATION

This chapter provides information to install the Sensaphone® Express. Please read the entire chapter before starting.

Within the packaging will be a Warranty Registration Card. Please take the time to fill this out and mail. The Limited 1 Year Warranty is explained in the back of this manual.

CAUTION: Express is a sensitive electronic device. Personnel and work area should be grounded before handling this device. Do not install Express near strong electrostatic, electromagnetic, magnetic or radioactive fields.

OPERATING ENVIRONMENT

Express should be mounted and operated in a safe environment. The temperature range that Express can operate in is 32°F to 120°F (0°C to 48°C). If Express needs to operate below freezing, a strip heater should be added.

MOUNTING EXPRESS

When you receive Express, carefully remove it from the box. On the top and bottom of the enclosure are mounting holes to attach the unit to the wall. Mount Express in an upright position on a wall so that you can easily gain access to the front panel. There must be a power outlet nearby. Decide where you will be mounting Express and drill holes according to Figure 1 below.

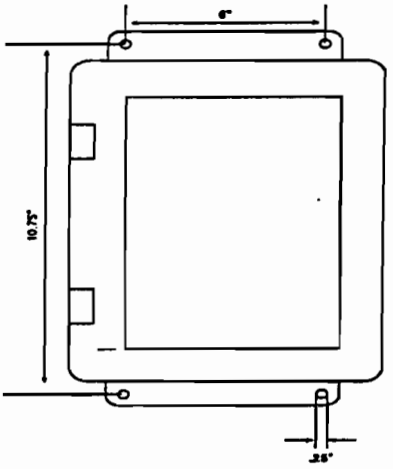


Figure 1: Mounting Express

STRAIN RELIEF
Strain relief clamps are provided in the Express enclosure to prevent wiring from being pulled from the circuit board or damaged when passing through the enclosure. To use the strain relief, thread wires through the clamp and clear rubber bushing. Position the bushing in the clamp and tighten the screws on either side so that the wiring does not move.

POWERING EXPRESS
Express is provided with a 12V AC power transformer. This should be plugged into a 117V AC outlet, ± 20%, 60Hz.

Wire from the transformer is pre-wired to the terminals labelled AC.

GROUNDING EXPRESS
Express should be earth grounded by connecting a true earth ground to the terminal labelled EG. This is not essential for Express to operate, but it is necessary to prevent possible damage caused by a lightning strike.

IMPORTANT: Express should be grounded to a true earth ground. This will help protect against the possible effects of lightning strikes in or around the immediate area.

BACKUP BATTERY
Express has a 12V 1.9AH sealed Gel Cell (lead-acid) rechargeable battery. This will provide approximately 12 hours backup time. This comes pre-wired with the red wire attached to the BAT terminal and the black wire attached to the G terminal.

The battery is recharging whenever the power switch is turned on and the unit is plugged in. NOTE: Have battery serviced by qualified service personnel only.

Also included is a 3V lithium battery for memory storage to retain user recorded messages and programming.

TURNING EXPRESS ON
Now that Express has power, the ON-OFF switch may be turned on. Express's BATTERY OK LED will go on and glow steadily. The unit will say: "Hello."

When the unit is turned off, it is disabled but your voice messages and programming are retained by the 3V lithium battery. In the off position, the 3V lithium battery is in use. The 12V battery backup is not.

PHONE LINE

On the Express circuit board there is an RJ11C phone jack. It is located at the bottom left corner of the circuit board and is labeled PHONE. Connect Express to a standard 2 wire phone line. Express dials using pulse or tone, with loop start only. Express will recognize ringer frequencies from 16 to 60 Hz.

NOTE: Express will operate with all standard telephone systems that accept pulse or tone dialing.

Certain private telephone systems and public switching equipment may not accept Express dialing or may generate an unacceptable ring signal. In those cases, a dedicated line may be required for Express. Consult the supplier of your telephone system if you encounter problems.

CAUTION: Never install telephone wiring during a lightning storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Use caution when installing or modifying telephone lines.

TEMPERATURE SENSORS

Express is provided with a 2.8K remote temperature sensor. This is pre-wired to the temperature terminals labelled TMP and G. It is on a 20 ft. cable. It is used to measure temperature for your application.

THE MICROPHONE

Express is provided with a polarity-sensitive microphone. It is pre-wired on a 25 ft. cord. The microphone is used for recording alarm messages and remote monitoring of on-site sounds.

THE ALARM INPUTS

Express can monitor up to four dry contacts. These sensors are to be wired to the terminal block located directly to the right of the phone jack. An alarm input can be used with any normally open

(N.O) or normally closed (N.C.) input device. Open is when there is no contact and closed is when a contact exists. Express will adapt to N.O. or N.C. sensors when the unit's ID number is programmed (see Chapter 4, page 25).

Each alarm input consists of two screws called a terminal pair. Each screw in the terminal pair is labelled. The labels are: 1 C, 2 C, 3 C, and 4 C. You must determine what type of sensor will by connected to each alarm input. See Figure 2.

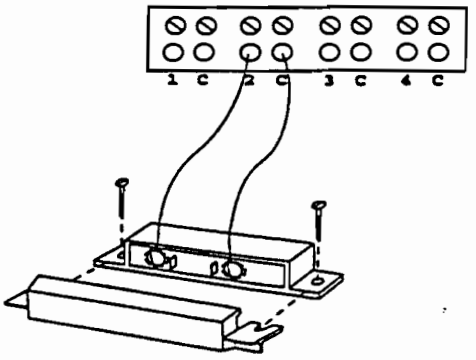


Figure 2: Connecting a sensor to an input terminal

After you have selected the sensor, loosen the two screws of the alarm input to which it will be connected. Two wire leads are used to connect any monitoring sensor. Fasten one lead to the numbered screw (1, 2, 3, or 4) and the other lead to the common screw (C). Tighten both screws. Express may recite an alarm message as you connect the sensor. If it does, press the ALARM CANCEL key to stop it.

Do not use sensors, switches, or relays that supply any voltage or current to Express.

NOTE: Any N.O. or N.C. sensor can be attached to Express using 22-gauge wire. The sensor can be up to 1500 ft. from the unit. The total resistance of the circuit cannot be greater than 50 ohms. Use wire appropriate for the application. See Length of Wire, page 10.

Express may have more than one sensor connected to the same terminal. However, the normal condition for each sensor on the same terminal must be identical (either all N.O. or all N.C.).

NORMALLY CLOSED SENSORS

To wire more than one normally closed sensors on one input, they must be connected in series. Connect one lead from the first sensor to the numbered screw of the terminal pair. Next, take the other lead from the first sensor and connect it to one lead from the next sensor. Continue connecting sensors end-to-end until you have connected all of your sensors. Take the second lead from your last sensor and connect it to the common screw of the terminal pair. See Figure 3.

Multiple N.C. inputs are typically magnetic reed switches to monitor the security of windows and doors.

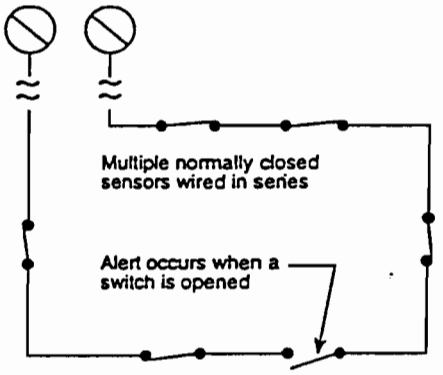


Figure 3: Connecting multiple N.C. sensors to one input terminal

NORMALLY OPEN SENSORS

To wire several normally open sensors to one alert input, connect them in parallel. To do this, take one lead from each sensor and attach it to the numbered terminal. Then, take the second lead from each sensor and attach each to the corresponding common screw. See Figure 4.

Multiple N.O. inputs are typically TEMP°ALERTs to monitor the temperature in several different locations simultaneously.

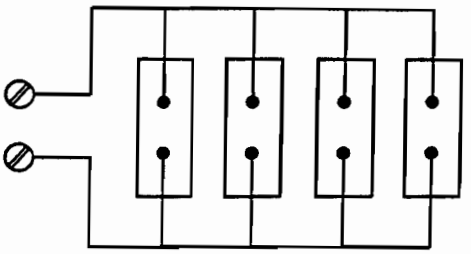


Figure 4: Attaching multiple N.O. sensors to one input terminal

SHIELDED WIRE

Express is designed to work in most installations without the need of shielded wire. This does not apply to wire run in conduit that has other noise-generating conductors, such as 60Hz AC. It is strongly recommended that input wiring be run in a conduit separated from AC power or output wiring. When wire runs are long or are in close proximity to large power consuming, power generating or power switching equipment, it is recommended that SHIELDED WIRE be used.

LENGTH OF WIRE

Temperature Sensors - It is recommended that long wire runs be avoided when using a thermistor as a sensor. A long run of wire could alter the RESISTANCE of the circuit therefore providing an inaccurate temperature reading on the input. Below is a chart of recommended gauges and wire lengths:

Minimum Wire Gauge	Maximum Wire Length
#26	250 feet
#24	700 feet
#22	1500 feet
#20	2500 feet

Dry Contact Sensors - The total resistance of the loop cannot exceed 50 Ohms. Use the appropriate gauge wire for your application.

NOTE: All wiring should comply with Section 17 of the UL requirements.

POWER SUPPLIES

Express has two power supplies available from the PC board. They are provided to power your external sensors or output devices.

Power Supplies: 5 Volt supply; 12 Volt supply

Maximum Current Available: 100 mA total (for both supplies combined, not 100 mA for each supply.)

FCC REQUIREMENTS

PART 68 - This equipment complies with Part 68 of the FCC rules. On the outside of the enclosure there is a label that contains, among other information, the FCC Registration Number and the Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your local telephone company.

The REN is useful to determine the quantity of devices that you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the REN's of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices that you may connect to your line, you may want to contact your local telephone company to determine the maximum REN for your calling area.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

Should EXPRESS cause harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advanced notice isn't practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with this equipment, please contact:

PHONETICS, INC.
901 Tryens Road
Aston, PA 19014
(215) 558-2700
Fax: (215) 558-0222

for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

PART 15 - This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTICE

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100. For Sensaphone EXPRESS, the Load Number is 9.

CHAPTER 3: COMMUNICATION PROGRAMMING

This chapter explains the keyboard functions for the communications operations for Express. This includes programming, interrogating and/or resetting of:

- Voice messages
- Dial-out phone numbers
- Special dialing
- Tone or pulse dialing
- Rings until answer
- Call delay time
- Intercall delay time
- Voice repetitions
- Maximum number of calls
- Telephone Answering Device compatibility
- Listen-in time
- Security code
- Local voice mute

VOICE MESSAGES

Express's digital speech recording feature allows you to record your own voice for the four dial-out alarm messages and the ID message. This means that when Express calls you during an alarm, you will receive your personalized voice message telling you exactly what alarm condition exists. You can record a separate message for each of the four inputs. The message can be a maximum of 8 seconds. The ID message can be a maximum of 10.5 seconds. Each input has a default dialout message if none is programmed.

To program the voice message for input 1:

1. Press the SET key
2. Press the MESSAGE key
3. Press number key 1
4. Holding the microphone approximately 12 inches from your mouth, say your prepared message clearly.
5. Press the ENTER key when finished speaking. **NOTE:** Express will **not** beep when you press ENTER as it does for other commands. Express will beep when the 8 seconds is over.

To program the voice messages for inputs 2-4, press number keys 2-4 accordingly for step 3.

To program the ID voice message:

1. Press the SET key
2. Press the MESSAGE key
3. Press the ID# key
4. Holding the microphone approximately 12 inches from your mouth, say your 10.5-second prepared message clearly.
5. Press the ENTER key when finished speaking. Express will not beep when ENTER is pressed. It will beep when the 10.5 seconds is over.

To play back your messages:

1. Press the WHAT IS key
2. Press the MESSAGE key
3. Press number key 1, 2, 3, or 4 to hear the corresponding recorded input message. Press the ID# key to hear the ID message. Express will play back your recorded message. If a message had been erased, a beep will be heard instead.

To erase a message:

1. Press the SENSOR ON/OFF key
2. Press the MESSAGE key
3. Press number key 1, 2, 3, or 4 to erase an input message. Press the ID# key to erase the ID message.

Express will say "*OK*."

DIAL-OUT TELEPHONE NUMBERS

The Sensaphone Express can store up to eight 32-digit phone numbers. These are the numbers that will be called during an alarm dial-out. The numbers are dialed sequentially 1 through 8. Therefore, program the first number you want called as Phone #1, the second one as Phone #2, and so on. A *pause*, *pound* or

asterisk can be added to the phone number to access different phone and beeper systems. **See Special Dialing, page 17.**

To program the dial-out telephone numbers:

1. Press the SET key
2. Press the PHONE NUMBER key
3. Select the Phone number (keys 1-8)

Express will say "*Enter number*"

4. Enter the phone number using the number keys
5. Press the ENTER key

Express will say "*OK*"

To interrogate a dial-out telephone number:

1. Press the WHAT IS key
2. Press the PHONE NUMBER key
3. Select the Phone number (keys 1-8)

Express will recite the number programmed. If there is no number programmed, Express will say "*No number.*"

To erase a Phone number:

1. Press the SET key
2. Press the PHONE NUMBER key
3. Select the Phone number (1-8) to erase

Express will say "*Enter number.*"

4. Press the ENTER key

Express will say "*OK.*"

—

SPECIAL DIALING

Express has provisions for special dialing sequences. There are four keys that represent special functions when used within a phone number. The SET key produces a # tone. The WHAT IS

key produces the * tone. The PAUSE key represents a four-second pause in dialing. The CODE key instructs Express to wait until the call is answered before continuing. These provisions are mainly for dialing out to a beeper or pager, or when the phone system requires dialing an access number to reach an outside line.

The following is a typical scenario:

SET PHONE 1
1 800 555 1212 CODE PAUSE 1 2 3 4 #
ENTER

Express will dial the pager number, wait for it to answer, pause and then give 1234#.

NOTE: When interrogating a Phone Number, a PAUSE is represented as a beep, the asterisk (*) = 11, the pound (#) = 12, and CODE = 14.

TONE OR PULSE DIALING
Express can dial out in pulse or touch-tones. All eight phone numbers are programmed as either tone or pulse. The default is TONE. To program as either tone or pulse:

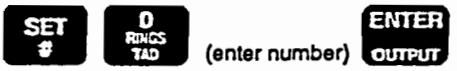
1. Press the SENSOR ON/OFF key
2. Press the TONE key
Express will respond by saying "OFF" to indicate that tone dialing is off, or "ON" to indicate that tone dialing is on.
3. Repeat key sequence to change

RINGS UNTIL ANSWER
The rings until answer is the number of rings that must occur before Express answers the phone. This value can be from 1 to 32. The default value is 4.

To program rings until answer:

1. Press the SET key
2. Press the RINGS key

Express will say "*Enter number.*"
3. Using the number keys, enter a value
4. Press the ENTER key
Express will say "*OK.*"



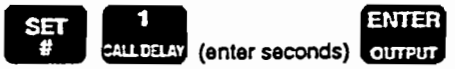
To interrogate:

1. Press the WHAT IS key
2. Press the RINGS key
Express will recite the current value.

CALL DELAY TIME
The call delay time is the length of time Express will wait after an alarm is recognized before it starts the dial-out sequence. This is only for the first call. To set delay time between calls, see INTERCALL DELAY TIME. The default time is 30 seconds. The call delay time can be programmed from 0 to 255 seconds.

To program call delay time:

1. Press the SET key
2. Press the CALL DELAY key
Express will say "*Enter seconds.*"
3. Enter the seconds using the number keys
4. Press the ENTER key
Express will say "*OK.*"



To interrogate:

1. Press the WHAT IS key
2. Press the CALL DELAY key
Express will recite the programmed time.

INTERCALL DELAY TIME
If the alarm has not been acknowledged, the intercall delay time is the length of time between each phone call that Express waits before dialing the next Phone number. This time can be 0 to 272 minutes. The default intercall time is 30 seconds.

To program intercall delay time:

1. Press the SET key
2. Press the INTERCALL TIME key
Express will say "*Enter minutes.*"
3. Using the number keys, enter the number of minutes
4. Press the ENTER key
Express will say "*Enter seconds.*"
5. Using the number keys, enter the number of seconds
6. Press the ENTER key
Express will say "*OK.*"

To interrogate:

1. Press the WHAT IS key
2. Press the INTERCALL TIME key
Express will recite the programmed time.

CALL PROGRESS
Express monitors call progress when it dials out for an alarm. If Express encounters a busy signal or receives no answer after 8 rings, the unit hangs up, waits the programmed intercall wait time and then dials the next phone number.

VOICE REPETITIONS
The voice repetitions is how many times Express will repeat the alarm message per phone call when it dials out. This can be programmed from 0 to 255 repetitions. The default value is 3 repetitions.

To program the voice repetitions:

1. Press the SET key
2. Press the VOICE REPS key

Express will say "*Enter number.*"
3. Using the number keys, enter a value
4. Press the ENTER key
Express will say "*OK.*"

To interrogate:

1. Press the WHAT IS key
2. Press the VOICE REPS key
Express will repeat the number programmed.

MAX CALLS
This value determines the maximum number of calls Express will make if none of the calls are acknowledged. If the number of calls reaches this value, Express will automatically acknowledge the alarms and stop the dialout. The max calls can be programmed from 0 to 255. The default is 100.

NOTE: If only one Phone Number is programmed, Express will dial a maximum of 15 times, regardless of the programmed value of max calls.

To program max calls:

1. Press the SET key
2. Press the MAX CALLS key
Express will say "*Enter number.*"
3. Using the number keys, enter a value
4. Press the ENTER key
Express will say "*OK.*"

To interrogate:

1. Press the WHAT IS key
2. Press the MAX CALLS key

Express will recite the value of max calls.

TELEPHONE ANSWERING DEVICE COMPATIBILITY

Express can be used on the same telephone line that also has a telephone answering device, such as an answering machine or modem. This feature allows you to call in to Express and bypass the answering device.

To use TAD:

1. Program Express' RINGS (see page 18) to a greater number than the rings until answer for your answering device. For example, Express RINGS = 5, device rings = 3.
2. Press the SENSOR ON/OFF key
3. Press the TAD key

Express will say "*On.*" (If Express says "*Off*" repeat steps 2 and 3.)

4. Using the above example, when you call in let the phone ring twice and then hang up. Express recognizes that a call was made and activates a 3 minute internal timer. This allows you 3 minutes to call back to Express.
5. Call back within 3 minutes. Express will override the answering device on the callback and answer the phone on the first ring. Express resets TAD after one incoming call is received. If you want to call the unit again, you must repeat steps 4 and 5.

LISTEN-IN TIME

The listen-in time is the amount of time you can listen to sounds at the microphone site during a status call-in. The programmable range is 0 to 255 seconds. The default setting is 15 seconds.

To program the listen-in time:

1. Press the SET key
2. Press the LISTEN TIME key

Express will say "*Enter seconds.*"
3. Using the number keys, enter the seconds
4. Press the ENTER key
Express will say "*OK.*"

To interrogate:

1. Press the WHAT IS key
2. Press the LISTEN TIME key
Express will recite the time programmed.

SECURITY CODE
The security code is a 4-digit number that you program to prevent unauthorized access to Express' programming. Locally, when the security code is employed, it will lock the keyboard, not allowing the programmed parameters to be changed. You may only interrogate the unit using the WHAT IS key. You must unlock the keyboard by entering the security code to change the programming parameters.

For call-in access, the position of the REMOTE SECURITY PIN determines whether the security code must be entered via touch-tone phone to obtain a status report (see Chapter 6, page 42). You may set the remote security pin so that Express will ignore the code to allow access during a dial-in. Or, you may set the remote security pin to check the code when you call in. If you enter the correct code, you will gain access to Express to obtain a status report and use the phone commands. If you enter the incorrect code, Express will hang up. You cannot program or change the security code remotely. For explanation of how to use the security code during a call-in see Chapter 5, page 37.

To program the security code / lock the keyboard:

1. Press the SET key
2. Press the CODE key
Express will say "*Enter code.*"
3. Using the number keys, enter 4 digits
4. Press the ENTER key

Express will say "*OK.*"

To unlock the keyboard:

1. Press the WHAT IS key
2. Press the CODE key
Express will say "*Enter code.*"
3. Using the number keys, enter your 4 digit code. (If you enter the incorrect code, Express will say "*Error.*")
4. Press the ENTER key
Express will say "*OK*" if the correct code was entered.

NOTE: You may not interrogate the security code. The WHAT IS key is used to unlock the keyboard when the correct code is entered.

LOCAL MUTE
When Express dials out with an alarm, it recites the alarm message over the phone and at the monitor site. The local voice mute command allows you to mute the voice repetitions at the monitor site.

To locally mute Express:

1. Press the SENSOR ON/OFF key
2. Press the MUTE key
Express will say "*On*" to indicate that the mute is on. It will say "*Off*" to indicate when the mute is off.
3. Repeat key sequence to change.

CHAPTER 4: ALARM PROGRAMMING

This chapter explains the keyboard commands for the monitoring functions of Express. This includes:

- Enable/disable inputs
- Configure input normality- The ID number
- Input recognition time
- Temperature scale
- Temperature limits
- Enable/disable temperature inputs
- Temperature recognition times
- Temperature calibration
- AC power monitoring enable/disable
- AC Power recognition time

ENABLE/DISABLE INPUTS

This function allows you to enable or disable an input (1-4) to dial out during an alarm. An enabled input will respond to an alarm and allow dial-out. A disabled input will not initiate a dial-out. This command is useful while you are wiring your inputs or at any other time you would like the alarms to be ignored. The default setting for all inputs is enabled (on).

To enable/disable inputs:

1. Press the SENSOR ON/OFF key
2. Press the corresponding number key (1-4) of the input you want to enable/disable
Express will say "*Off*" to indicate disabled or "*On*" to indicate enabled.
3. Repeat key sequence to change

CONFIGURE INPUT NORMALITY

Inputs must be configured as normally open or normally closed. The default for all inputs is open. See Chapter 2, page 7 for explanation on wiring inputs. It is useful to disable the inputs prior to wiring to prevent an alarm dial-out. After this is done, Express must initialize the wiring as normal. This is done by setting the unit's ID number. When the ID number is set, Express looks at the four inputs and establishes the present open/closed state as normal. Any change from that normal state is an alarm. The ID number is also usually programmed as the unit phone

number. This number is recited during a status report and alarm dial-out report.

To set the status of the inputs as normal:

1. Disable the input (see above)
2. Wire the input (see Chapter 2, page 7)
3. Press the SET key
4. Press the ID# key

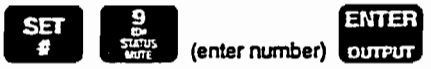
Express will say "*Enter number.*"

5. Using the number keys, enter the unit's phone number
6. Press the ENTER key

Express will say "*OK*" if the number was accepted.

7. Enable the input

The inputs are now considered normal. If a normally closed input becomes open, an alarm will occur. If a normally open input becomes closed, an alarm will occur.



To interrogate the ID number:

1. Press the WHAT IS key
2. Press the ID# key

Express will say "*Hello, this is ...*" followed by a recitation of the programmed ID# and a status report.

Note: This command will also clear alarms that occur during the status report. See page 32 for details. See page 36 for a more detailed description of the status report.

INPUT RECOGNITION TIME

The input recognition time is the length of time an input must have an alarm continuously before Express will recognize the condition. If an alarm exists and then clears within the recognition time, it is never considered an alarm. This is useful to prevent dialouts for momentary blips or on self-correcting equipment. Each input can be programmed with a different recognition time. The default recognition time is 3 seconds. You may program the recognition time from 0 seconds to 272 minutes.

To program the recognition time:

1. Press the SET key
2. Press the REC TIME key
3. Press the corresponding input key (1-4)

Express will say "*Enter minutes.*"

4. Using the number keys, enter minutes
5. Press the ENTER key

Express will say "*Enter seconds.*"

6. Using the number keys, enter seconds
7. Press the ENTER key

Express will say "*OK.*"

To interrogate the recognition time:

1. Press the WHAT IS key
2. Press the REC TIME key
3. Press the corresponding input key (1-4)

Express will recite the programmed recognition time for that input.

TEMPERATURE SCALE

Express can monitor temperature in degrees Fahrenheit or degrees Celsius. The default setting is Fahrenheit. **NOTE:** When switching from Fahrenheit to Celsius or vice versa, remember to reprogram your temperature limits accordingly.

To program the temperature scale:

1. Press the SENSOR ON/OFF key
2. Press the TEMP key

Express will either say "*On*" to indicate Celsius, or "*Off*" to indicate Fahrenheit.

3. Repeat key sequence to change

TEMPERATURE LIMITS

The following keyboard commands are used to set the low and high temperature limits. The default settings are Low Temp = 10° and High Temp = 100°. The range of programming is -60 to 300°F. Note: the sensor included with Express has a sensory range of only -60° to 175°F.

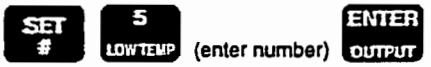
To program the low temperature limit:

1. Press the SET key
2. Press the LOW TEMP key

Express will say "Enter number."

3. Using the number keys, enter the low temperature number. If you want the number to be negative, press the PAUSE key followed by the number.
4. Press the ENTER key

Express will say "*OK.*"



To program the high temperature limit:

1. Press the SET key
2. Press the HIGH TEMP key

Express will say "Enter number."

3. Using the number keys, enter the high temperature limit. If you want the number to be negative, press the PAUSE key followed by the number.
4. Press the ENTER key

Express will say "*OK.*"

To interrogate the temperature limits:

1. Press the WHAT IS key
2. Press the LOW TEMP key to check the low temperature limit. Press the HIGH TEMP key to check the high temperature limit.

ENABLE/DISABLE TEMPERATURE INPUTS

This feature allows you to enable or disable the temperature input to dialout for a temperature alarm. When the temperature input is enabled, it will cause a dialout for an alarm. If it is disabled, it will not cause a dialout. It is helpful to disable the temperature inputs while wiring thermistors and setting limits to prevent tripping an alarm.

To enable/disable the low temperature alarm:

1. Press the SENSOR ON/OFF key
2. Press the LOW TEMP key

Express will say "*On*" to indicate that the low temperature alarm is enabled, or "*Off*" to indicate the input is disabled.

3. Repeat key sequence to change

To enable/disable the high temperature alarm:

1. Press the SENSOR ON/OFF key
2. Press the HIGH TEMP key

Express will say "*On*" to indicate that the high temperature alarm is enabled, or "*Off*" to indicate the input is disabled.

3. Repeat key sequence to change

TEMPERATURE RECOGNITION TIMES

The temperature recognition times are the length of time that a low or high temperature alarm must exist continuously before Express will recognize it as an actual alarm and start an alarm dialout. If an alarm exists and then clears within the recognition time, it is never considered an alarm. The default setting is 3 seconds. You may set the recognition time from 0 seconds to 272 minutes.

To program the low temperature recognition time:

1. Press the SET key
2. Press the REC TIME key
3. Press the LOW TEMP key

Express will say "*Enter minutes.*"

4. Using the number keys, enter the number of minutes
5. Press the ENTER key

Express will say "*Enter seconds.*"

6. Using the number keys, enter the number seconds
7. Press the ENTER key

Express will say "*OK.*"

To program the high temperature recognition time:

1. Press the SET key
2. Press the REC TIME key
3. Press the HIGH TEMP key

Express will say "*Enter minutes.*"

4. Using the number keys, enter the number of minutes
5. Press the ENTER key

Express will say "*Enter seconds.*"

6. Using the number keys, enter the number seconds
7. Press the ENTER key

Express will say "*OK.*"

To interrogate the low or high temperature recognition time:

1. Press the WHAT IS key
2. Press the REC TIME key
3. Press LOW TEMP key for the low temperature recognition time. Press the HIGH TEMP key for the high temperature recognition time.

Express will recite the programmed low or high temperature recognition time.

TEMPERATURE CALIBRATION

Due to tolerance variations or other factors, you may want to program an offset to calibrate the temperature input. The offset can be from 1 to 15, or -1 to -15. Setting a positive number will

add that number to the temperature reading. Setting a negative number will subtract.

To calibrate the temperature input:

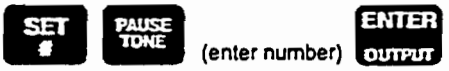
1. Press the SET key
2. Press the PAUSE key

Express will say "Enter number."

2a. To program a negative number (i.e. -7), press the PAUSE key again.

3. Enter the number
4. Press the ENTER key

Express will say "OK."



To interrogate the present calibration:

1. Press the WHAT IS key
2. Press the PAUSE key

Express will recite the programmed temperature calibration.

AC POWER MONITORING ENABLE/DISABLE

Express monitors AC power failure. This command enables or disables the power failure detection. When enabled, Express will monitor power and dial out if a valid failure occurs (see Chapter 4, page 32). When disabled, Express will not dial-out for a power alarm. The default setting is ON.

To enable/disable the power input:

1. Press the SENSOR ON/OFF key
2. Press the POWER key

Express will say "*On*" to indicate that the power input is enabled; OR, Express will say "*Off*" to indicate that the power input is disabled.

3. Repeat key sequence to change

POWER RECOGNITION TIME

The power recognition time is the length of time that a power failure must exist continuously before Express will recognize it as an actual alarm and start the dial-out sequence. The default setting is 5 minutes. You may program the power recognition time from zero seconds to 272 minutes.

To program the power recognition time:

1. Press the SET key
2. Press the REC TIME key
3. Press the POWER key

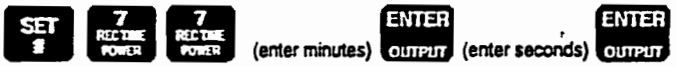
Express will say "*Enter minutes.*"

4. Using the number keys, enter the number of minutes
5. Press the ENTER key

Express will say "*Enter seconds.*"

6. Using the number keys, enter the number of seconds
7. Press the ENTER key

Express will say "*OK.*"



To interrogate the power recognition time:

1. Press the WHAT IS key
2. Press the REC TIME key
3. Press the POWER key

Express will recite the power recognition time.

EXIT DELAY

This command will clear any alarms that occur during the recitation of the status report. This is helpful if you must unavoidably cause an alarm (such as leaving the building using a door that is monitored) that you do not want to dial out but will not be able to clear by pressing ALARM CANCEL. If the alarm still exists after the status report is complete, the alarm is considered acknowledged and will not cause a dialout.

To clear alarms locally:

1. Press the WHAT IS key
2. Press the STATUS key

Express will say "*Hello, this is ...*" followed by the ID# and a status report. Any alarms that occur during this recitation will be automatically cleared at the end of the status report. Any alarms that still exist will be automatically acknowledged and will not initiate dialout.

CHAPTER 5: CALL-IN COMMANDS

The following three functions are call-in commands. This means that to utilize them, you must call Express to execute the command. These features are: alarm acknowledgment, status report and the phone commands. Alarm acknowledgment can be accomplished and the status report can be obtained by pulse (rotary) or touch-tone phone. To use the phone commands, you must be at a touch-tone phone.

ALARM ACKNOWLEDGMENT

When Express dials out with an alarm message, it will request *acknowledgment* before hanging up. Acknowledgment indicates to Express that the alarm message has been received. Upon acknowledgment, Express will cease the dialout sequence. The red LED for the alarm will stop blinking and glow steadily until the alarm condition has been resolved.

There are four ways that an alarm can be acknowledged: locally, by code, by call-in code acknowledgment and callback automatic acknowledgment.

1. Local alarm acknowledgment: On the Express keyboard is the ALARM CANCEL key. When an alarm exists, press the ALARM CANCEL key to acknowledge the alarm. Express will say "*OK*" and the red LED for that input will stop blinking.

2. Code acknowledgment: This method can only be used on a touch-tone phone. At the end of the alarm dialout message, Express requests acknowledgment that the message has been received by saying: "*Please acknowledge.*" You have 10 seconds to enter the code "555."

To do this, press the number key 5 on the touch-tone phone keypad three times. Express will say: "*OK. Have a good day.*" The unit will then hang up.

If you did not enter a correct code within 10 seconds, Express will say: "*Have a good day.*" Express will then hang-up. The alarm has not yet been acknowledged.

3. Call-in acknowledgment: This feature allows you to call-in to Express from a touch-tone phone and enter the acknowledgment code. To do this, call Express back after receiving an alarm dialout message. When Express answers, you will receive the alarm dialout message followed by a request for alarm acknowledgment: "*Please acknowledge.*" You have 10 seconds to enter the code "555" by pressing the corresponding key on the touch-tone phone keypad.

If the correct code is entered within 10 seconds, Express will say *"OK. Have a good day,"* to indicate that the alarm was acknowledged. The dialout sequence is stopped. The red LED will stop blinking and glow steadily until the alarm condition is resolved.

If you did not enter a correct code within 10 seconds, Express will say: *"Have a good day,"* and then hang up.

4. Callback acknowledgment: This method is controlled by the configuration of pin #2 on the Express circuit board (see Chapter 6, page 41. When shunt on pin #2 is in the on position, simply calling Express will acknowledge an existing alarm. You may call from either a touch-tone or pulse (rotary) phone to acknowledge the alarm.

To use, call Express. The unit will recite the dialout alarm message and then say: *"Alarm OK. Have a good day,"* to indicate that the alarm has been acknowledged.

STATUS REPORT

The status report feature allows you to call-in to Express and check the temperature and power status. If any alarm conditions exist, the alarm message will be recited. You can also listen in to on-site sounds and access the unit programming via phone commands. NOTE: If you happen to call Express during the alarm dialout sequence (when an alarm condition exists but is not yet acknowledged) you will not receive a status report. Express will consider the call as either a call-in code acknowledgment or callback acknowledgment (see above).

To obtain a status report, call Express. The following is an example of what the unit will recite when it answers:

This is 555-3833 (unit phone number).
This is the equipment room located in Building One North (ID message).
The temperature is 70 degrees (current temperature).
The electricity is on (power status).
No alarm exists (alarm status).
Listen for 10 seconds (user-programmed listen-in time).
(on-site sound monitoring for 10 seconds)
OK.
(10-second wait for phone command access)
Have a good day. (hangs up)

If an alarm condition has been acknowledged but still exists, Express will recite that input's recorded alarm message. Below is an example of a status report with an acknowledged smoke alarm.

This is 555-3833.
This is the equipment room located in Building One North.
The temperature is 70 degrees.
The electricity is on.
Smoke has been detected. A fire emergency is possible
(recorded alarm message).
Listen for 10 seconds.
(on-site sound monitoring)
OK.
(10-second wait for phone command access)
Have a good day.
(hangs up)

If the power is out but has not reached the recognition time to be considered an alarm, Express will recite the following message during the status report:

"... The temperature is 70 degrees.
The electricity is off.
No alarm exists.
Listen for ..."

If the power is out and has reached the recognition time to be considered an alarm, Express will recite:

"... The temperature is 70 degrees.
The electricity is off.
Listen for ..."

Access to programming: Following the on-site monitoring, Express allows you 10 seconds to access the unit via phone commands. You must use a touch-tone phone to use the phone commands. To initiate access, press any key on the phone keypad after Express says "*OK*" within 10 seconds.

If the security code is not set (see Chapter 3, page 23), or the remote security is off (see Chapter 6, page 42), Express will say "*OK*" after a key is pressed. You have gained access to the unit's programming. You may now use the phone commands to program Express remotely.

If the security code is set and the remote security bypass is on, Express will say: "*Enter code*" after a key is pressed. Using the phone keypad, enter the security code. If the code entered is correct, Express will say "*OK.*"

You may now program Express remotely.

If the security code entered is incorrect, Express will say: "*Error. Have a good day.*" The unit will then hang up.

NOTE: You cannot unlock the security code remotely. You must do so on the local keypad only (see Chapter 3, page 23).

PHONE COMMANDS

You can record, interrogate and program Express remotely using a touch-tone phone. This is accomplished through the phone commands. You may perform the following functions via touch-tone phone:

- What is:
  - Alert message 1
  - Alert message 2
  - Alert message 3
  - Alert message 4
  - ID message
- Record:
  - Alert message 1
  - Alert message 2
  - Alert message 3
  - Alert message 4
  - ID message
- Turn ON/OFF OUTPUT
- Enable/Disable:
  - Alerts 1-4
  - Low Temp
  - High Temp
  - Power

To use the phone commands, call Express. You will receive a status report. After the listen-in time, Express will say "*OK.*" Press ANY KEY within 10 seconds to access the phone command mode. If this is done, Express will say "*OK.*" You now have 30 seconds to enter a key command before Express will hang up. If you do not press a key within 30 seconds Express will say "Have a good day," and disconnect. More than one

command can be entered. The 30-second time out restarts at the end of each command.

To listen to a recorded alarm message:

1. Press the * key on your phone
2. Press the corresponding number key: 1-4, or
   Press number key 9 to listen to an ID message.

Express will recite the recorded message

To record a message remotely:

1. Press the # key
2. For an alarm message, press the corresponding number key: 1-4, or to record the ID message, press number key 9.
3. After the beep, say your message clearly. The alarm message can be up to 8 seconds long. The ID message can be up to 10.5 seconds long. Express will beep at the end of the time allotment.

To turn ON/OFF the output:

1. The output (pin #6) must be in the ON position for manual control. See Chapter 6, page 44 for explanation of pin #6.
2. To turn the output ON, press O (number 6) then N (number 6)
Express will say "*On.*"
3. To turn the output OFF, press O (number 6) then F (number 3)
Express will say "*Off.*"

If pin #6 is in the off position for automatic control, Express will say "*Error*" if you try to turn the output on or off.

To enable or disable an input to have an alarm:

1. Press the number key 0.
2. Press number key 1-4 to enable/disable alert 1-4
Press number key 5 to enable/disable Low Temp
Press number key 6 to enable/disable High Temp
Press number key 7 to enable/disable Power
3. Repeat key sequence to change

Express will say "*On*" to indicate the input is enabled or "*Off*" to indicate the input is disabled.

CHAPTER 6: USER OPTIONS

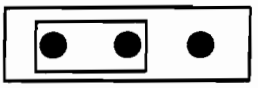
The following are user options designed to increase the versatility for Express's programming features. These options are accessed by setting shunts on pins on the circuit board. The pins are located to the right of the ON/OFF switch. There are seven user options available that are activated by placing the shunt in the ON or OFF position on the pin. This allows you to further customize Express to dial-out and monitor according to your application. These options include:

- Tone/Pulse Acknowledgment
- Remote Security
- Automatic Redial on Busy
- Thermistor Alternative
- Output Control
- Dialing Options

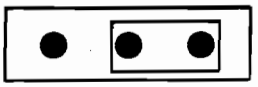
When the shunt is in the left position, it is considered off:
When the shunt is in the right position, it is considered on:

To move a shunt:
1. Using a pair of narrow-tipped or needlenose pliers, pull the shunt up off the pins.
2. Move the shunt to the on or off position
3. Carefully push the shunt back into place.

Shunt in OFF position:



Shunt in ON position:

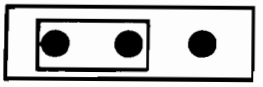


TONE/PULSE ACKNOWLEDGMENT
PIN#2: This feature enables you to acknowledge an alarm dial-out call from a pulse (rotary) phone. Use only when phones receiving the calls cannot use touch-tone. When the shunt is in the off position, alarm calls can only be acknowledged from a touch-tone phone by entering the code "555."

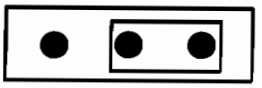
When the shunt on pin #2 is in the on position, alarm calls can be acknowledged by a pulse phone in addition to a touch-tone phone. Acknowledgment by pulse phone is accomplished by simply calling the unit back after receiving an alarm call. When

Express answers the callback, the alarm(s) will be acknowledged. See diagram.

Touch-Tone acknowledgment only:



Pulse/Tone callback acknowledgment:



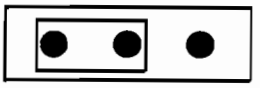
REMOTE SECURITY

PIN #3: This option is used to control access to Express's programming via telephone by enabling or disabling the security code (see Chapter 3, page 23). When the security code is enabled, the keyboard is locked. Locally, this means that only interrogation is permitted. When you call in, a full status report is provided but you may not use the phone commands to change programming unless you enter the security code (touch-tone phone only). The remote security shunt can be used to enforce or disable the security code during a call-in.

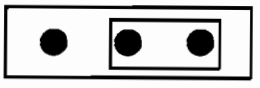
When the shunt on pin #3 is in the off position, the security code is disabled during a call-in. Interrogation and programming by the phone command are accessible without knowing the security code.

When shunt on pin #3 is in the on position and the security code is set, that code is needed to access programming with the phone commands.

Remote security code disabled:



Remote security code enabled:



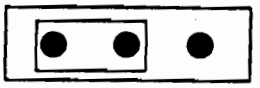
REDIAL ON BUSY

PIN #4: This feature determines what Express will do when it encounters a busy signal during an alarm dial-out. Depending on the position of this shunt, Express will either hang up and proceed to dial the next phone number, or it will dial the busy phone number again before going on to the next number.

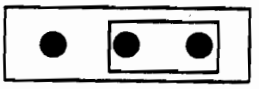
This feature is set by moving shunt on pin #4 on the circuit board. When the shunt is in the off position, Express will hang up if it encounters a busy signal and proceed with calling the next phone number.

When shunt on pin #4 is in the on position, Express will dial the phone number again if it encounters a busy signal. If the number is still busy, Express will hang up and proceed with the next phone number.

Hang up on busy:



Dialback on busy:



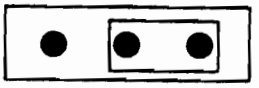
THERMISTOR ALTERNATIVE

PIN #5: Two different kinds of thermistors are compatible with Express for temperature monitoring — the 2.8K thermistor and the 10K thermistor. A 2.8K thermistor is included with Express. However, you may use the 10K sensor as an alternate. You would use the 10K thermistor to get a broader range of temperature monitoring, particularly the warmer temperatures. Also, the 10K thermistor is available in a variety of special packages for specific locations for temperature sensing, indoor/outdoor, etc. See Appendix B for specifications.

To use the alternate 10K thermistor, you must switch the shunt on pin #5 on the circuit board. When the shunt is in the off position (to the left), the board is configured to use the normal (2.8K) sensor. This is the factory default. To use the 10K thermistor move the shunt to the on position. See diagram below.

Normal – 2.8K thermistor:

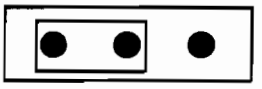
Alternate – 10K thermistor:



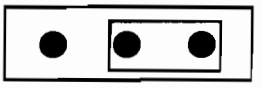
OUTPUT CONTROL

PIN #6: This pin allows you to control the output in one of two ways: automatically or manually. Automatic output control turns on the output when an alarm occurs on any of the inputs. The output is then turned off when the alarm is acknowledged. For manual control, you call into the unit and control the output via phone command. When the shunt is in the off position, it is configured for automatic control. Move the shunt to the on position for manual (phone command) control.

Automatic output control:



Manual output control:



DIALING PATTERN

PINS #7 AND #8: Dialing pattern is a calling process that allows you to prioritize your phone list by assigning dial-out for certain alarms to Phone #1 only. There are four dialing choices available with this feature. Each allows you to program Phone #1 to be called only on specific alarms. Choice 1 enables dial-out to all Phone numbers for all alarms. Choice 2 enables dial-out to Phone #1 for input alarm #1. Choice 3 enables dial-out to Phone #1 for temperature alarms only. Choice 4 enables dial-out to Phone #1 for a power alarm only. Dialing choices are set by moving the shunts on pins #7 and #8. When a shunt is to the left, it is in the off position. When it is moved to the right, it is in the on position. For each dialing choice below, there are two diagrams. One is a chart illustrating the dial-out sequence for each option. The second diagram shows the shunt configurations for each option.

Key for Dialout Charts:

An 'x' indicates that a phone number is dialed for an input alarm.
1-4 = dry contact inputs
TL = temperature low
TH = temperature high
PW = power

DIALING CHOICE 1:
This choice enables dial-out for all alarms to all Phone numbers. All 8 Phone numbers will be called for alarms 1-4, Temp Low, Temp High, and power failure. To program dialing choice 1, move shunts for pins #7 and #8 to the off position.

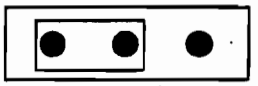
Dialout Chart - Choice 1

PHONE # 1 - 8

INPUTS	1	2	3	4	5	6	7	8
01	x	x	x	x	x	x	x	x
02	x	x	x	x	x	x	x	x
03	x	x	x	x	x	x	x	x
04	x	x	x	x	x	x	x	x
TL	x	x	x	x	x	x	x	x
TH	x	x	x	x	x	x	x	x
PW	x	x	x	x	x	x	x	x

Shunt Configuration - Choice 1

Shunt #7:



Shunt #8:

DIALING CHOICE 2:
This choice enables dial-out to Phone #1 for alarm 1 only. Phone #2-8 will be called for alarms 2-4, Temp Low, Temp High, and power failure. To program dialing choice 2, move shunt on pin #7 to the off position. Move shunt on pin #8 to the on position.

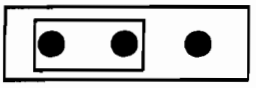
Dialout Chart - Choice 2

PHONE # 1 - 8

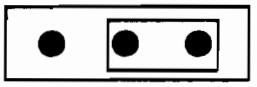
INPUTS	1	2	3	4	5	6	7	8
01	x							
02		x	x	x	x	x	x	x
03		x	x	x	x	x	x	x
04		x	x	x	x	x	x	x
TL		x	x	x	x	x	x	x
TH		x	x	x	x	x	x	x
PW		x	x	x	x	x	x	x

Shunt Configuration - Choice 2

Shunt #7:



Shunt #8:



DIALING CHOICE 3:
This choice enables dial-out to Phone #1 for Temp Low and Temp High alarms only. Phone #2-8 will be called for alarms 1-4 and power failure. To program dialing choice 3, move shunt on pin #7 to the on position. Move shunt on pin #8 to the off position.

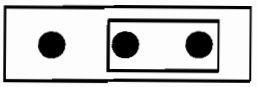
Dialout Chart - Choice 3

PHONE # 1 - 8

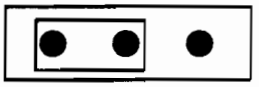
INPUTS	1	2	3	4	5	6	7	8
01		x	x	x	x	x	x	x
02		x	x	x	x	x	x	x
03		x	x	x	x	x	x	x
04		x	x	x	x	x	x	x
TL	x							
TH	x							
PW		x	x	x	x	x	x	x

Shunt Configuration - Choice 3

Shunt #7:



Shunt #8:



DIALING CHOICE 4:
This choice enables dial-out to Phone #1 for a power failure alarm only. Phone #2-8 will be called for alarms 1-4, Temp Low and Temp High. To program dialing choice 4, move the shunts on pins #7 and #8 to the on position.

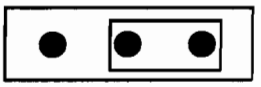
Dialout Chart - Choice 4

PHONE # 1 - 8

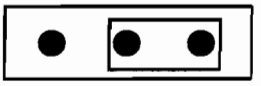
INPUTS	1	2	3	4	5	6	7	8
01		x	x	x	x	x	x	x
02		x	x	x	x	x	x	x
03		x	x	x	x	x	x	x
04		x	x	x	x	x	x	x
TL		x	x	x	x	x	x	x
TH		x	x	x	x	x	x	x
PW	x							

Shunt Configuration - Choice 4

Shunt #7:



Shunt #8:



CHAPTER 7: THE OUTPUT

Express has one relay output that can be controlled automatically or manually. Pin #6, located to the right of the ON/OFF switch on the circuit board, is used to determine how the output will be controlled. See Chapter 6, page 44 for more information on Pin #6.

AUTOMATIC CONTROL
For automatic control, Express will switch on the device wired to the relay output whenever an alarm occurs on any of the inputs. When the alarm is acknowledged **(NOT when the alarm is cleared)**, the output is switched off.

To have the output controlled automatically, you must position the shunt on pin #6 to the left (OFF position).

MANUAL CONTROL
You may manually control the output from the local keyboard, or remotely by touch-tone phone. To allow the output to be controlled manually, you must position Shunt #6 to the right (ON position).

To switch the output locally:
1. Press the SENSOR ON/OFF key
2. Press the OUTPUT key

Express will say either "On" or "Off." Repeat the steps to change.

To switch the output remotely:
You must use the phone commands to manually switch the output remotely. To do this, call into Express using a touch-tone phone. First, you will receive a status report. After the listen-in time, Express will say "*OK*." Press ANY KEY on the touch-tone keypad within 10 seconds to access the phone command mode. If this is done, Express will say "*OK*" again. You now have 30 seconds to enter a key command before Express will hang up. If you do not press a key within 30 seconds, Express will say "Have a good day," and disconnect.

1. To turn the output on, press **O** (number 6), then **N** (number 6). Express will say "*On.*"

2. To turn the output off, press **O** (number 6), then **F** (number 3). Express will say "*Off.*"

If Pin #6 is set in the off position for automatic control, Express will say "*Error*" if you try to turn the output on or off manually.

For more information on other phone commands, see Chapter 5, page 38.

POWER LIMITATIONS

Power limits for an output device that is using Express as a power source:

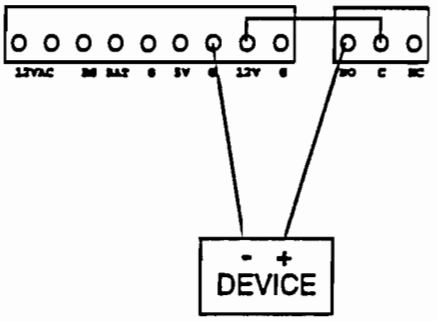
5V 100mA;
12V 100mA

Maximum switching capacity for an output using an external power source:

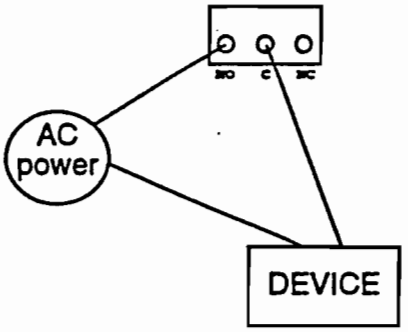
5A at 120VAC;
5A at 30VDC

EXAMPLE WIRING

12V device using Express power:



110VAC device using external power source:



POSSIBLE APPLICATIONS

Automatic Control - If you want to warn on-site personnel that an alarm is occurring, you can wire a horn or buzzer device to Express. In this instance, the output would be best controlled automatically so that whenever an alarm occurred Express would switch the horn on. When the alarm is acknowledged, the horn would be automatically switched off.

Manual Control - You may have a backup generator wired to Express's relay output that you would only want to switch on during a power failure (instead of any alarm). In this instance, you would have the output manually controlled so that when you received an alarm call that a power failure is occurring, you can call Express back and switch the output on. When the power is restored, you can call Express again and switch the generator off.

CHAPTER 8: PROGRAMMING SUMMARY

After Express has been completely installed, you are ready to begin programming the unit. It is advisable to disable the inputs while programming to avoid a dial-out if you accidentally trip an alarm. Remember to enable the inputs after programming has been completed. The following is a summary of the possible programming commands. Refer to the programming chapters 3 and 4 for explanation on how to use each command. This section is intended to help you understand the commands and organize your programming.

MONITORING FUNCTIONS

1. Disable inputs 1-4. This action will allow you to wire and set the dry contact inputs without tripping an alarm dial-out.

2. Wire inputs 1-4.

3. Configure inputs as normally opened or normally closed. This command determines what will be the normal or alarm status for each input 1-4. When you set the ID number, the present open/closed state of your sensors will be considered *normal.* For example, if you have input 1 wired as a closed input, setting the ID number will make it normally closed. If the input should be opened, an alarm will result.

4. Set input recognition time. This command determines the length of time an alarm condition must exist before it is considered an alarm. It helps you to minimize alarm dial-outs for momentary and/or self-correcting alert incidents. For example, input 1 monitors fluid depth in a brewing vat. Liquid is periodically poured into and drained from the vat. This action causes the liquid to splash above the high fluid mark, resulting in an alarm. However, the fluid quickly settles, just as personnel arrive at the site to siphon the dangerous excess. Setting the recognition time for input 1 to 5 minutes would allow the liquid to stabilize, preventing a false alarm.

5. Enable inputs 1-4. The inputs are now operational and monitoring chosen conditions.

6. Disable temperature inputs. This will allow you to determine Fahrenheit/Celsius, set limits and recognition times without causing an alarm dialout.

7. Determine temperature scale. Express has the capability to monitor in Fahrenheit or Celsius. You should determine the temperature scale before setting limits so that the temperature readings will make sense in your application.

8. Set low and high temperature limits. The range of these limits depends directly on the temperature scale you chose (°F or °C) and the type of thermistor wired (2.8K or 10K).

With the 2.8K thermistor (included) the range is:
-60°F to 175°F
-50°C to 80°C

With a 10K thermistor (optional) the maximum* range is:
-60°F to 300°F
-50°C to 150°C

*Note: The range may be less depending on the sensor used.

It is extremely important to choose the appropriate temperature scale for your application and to properly configure the thermistor before setting limits. Meaningless temperature readings and alarms will result otherwise.

9. Temperature recognition times. This command determines the length of time a low or high temperature condition must exist before Express recognizes it as an alarm. This will prevent dialouts from occuring for momentary and/or self-correcting temperature alerts.

10. Enable temperature inputs. Express is now temperature operational.

11. Enable or disable AC power monitoring. Express is capable of monitoring AC power failure. This feature is built-in, no external wiring is required. You can enable or disable the power detection. When enabled, Express will dial out for a power failure. When disabled, Express will not dial out if a power failure occurs. The default for this parameter is ENABLED.

12. Power recognition time. This is the length of time a power failure condition must exist before Express considers it an alarm. This feature helps eliminate dialouts during power blips or minor brownouts.

COMMUNICATIONS FUNCTIONS

Express is now prepared for alarm monitoring. Next, you must program your alarm voice messages, Phone numbers, and related dialing specifications.

1. Voice messages. Express's unique digital speech technology allows you to record your own voice for the 4 input alarm messages and an ID message. You have 8 seconds per message for each of the 4 input messages, and 10.5 seconds for the ID message. You can rerecord your messages as often as you wish. Messages may also be recorded remotely over a touch-tone phone. Messages are stored in nonvolatile memory to prevent loss during a power failure or storage.

When recording, speak clearly. This is important locally and remotely. Hold the microphone about 12 inches from your mouth, You may have to experiment to see what voice level records best for you.

2. Dial-out telephone numbers. Express can dial up to eight 32-digit phone numbers. These phone numbers are dialed sequentially, so program the first number you want called as Phone #1, the second as Phone #2, etc.

You can also incorporate a pause, pound, or asterisk into the phone number for special dialing circumstances. For example, Express has the capability to call out to a beeper. The desired result when calling a beeper is: 1) Express dials the phone number, 2) a beeper service will answer, 3) the service will look for digits after that to send to the beeper.

3. Tone or pulse dialing. Express' phone numbers can be dialed out in either touch-tones or pulse depending on your line service. This parameter programs all 8 Phone numbers as tone or pulse. The default is TONE.

4. Rings until answer. This parameter determines how many times Express will allow the phone to ring before answering. For example, if you set this to 4, Express will wait 4 rings and then answer. This feature is also used in conjunction with the Telephone Answering Device (TAD) compatibility.

5. TAD compatibility. Express can operate on the same phone line as other telephone answering devices such as a modem or answering machine. To use this feature, program Express' rings

until answer to a larger number than the other answering device's rings. For example, Express and an answering machine are on the same phone line. You program the answering machine to answer on the 3rd ring. Set Express to answer on the 5th ring. When you call Express to obtain a status report, you will want to bypass the answering machine. To do this, allow the phone to ring twice, hang up, and call again. On the second call Express will override the answering machine by answering on the first ring.

6. Call delay time. This is the amount of time Express will wait after an alarm is recognized before it starts the dial-out sequence. NOTE: This feature is different from the input recognition times. Recognition time is the amount of time Express waits to declare an alarm. Call delay is the amount of time Express waits to start the dialout for a declared alarm.

7. Intercall delay time. After the initial phone call, this is the amount of time Express will wait between calls before dialing the next number. For example, you set the intercall delay time to 2 minutes. When an alarm occurs and Phone #1 has been called, Express will wait 2 minutes after hanging up with Phone #1 before calling Phone #2.

8. Voice repetitions. This parameter determines how many times Express will repeat the alarm message when it dials out. For example, if you have this feature set to 5, Express will repeat its message 5 times before requesting acknowledgment when an alarm dialout is answered.

9. Max calls. The maximum number of calls Express will dial if none of the calls are acknowledged is determined by this feature. If the number of calls reaches the max calls value, Express will automatically acknowledge the alarm and the dialout will be stopped. Of course, when a call is acknowledged the dial-out sequence is automatically stopped.

NOTE: If only one Phone Number is programmed, Express will dial a maximum of 15 times, regardless of the value of max calls.

10. Listen-in time. Express allows you to listen in to sounds at the monitor site through its microphone when you call in for a status report. This parameter allows you to determine the amount of time for sound monitoring.

11. Local mute. This parameter allows you to mute the local

voice when Express dials out for an alarm. When the mute is on, the dial-out alarm message will not be heard at the monitor site. When the mute is off, Express will repeat the message locally as well as over the phone.

USER OPTIONS

There are two other features available to further control and customize the dial-out sequence: Redial on Busy and Dialing Pattern. These two features are enabled by configuring PIN #4, PIN #7 and PIN #8 on the circuit board.

Redial on Busy. This feature enables Express to redial a phone number that is busy. Redial on Busy is determined by PIN #4 on the circuit board. Depending on the position of the shunt, Express will either proceed to the next phone number when it encounters a busy signal, or it will wait 10 seconds and dial the phone number again. If on the second try the number is still busy, Express will proceed to the next phone number.

Dialing Pattern. This feature allows you to organize your dialout sequence so that Phone #1 will be called for specific input alarms rather than all input alarms. There are four dialing choices that are governed by the positions of PIN #7 and PIN #8 located to the right of the ON/OFF switch on the Express circuit board. This option is useful if you want Phone #1 to have Express dial out to a municipal service, such as the fire company. In this instance, you would only want it called for a fire alarm. You would configure input 1 to monitor fire/smoke. Program in the fire company phone number as Phone #1. Configure the priority calling pins #7 and #8 to the dialing choice #2. Now an alarm on input 1 will only call Phone #1. All other input alarms will call the remaining 7 Phone numbers.

CHAPTER 9: EXPRESS EXAMPLES

This section is provided to illustrate how Express operates. An example programming strategy is outlined below. The communications programming, monitoring setup and pin configurations are charted to give you a reference for the sample Express. Next, possible alarm situations that you may encounter are given to explain the process by which Express will respond. This section does not provide all the possible circumstances that may happen, but it will give you an understanding of how the many features of Express interplay to create a comprehensive monitoring package. Refer to Chapters 3, 4 and 5 for how to program Express. See Chapter 8 for a summary of each parameter and examples of how they are used.

The following is a quick outline of the alarm situations discussed in this chapter. Refer to the corresponding heading for further details:

EXAMPLE 1:
An alarm on input 1 demonstrates the dialing pattern and touch-tone acknowledgment.

EXAMPLE 2:
An alarm on input 2 illustrates the function of the alarm recognition time.

EXAMPLE 3:
An alarm on input 3 demonstrates the redial on busy feature and callback acknowledgment.

EXAMPLE 4:
An alarm on input 4 explains what happens when an input has been disabled.

EXAMPLE 5:
A low temperature alarm demonstrates the dialout sequence when a call is answered but not acknowledged, and callback acknowledgment.

EXAMPLE 6:
A high temperature alarm illustrates the max calls parameter.

EXAMPLE 7:
A power alarm explains on-site acknowledgment.

SAMPLE STRATEGY
Below is a sample Express setup. This setup will be used and referred to in explaining how Express operates according to its programming.

COMMUNICATIONS PARAMETERS

Voice Messages:
Location ID message: "This is the equipment room located in Building One North."
Input alarm message 1: "Water tank level exceeds acceptable limits."
Input alarm message 2: "Boiler 3 pressure has surpassed the safe limits."
Input alarm message 3: "Smoke has been detected. Fire emergency possible."
Input alarm message 4: "Motion sensors have detected an intruder on the premises."

Dial-out Telephone Numbers:
Phone 1: 555-1111
Phone 2: 555-1222
Phone 3: 555-1233
Phone 4: 555-1234
Phone 5: 1-215-555-4555
Phone 6: 1-609-555-4566
Phone 7: 555-4567
Phone 8: 555-7888

TONE Dialing: ON
Rings Until Answer: 5
Call Delay Time: 150 seconds (2 min. 30 sec.)
Intercall Delay Time: 3 minutes 0 seconds
Voice Repetitions: 4
Max Calls: 50
Listen-In Time: 10 seconds
Security Code: 2327
Callback Acknowledgment (Pin #2): ON
Security Bypass (Pin #3): OFF
Redial on Busy (Pin #4): ON
Dialing Pattern (Pins #7 & #8): Dialout Option #1
ID #: 555-3833

MONITORING PARAMETERS

Input	enabled/disabled	open/closed	rec. time	condition
Input 1: level	Enabled	N/O	2 min	Tank water
Input 2:	Enabled	N/O	30 sec	Pressure
Input 3:	Enabled	N/O	30 sec	Smoke/fire
Input 4:	Disabled	N/C	1 min	Intrusion
Low Temp:	Enabled		10 min	Low limit: 60°F
High Temp:	Enabled		10 min	High limit: 70°F
AC Power:	Enabled		30 min	Power failure

EXPRESS EXAMPLES

The following section presents hypothetical alarm situations for each of the inputs and illustrate what sequence of steps Express will take depending on its programming.

EXAMPLE 1

Alarm Recognition:
The water level in Tank 1 has exceeded acceptable limits. The normally open sensor has closed causing an alarm. This condition has existed longer than 2 minutes (recognition time for input 1) and Express has recognized the condition as a valid alarm. The red LED for input 1 on the Express face plate is lit and blinking to indicate to on-site personnel that an alarm condition exists and has not been acknowledged.

Dialout:
1. After 2 minutes 30 seconds (call delay time), Express will begin the alarm dial-out sequence.
2. Express dials Phone #1 and receives no answer.
3. Express hangs up. This will count as one call toward the max calls total of 50.
4. Express waits 3 minutes (intercall delay time) and dials Phone #2. Again, Express receives no answer and hangs up.
5. Express waits 3 minutes and dials Phone #3. The call is answered.
6. Express recites the following dialout alarm message:

"Hello, this is 555-3833. This is the equipment room located in Building One North. Water tank level exceeds acceptable limits."

The dialout message is repeated four times. At the end of the fourth repetition, Express will request acknowledgment of the alarm.

"Please acknowledge."

Acknowledgment:
1. The receiver is at a touch-tone phone; she enters the code "555" within 10 seconds to acknowledge the alarm.
2. Express says: "OK. Have a good day," and hangs up. The alarm is acknowledged.

Once the alarm is acknowledged, the dialout sequence is stopped. The red LED will glow steadily but not blink as long as the condition still exists. The max calls counter is reset to zero.

EXAMPLE 2

Alarm recognition:
The pressure in boiler 3 has suddenly exceeded safe levels. Input 2 is wired to monitor the pressure in boiler 3. The N/O sensor closes to indicate the alarm. In response, a pressure-sensitive valve opens. This self-correcting mechanism reduces the pressure to acceptable levels within 15 seconds. The alarm recognition time for Input 2 is 30 seconds. Because the alarm condition did not exist for 30 seconds, Express did not recognize the situation as a valid alarm. No dialout occurred.

NOTE: For the remaining examples, the Dialing Pattern has been changed to illustrate an alternate dialing choice. Dialing Choice #2 enables the alarm dialout to Phone #1 for an alarm on input 1 only. Phone # 2-8 will be called for alarms 2-4, Low Temp, High Temp and power failure.

EXAMPLE 3

Alarm recognition:
A frayed wire sparks and sets off a small fire and smoke begins to fill the room. Input 3 detects smoke and the sensor closes. After the 30 second recognition time, Express recognizes the

condition as a valid alarm. The red LED for Input 3 will be lit and blinking. After the 2 minute, 30 second call delay time, Express begins the alarm dialout.

Dialout:
1. The first number Express dials is Phone #2 (555-1222). This is because Phone #1 is reserved for alarms on input 1. There is no answer at Phone #2.
2. Express hangs up and waits 3 minutes.
3. Express then dials Phone #3 and receives a busy signal.
4. Express hangs up, waits 10 seconds and dials Phone #3 again (the redial on busy option is on).
5. This time the call is answered. The following message is repeated four times:

"Hello, this is 555-3833. This is the equipment room located in Building One North. Smoke has been detected. Fire emergency possible."

Acknowledgment:
The receiving phone is pulse (rotary) dial. After the message has been repeated, Express requests acknowledgment:

"Please acknowledge."

Since Phone #3 is a pulse phone, it is not possible for the receiver to enter the acknowledgment code. However, the callback acknowledgment feature is set to on so the receiver can call the unit back to acknowledge that the alarm message was received. Because the code was not entered within 10 seconds, Express says, "Have a good day."

To acknowledge the alarm, the receiver must call back the unit.
1. Dial the unit phone number: 555-3833.
2. Express recites the dialout alarm message.
3. Simply stay on the line. After 10 seconds, Express will say, "Alarm OK. Have a good day." This indicates that the alarm has been acknowledged.

The dialout sequence has been stopped. The red LED will glow steadily until the alarm condition has been resolved.

EXAMPLE 4

Alarm recognition:
A suspicious character enters through the side door monitored by a sensor wired to input 4. The normally closed sensor is thus opened, tripping the sensor. However, input 4 has been disabled therefore, no alarm dialout will occur. The red LED will turn on after the one minute recognition time. It will glow steadily (no blinking) until the alarm condition has been resolved.

EXAMPLE 5

Alarm recognition:
The tropical fish aquarium temperature has dropped below 60°F, and is still falling. The tank heater has malfunctioned. Low tank temperature is monitored on the temperature input. This condition has existed for 10 minutes (recognition time) and the fish are beginning to shiver. Express recognizes the condition as an alarm. The red LED for low temp is blinking to alert on-site personnel.

Dialout:
1. After the 2 minute, 30 second call delay, Express begins the alarm dialout sequence.
2. Since this unit is programmed for Dialing Choice #2, the first Phone number Express calls for a low temperature alarm is Phone #2.
3. It receives no answer and hangs up.
4. After the 3 minute intercall delay time, Express dials Phone #3. Again, no answer.
5. After 3 minutes, it dials Phone #4. Still receiving no answer, Express hangs up, waits 3 minutes and dials Phone #5, then Phone #6, Phone #7, and Phone #8 – waiting the intercall time between each call. (Total calls = 7)
6. Express calls Phone #2 again. This time, the call is answered.
7. Express recites the following alarm message four times:

"Hello, this is 555-3833. This is the equipment room located in Building One North. The temperature is low. The temperature is 54 degrees."

After the last repetition, Express will request acknowledgment:

"Please acknowledge."

Acknowledgment:
The receiver did not enter the acknowledgment code within the 10-second time requirement. Express says:

"Have a good day."

1. Express then hangs up. The receiver did not call the unit to acknowledge the alarm.
2. Express waits 3 minutes (intercall delay), and calls Phone #3.
3. The call is answered. Express recites the above alarm message and requests acknowledgment.
4. Because the receiver is at a pulse phone, he cannot enter the acknowledgment code,
5. However, after Express has hung up, he calls the unit back, thus acknowledging the alarm.

The dialout sequence has been stopped. The red LED for low temp stops blinking and glows steadily until the condition is corrected.

EXAMPLE 6

Alarm recognition:
Now the heater is back on in the fish aquarium. Unfortunately, it has gone haywire. The water temperature has risen above 70°F and the fish are hopping. After 10 minutes, this condition still exists. Express recognizes it as a valid alarm. The red LED for high temp is on and blinking. After the 2 minute 30 second call delay time, Express begins the dialout sequence.

Dialout:
1. Express dials out to Phone #2 and receives no answer.
2. The unit waits the 3 minute intercall delay time and then dials Phone #3. No answer.
3. The unit waits 3 minutes and then dials Phone #4. The call is answered by an answering machine.
4. Express recites the following message:
"Hello, this is 555-3833. This is the equipment room located in Building One North. The temperature is high. The temperature is 73 degrees."

Express repeats this message four times and then requests acknowledgment.

"Please acknowledge."

Acknowledgment:
Since the receiver is an answering machine, it cannot enter the acknowledgment code. After 10 seconds, Express says "Have a good day."

1. Express waits the 3 minute intercall delay time and then dials Phone #5. (Total calls = 4)
2. The unit receives no answer, hangs up, waits 3 minutes and dials Phone #6. The phone is busy.
3. Express hangs up and dials Phone #6 again (The dialback option is on). The line is still busy.
4. Express hangs up, waits 3 minutes and dials Phone #7.

Express does not receive an answer from any of the Phone numbers. There was no callback acknowledgment. After 50 phone calls (max calls), Express automatically acknowledges the alarm and stops the dialout sequence. The red LED will remain on as long as the alarm condition still exists.

EXAMPLE 7

Alarm recognition:
The building power blacked out at 7:25AM. At 7:55AM, the power is still out, and Express recognizes the failure as an alarm (30-minute recognition time).

Dialout:
1. After the 2-minute 30-second call delay time, Express begins the dialout to Phone #2.
2. The call is not answered, so Express hangs up.
3. After the 3-minute intercall delay time, the unit dials Phone #3 and again receives no answer.
4. In the meantime, the plant manager arrives at the building at 8AM. She discovers the power failure and checks Express to see if the dialout sequence has been started and if the alarm has been acknowledged.

Acknowledgment:
The manager sees that the alarm has been recognized (because it existed beyond 30 minutes), and that it has not yet been acknowledged (the red LED is still blinking). She presses the alarm cancel key to acknowledge the alarm. Express says: "OK." The dialout sequence has been stopped. The red LED will glow steadily until the condition is resolved or the battery backup is exhausted.

CHAPTER 10: TROUBLESHOOTING

Problems with the Express can range from simply making sure the unit is plugged in, to lightning damage. This chapter is provided to help you pinpoint and solve functioning problems. It is divided into the common areas where problems occur. They are:

- Communications / Dialout problems
- Incorrect temperature readings
- Monitoring problems

If the unit still does not work after you have tried the following solutions, call our Customer Service Department at (610)558-2700 or follow the guidelines for sending the unit in for repair.

Problem	Possible Cause	Solution
Communications / Dialout:		
Unit won't dial out	Phone number incorrectly programmed	See Chapter 3, page 16.
	Incorrect tone/pulse selection	See Chapter 3, page 18.
	Incompatible phone line	Express must be hooked up to a standard 2-wire analog phone line, NOT a digital extension to a phone system. If the unit won't dial out and it is not the two previous problems, try hooking the unit up to a phone line that you know is standard (such as a residential or home phone). If it works, then there is an incompatibility with the other phone system. If this does not work, call Phonetics Customer Service Department.
Unit won't answer phone	Incorrect programming of rings until answer	When used on a proper extension line, some phone systems won't let the phone ring past 4 rings. If rings until answer is greater than 4, you cannot get to the unit. Try setting the rings to less than 4 (see Chapter 3, page 18). If it still does not work, then the phone line may be incompatible. See below.
	Incompatible phone line	Express must be hooked up to a standard 2-wired analog phone line, NOT a digital extension to a phone system. If you cannot call into the unit, try hooking it up to a phone line that you know is standard (such as a residential or home phone). If you can call in, then there is an incompatibility with the other phone system. If you still cannot call in, call Phonetics Customer Service Department.

Problem	Possible Cause	Solution
Incorrect temperature readings:		
Temperature reads -60°	Temperature sensor is either disconnected or has broken wires	Check wires to temperature sensor and connect or replace wiring.
Temperature reads 175°	Temperature sensor wires touching or shorted	Verify and correct wiring.
Temperature inaccurate	The temperature sensing may be affected by ambient heat source (i.e.. direct sunlight, heating vent)	Move the temperature sensor to a different location.
	Incorrect Fahrenheit/Celsius selection	See Chapter 4, page 27.
Monitoring Problems:		
Alarm status of alert input incorrect	Incorrect input normality	Reset input normality. See Chapter 4, page 25.
False power out alarms	Power recognition time too short	It is common for the power to have brief interruptions. To solve a false alarm, program the power recognition time longer.
Unit does not recognize any alarms.	Inputs disabled for alarm	Enable the inputs for alarm. See Chapter 4, page 25.

1 YEAR LIMITED WARRANTY

1. **WARRANTOR:** Dealer, Distributor, Manufacturer

2. **ELEMENTS OF WARRANTY:** This Product is warranted to be free from defects in materials and craftsmanship with only the limitations and exclusions set out below.

3. **WARRANTY AND REMEDY:**

One-Year Warranty — In the event that the Product does not conform to this warranty at any time during the time of one year from original purchase, warrantor will repair the defect and return it to you at no charge

This warranty shall terminate and be of no further effect at the time the Product is (1) damaged by extraneous cause such as fire, water, lightning, etc. or not maintained as reasonable and necessary; (2) modified; (3) improperly installed; (4) repaired by someone other than warrantor; (5) used in a manner or purpose for which the Product was not intended; or (6) sold by original purchaser.

WARRANTORS' OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT. THIS WARRANTY DOES NOT COVER PAYMENT OR PROVIDE FOR THE REIMBURSEMENT OF PAYMENT OF INCIDENTAL OR CONSEQUENTIAL DAMAGES.

It must be clear that the warrantors are not insuring your premises or guaranteeing that there will not be damage to your person or property if you use this Product. The warrantors shall not be liable under any circumstances for damage to your person or property or some other person or that person's property by reason of the sale of this product or its failure to operate in the manner in which it is designed. The warrantors' liability, if any, shall be limited to the original cost of the Product. The warrantors assume no liability for installation of the Product and/or interruptions of the service due to strikes, riots, floods, fire, and/or any cause beyond Seller's control.

4. **PROCEDURE FOR OBTAINING PERFORMANCE OF WARRANTY:** In the event that the Product does not conform to this warranty, the Product should be shipped or delivered freight prepaid to a warrantor with evidence of original purchase.

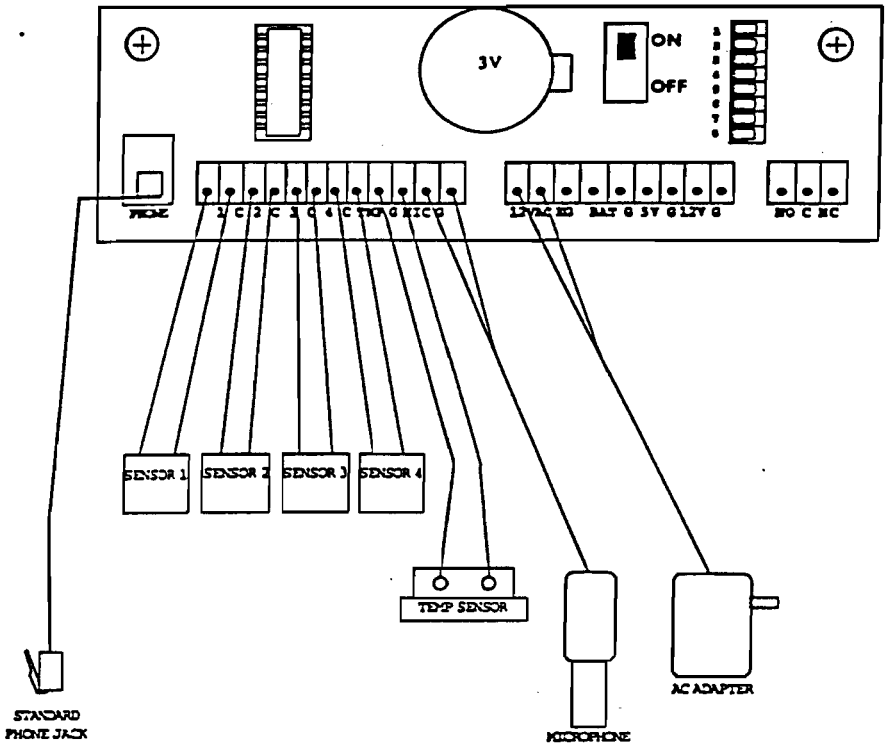
5. **LEGAL REMEDIES:** This warranty gives you specific legal rights, and you may also have other rights which vary from state to state to the extent allowed by law expressly in lieu or any other express or implied warranty, condition, or guarantee.

Effective date 7/01/90

PHONETICS, INC.
901 Tryens Road
Aston, PA 19014
(610) 558-2700
Fax (610) 558-0222

Sensaphone® *EXPRESS*

Wiring Summary



Specifications

Mounting: Mount in an upright position on a wall.
Mounting dimensions: 10.75" x 6"; holes: .25"

Dimensions: With enclosure, 11.7" x 8.4" x 5.9"

Power: AC adapter with 6 ft. cord provided, plugs into standard outlet.

Phone: Standard RJ11C phone jack on 10 ft. cord provided.

Temperature monitoring: 2.8K remote temperature sensor on 25 ft. cable provided.

Microphone: Microphone on 25 ft. cord provided.

Dry contact inputs 1 to 4: Two conductor 22-gauge wire required. Not included.

APPENDIX A

The sensors listed are the most commonly used input devices. However, there is a virtually unlimited variety of sensor/switch input devices available at commercial or industrial electrical supply houses. They can provide a device to monitor virtually any condition that might be required for your business, industrial or residential needs. Contact Phonetics, Inc. at (610) 558-2700 for more information.

MODEL NUMBER	SENSOR/SWITCH
FGD-0006	Magnetic Reed Switch
FGD-0007	Passive Infra-Red Detector
FGD-0011	Optical Pick-up
FGD-0013	Water Detection Sensor
FGD-0022	Temp Alert
FGD-0025	Line Seizure Module
FGD-0027	Humidistat

APPENDIX B

10K THERMISTOR LOOK-UP TABLE

DEGREES (Celsius)	DEGREES (Fahrenheit)	RESISTANCE (Ohms)
-37	-35	203.60K
-35	-30	173.60K
-32	-25	148.30K
-29	-20	127.10K
-26	-15	109.20K
-23	-10	94.07K
-21	-5	81.23K
-18	0	70.32K
-15	5	61.02K
-12	10	53.07K
-9	15	46.27K
-6	20	40.42K
-4	25	35.39K
-1	30	31.06K
2	35	27.31K
4	40	24.06K
7	45	21.24K
10	50	18.79K
13	55	16.65K
16	60	14.78K
18	65	13.15K
21	70	11.72K
24	75	10.46K
27	80	9.35K
30	85	8.38K
32	90	7.52K
35	95	6.75K
38	100	6.08K
41	105	5.48K
44	110	4.95K
47	115	4.47K
49	120	4.05K
52	125	3.67K
55	130	3.33K
58	135	3.31K
60	140	2.76K
63	145	2.52K
66	150	2.30K
69	155	2.10K
71	160	1.92K
74	165	1.76K
77	170	1.61K
80	175	1.48K
83	180	1.36K
86	185	1.25K
88	190	1.16K
91	195	1.07K
94	200	0.98K
97	205	0.91K

APPENDIX C

RETURNING UNITS FOR REPAIR

In the event that Express does not function properly and you cannot reprogram it, we suggest that you do the following:

1) Carefully write down your observations of Express's malfunctioning.

2) Call Phonetics' Customer Service at (610) 558-2700 if any instructions are not clear or if you have any questions.

If the unit must be sent to us for servicing, do the following:

1) Unplug the AC power supply from the wall outlet, disconnect the battery, and disconnect all sensors from the alert inputs.

2) Carefully pack unit into its original container or a sturdy shipping box. Be certain to use sufficient cushioning material to avoid damage in transit.

3) Address package to:

SERVICE DEPARTMENT
PHONETICS, INC.
901 TRYENS ROAD
ASTON, PA 19014

4) Ship prepaid and insured via UPS or US Mail to ensure a traceable shipment with recourse for damage or replacement.

5) To avoid processing delays, be sure to include the following:

a) Your name, address, and phone number

b) Model and Serial numbers

c) A letter explaining Express's problem

SENSAPHONE WARRANTY REGISTRATION CARD

NAME _____

COMPANY NAME _____

STREET _____

CITY _____ STATE _____ ZIP _____

PHONE (___)_____-_____ EXT _____

MODEL # _____ SERIAL # _____

DATE PURCHASED _____

PURCHASED FROM _____

1. Which of the following best describes the type of facility where your Sensaphone is being used?

__Agriculture
__Animal Farming
__Aquaculture
__Data Center
__Educational
__Government/Military
__Greenhouse
__Manufacturing
__Other _____
__Medical
__Oil & natural Gas
__Other Communication Facility
__Retail
__Telecommunications
__Utilities
__Vacation Home
__Water/Wastewater Treatment

2. Within the above facility, will the Sensaphone be monitoring:

__The environmental conditions within the facility
__The computer room
__Other equipment within the facility
__Other_____

3. Which features of your Sensaphone are you using?(Please check all that apply)

__Temperature __Voice __Power Failure __Modem
__Sound Level __Fax __Alert Inputs __Internet E-mail
__Outputs __Data Logger __Other_____

4. How did you learn about Sensaphone?

__Trade Show
__Internet
__Card Deck Advertisement
__Other advertisement
__Catalog
__Referral: __Phone Company __Friend/Neighbor
__Electric Company __Specification/Contract
__Sensaphone Reseller __Other_____

5. Would you like to be placed on our mailing list for new product updates and announcements?

__Yes __No

- over -

6. Have you seen any other similar products?

__No
__Yes_____

7. Why did you select Sensaphone?

_____
_____
_____

8. How can we improve our products or services?

_____
_____
_____

9. Is there someone you know that would also benefit from our Sensaphone products?

NAME _____

STREET _____

CITY _____ STATE ____ ZIP_____

PHONE (_____) _____ - _____ EXT _____

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 22 CHESTER, PA 19013-9998

POSTAGE WILL BE PAID BY ADDRESSEE

Phonetics, Inc.
901 Tryens Road
Aston, PA 19014-9952

MSA

Model 5100 Monitoring System

Instruction Manual

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING, MAINTAINING OR SERVICING THIS PRODUCT. Like any piece of complex equipment, this product will perform as designed only if installed, used and serviced in accordance with the manufacturer's instructions. OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to this product are voided if the product is not installed, used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

Instrument Division 1-800-MSA-INST or FAX (724) 776-8783
MSA International (412) 967-3228 or FAX (412) 967-3451
In Canada 1-800-267-0672 or FAX (416) 663-5908

Manufactured by
MINE SAFETY APPLIANCES COMPANY
PITTSBURGH, PENNSYLVANIA 15230

(L) REV 8

486292

MSA
Permanent Instrument Warranty

1. **Warranty-** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of eighteen (18) months from date of shipment or one (1) year from installation, whichever occurs first, provided it is maintained and used in accordance with Seller's instructions and/or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, filament units, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

2. **Exclusive Remedy-** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.

3. **Exclusion of Consequential Damage-** Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of nonoperation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

General Warnings

⚠ WARNING

1. The Monitor described in this manual must be installed, operated and maintained in strict accordance with its labels, cautions, warnings, instructions, and within the limitations stated.
2. The control module housing must be located in a nonhazardous area.
3. Use genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the Model 5100 Monitor, beyond the scope of these instructions or by anyone other than a certified MSA serviceman, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain severe bodily injury or death.

Failure to follow the above warnings can result in serious personal injury or death.

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Model 5100 General-Purpose Enclosure Installation Outline Drawing A-2

Section 1
General Information

General Description

The Model 5100 Monitoring System is designed to monitor various sensors.

There are two models; a frequency type of sensor input and a 4 to 20 mA type of sensor input. This manual applies to both models. To identify your model, see Appendix A "Installation Outline Drawing." This drawing describes the assemble-to-order (ATO) code. Locate your ATO code from the invoice or packing slip and determine the options you have ordered.

Each Monitor has three set points per channel to offer the user maximum Hazard Level set point flexibility. The Monitor is a dual-channel, wall-mount indicating and alarm unit for independent monitoring of two sensors.

Table 1-1. General Specifications

Electrical Characteristics		
POWER REQUIREMENT	AC	120/220 VAC, 50/60 Hz input 35 VA max. (85 Volts to 264 Volts)
	DC	12 Volts (9.2 - 16); 24 Volts (19 - 32); 48 Volts (38 - 63). 25 Watts max.
SENSOR CAPACITY		Two sensors, one per channel
READOUT		Three digit LED display per channel; 3/8" digits
SET POINTS	HAZARD LEVEL	Three Hazard set points per channel (CAUTION, WARNING and ALARM with indicating DESCRIPTORS (C, W & A)
	FULL SCALE INDICATION	Variable .1 to 99.9 or 1 to 999 or commonly used pre-sets
HYSTERESIS		2% of the selected full-scale range for all set points
RELAYS	HAZARD LEVEL	One discrete relay for each Hazard Level (six total)
	TROUBLE	One (common)
	HORN	One (common)
	STATUS	All (except horn) have one LED to indicate coil voltage
	TERMINALS	#12 gauge maximum wire size
	CONTACTS	Single-pole, double-throw (form C); Rated 120 VAC, 5 amps, resistive
AUDIBLE ALARM		Piezo electric horn: approximately 75 decibels at 3 feet with door open
CURRENT LOOP OUTPUT		4-20 mA output (±1% of full-scale) per channel Non-isolated, 250 Ohm load (maximum), Current sourcing
RECEIVER INPUT		Frequency reception 4-9 KHz range (nominal) 200 mV peak-to-peak sensitivity
		4 to 20 mA, non-isolated, sinking, 300 ohms input resistance to common (-)
OPERATING RANGE	RELATIVE HUMIDITY	15 to 95%*
	TEMPERATURE	Operating: 32° to 104°F (0° to 40°C); Storage: -40° to 131°F (-40° to 55°C)
CLASSIFICATION	NEMA 4X	Type 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water. They shall meet the hose-down, dust, external icing, and corrosion-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing. This enclosure should only be used in non-hazardous areas.
Physical Characteristics		
GENERAL-PURPOSE NEMA 4X ENCLOSURE DIMENSIONS		15.50 in. high x 11.75 in. wide x 7.62 in. deep; (393 mm. high x 298 mm. wide x 194 mm. deep)
NEMA 4X CASE WEIGHT		Approximately 13 lbs. (5.9 KG.)
*Tested to 85% relative humidity by UL.		

Features

One-man Calibration

Model 5100 Monitor calibration requires only one person at the sensor. No calibration adjustments are made at the Model 5100.

Protected Hazard Level Set Point Values

All Hazard Level set point settings, made via the front-panel, are placed into the Monitor's memory. These values remain unchanged during power outages and when the Monitor is turned OFF. There are no back-up batteries to monitor or replace.

User Readout Range Select

The Monitor Processor Board includes a READOUT RANGE SELECTOR SWITCH for each channel (SW2 and SW3, FIGURE 1-1). These switches enable the user to connect a different type of sensor for each channel, and to select the proper readout full scale indication for each application. It is also possible to select a different full scale indication than the ones given in TABLE 3-1. This allows any full scale reading from .1 to 999 in .1 increments or 1 to 999 in 1.0 increments.

User Function Select

The warning and alarm Hazard Level set points can be activated upon excursions above or below a set value of the LED display. Either or both channels may be disabled when not in use to avoid misleading Trouble indications. Each channel's warning and alarm Hazard Level set points may

be selected to provide either an all latching or an all non-latching operation. This is done via the two FUNCTION SELECTOR SWITCHES on the Processor Board (SW1 and SW4, FIGURE 1-1).

⚠ CAUTION

To comply with FMRC, the alarm must be in the Latching Mode.

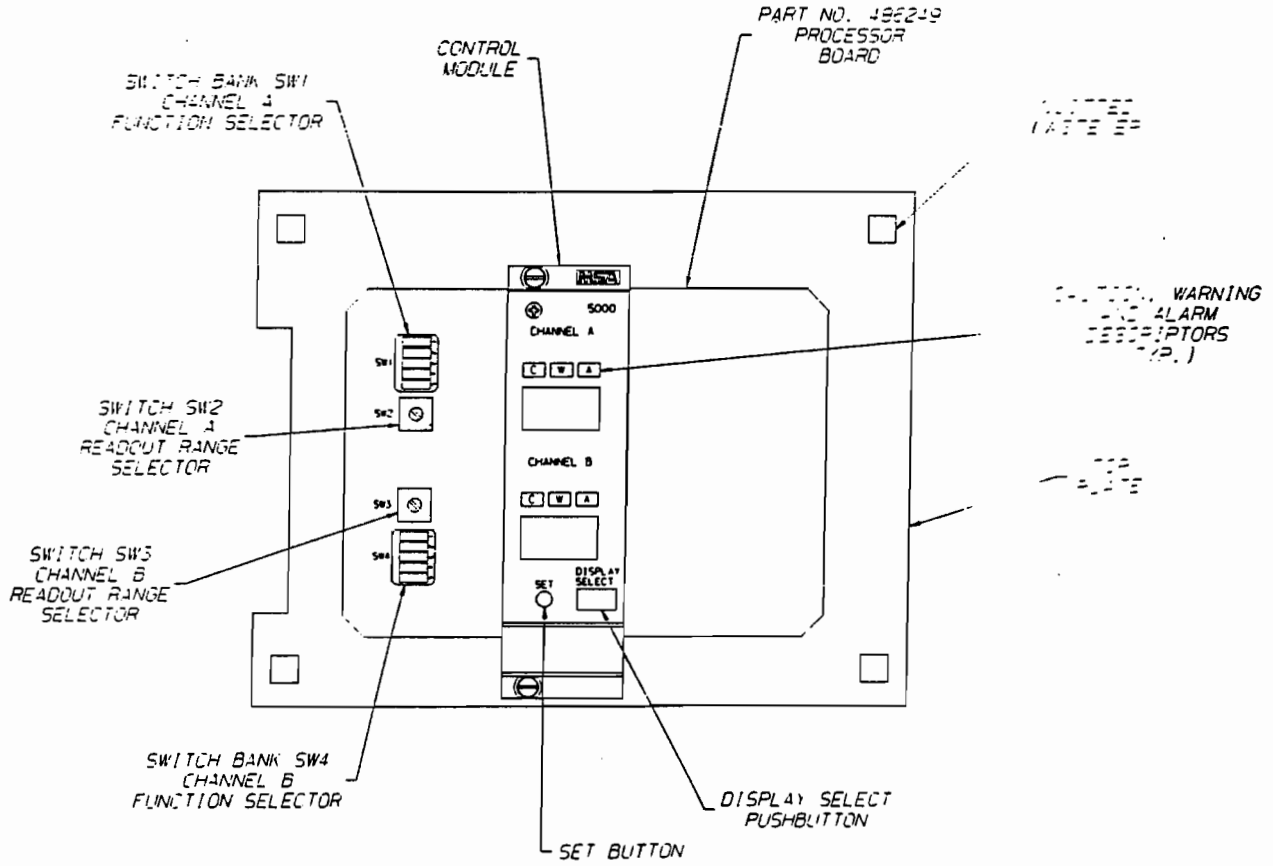


Figure 1-1.

Model 5100 Monitor, Two-Channel Front Panel and Processor Board Functions

Relay Printed Circuit Board (PCB)

Any or all of the six Hazard Level relays may be selected to provide a normally energized (fail-safe) or normally non-energized mode of operation by jumper selection on the Relay Board (FIGURE 1-2). The normally energized relay (fail-safe) de-energizes and transfers contact on loss of power or when Trouble is indicated on any channel.

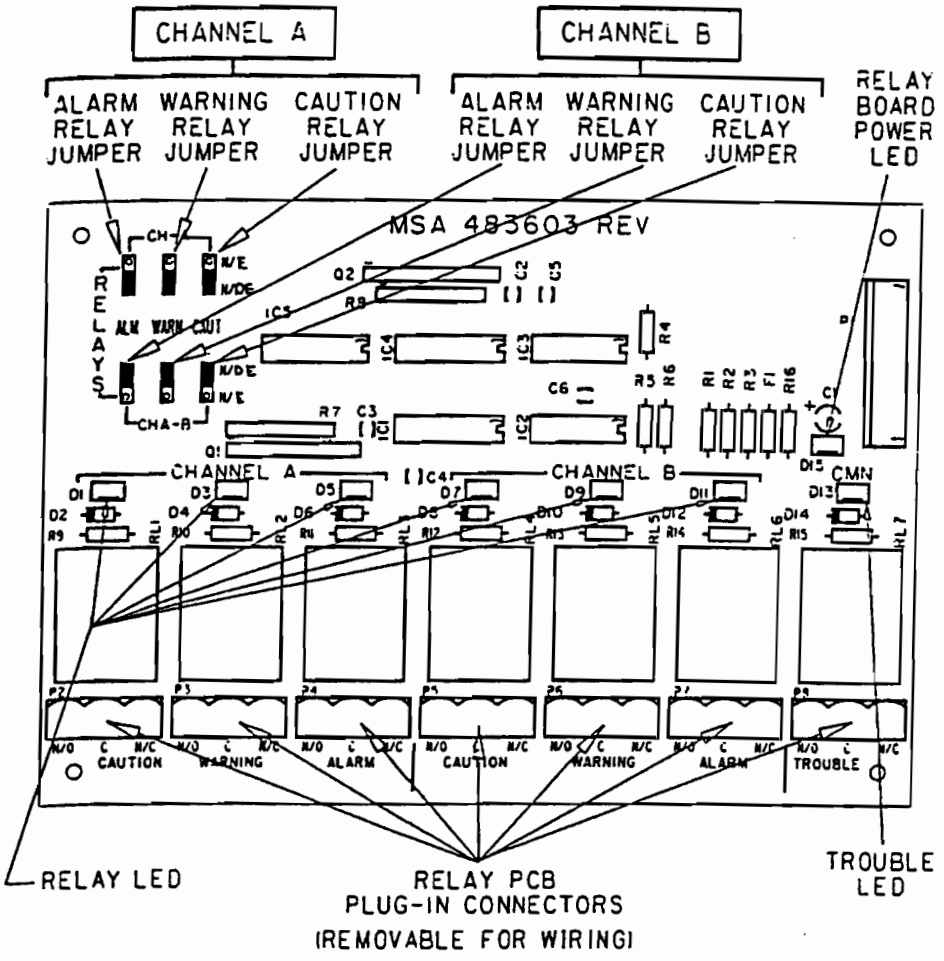


Figure 1-2.

Relay Printed Circuit Board (PCB) Functions

Section 2
Installation

Mounting the System

1. Choose a mounting location that is as free as possible from shock, vibration, physical damage and water. (See Appendix A, Installation Outline Drawing.)

⚠ CAUTION

Make sure that the front panel of the Control Module is not blocked; otherwise, the front-panel lights and controls will be obscured from view.

2. The Model 5100 Monitor is designed for easy installation and can be removed from the case to allow the user to create sensor and power entries before final Monitor installation.

Model 5100 Monitor Installation
(See Appendix A Drawing)

1) Loosen the six captive screws on the Monitor front door, and open the front door.
2) Remove the two wires from the HORN/ALARM ACKNOWLEDGE PUSH BUTTON inside the front door.
3) Remove the four corner screws from the bottom mounting plate.
4) Lift the complete Monitor from the case.
5) Create sensor and power entries. Use NEMA 4X rated components to maintain the rating of the enclosure.
6) Re-insert Monitor into its case, fastening it via the four corner screws on the bottom mounting plate.
7) Re-attach the wires on the HORN /ALARM ACKNOWLEDGE PUSH BUTTON on the inside of the front door.
8) lose Monitor front door, and tighten the six captive screws.
9) Mount the Monitor, using 1/4-inch diameter bolts (not supplied).

Connections

Perform all wiring connections and conduit runs according to accepted commercial wiring practices. Install the Model 5100 Monitor in compliance with the applicable requirements of the National Electrical Code and/or any other local code requirements. Use NEMA 4X rated components to maintain the rating of the enclosure.

Primary Power Connections

⚠ WARNING

Before wiring the Control Module, disconnect the main power; otherwise, an electrical shock could occur.

NOTE: The Model 5100 Monitor does not include an ON/OFF switch; a convenient disconnect should be installed.

1. Route power, ground and signal wiring through electrical entry holes in the housing. Power and ground wiring must be separated from signal wiring. See Appendix A, Installation Outline Drawing for recommended entry locations.
2. Connect the Monitor power source to the POWER BLOCK, located at the base of the chassis (FIGURE 2-1). See "Power Connections" portion of Appendix A, Installation Outline Drawing.

⚠ CAUTION

Improper application of the primary power to the Monitor may cause damage to the unit. If unsure of the available power, contact your local power utility for clarification. Verify that the unit's voltage rating matches the power supply line.

To determine the type of power supply module in your Monitor, check the base plate label.

Sensor Connections

There are two basic models of the Model 5100 Monitor, corresponding to current or frequency input signals.

Refer to Appendix A, "Sensor Connections" portion of the Installation Outline Drawing for your Model 5100 sensor connection information.

Remote Device Connections

Relay Connections
4 to 20 mA Output Connections

(See "Current Output" portion of Appendix A, Installation Outline Drawing)

All monitors provide a 4 to 20 mA output from each channel for use with remote readout or control device(s). Connections can be made with a two-conductor, shielded cable. Connections are made to the positive (+) and negative (-) terminals of each channel. The Shield Ground screws are available for the cable shield(s). Route remote wiring through electrical entry holes, separate from AC power wiring.

NOTE: This signal is non-isolated and can drive a 250-Ohm load max.

Make connections to relay terminals as required for the installation; see Appendix A Drawing for terminal descriptions.

NOTES:

1) The Horn and Horn Relay (located on the Input/Output Board) energizes with all Hazard Levels configured as latching. They are dedicated Latching, and will remain energized until acknowledged. On any Hazard Levels configured as non-latching, the Horn and Horn Relay will not activate upon Hazard Level conditions.

2) The Trouble relay (located on the Relay Board) is normally energized, and de-energizes when Trouble is detected.

   The common Trouble and common Horn relays cannot be programmed

3) The dedicated relays (Channel A or B CAUTION, WARNING and ALARM) are located on the Relay Board and are selectable for normally-energized (N/E) or normally non-energized (N/DE) modes of operation.

4) Establish and verify the intended function before wiring.

5) In order to prolong Relay Printed Circuit Board life and to reduce noise, it is recommended that the user install capacitor-resistor protective devices [such as the Paktron Quencharc™ (MSA Part No. 630413) at the load]. Ratings must correspond to the line voltage and load.

Front-Panel Indicator and Control Description

The Control Module front-panel contains 3-digit LED displays and Hazard Level DESCRIPTORS for each channel, as well as a SET PUSH BUTTON and a DISPLAY SELECT PUSH BUTTON (FIGURE 1-1). The Hazard Level indicators are outlined in TABLE 2-1.

Table 2-1.
Hazard Level Indications for Each Channel

HAZARD LEVELS	FRONT-PANEL DESCRIPTORS	COLOR CODE
CAUTION	C	YELLOW
WARNING	W	ORANGE
ALARM	A	REO

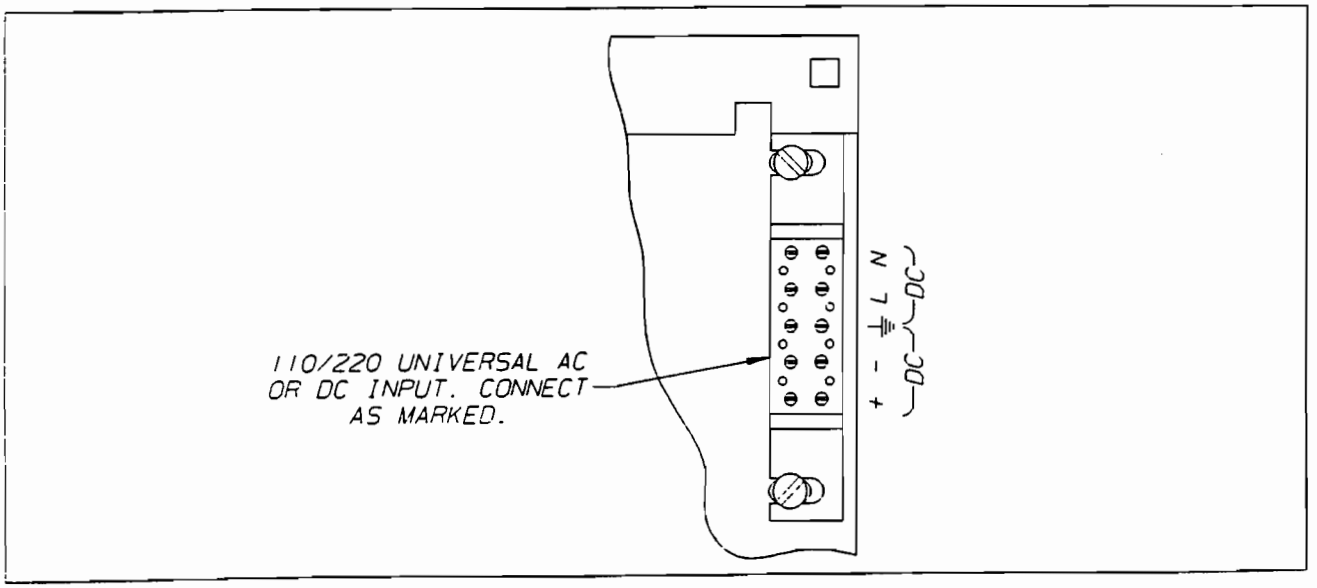


Figure 2-1.
Power Terminal Block and Bracket

Front-Panel Push Buttons

When the power is ON during and after start-up, the front-panel push buttons enable the user to:

1) Change the Caution, Warning and Alarm set points for each Channel
2) Place Channel A and/or Channel B of the Control Module into the CALIBRATE mode
3) Monitor the value from the sensors
4) Change the full scale indication reading.

⚠ CAUTION

Always ensure that the full scale (FS) indication matches that of the sensor.

Processor Printed Circuit Board Rocker Switches

When the power is OFF before start-up, the processor printed circuit board ROCKER SWITCHES (SW1 and SW4) enable the user to:

1) Disable or enable channels
2) Set Latching or Non-Latching remote relay status when a warning or alarm set point is exceeded (See TABLE 3-2 for definitions)
3) Set the warning and alarm set point for response on an increasing or decreasing value.

Processor Printed Circuit Board Rotary Switches

ROTARY SWITCHES (SW2 and SW3) enable the user to select the digital, full-scale readout designated for that channel's application.

Section 3
Start-Up and Operation

Initial Power-up

Before turning ON the main power, ensure that the proper voltage is available as described in Section 2, *"Power Connections."*

Start-up Procedure

Setting Full-Scale Indication

1. Before powering the Monitor, loosen the six captive screws on the front of the NEMA 4X enclosure cover, and open the cover. This allows direct access to the Processor Printed Circuit Board.

⚠ WARNING

Always remove power from the Monitor before performing any internal operation on the instrument; otherwise, an electrical shock could occur.

2. Verify channel application and sensor type; determine the proper full scale indication required for the application.
3. Set the desired full scale indication for the front-panel displays for Channels A and B to match the FS of the sensor, via the rotary READOUT SELECTOR SWITCHES SW2 and SW3 (FIGURE 1-1), according to TABLE 3-1.

⚠ CAUTION

Full scale settings must match that of the sensor.

4. If the desired full scale indication is not found on TABLE 3-1, place the corresponding READOUT SELECTOR SWITCH SW2 or SW3 in position 7 (position 7 is not FMRC approved). The full scale indication must be selected to match the FS of the sensor. This is accomplished during the start-up sequence.

   NOTE: If the READOUT RANGE SELECTOR SWITCH position is changed, the Hazard Level set point values automatically correspond to the same percentage of new full-scale display reading. Do not change RANGE position with power ON.

Example:
A Hazard Level set point of 40.0 on RANGE 6 (0-100) of READOUT SELECTOR SWITCH will change to 20 when RANGE 4 (0-50) is selected.

⚠ WARNING

Do not change the RANGE position while power is ON; otherwise, the indication will not switch from the previous selection, and erroneous readings will result.

Channel Enable and Alarm Function Selection

(FIGURE 1-1 and TABLE 3-2)

1. With power OFF, function selections are made via Processor Board CHANNEL A and B FUNCTION SELECTOR SWITCH BANKS SW1 and SW4; these switches are accessed by opening the enclosure.

   NOTE: The depressed side of the rocker switch indicates the switch position.

2. Enable or disable channels by turning the first rocker switch OFF or ON, respectively, of Channel A (SW1) and Channel B (SW4). See TABLE 3-2.

   NOTE: If an unused channel is left enabled, a continuous TROUBLE indication will result.

3. Latching and Non-Latching Warning and Alarm functions are set by using the second or third rocker switch (see TABLE 3-2 and FIGURE 1-1).

Table 3-1.
Setting Full-Scale Indications

SELECTOR SWITCH POSITIONS FOR CHANNEL A (SW2) OR CHANNEL B (SW3)	FULL-SCALE INDICATION	RESOLUTION
0	0.0 to 10.0	0.1
1 †	0 to 100	1.0
2 †	0.0 to 25.0	0.1
3	0 to 250	1.0
4 †	0.0 to 50.0	0.1
5	0 to 500	1.0
*6 †	*0 to 100	1.0
**7	.1 to 99.9	.1
	1 to 999	1.0
8 & 9	DO NOT USE	---

*CAUTION
SWITCH position 6 prohibits set point settings of above 60% of full-scale. FMRC approval void if position 6 not used with combustible sensors.

**Variable. Default 999 full scale

† Approved by FMRC; All other positions void FMRC approval.

Table 3-2.
Setting Channel Enable and Hazard Response Functions (Function Selector Switches)

CHANNEL A SW1 SWITCH	CHANNEL B SW4 SWITCH	ROCKER SWITCH *OFF* (PRESSED AT LEFT)	ROCKER SWITCH *ON* (PRESSED AT RIGHT)
1	1	Channel enabled †	Channel disabled (for unused channel)
2	2	* NON-LATCHING: WARNING	* LATCHING: WARNING †
3	3	* NON-LATCHING: ALARM	* LATCHING: ALARM †
4	4	** Warns upon exceeding WARNING level set point †	*** Warns upon dropping below WARNING level set point
5	5	** Alarms upon exceeding ALARM level set point †	*** Alarms upon dropping below ALARM level set point

† Factory-Set Position

* LATCHING/NON-LATCHING DEFINITIONS:
LATCHING: Even though the alarm condition may no longer exist, the descriptors and horn remain ON until the HORN/ALARM ACKNOWLEDGE PUSHBUTTON pressed.
NON-LATCHING: When alarm condition no longer exists, the descriptors turn OFF. FMRC approval is void if Non-Latching position is chosen.

** Descriptor ON when sensor signal goes above set point.

***Descriptor ON when sensor signal goes below set point.

4. ROCKER SWITCHES 4 and 5 allow selection of the Warning and Alarm Hazard Level outputs for signal increasing or decreasing in value through set points.

   NOTE: The Caution Hazard Level is factory-set for non-latching and activation on increasing signal. It is not user changeable.

Setting the Relay Printed Circuit Board

(FIGURES 1-2 and 3-1)

Relay Set-Up

1. Remove power to Monitor via a conveniently located breaker (Appendix A, Installation Outline Drawing).

⚠ WARNING

Always remove power from Monitor before performing any internal operation on the instrument; otherwise, an electrical shock may occur.

2. Loosen the six captive cover screws to reveal the metal TOP PLATE assembly (FIGURE 1-1). Remove the TOP PLATE cover by turning the four black slotted fasteners 90° and lifting the TOP PLATE. This allows access to the Relay Printed Circuit Board (FIGURE1-2).
3. For normally energized operation (de-energizes at Hazard Level set point) of any relay, place the associated JUMPER on the Relay Printed Circuit Board over the prongs marked N/E (FIGURE 3-1).
4. For normally de-energized operation (energizes at Hazard Level set point) of any relay, place the associated JUMPER on the Relay Printed Circuit Board over the prongs marked N/DE (FIGURE 3-1).
5. Re-assemble the top plate to the chassis, and close and secure the cover after relay functions are set.

30-Second Menu Sequence at Instrument Start-Up and Reset

(FIGURE 1-1)

Turn ON the main power which feeds the Monitor; there is no power switch on the instrument.

- The green RELAY BOARD POWER LED (FIGURE 1-2) should turn ON.

  NOTE: To view the RELAY BOARD POWER LED, remove the TOP PLATE of the Monitor (FIGURE 1-1). If the LED does *not* turn ON, refer to Section 5, *"Troubleshooting Guidelines"* for proper diagnostic steps.

- The Control Module automatically runs a 30-second menu sequence for Channels A and B.
- During this 30-second period:
  - All alarms are disabled
  - The 4-20 mA remote output will go to approximately 4 mA
  - Sensors stabilize without erroneous Hazard indications
  - The Trouble relay drops out

The 30-Second Menu Sequence Is Divided Into two 15-second Modes:

- The Full Scale Mode and
- The Lamp Test Mode.

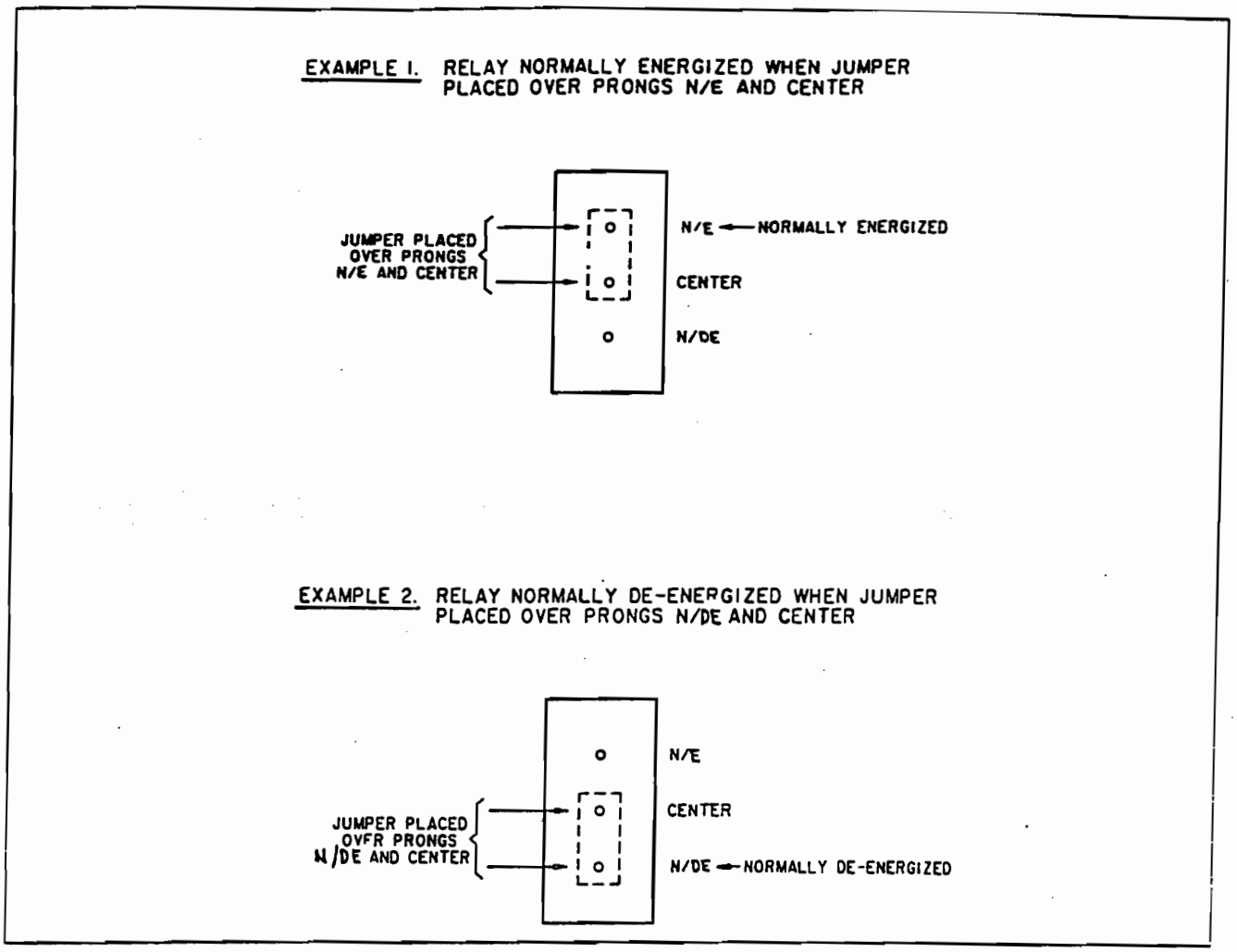


Figure 3-1.
Model 5100 Relay PC Board Relay Set-Up

- As CHANNEL A performs the Full Scale Mode, CHANNEL B performs the Lamp Test Mode.
- Fifteen seconds into the Menu sequence, CHANNEL A switches to the Lamp Test Mode and CHANNEL B switches to the Full Scale Mode.

Full Scale Mode

When power is applied, the Monitor provides the full scale indication for the channel currently in the Full Scale Mode:

1) The 3-digit reading provides the following data:
   a) ALL THREE DIGITS (XX.X or XXX) denote the actual Full Scale Setting.
   Example:
   99.9 = Actual Full Scale Setting
   b) During the Full Scale Mode, observe the front-panel DESCRIPTORS (C, W and A LEDs, FIGURE 1-1) to determine if the Hazard Level set point provides an increasing or decreasing alarm according to TABLE 3-3.
2) Direct Full Scale setting Capability: (application when in position 7 on the RANGE SWITCH). If the DISPLAY SELECT PUSH

Table 3-3.
Determine Increasing/Decreasing Hazard Level Set Points

C, W AND A LED STATUS DURING COUNTDOWN MODE	ASSOCIATED HAZARD LEVEL SET POINT TYPE
ON	LATCHING AND INCREASING HAZARD
OFF	NON-LATCHING AND INCREASING HAZARD
BLINKING	LATCHING OR NON-LATCHING/ DECREASING HAZARD

BUTTON is pressed during the start-up sequence, the channel displaying its full scale range will blink. It is, in effect, asking the user for a new full scale value. By pressing the SET button, it is possible to scroll to a new full scale range. This value (which must correspond to the sensor full scale) will be stored in memory. All hazard levels will be scaled to reflect the new full scale indication. Pressing the DISPLAY SELECT again allows the module to continue its start up sequence. The other channel is programmed in the same way.

If the DISPLAY SELECT is not pushed during the start up sequence, the module will use the default 999 full scale value or a full scale value that was entered previously.

Lamp Test Mode

During the channel Lamp Test Mode, the channel:

- Displays a front-panel digital reading of 88.8
- Turns ON the C, W and A DESCRIPTORS to verify that all lamps are working properly.

Control Module Factory-Set Values

Full Scale Selector SW2 and SW3

TABLE 3-1 and FIGURE 1-1

The normal factory-setting is position 6, 0 to 100 full scale.

NOTE: If position 7 (variable full scale) is selected, the pre-set full scale is 999.

Hazard Level Set Point Values

The Hazard Level set point values for each channel are factory-set as follows:

- Caution set point: 20
- Warning set point: 30
- Alarm set point: 40

These set point values can be changed (See Section 3, "Changing Hazard Level Set Points" and TABLE 3-1). The user must verify that the Monitor is set up to meet his requirements.

Function Selector Switch Position

(TABLE 3-2 and FIGURE 1-1)

All FUNCTION SELECTOR SWITCHES are normally factory-set for the following operation:

SW1 and SW4 FACTORY SET-UP		
NUMBER	FUNCTION	POSITION
1	Channel enabled	OFF
2	Latching Warning	ON
3	Latching Alarm	ON
4	Warns upon exceeding WARNING set point	OFF
5	Alarms upon exceeding ALARM set point	OFF

Relay Printed Circuit Board Factory-Settings

Relay Jumpers

All relay jumpers are factory-set in the N position (normally energized relays) (FIGURES 1-2 and 3-1).

Viewing Existing Hazard Level Set Points On Front-Panel Display Select Menu

(FIGURE 1-1 and TABLE 3-4)

To view the existing Hazard Level set points, step through the Display Select Menu by pressing the front-panel DISPLAY/SELECT PUSH BUTTON (FIGURE 1-1) the number of times indicated in column 1 of TABLE 3-4.

Changing Hazard Level Set Points

(FIGURE 1-1 and TABLE 3-4)

To Change the Hazard Level Set Points:

1. Press the front-panel DISPLAY/SELECT PUSH BUTTON on the Control Module the number of times indicated in TABLE 3-4 until reaching the set point to be changed.
   - The appropriate Caution, Warning or Alarm DESCRIPTOR will turn ON (steady).
   - The existing set point value will flash.
2. Using a small device such as a screwdriver, press the Control Module front-panel SET push button, via the hole in the front-panel.
3. Hold down the SET push button, and allow the set point values to scroll. When the desired set point is displayed, release the button.
4. Press the DISPLAY/SELECT push button to manually place the Module in the RUN MODE. This also enters the new set point into the memory. The display will now show the sensor value. The new set point can be verified by stepping through the menu per TABLE 3-4.

Table 3-4. Front-Panel Display/Select Menu

TIMES DISPLAY SELECT BUTTON PUSHED	ASSOCIATED DISPLAY SELECTED	ASSOCIATED CHANNEL		FRONT-PANEL DISPLAY DESCRIPTION (SEE NOTES BELOW)
START	RUN MODE			SENSOR VALUE SHOWN
1	CAUTION SET POINT	A	(*)	CAUTION DESCRIPTOR ON
2	RUN MODE			SENSOR VALUE SHOWN
3	WARNING SET POINT	A	(*)	WARNING DESCRIPTOR ON
4	RUN MODE			SENSOR VALUE SHOWN
5	ALARM SET POINT	A	(*)	ALARM DESCRIPTOR ON
6	RUN MODE			SENSOR VALUE SHOWN
7	CAUTION SET POINT	B	(*)	CAUTION DESCRIPTOR ON
8	RUN MODE			SENSOR VALUE SHOWN
9	WARNING SET POINT	B	(*)	WARNING DESCRIPTOR ON
10	RUN MODE			SENSOR VALUE SHOWN
11	ALARM SET POINT	B	(*)	ALARM DESCRIPTOR ON
12	RUN MODE			SENSOR VALUE SHOWN
13	CALIBRATE MODE	A	(**)	Flashes sensor value; sensor can now be calibrated with Calibration Box and appropriate calibration procedure
14	RUN MODE			SENSOR VALUE SHOWN
15	CALIBRATE MODE	B	(**)	Flashes sensor value; sensor can now be calibrated with Calibration Box and appropriate calibration procedure
16	RUN MODE			SENSOR VALUE SHOWN
17	CALIBRATE MODE	A & B	(**) (***)	Can calibrate 2 sensors simultaneously
START	RUN MODE			Repeat cycle

CAUTION: Do not leave the instrument in the CALIBRATE mode; otherwise, the instrument will not actuate the Horn or relays to alert the user of any dangerous conditions that may develop. There is a two hour time limit. After the time limit, the instrument returns to the RUN MODE.

NOTES:
(*) When in this Select Mode, the display flashes existing value of Hazard Level set points. The 4-20 mA signal continues to follow the sensor output signal.
If left idle, the System automatically reverts to the RUN mode in several minutes.
(**) When in this Select Mode, the 4-20 mA output of that channel will hold at that channel's preceding RUN Mode output value.
(***) It is possible to go direct to calibration of both channels by pressing both the DISPLAY SELECT and the SET push buttons simultaneously.

5. Repeat steps 1 through 4 above until the desired set point change for the second Channel of the Control Module is completed.

Interpreting Control Module Front-Panel Display Indications

(FIGURE 1-1 and TABLE 3-5)

TABLE 3-5 identifies Control Module front-panel, three-digit displays for TROUBLE, OVER RANGE, UNDER RANGE and CALIBRATION conditions.

Responding to Hazard Level Conditions

When the Sensor Value Digital Reading Exceeds a Hazard Level Set Point:

NOTE: Decreasing value may be for oxygen deficiency monitoring.

1. With the *non-latching* function selected (TABLE 3-2):
   a. The digital reading and the hazard level descriptor of the exceeded set point will flash simultaneously, and any relay selected for that descriptor will transfer. This condition will continue until acknowledged or until that hazard condition no longer exists.

   Acknowledge:

   1) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *while the hazard condition still exists* will:
      a) Stop the flashing of the digital reading and descriptor (they will remain steadily ON)
      b) Allow any selected relay to remain transferred until that hazard condition no longer exists.

Table 3-5. Control Module Front-Panel Display Indications

LED READOUT	ASSOCIATED INDICATION	DESCRIPTION
— — —	*TROUBLE	No signal received;Sensor reading below -15% of full-scale
— 0 —	*OVER RANGE	Sensor reading above range select value
— U —	UNDER RANGE	Displayed below -10% of full-scale; System still operates, but warns operator to calibrate sensor before reading falls to -15% of full-scale and TROUBLE indication occurs
0.0	CENTERED ZERO	Extra precision zero in "CALIBRATION" only
FLASHES SENSOR VALUE	**CALIBRATION	Sensor can be calibrated without inadvertently tripping an ALARM. During calibration, if set points are exceeded, that descriptor will flash alternately with the digital reading, but no alarms will activate

*WARNING: A hazardous and over limit condition may exist at the sensor location when the OVER RANGE or Trouble indication is displayed on the LED readout.

**CAUTION: Do not leave the Monitor in the CALIBRATION mode; otherwise, the instrument will not monitor the sensors or alert the user of any dangerous conditions that may develop. There is a two hour time limit. After the time limit, the instrument returns to the run mode.

2) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *after the hazard condition no longer exists* will:

Clear all hazard indications, silence the horn, and de-energize the horn relay.

2. With the *latching* function selected:

a) The digital reading and the Hazard Level descriptor of the exceeded set point will flash simultaneously, and any relay selected for the descriptor will transfer. This condition will continue until acknowledged.

b) The horn will sound, and the horn relay will energize.

Acknowledge:

1) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *while the hazard condition still exists* will:

a) Silence the horn, and de-energize the horn relay

b) Stop the flashing of the digital reading and descriptor (they will remain steadily ON)

c) Allow any selected relay to remain transferred (see "NOTE").

NOTE: When the Latching Function is selected, the HORN/ALARM ACKNOWLEDGE PUSH BUTTON must be pressed *again* when the hazard condition no longer exists in order to clear all hazard indications. Otherwise, the Monitor will not respond to a repeat of that hazard condition for that sensor (horn will not sound, etc.).

2) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON after the Hazard condition no longer exists will:

Clear all hazard indications, silence the horn, and de-energize the horn relay.

Section 4
Calibration and Maintenance

Calibration

1. Press the DISPLAY SELECT PUSH BUTTON until the CALIBRATE mode appears on the display (TABLE 3-4) or by pressing both DISPLAY SELECT and SET PUSH BUTTONS simultaneously.
2. The sensor can be calibrated with the appropriate calibration procedure. Refer to the sensor instruction manual for details

⚠ WARNING

Do not leave the instrument in the CALIBRATE mode during normal use; otherwise, the instrument will not actuate the Horn or relays to alert the user of any dangerous conditions that may develop. There is a two hour time limit. After the time limit, the instrument returns to the RUN mode

Maintenance

See the following "Troubleshooting Guidelines."

Troubleshooting Guidelines

SYMPTOM	CAUSE	SOLUTION
RELAY BOARD POWER LED fails to turn ON	1) Customer input power interrupted	1)* Check and correct input power
	2) Bad connection between power cable and terminal block	2)* Check power terminal block
	3) Inoperative LED	3) Replace Relay PCB
	4) Inoperative Relay PCB	4) Replace Relay PCB
TROUBLE (—) indication turns ON	1) Open or shorted cable between the control unit and the sensor assembly	1) Check for continuity of sensor cable, or tighten sensor-to-pc board connections
	2) Uncalibrated sensor	2) Calibrate sensor
	3) Inoperative sensor	3) Replace sensor
	4) Blown sensor fuse	4) Replace sensor fuse
OVER RANGE (-O-) indication turns ON	1) Uncalibrated sensor	1) Calibrate sensor
	2) Loose sensor connections	2) Tighten sensor-to-pc board connections
	3) Inoperative sensor	3) Replace sensor
	4) Inoperative processor board	4) Replace processor board
UNDER RANGE (-U-) indication sensor turns ON	1) Uncalibrated sensor	1) Calibrate sensor
	2) Inoperative sensor	2) Replace sensor
	3) Inoperative processor board	3) Replace processor board
Hazard Level (AAA) error	1) Accidental Hazard Level changes	1) Verify setpoints; Replace processor board if condition persists
If known CAUTION WARNING and/or or ALARM conditions exist, and digital readout is correct, but DESCRIPTORS do not turn ON	1) CAUTION, WARNING and/or ALARM set points set too high	1) Re-set set points

*CAUTION: Exercise caution as potential shock hazard exists.

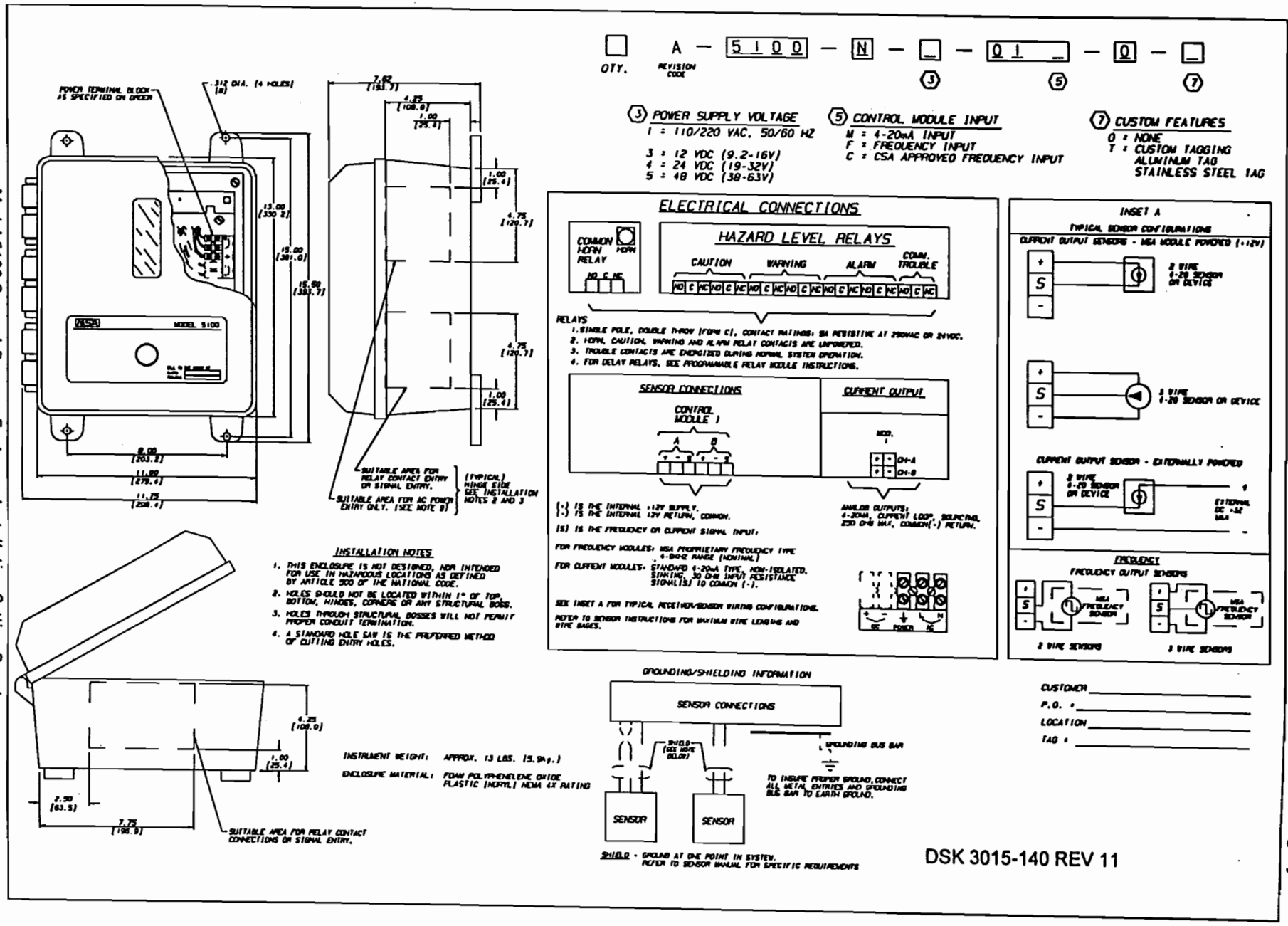
Troubleshooting Guidelines

SYMPTOM	CAUSE	SOLUTION
Digital readout does not indicate condition	1) Uncalibrated sensor	1) Calibrate sensor
	2) Inoperative or dirty sensor	2) Replace Sensor
	3) Disabled processor board	3) Verify and re-power the instrument; replace board if necessary
Digital readout blank	1) Channels disabled	1) Verify that FUNCTION SELECTOR SWITCH #1 of SWITCH BANKS SW1 and SW4 are in the OFF position
CAUTION, WARNING and/or ALARM DESCRIPTORS will not turn OFF, and digital readout indicates non-hazard condition	1) Latched function selected	1) Reset
	2) Improperly set CAUTION, WARNING and/or ALARM set points	2) Re-adjust set points
	3) Printed circuit board failure	3) Replace processor board
Remote devices fail to operate	1) Remote devices improperly connected	1) Verify remote device wiring connections
	2) Improperly seated relay PCB	2) Re-install Relay PCB
	3) Relay PCB controls improperly set	3) Verify and re-set Relay PCB
	4) No output from current loop connections	4) Verify and re-connect current output connections
	5) Low output from current loop connections	5) Reduce external load to 250 Ohms or less; check at 4 and 20 mA
HORN does not sound when Hazard condition exists	1) Improperly set level points	1) Re-set levels; then, verify
	2) Loose interconnecting cables	2) Re-connect interconnecting cables
	3) Inoperative User I/O PC Board	3) Replace User I/O PC Board
TROUBLE relay de-activates (Trouble LED on Relay PCB is OFF)	1) Loose interconnecting cables	1) Re-connect interconnecting cables
	2) Inoperative Relay PCB	2) Replace Relay PCB

Section 5
Parts List

ITEM		MSA PART NO.
Model 5100 Frequency Input	†	486124
Model 5100, VR-CS Type Frequency Input	††	801006
Model 5100, 4 to 20 mA Input		815788
SUB-ASSEMBLIES		
Relay Module	†	483603
AC Power Supply, Universal 110/220	†	488524
DC Power Supply:		
• 12 VDC (9.2 to 16)		655794
• 12 VDC (19 to 32)		655795
• 12 VDC (38 to 63)		655796
User I/O P.C. Board Assembly	†	482452
Processor Board	†	486249
Processor Board, VR-CS Type	††	801003
Processor Board, 4 to 20 mA Input		815684
Display Board Assembly	†	479767
Interconnect Cable (Processor to Display Board)	†	486137
Wiring Harness Assembly with Connectors	†	486136
ACCESSORIES		
Paktron Quencharc™		630413
†Only the indicated to be used for FMRC approval		
†† For CSA approved instruments		

Appendix A
Installation Outline Drawing


QTY.
REVISION CODE
A – 5100 – N – _ – 01 _ – 0 – _
③
⑤
⑦
③ POWER SUPPLY VOLTAGE
1 = 110/220 VAC, 50/60 HZ
3 = 12 VDC (9.2-16V)
4 = 24 VDC (19-32V)
5 = 48 VDC (38-63V)
⑤ CONTROL MODULE INPUT
M = 4-20mA INPUT
F = FREQUENCY INPUT
C = CSA APPROVED FREQUENCY INPUT
⑦ CUSTOM FEATURES
0 = NONE
T = CUSTOM TAGGING
ALUMINUM TAG
STAINLESS STEEL TAG
POWER TERMINAL BLOCK AS SPECIFIED ON ORDER
.312 DIA. (4 HOLES)
MSA
MODEL 5100
13.00 (330.2)
13.80 (381.0)
15.50 (393.7)
8.00 (203.2)
11.00 (279.4)
11.75 (298.4)
7.62 (193.7)
4.25 (108.0)
1.00 (25.4)
4.75 (120.7)
SUITABLE AREA FOR RELAY CONTACT ENTRY OR SIGNAL ENTRY.
SUITABLE AREA FOR AC POWER ENTRY ONLY. (SEE NOTE 3)
(TYPICAL) HINGE SIDE
SEE INSTALLATION NOTES 2 AND 3
INSTALLATION NOTES
1. THIS ENCLOSURE IS NOT DESIGNED, NOR INTENDED FOR USE IN HAZARDOUS LOCATIONS AS DEFINED BY ARTICLE 500 OF THE NATIONAL CODE.
2. HOLES SHOULD NOT BE LOCATED WITHIN 1" OF TOP, BOTTOM, HINGES, CORNERS OR ANY STRUCTURAL BOSS.
3. HOLES THROUGH STRUCTURAL BOSSES WILL NOT PERMIT PROPER CONDUIT TERMINATION.
4. A STANDARD HOLE SAW IS THE PREFERRED METHOD OF CUTTING ENTRY HOLES.
2.50 (63.5)
7.75 (196.9)
SUITABLE AREA FOR RELAY CONTACT CONNECTIONS OR SIGNAL ENTRY.
INSTRUMENT WEIGHT: APPROX. 13 LBS. (5.9kg.)
ENCLOSURE MATERIAL: FOAM POLYPHENELENE OXIDE PLASTIC (NORYL) NEMA 4X RATING
ELECTRICAL CONNECTIONS
COMMON HORN RELAY
HORN
NO C NC
HAZARD LEVEL RELAYS
CAUTION
WARNING
ALARM
COMM. TROUBLE
NO C NC NO C NC NO C NC NO C NC NO C NC NO C NC NO C NC
RELAYS
1. SINGLE POLE, DOUBLE THROW (FORM C), CONTACT RATINGS: 5A RESISTIVE AT 250VAC OR 24VDC.
2. HORN, CAUTION, WARNING AND ALARM RELAY CONTACTS ARE UNPOWERED.
3. TROUBLE CONTACTS ARE ENERGIZED DURING NORMAL SYSTEM OPERATION.
4. FOR DELAY RELAYS, SEE PROGRAMMABLE RELAY MODULE INSTRUCTIONS.
SENSOR CONNECTIONS
CONTROL MODULE 1
A
B
CURRENT OUTPUT
MOD. 1
CH-A
CH-B
(+) IS THE INTERNAL +12V SUPPLY.
(-) IS THE INTERNAL 12V RETURN, COMMON.
(S) IS THE FREQUENCY OR CURRENT SIGNAL INPUT.
FOR FREQUENCY MODULES: MSA PROPRIETARY FREQUENCY TYPE 4-9kHz RANGE (NOMINAL)
FOR CURRENT MODULES: STANDARD 4-20mA TYPE, NON-ISOLATED, SINKING, 30 OHM INPUT RESISTANCE SIGNAL(S) TO COMMON (-).
ANALOG OUTPUTS: 4-20mA, CURRENT LOOP, SOURCING, 250 OHM MAX, COMMON(-) RETURN.
SEE INSET A FOR TYPICAL RECEIVER/SENSOR WIRING CONFIGURATIONS.
REFER TO SENSOR INSTRUCTIONS FOR MAXIMUM WIRE LENGTHS AND WIRE GAGES.
SIG
POWER
NC
INSET A
TYPICAL SENSOR CONFIGURATIONS
CURRENT OUTPUT SENSORS - MSA MODULE POWERED (+12V)
+
S
-
2 WIRE 4-20 SENSOR OR DEVICE
3 WIRE 4-20 SENSOR OR DEVICE
CURRENT OUTPUT SENSOR - EXTERNALLY POWERED
2 WIRE 4-20 SENSOR OR DEVICE
EXTERNAL DC +32 VDC
FREQUENCY
FREQUENCY OUTPUT SENSORS
MSA FREQUENCY SENSOR
2 WIRE SENSORS
3 WIRE SENSORS
GROUNDING/SHIELDING INFORMATION
SENSOR CONNECTIONS
SHIELD (SEE NOTE BELOW)
GROUNDING BUS BAR
TO INSURE PROPER GROUND, CONNECT ALL METAL ENTRIES AND GROUNDING BUS BAR TO EARTH GROUND.
SENSOR
SENSOR
SHIELD - GROUND AT ONE POINT IN SYSTEM. REFER TO SENSOR MANUAL FOR SPECIFIC REQUIREMENTS
CUSTOMER
P.O. #
LOCATION
TAG #
DSK 3015-140 REV 11

FOR CALIBRATION OR REPAIR, PLEASE COMPLETE THE REVERSE SIDE OF THIS CARD AND ENCLOSE WITH INSTRUMENT. (USE A SEPARATE CARD FOR EACH INSTRUMENT.)

SHIPPING INSTRUCTIONS:

1. Ship U.P.S. or insured mail to:

   Mine Safety Appliances Company
   Attn: Service Department
   300 Walden Road
   Cranberry Township, PA 16066-5296

   Inquiries: Phone 1-800-MSA-INST

2. Requests for estimate of repair generally take as long as actual repairs and will be subject to the following minimum service charges if you decide not to proceed with the repair.

Portable or Permanent Instrument	$ 75.00
Medical Instruments	$ 60.00
Lira & Optical Bench	$150.00

3. To improve turnaround time and eliminate the need for estimates, MSA's repair policy is, "If the cost to repair exceeds 60% of the replacement value, MSA will contact you for disposition." (See front of card for alternatives.)

4. After repair, your unit is calibrated to original factory specifications and is warranted against defects and workmanship, of items repaired, for 90 days. Disposable items such as fuses, lamps, nonrechargeable batteries, etc., are not warranted.

5. Items sent for repair, which do not have a purchase order number or for which we are not able to receive your disposition within 60 days, will be returned freight collect.

6. Repairing or altering of this article of equipment beyond the scope of maintenance instructions by other than MSA factory or authorized service stations may void all warranties and approvals and could cause the product to fail to perform as designed. Persons who rely on this product for their safety could sustain severe bodily injury or death.

MSA REPAIR & SERVICE POLICY

TO SPEED YOUR REPAIRS

NOTE: WE MUST HAVE YOUR ORDER NUMBER BEFORE PROCEEDING WITH REPAIR. FILL IN ALL REQUESTED INFORMATION AND ENCLOSE WITH PRODUCT.

BILLING ADDRESS: COMPANY NAME		**SHIPPING ADDRESS:** COMPANY NAME
STREET/P.O. BOX		STREET
CITY/STATE/ZIP		CITY/STATE/ZIP
CUSTOMER CONTACT NAME		PHONE: AREA CODE/NUMBER/EXTENSION
ITEM NAME	MODEL NO.	ORIG. MSA ORDER # (IF KNOWN)
YOUR PURCHASE ORDER NO.		☐ TAXABLE ☐ EXEMPT ☐ NON-TAXABLE

To save time –
Please check one of these alternatives:

- ☐ Repair and return (P.O. # Required)
- ☐ Estimate required before repair
- ☐ Warranty claim (MSA invoice number required)
- ☐ Medical R.A. No. _____
- ☐ Other – specify _____

Description of problem/Special Instructions

_____

_____

_____

_____

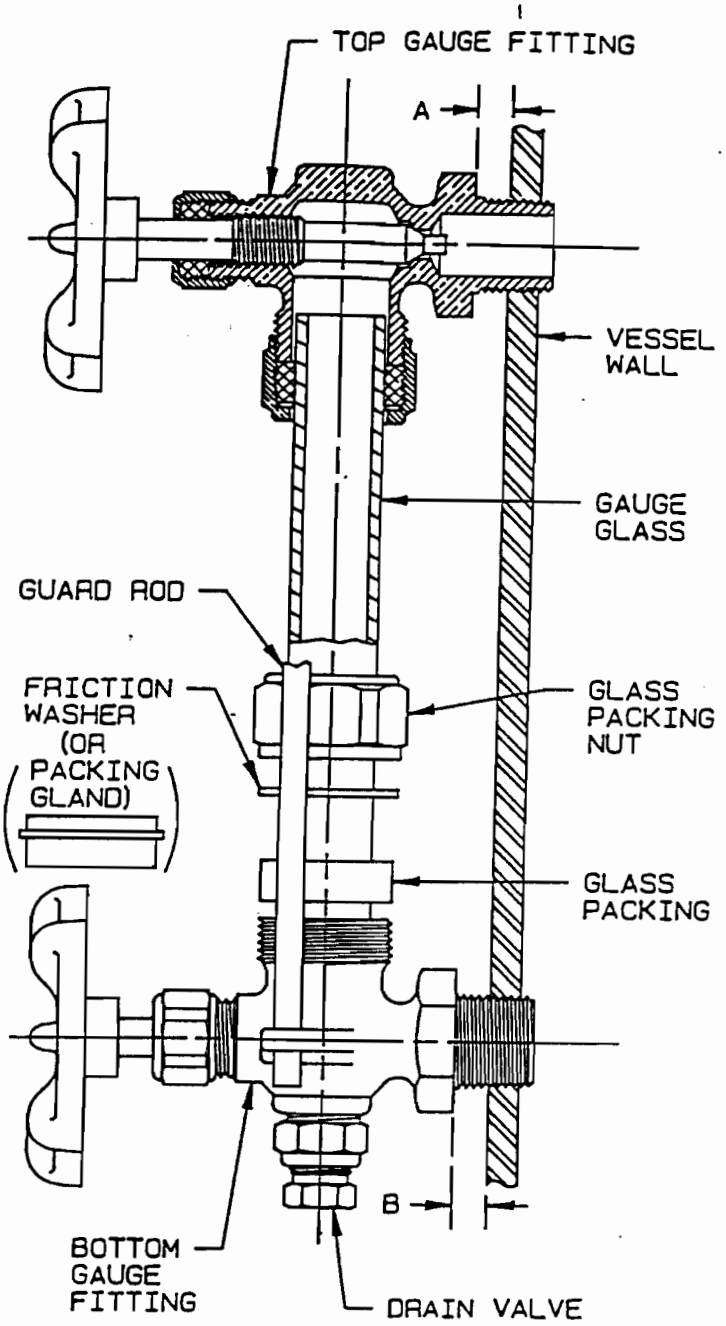
AUTHORIZED BY: TITLE: DATE:

WATER GAUGE & GAUGE GLASS INSTALLATION INSTRUCTIONS

INSTALLATION

Only properly trained personnel should install and maintain water gauge glass and connections. Remember to wear safety gloves and glasses during installation. Before installing, make sure all parts are free of chips and debris.

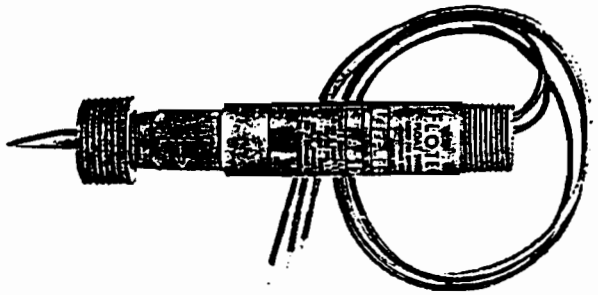
1. Apply Teflon tape or pipe dope to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tighten the fitting until it is snug and the glass outlet is pointing at five o'clock (about 1/8 turn from its final downward vertical position).
2. Install the bottom gauge fitting (the fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward. Verify top and bottom fittings are threaded into the tappings the same number of turns (distance A= distance B).
3. Remove glass packing nut, friction washer (or packing gland, depending upon the model), and glass packing from the fittings, and place them, in the same order, on to both ends of the gauge glass. Push both packings about an inch up the gauge glass.
4. Gently insert one end of the glass into the top gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge fitting, then insert glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.
5. Carefully raise glass about 1/16" and slide lower glass packing down until the glass packing contacts the lower gauge fitting. <u>DO NOT</u> allow the glass to remain in contact with any metal!
6. Carefully slide upper glass packing up as far as possible.
7. Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. **DO NOT OVER TIGHTEN!** If any leakage should occur, tighten slightly, a quarter turn at a time, checking for leakage after each turn.

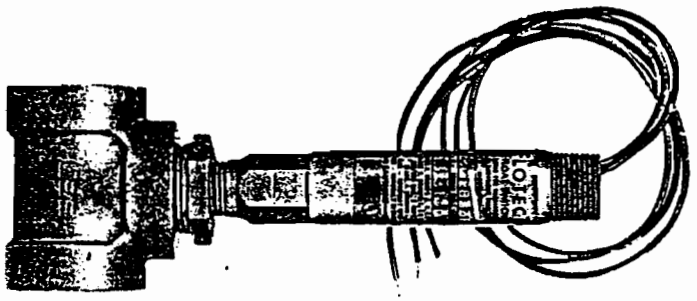


I-5387-00 Rev. B.

FLOTECT™ MODEL L-6 FLOAT SWITCH

Installation and Operating Instructions





Explosion-Proof; U.L. and C.S.A. Listed -
Class I, Groups *A, B, C & D
Class II, Groups E, F & G
CENELEC: EExd IIC T6 (T amb=75°C)
*(Group A, stainless steel body only)

PHYSICAL DATA

Temperature Limit: 220°F (105°C) maximum
Maximum Pressure: See chart below
Switches: One or two SPDT snap switches
Electrical Rating: U.L.: 5A @ 125/250 VAC.
C.S.A. and CENELEC: 5A @ 125/250 VAC, 5A resistive, 3A inductive @ 30 VDC.
Optional ratings: MV option—Gold contacts for dry circuits. Rated 0.1A @ 125 VAC MT option: 400°F (205°C) 5A @ 125/250 VAC (not listed).
Wiring Connections: 3-18" (460mm) wire leads, 18 ga.
CENELEC models only: push-in type terminal blocks
Black = common, blue = N.O., red = N.C.
Minimum Specific Gravity:
Polypropylene float - 0.9
Round SS float - 0.7
Cylindrical SS float - 0.5
Switch Body: Brass 3/4" NPT conduit connection.
For SS switch body, change model no. to L6EPS.
Piping/Mounting Connection: 1" NPT
Installation: Horizontal, index arrow pointing down.
Weight: 1 lb. (.5 KG); w/external chamber 1-3/4 lb. (.8 KG)

WETTED MATERIALS CHART

Model	Brass	Bronze	Ceramic	Polypropylene	301SS	303SS	304SS
B-S-3-A	X		X		X		X
B-S-3-B	X	X	X	X	X		
B-S-3-C	X		X		X		X
B-S-3-H	X	X	X		X		X
B-S-3-O	X		X	X	X		
S-S-3-A			X	X	X		X
S-S-3-C			X		X	X	X
S-S-3-L			X		X	X	X
S-S-3-O			X	X	X	X	
S-S-3-S			X	X	X	X	

MAXIMUM PRESSURE CHART

Model Number	Float	Pressure Rating PSIG (KG/CM²)
L6EPB-B-S-3-A	Cylindrical SS	200 (14)
L6EPB-B-S-3-B	Polypropylene	250 (18)
L6EPB-B-S-3-C	Round SS	350 (25)
L6EPB-B-S-3-H	Round SS	250 (18)
L6EPB-B-S-3-O	Polypropylene	1000 (70)
L6EPB-S-S-3-A	Cylindrical SS	200 (14)
L6EPB-S-S-3-C	Round SS	350 (25)
L6EPB-S-S-3-L	Round SS	350 (25)
L6EPB-S-S-3-O	Polypropylene	2000 (140)
L6EPB-S-S-3-S	Polypropylene	2000 (140)

INSTALLATION:

Unpack switch and remove any packing material found inside lower housing or float chamber.

Switch must be installed with body in a horizontal plane and arrow on side pointing down.

If switch has an external float chamber (tee), connect it to vertical sections of 1" NPT pipe installed outside vessel walls at appropriate levels. If unit has no external float chamber, it must be mounted in a 1" NPT half coupling welded to the vessel wall. The coupling must extend through the wall.

Inspect and clean wetted parts at regular intervals.

ELECTRICAL CONNECTIONS:

Connect wire leads in accordance with local electrical codes and switch action required. N.O. contacts will close and N.C. contacts will open when liquid level causes float to rise. They will return to "normal" condition on decreasing liquid level. Black = common, Blue = N.O. and Red = N.C.

For units supplied with both internal and external grounds, the ground screw inside the housing must be used to ground the control. The external ground screw is for supplementary bonding when allowed or required by local code. Some CSA listed models are furnished with a separate green ground wire. Such units must be equipped with a junction box, not supplied but available on special order.

CENELEC certified models include a junction box. Cable should enter enclosure through an approved EX cable gland, not supplied. Push stripped and tinned leads into appropriate openings in terminal block(s). To connect fine stranded leads or to remove any wire, depress spring release with small screwdriver first.

All wiring, conduit and enclosures must meet applicable codes for hazardous areas. Conduits and enclosures must be properly sealed. For outdoor or other locations where temperatures vary widely, precautions should be taken to prevent condensation inside switch or enclosure. Electrical components must be kept dry at all times. **CAUTION:** To prevent ignition of hazardous atmospheres, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in use.

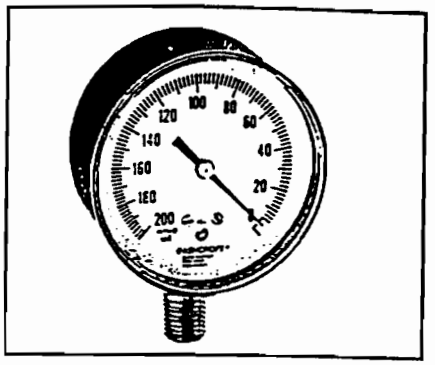
Dimensions on reverse

ASHCROFT'

Low Pressure Diaphragm Gauges Series 1490, Grade A (2-1-2%)

- *2½" dial size*
- *Steel case/black epoxy painted*
- *Bronze diaphragm*
- *Brass socket*
- *Sensitive diaphragm-capsule sensor mechanism*
- *For use with gases that are not corrosive to bronze and brass*

The Ashcroft® Type 1490 series of product measures low pressures from 10" H_2O thru 15 psi as well as vacuum and compound ranges. This gauge uses a diaphragm capsule which is very sensitive for measuring low pressures and vacuum.



SELECTION TABLE

Case Size		Gauge Type		Tube and Socket Material		Connection Size and Location		Variations		Range
Code		Code		Code		Code		Code		
25	2½	1490	Steel-Black Painted case; Push-in poly-carbonate window	A	Bronze diaphragm	02L	¼ lower	TU	Throttle plug	Per standard range table
						02B	¼ back	NH	Wired stainless steel tag	
		1491	Threaded poly-carbonate window		Brass socket	01L	⅛ lower			Consult factory for special range requirements
						01B	⅛ back			
		1492	Threaded poly-carbonate window with flush mounting U-clamp							
		1493	Push in poly-carbonate window with flush mounting U-clamp							

STANDARD METRIC RANGES

Pressure	Figure Intervals	Minor Graduation
0/60 cm. H-O	10	1
0/2.5 kPa	0.5	0.05
0/4.0 kPa	0.5	0.05
0/10 kPa	1	0.1
0/16 kPa	1	0.1
0/25 kPa	5	0.5
0/40 kPa	5	0.5
0/100 kPa	10	1
Vacuum		
2.5/0 kPa	0.5	0.05
4.0/0 kPa	0.5	0.05
10/0 kPa	1	0.1
16/0 kPa	1	0.1
25/0 kPa	5	0.5
40/0 kPa	5	0.5
100/0 kPa	10	1
Compound		
-10/60 cm H-O	10	1
-10/80 cm H-O	10	1
-20/40 cm H-O	10	1
-10/100 cm H_2O	10	1
-10/120 cm H_2O	10	1

STANDARD RANGES

Pressure	Figure Intervals	Minor Graduation
0/10 in. H_2O	1	0.1
0/15 in. H_2O	5	0.2
0/30 in. H_2O	5	0.5
0/60 in. H_2O	10	1
0/100 in. H_2O	10	1
0/160 in. H_2O	20	2
0/200 in. H_2O	20	2
0/300 in. H_2O	50	5
0/10 oz./in.²	1	0.1
0/15 oz./in.²	5	0.2
0/30 oz./in.²	1	0.1
0/60 oz./in.²	10	1
0/100 oz./in.²	10	1
0/160 oz./in.²	20	2
0/250 oz./in.²	50	5
0/3 psi	0.5	0.5
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2
Vacuum		
15/0 in. H_2O	5	0.2
30/0 in. H_2O	5	0.5
60/0 in. H_2O	10	1
100/0 in. H_2O	10	1
200/0 in. H_2O	20	2
15/0 oz./in.²	5	0.2
30/0 oz./in.²	1	0.1
60/0 oz./in.²	10	1
100/0 oz./in.²	10	1
Compound		
-30/30 in. H_2O	10	1
-30/30 in.oz./in.²	10	1
-10/10 in. H_2O	2	0.2

Dual Scale

Range		Graduations			
		Inner Scale		OuterScale	
Inner Scale	Outer Scale	Figure Intervals	Minor Grad.	Figure Intervals	Minor Grad.
0/9 oz./in.²	0/15 in. H_2O	1	0.2	5	0.2
0/20 oz./in.²	0/35 in. H_2O	5	0.5	5	0.5
0/35 oz./in.²	0/60 in. H_2O	5	0.5	5	0.5
0/60 oz./in.²	0/100 in. H_2O	10	1	10	1

Other ranges available on request. Consult factory.

TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:

Select: 25 1490 A 02L XXX 10"H_2O

1. Dial size–2½
2. Case type
3. Tube and socket material
4. Connection size–¼ (02), ⅛ (01)
5. Connection location–Lower (L), Back (B)
6. Optional features–see page 88
7. Standard pressure range–10"H_2O

Accessories–see pages 138-144

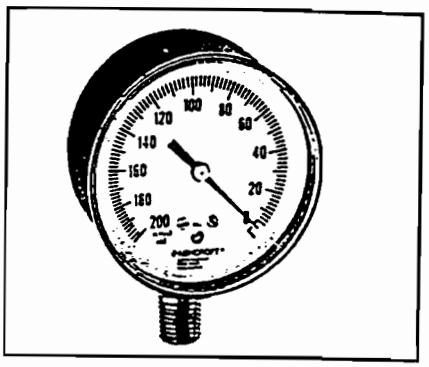
Reference Bulletin OG-1

ASHCROFT®

Low Pressure Diaphragm Gauges
Series 1490, Grade A (2-1-2%)

- *2½" dial size*
- *Steel case/black epoxy painted*
- *Bronze diaphragm*
- *Brass socket*
- *Sensitive diaphragm-capsule sensor mechanism*
- *For use with gases that are not corrosive to bronze and brass*

The Ashcroft® Type 1490 series of product measures low pressures from 10" H_2O thru 15 psi as well as vacuum and compound ranges. This gauge uses a diaphragm capsule which is very sensitive for measuring low pressures and vacuum.



SELECTION TABLE

Case Size		Gauge Type		Tube and Socket Material		Connection Size and Location		Variations		Range
Code		Code	Steel-Black Painted case	Code		Code		Code		
25	2½	1490	Push-in poly-carbonate window	A	Bronze diaphragm Brass socket	02L 02B 01L 01B	¼ lower ¼ back ⅛ lower ⅛ back	TU NH	Throttle plug Wired stainless steel tag	Per standard range table
		1491	Threaded poly-carbonate window							Consult factory for special range requirements
		1492	Threaded poly-carbonate window with flush mounting U-clamp							
		1493	Push in poly-carbonate window with flush mounting U-clamp							

STANDARD RANGES

Pressure	Figure Intervals	Minor Graduation
0/10 in. H_2O	1	0.1
0/15 in. H_2O	5	0.2
0/30 in. H_2O	5	0.5
0/60 in. H_2O	10	1
0/100 in. H_2O	10	1
0/160 in. H_2O	20	2
0/200 in. H_2O	20	2
0/300 in. H_2O	50	5
0/10 oz./in.²	1	0.1
0/15 oz./in.²	5	0.2
0/30 oz./in.²	1	0.1
0/60 oz./in.²	10	1
0/100 oz./in.²	10	1
0/160 oz./in.²	20	2
0/250 oz./in.²	50	5
0/3 psi	0.5	0.5
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2
Vacuum		
15.0 in. H_2O	5	0.2
30.0 in. H_2O	5	0.5
60.0 in. H_2O	10	1
100.0 in. H_2O	10	1
200.0 in. H_2O	20	2
15.0 oz./in.²	5	0.2
30.0 oz./in.²	1	0.1
60.0 oz./in.²	10	1
100.0 oz./in.²	10	1
Compound		
-30/30 in. H_2O	10	1
-30/30 in.oz./in.²	10	1
-10/10 in. H_2O	2	0.2

Dual Scale

Range		Graduations			
		Inner Scale		OuterScale	
Inner Scale	Outer Scale	Figure Intervals	Minor Grad.	Figure Intervals	Minor Grad.
0/9 oz./in.²	0/15 in. H_2O	1	0.2	5	0.2
0/20 oz./in.²	0/35 in. H_2O	5	0.5	5	0.5
0/35 oz./in.²	0/60 in. H_2O	5	0.5	5	0.5
0/60 oz./in.²	0/100 in. H_2O	10	1	10	1

Other ranges available on request. Consult factory.

STANDARD METRIC RANGES

Pressure	Figure Intervals	Minor Graduation
0/60 cm. H_2O	10	1
0/2.5 kPa	0.5	0.05
0/4.0 kPa	0.5	0.05
0/10 kPa	1	0.1
0/16 kPa	1	0.1
0/25 kPa	5	0.5
0/40 kPa	5	0.5
0/100 kPa	10	1
Vacuum		
2.5/0 kPa	0.5	0.05
4.0/0 kPa	0.5	0.05
10/0 kPa	1	0.1
16/0 kPa	1	0.1
25/0 kPa	5	0.5
40/0 kPa	5	0.5
100/0 kPa	10	1
Compound		
-10/60 cm H_2O	10	1
-10/80 cm H_2O	10	1
-20/40 cm H_2O	10	1
-10/100 cm H_2O	10	1
-10/120 cm H_2O	10	1

TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:

Select: 25 1490 A 02L XXX 10"H_2O

1. Dial size–2½
2. Case type
3. Tube and socket material
4. Connection size–¼ (02), ⅛ (01)
5. Connection location–Lower (L), Back (B)
6. Optional features–see page 88
7. Standard pressure range–10"H_2O

Accessories–see pages 138-144

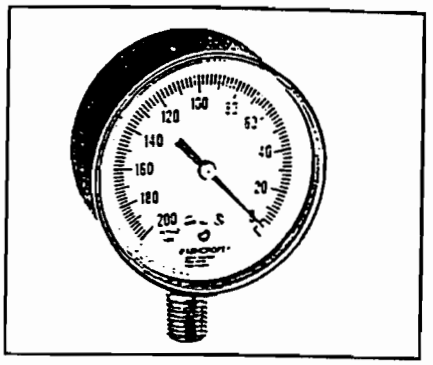
Reference Bulletin QG-1

ASHCROFT

Low Pressure Diaphragm Gauges
Series 1490, Grade A (2-1-2%)

- *2½" dial size*
- *Steel case/black epoxy painted*
- *Bronze diaphragm*
- *Brass socket*
- *Sensitive diaphragm-capsule sensor mechanism*
- *For use with gases that are not corrosive to bronze and brass*

The Ashcroft® Type 1490 series of product measures low pressures from 10" H_2O thru 15 psi as well as vacuum and compound ranges. This gauge uses a diaphragm capsule which is very sensitive for measuring low pressures and vacuum.



SELECTION TABLE

Case Size		Gauge Type		Tube and Socket Material		Connection Size and Location		Variations		Range
Code		Code	Steel-Black Painted case	Code		Code		Code		
25	2½	1490	Push-in poly-carbonate window	A	Bronze diaphragm	02L 02B	¼ lower ¼ back	TU NH	Throttle plug Wired stainless steel tag	Per standard range table
		1491	Threaded poly-carbonate window		Brass socket	01L 01B	⅛ lower ⅛ back			Consult factory for special range requirements
		1492	Threaded poly-carbonate window with flush mounting U-clamp							
		1493	Push in poly-carbonate window with flush mounting U-clamp							

STANDARD METRIC RANGES

Pressure	Figure Intervals	Minor Graduation
0/60 cm H_2O	10	1
0/2.5 kPa	0.5	0.05
0/4.0 kPa	0.5	0.05
0/10 kPa	1	0.1
0/16 kPa	1	0.1
0/25 kPa	5	0.5
0/40 kPa	5	0.5
0/100 kPa	10	1
Vacuum		
2.5/0 kPa	0.5	0.05
4.0/0 kPa	0.5	0.05
10/0 kPa	1	0.1
16/0 kPa	1	0.1
25/0 kPa	5	0.5
40/0 kPa	5	0.5
100/0 kPa	10	1
Compound		
-10/60 cm H_2O	10	1
-10/80 cm H_2O	10	1
-20/40 cm H_2O	10	1
-10/100 cm H_2O	10	1
-10/120 cm H_2O	10	1

STANDARD RANGES

Pressure	Figure Intervals	Minor Graduation
0/10 in. H_2O	1	0.1
0/15 in. H_2O	5	0.2
0/30 in. H_2O	5	0.5
0/60 in. H_2O	10	1
0/100 in. H_2O	10	1
0/160 in. H_2O	20	2
0/200 in. H_2O	20	2
0/300 in. H_2O	50	5
0/10 oz./in.²	1	0.1
0/15 oz./in.²	5	0.2
0/30 oz./in.²	1	0.1
0/60 oz./in.²	10	1
0/100 oz./in.²	10	1
0/160 oz./in.²	20	2
0/250 oz./in.²	50	5
0/3 psi	0.5	0.5
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2
Vacuum		
15/0 in. H_2O	5	0.2
30/0 in. H_2O	5	0.5
60/0 in. H_2O	10	1
100/0 in. H_2O	10	1
200/0 in. H_2O	20	2
15/0 oz./in.²	5	0.2
30/0 oz./in.²	1	0.1
60/0 oz./in.²	10	1
100/0 oz./in.²	10	1
Compound		
-30/30 in. H_2O	10	1
-30/30 in.oz./in.²	10	1
-10/10 in. H_2O	2	0.2

Dual Scale

Range		Graduations			
		Inner Scale		OuterScale	
Inner Scale	Outer Scale	Figure Intervals	Minor Grad.	Figure Intervals	Minor Grad.
0/9 oz./in.²	0/15 in. H_2O	1	0.2	5	0.2
0/20 oz./in.²	0/35 in. H_2O	5	0.5	5	0.5
0/35 oz./in.²	0/60 in. H_2O	5	0.5	5	0.5
0/60 oz./in.²	0/100 in. H_2O	10	1	10	1

Other ranges available on request. Consult factory.

TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:

Select: 25 1490 A 02L XXX 10"H_2O

1. Dial size–2½
2. Case type
3. Tube and socket material
4. Connection size–¼ (02), ⅛ (01)
5. Connection location–Lower (L), Back (B)
6. Optional features–see page 88
7. Standard pressure range–10"H_2O

Accessories–see pages 138-144

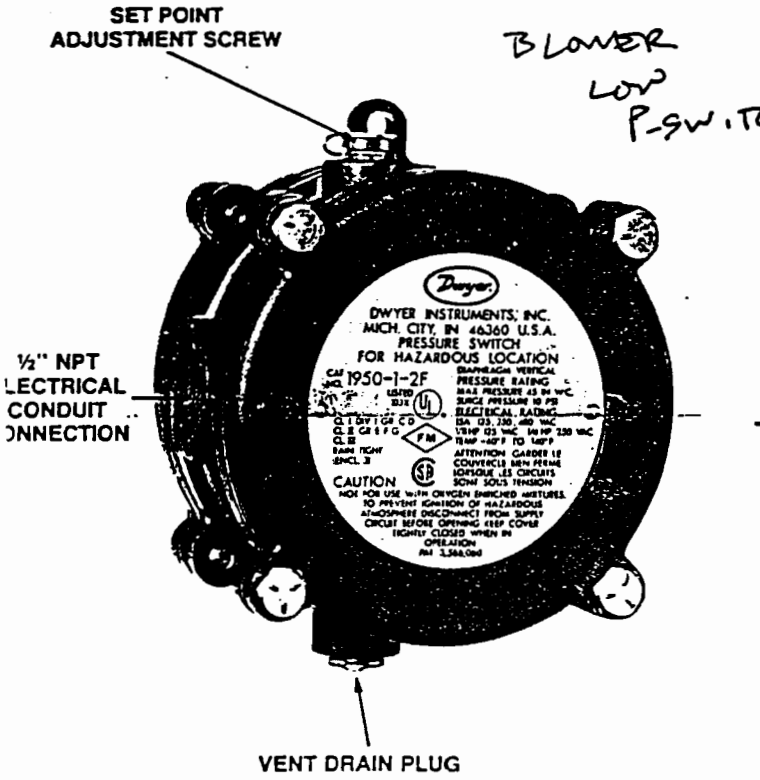
Reference Bulletin QG-1

Dwyer

SERIES 1950

INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

Specifications - Installation and Operating Instructions



UL and CSA Listed, FM Approved For
CL. I GR. C,D – CL. II GR. E,F,G – CL. III

Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.6

Model Number	Operating Range PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-2	.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

PHYSICAL DATA

Temperature Limits: –40° to 140°F (–40° to 60°C), 1950P-8, 15, 25 & 50: 0° to 140°F (–17.8° to 60°C), 1950-02: –30° to 130°F (–34.4° to 54.4°C).

Rated Pressure: 1950 — 45 IN. W.C., 1950P — 35 PSI, 1950P-50 only — 70 PSI.

Maximum surge pressure: 1950 — 10 PSI, 1950P — 50 PSI, 1950P-50 only — 90 PSI.

Pressure Connections: 1/8" NPT.

Electrical Rating: 15 amps, 125, 250,480 volts, 60 Hz. A.C. Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.

Wiring connections: 3 screw type; common, norm. open and norm. closed.

Conduit connections: 1/2" NPT.

Set point adjustment: Screw type on top of housing. Field adjustable.

Housing: Anodized cast aluminum.

Diaphragm: Molded fluorosilicone rubber. 02 model, silicone on nylon.

Calibration Spring: Stainless Steel.

Installation: Mount with diaphragm in vertical position.

Weight: 3 1/4 lbs. 02 model, 4 lbs., 7 oz.

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembly of the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION: For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the **Low** pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

Response Time: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

NOTE: The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/8 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V; Viton.

DWYER INSTRUMENTS, INC.
P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/879-8000
Fax 219/872-9057

Dwyer

SERIES 1950

INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHE

Specifications - Installation and Operating Instruction

UL and CSA Listed, FM Approved For
CL. I GR. C,D – CL. II GR. E,F,G – CL. III

Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.6
Model Number	**Operating Range PSI**	**Approximate Dead Band**	
		Min. Set Point	**Max. Set Point**
1950P-2	.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

PHYSICAL DATA

Temperature Limits: –40° to 140°F (–40° to 60°C), 1950P-8, 15, 25 & 50: 0° to 140°F (–17.8° to 60°C), 1950-02: –30° to 130°F (–34.4° to 54.4°C).

Rated Pressure: 1950 — 45 IN. W.C., 1950P — 35 PSI, 1950P-50 only — 70 PSI.

Maximum surge pressure: 1950 — 10 PSI, 1950P — 50 PSI, 1950P-50 only — 90 PSI.

Pressure Connections: 1/8" NPT.

Electrical Rating: 15 amps, 125, 250,480 volts, 60 Hz. A.C. Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.

Wiring connections: 3 screw type; common, norm. open and norm. closed.

Conduit connections: 1/2" NPT.

Set point adjustment: Screw type on top of housing. Field adjustable.

Housing: Anodized cast aluminum.

Diaphragm: Molded fluorosilicone rubber. 02 model, silicone on nylon.

Calibration Spring: Stainless Steel.

Installation: Mount with diaphragm in vertical position.

Weight: 3 1/4 lbs. 02 model, 4 lbs., 7 oz.

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembly of the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION: For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the **Low** pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

Response Time: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

NOTE: The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - ⅛ HP 125 VAC, ¼ HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V; Viton.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
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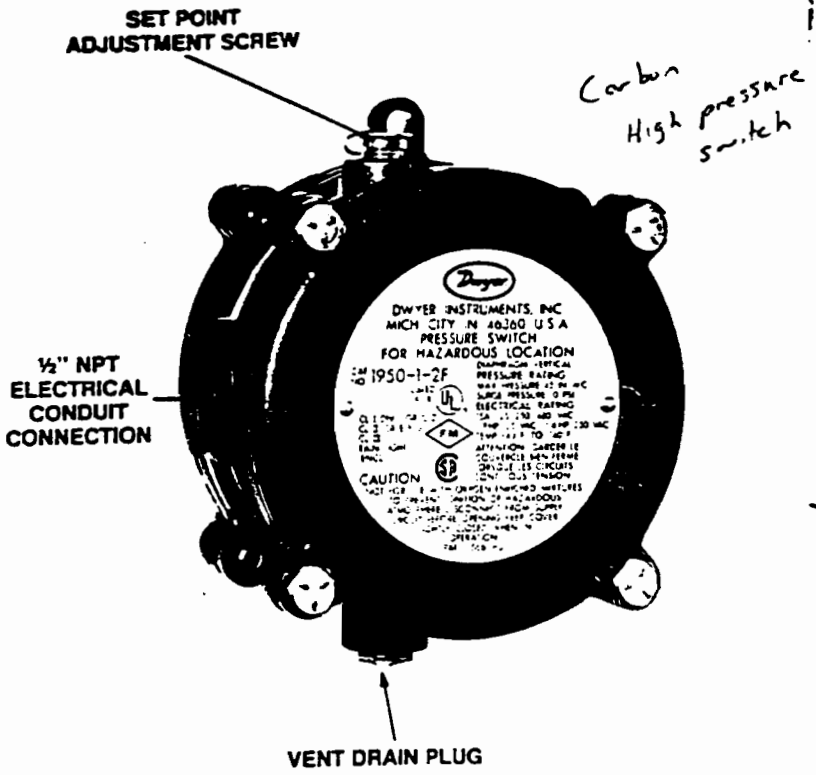
SERIES 1950

INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

Specifications - Installation and Operating Instructions



Carbon
High pressure switch

UL and CSA Listed, FM Approved For
CL. I GR. C,D – CL. II GR. E,F,G – CL. III

Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.6
Model Number	**Operating Range PSI**	**Approximate Dead Band**	
		Min. Set Point	**Max. Set Point**
1950P-2	.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

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PHYSICAL DATA

Temperature Limits: -40° to 140°F (-40° to 60°C), 1950P-8, 15, 25 & 50: 0° to 140°F (-17.8° to 60°C), 1950-02: -30° to 130°F (-34.4° to 54.4°C).

Rated Pressure: 1950 — 45 IN. W.C., 1950P — 35 PSI, 1950P-50 only — 70 PSI.

Maximum surge pressure: 1950 — 10 PSI, 1950P — 50 PSI, 1950P-50 only — 90 PSI.

Pressure Connections: 1/8" NPT.

Electrical Rating: 15 amps, 125, 250,480 volts, 60 Hz. A.C. Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.

Wiring connections: 3 screw type; common, norm. open and norm. closed.

Conduit connections: 1/2" NPT.

Set point adjustment: Screw type on top of housing. Field adjustable.

Housing: Anodized cast aluminum.

Diaphragm: Molded fluorosilicone rubber. 02 model, silicone on nylon.

Calibration Spring: Stainless Steel.

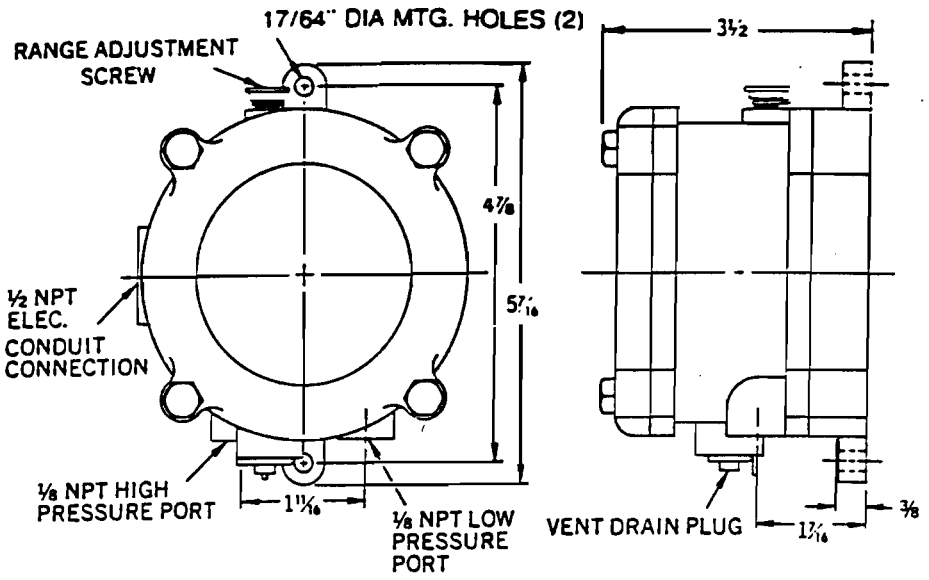
Installation: Mount with diaphragm in vertical position.

Weight: 3 1/4 lbs. 02 model, 4 lbs., 7 oz.

Response Time: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

NOTE: The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/8 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V; Viton.

SERIES 1950
INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES
Installation and Operating Instructions



1950-02: 7-3/4" dia. × 4-11/32" depth. For complete dimensions request drawing 28-700175-00 from our Customer Service Department.

1950 SWITCH OUTLINE DIMENSIONS

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.
2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical. Special units can be furnished for other than vertical mounting arrangements if required.
3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT female pressure ports as noted below:
   A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS. and from source of lower pressure to low pressure port marked LOW PRESS.
   B. Pressure only (above atmospheric) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere. See CAUTION on page 1.
   C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.
4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common," "norm open," and "norm closed." The normally open contacts close and the normally closed contacts open when pressure increases beyond the setpoint. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT

To change the setpoint:

A. Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the setpoint pressure and counter-clockwise to lower the setpoint. After calibration, replace the plastic cap and re-check the setpoint.

B. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the setpoint very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

C. For highly critical applications check the setpoint adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the setpoint. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.

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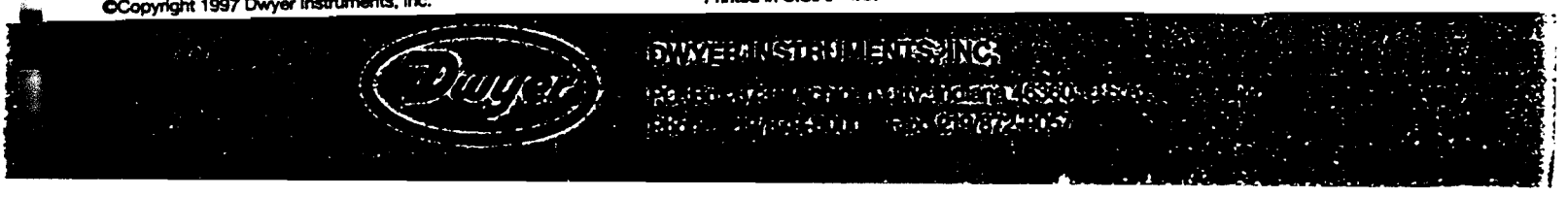
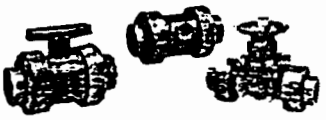
FR26-440332-00



TRUE UNION BALL VALVE, TRUE UNION BALL CHECK VALVE & TRUE UNION DIAPHRAGM VALVE Installation Information

TU-3A-0297



Read all applicable instructions and procedures thoroughly before starting. Suitability of the intended service application must be determined prior to installation. Please review **"Material Considerations in Application and System Design"**, in the Materials section of Spears' *THERMOPLASTIC VALVE PRODUCT GUIDE & ENGINEERING SPECIFICATIONS*, V-4, for important additional considerations related to valve installations. Plastic piping systems must be engineered, installed, operated and maintained in accordance with accepted standards and procedures for plastic piping systems. It is absolutely necessary that all design, installation, operation and maintenance personnel be trained in proper handling, installation requirements and precautions for installation and use of plastic piping systems before starting.

True Union type ball and check valves use removable end connectors. To avoid problems, NEVER MAKE THE JOINT TO THE END CONNECTOR WHILE THEY ARE ATTACHED TO THE VALVE CARTRIDGE. The valve cartridge has a removable seal carrier for internal component service or replacement. Valves are factory pre-adjusted and cartridge disassembly is not necessary for general installation. (See *"Precautions & Warnings For All Valve Installations"* on back page.)

Step 1: Prepare connecting pipe as required for solvent cement, thread, or flanged connections).

Step 2: Remove union nuts and end connectors from valve body. Slide union nuts over pipe to which each end connector socket is to be connected, being sure nut threads are facing toward valve, before making the joint. Attach each end connector to the pipe, making sure that face of each end connector is at a square, 90° angle to the pipe, according to the Solvent Cementing, Threading, or Flanging procedures listed on the following pages.

Step 3: End connector o-rings must be free from any signs of dirt or debris. Clean as necessary. If o-rings must be removed, clean all surfaces and re-install by pressing the o-ring evenly into retaining groove, being sure to avoid any wrinkles or creation of an uneven sealing surface.

Step 4: Apply a mild soap and water solution to valve body threads for lubrication. Open the valve completely and support valve body to hold its weight. Attach valve body to end connector via union nut. Tighten "hand-tight" only. (Do NOT use thread sealant.)

IMPORTANT: Check Valves MUST be installed with the valve's "FLOW" arrow pointing in the direction of flow in order to function properly. Check valves may be installed in either vertical or horizontal position.

Step 5: Repeat Step 4 to attach opposite end of the valve. Make sure face of end connector is squarely aligned with valve body and fits flush against o-ring seal. Adjust pipe positioning if needed. DO NOT USE THE UNION NUT TO DRAW TOGETHER ANY GAPS BETWEEN END CONNECTOR AND VALVE BODY.

Step 6: If any leaks are found at valve in either an open or closed position during pressure test, use a strap wrench to tighten union nut 1/4 turn to stop leak. DO NOT OVER TIGHTEN. Where threaded end connectors have been installed, a second strap-wrench must be used on end connector to prevent it from turning on pipe threads and breaking seal. Flanged connections may require additional tightening after initial pressure testing. If problems persist, see "BALL VALVE TROUBLESHOOTING GUIDE" in Spears' *THERMOPLASTIC VALVES PRODUCT GUIDE & ENGINEERING SPECIFICATIONS*, V-4.

SOLVENT CEMENT WELDED JOINTS

For best results, installation should be made at temperatures between 40°F and 110°F. All joint components should be inspected for any breaking, chipping gouging or other visible damage before proceeding. All pipe, fittings and valves should be removed from their packaging or containers and exposed to the installation environment for a minimum of one hour in order to thermally balance all components. All joining components must be clean and dry.

Remove union nuts and end connectors before priming and cementing connections. With the threads facing the valve, slide the union nut over the pipe to which the end connector socket is to be cemented. Reinstall the valve body and union nuts only after the joint has fully cured.

TAKE EXTRA CARE THAT NO PRIMER OR SOLVENT CEMENT IS ALLOWED TO COME IN CONTACT WITH THE BALL OR OTHER INTERNAL VALVE COMPONENTS.

Step 1: Cut Pipe Square

Pipe ends must be cut square, using a wheel-type cutter or saw & miter box. A fine-toothed hand saw (16-18 teeth/inch) with little or no set is recommended. A power cut-off saw with carbide blade is recommended for high volume cutting.

Step 2: Deburr & Bevel Pipe

Regardless of cutting method used in step 1, burrs are created which must be removed from both the pipe I.D. and O.D before joining. All pipe ends should be beveled 10° to 15°. Commercially available deburring & beveling tool is recommended, or a mill file may be used.

Step 3: Clean Joint Components

Wipe away all loose dirt and moisture from the pipe O.D. and fitting I.D. with a clean dry cotton rag. DO NOT ATTEMPT TO JOIN WET SURFACES.

Step 4: Check Joint Interference Fit

An interference between pipe and valve socket is necessary for proper fusion of the joint. To check, lightly insert pipe into valve socket. DO NOT FORCE. Interference between pipe and valve must occur between 1/2 of the socket depth (full interference fit) and the socket bottom (net fit) . Do not use components which improperly mate.

Step 5: Apply Primer

Primer is necessary to penetrate and soften both pipe and valve socket surfaces in order for the solvent cement to properly bond. THE MOST FREQUENT CAUSE OF JOINT FAILURES IS INADEQUATE SOLVENT PENETRATION AND SOFTENING OF BONDING SURFACES DURING THE WELDING OPERATION.

1. Using a brush or applicator size no less than 1/2 the pipe diameter, apply a liberal coat of primer with a scrubbing motion to the valve socket until the surface is softened and semi-fluid. This may take 5 to 15 seconds depending on size and temperature (larger diameters and lower temperatures will increase required time).
2. Apply primer to pipe in the same manner, extending application area to slightly more than the insertion depth into the valve socket.
3. Apply a second coat to both the valve socket and the pipe.
4. Check penetration and softening by scraping the primed surfaces. A few thousands of the semi-fluid surface should be easily removed. Repeat primer application if necessary.

Step 6: Apply Solvent Cement

Solvent cement must be applied IMMEDIATELY to primed surfaces before the primer dries, in an alternating 3-coat application. Using a brush or applicator size no less than 1/2 the pipe diameter, apply a liberal coat of solvent cement to the primed pipe surface, then apply a light to medium coat to the primed valve socket. If a "net fit" was experienced in during dry fit check (Step 4), apply an additional coat again to the pipe surface. BE SURE TO USE A VERY LIBERAL AMOUNT OF SOLVENT CEMENT ON PIPE.

VALVE INSTALLATION CAUTION: TAKE EXTRA CARE THAT NO PRIMER OR SOLVENT CEMENT IS ALLOWED TO CONTACT THE BALL OR OTHER INTERNAL VALVE COMPONENTS.

Step 7: Join Components

IMMEDIATELY following application of cement and before it starts to set, insert the pipe into the valve socket with a 1/4 - turn, twisting motion to evenly distribute cement within the joint. A full bead of cement should form around the circumference of the joint. Hold joint together for a approximately 30 seconds to make sure the pipe does not move or back out of the socket.

Step 8: Remove Excess Cement

Using a cloth, wipe clean all excess cement from the exterior juncture of the pipe and valve.

Step 9: Initial Set & Cure Time

Initial Set & Cure Time must be followed in accordance with the solvent cement manufacturer's instructions.

THREADED CONNECTIONS

Step 1: Apply Joint Sealant

Threaded connections require application of a quality grade thread sealant to seal and lubricate joint assembly. Sealant must be applied to male pipe threads. ***WARNING: SOME PIPE JOINT COMPOUNDS OR TEFLON PASTES MAY CONTAIN SUBSTANCES THAT COULD CAUSE STRESS CRACKING TO PLASTIC.*** Spears Manufacturing Company recommends the use of **Spears BLUE 75™** thread sealant which has been tested for compatibility with Spears products. Please follow the sealant manufacturers' application/ installation instructions. Choice of an appropriate thread sealant other than those listed above is at the discretion of the installer. 1 to 2 turns beyond FINGER TIGHT is generally all that is required to make a sound plastic threaded connection. Unnecessary OVERTIGHTENING will cause DAMAGE TO BOTH PIPE AND FITTING.

Step 2: Assemble Joint by Hand

Threaded pipe and valves or fittings must be initially assembled "finger tight" (just enough to fully engage thread clearance).

Step 3: Wrench Make-Up

Threaded plastic pipe and valve components must always be installed using commercially available strap wrenches. Do not use conventional pipe wrenches which can damage plastic piping materials.

Apply wrench make-up of ***no more than one to two turns*** beyond finger tight thread engagement. Care must be taken in final positioning so as to avoid the need to "back-up" the wrenched assembly.

FLANGED CONNECTIONS

Use full faced, 1/8" thick gaskets of a material suitable for the intended application having a shore "A" durometer of approximately 60. Use of well lubricated bolts and flat washers required. Bolts must be tightened in a 180° opposing pattern. The recommended torques ar 12 ft. lbs. for 1/2" - 1-1/2" sizes, 25 ft. lbs. for 2" - 4" sizes, and 40 ft. lbs. for venturied 6" size.

Precautions And Warnings For All Valve Installations

CAUTION: The system must be designed and installed so as not to pull the valve in ar direction. Pipe must be cut and installed in such a manner as to avoid all stress loac associated with bending, pulling, or shifting. Valve must be supported.

CAUTION: BEFORE THE VALVE IS CYCLED, all dirt, sand, grit or other material must b flushed from the system. This is to prevent scarring of internal components; e.g., ball, cur wedge, seats, etc.

WARNING: SOME LUBRICANTS, INCLUDING VEGETABLE OILS, ARE KNOWN TC CAUSE STRESS CRACKING IN THERMOPLASTIC MATERIALS. A mild soap solution c commercially available pipe gasket lubricant suitable for PVC and CPVC is recommended fo use where lubrication is needed for installation or maintenance service. Choice of lubricant is at the discretion of the installer.

WARNING: Systems must not be operated or flushed out at flow velocities greater than 5 fee per second.

NOT FOR USE WITH COMPRESSED AIR OR GAS

WARNING: DO NOT USE COMPRESSED AIR OR GAS TO TEST ANY PVC OR CPVC THERMOPLASTIC PIPING PRODUCT OR SYSTEM, AND DO NOT USE DEVICES PROPELLED BY COMPRESSED AIR OR GAS TO CLEAR SYSTEMS. THESE PRACTICES MAY RESULT IN EXPLOSIVE FRAGMENTATION OF SYSTEM PIPING AND COMPONENTS CAUSING BODILY INJURY OR DEATH. All air must be bled from the system during initial fluid fill. Pressure testing of the system must not be made until all solvent cement joints have properly cured. Initial pressure testing must be made at approximately 10% of the system hydrostatic pressure rating to identify potential problems, prior to testing at higher pressures.

SPEARS® MANUFACTURING COMPANY

CORPORATE OFFICES

15853 Olden Street, Sylmar, California 91342
P.O. Box 9203, Sylmar, CA 91392
(818) 364-1611 - http://www.spearsmfg.com

PACIFIC SOUTHWEST	NORTHWEST	ROCKY MOUNTAIN	SOUTH CENTRAL	UTAH
15860 Olden Street Sylmar (Los Angeles), CA 91342 P.O. Box 9203, Sylmar, CA 91392 (818) 364-1611 (800) 862-1499 *FAX:* (818) 367-3014	3902 "B" Street N.W. Auburn (Seattle), WA 98002 (253) 939-4433 (800) 347-7327 *FAX:* (253) 939-7557	4800 Nome Street Denver, CO 80239 (303) 371-9430 (800) 777-4154 *FAX:* (303) 375-9548	1838 Forms Drive Carrollton (Dallas), TX 75006 (972) 245-0387 (800) 441-1437 *FAX:* (972) 245-4205	1415 South 700 West #3 Salt Lake City, UT 84104 (801) 972-0659 *FAX:* (801) 972-0688

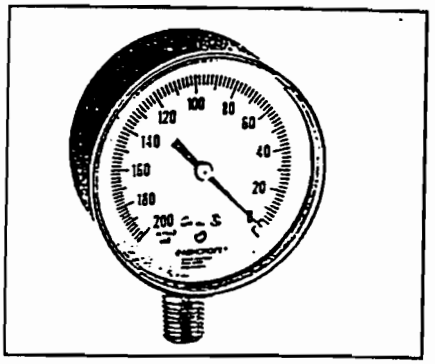
NORTHEAST	SOUTHEAST	FLORIDA	MIDWEST	INTERNATIONAL SALES
543 Industrial Drive Lewisberry (Harrisburg), PA 17339-9532 (717) 938-6844 (800) 233-0275 *FAX:* (717) 938-6547	8751 Miller Road Decatur (Atlanta), GA 30035 (770) 981-7122 (800) 662-6326 *FAX:* (770) 981-6108	3445 Bartlett Boulevard Orlando, FL 32811 (407) 843-1960 (800) 327-6390 *FAX:* (407) 425-3563	854 Fairway Drive Bensenville (Chicago), IL 60106 (630) 773-0075 (800) 662-6330 *FAX:* (630) 773-0435	15853 Olden Street Sylmar (Los Angeles), CA 91342 P.O. Box 9203 Sylmar, CA 91392 (818) 364-1611 *FAX:* (818) 898-3774

ASHCROFT®

Low Pressure Diaphragm Gauges
Series 1490, Grade A (2-1-2%)

- *2½" dial size*
- *Steel case/black epoxy painted*
- *Bronze diaphragm*
- *Brass socket*
- *Sensitive diaphragm-capsule sensor mechanism*
- *For use with gases that are not corrosive to bronze and brass*

The Ashcroft® Type 1490 series of product measures low pressures from 10" H_2O thru 15 psi as well as vacuum and compound ranges. This gauge uses a diaphragm capsule which is very sensitive for measuring low pressures and vacuum.



SELECTION TABLE

Case Size		Gauge Type		Tube and Socket Material		Connection Size and Location		Variations		Range
Code		Code	Steel-Black Painted case	Code		Code		Code		
25	2½	1490	Push-in poly-carbonate window	A	Bronze diaphragm	02L	¼ lower	TU	Throttle plug	Per standard range table
						02B	¼ back	NH	Wired stainless steel tag	
		1491	Threaded poly-carbonate window		Brass socket	01L	⅛ lower			Consult factory for special range requirements
						01B	⅛ back			
		1492	Threaded poly-carbonate window with flush mounting U-clamp							
		1493	Push in poly-carbonate window with flush mounting U-clamp							

STANDARD METRIC RANGES

Pressure	Figure Intervals	Minor Graduation
0/60 cm. H-O	10	1
0/2.5 kPa	0.5	0.05
0/4.0 kPa	0.5	0.05
0/10 kPa	1	0.1
0/16 kPa	1	0.1
0/25 kPa	5	0.5
0/40 kPa	5	0.5
0/100 kPa	10	1
Vacuum		
2.5/0 kPa	0.5	0.05
4.0/0 kPa	0.5	0.05
10/0 kPa	1	0.1
16/0 kPa	1	0.1
25/0 kPa	5	0.5
40/0 kPa	5	0.5
100/0 kPa	10	1
Compound		
-10/60 cm H-O	10	1
-10/80 cm H-O	10	1
-20/40 cm H-O	10	1
-10/100 cm H_2O	10	1
-10/120 cm H_2O	10	1

STANDARD RANGES

Pressure	Figure Intervals	Minor Graduation
0/10 in. H-O	1	0.1
0/15 in. H-O	5	0.2
0/30 in. H-O	5	0.5
0/60 in. H-O	10	1
0/100 in. H-O	10	1
0/160 in. H-O	20	2
0/200 in. H-O	20	2
0/300 in. H-O	50	5
0/10 oz./in.²	1	0.1
0/15 oz./in.²	5	0.2
0/30 oz./in.²	1	0.1
0/60 oz./in.²	10	1
0/100 oz./in.²	10	1
0/160 oz./in.²	20	2
0/250 oz./in.²	50	5
0/3 psi	0.5	0.5
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2
Vacuum		
15.0 in. H_2O	5	0.2
30.0 in. H_2O	5	0.5
60.0 in. H_2O	10	1
100.0 in. H_2O	10	1
200.0 in. H-O	20	2
15.0 oz./in.²	5	0.2
30.0 oz./in.²	1	0.1
60.0 oz./in.²	10	1
100.0 oz./in.²	10	1
Compound		
-30/30 in. H_2O	10	1
-30/30 in.oz./in.²	10	1
-10/10 in. H_2O	2	0.2
Dual Scale		

Range		Graduations			
		Inner Scale		OuterScale	
Inner Scale	Outer Scale	Figure Intervals	Minor Grad.	Figure Intervals	Minor Grad.
0/9 oz./in.²	0/15 in. H_2O	1	0.2	5	0.2
0/20 oz./in.²	0/35 in. H_2O	5	0.5	5	0.5
0/35 oz./in.²	0/60 in. H_2O	5	0.5	5	0.5
0/60 oz./in.²	0/100 in. H_2O	10	1	10	1

Other ranges available on request. Consult factory.

TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:

Select: 25 1490 A 02L XXX 10"H_2O

1. Dial size–2½
2. Case type
3. Tube and socket material
4. Connection size–¼ (02), ⅛ (01)
5. Connection location–Lower (L), Back (B)
6. Optional features–see page 88
7. Standard pressure range–10"H_2O

Accessories–see pages 138-144

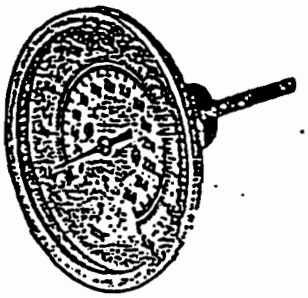
Reference Bulletin QG-1

Bi-metal Thermometers

Type A5300 3"

~~Type A5301 5"~~

- STAINLESS STEEL CASE
- HERMETICALLY SEALED
- ADJUSTMENT SCREW STANDARD



WIKA Bi-metal Thermometers are ideal for most rugged industrial temperature measurement applications. The hermetically sealed case offers protection from weather and dust. The bi-metal helix is coated with a viscous silicone to minimize pointer oscillation and improve temperature transmission.

Standard stem lengths up to 12" and custom lengths of up to 72" are available with a 3" or 5" dial size.

Standard Features

Sizes: 3" (A5300)
~~5" (A5301)~~
Case & Stem: 304 stainless steel
Window: Flat instrument glass
Dial: White aluminum
Pointer: Black aluminum
Accuracy: ± 1.0% of span
Scale: Dual scale °F/°C

External zero adjustment

STANDARD RANGES AND PART NUMBERS

Type	A5300 3"				
Connection	CBM				
Process Conn.	1/2" NPT				
Stem Length	2½"	4"	6"	9"	12"
Temperature Ranges (Fahrenheit/Celsius)					
-40 to 120 °F/C	8985023	8985024	9779796	9779809	9779817
25 to 125 °F/C		9779825	9779833	9779841	
0 to 140 °F/C					
-100 to 150 °F/C					
0 to 200 °F/C	9779850	9779868	9779876		
20 to 240 °F/C		9779906	9779914	9779922	
0 to 250 °F/C	9779931	9779949	9779957	9779965	9779973
50 to 300 °F/C		9779981	9779990	8985000	
50 to 400 °F/C					
50 to 500 °F/C	8985001	8985002	8985003	8985004	8985005
150 to 750 °F/C			8985006	8985007	8985008
200 to 1000 °F/C			8985009	8985010	8985011

Type	~~A5301 5"~~				
Connection	CBM				
Process Conn.	1/2" NPT				
Stem Length	2½"	4"	6"	9"	12"
Temperature Ranges (Fahrenheit/Celsius)					
-40 to 120 °F/C	8985012	8985013	8985014		
25 to 125 °F/C					
0 to 140 °F/C					
-100 to 150 °F/C					
0 to 200 °F/C					
20 to 240 °F/C					
0 to 250 °F/C	8985015	8985016	8985017	8985018	
50 to 300 °F/C					
50 to 400 °F/C					
50 to 500 °F/C	8985019	8985020	8985021		
150 to 750 °F/C					
200 to 1000 °F/C					

ABBREVIATIONS
CBM - Center Back Mount

- Items shown with part numbers are available from stock (subject to prior sale).
- Items shown without part numbers are available on special order. NO MINIMUM ORDER QUANTITY REQUIRED.

VAPOR FILTERS - STEEL
SQUARE LOW PRESSURE DROP SERIES

GENERAL DESCRIPTION

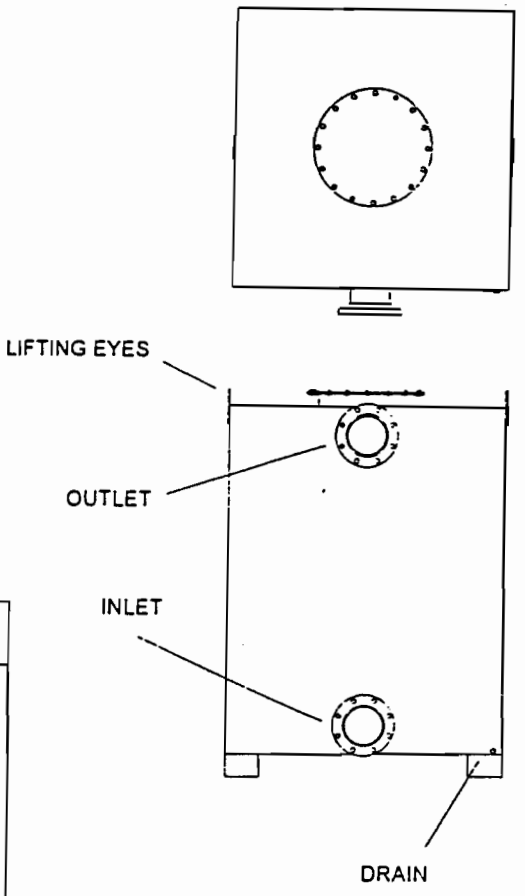
Designed for vapor treatment applications from 640 to 4800 CFM, the Low Pressure Drop Series vessels are a full-scale adsorption system. With four models designed to hold between 500 to 3000 lbs of media these versatile vessels are ideal for:

- Soil vent applications
- Storage tank venting
- Pressure drop sensitive applications
- Airstripper off-gas treatment
- Odor Control
- Airstripper retrofits

FEATURES

Low Pressure Drop Series filters offer several features and benefits for environmental, industrial and municipal users including:

- Quality Steel Vessels
- Rust-Inhibitive Lining
- Industrial Exterior Coating
- Low Pressure Drop and Wide Surface Area
- "False Floor" Design
- Simple Setup and Operation
- Large Bolted Manway
- Reactivation and Disposal Available



SPECIFICATIONS

Model # (Add "VF-")	500	1000	1500	2000	3000	5000
Overall Height	56"	56"	68"	80"	68"	80"
Footprint (Square)	36"	48"	48"	48"	72"	96"
Inlet / Outlet (ANSI Flange)	4"	6"	6"	6"	8"	10"
Max. Pres (PSI)	3	3	3	3	3	3
Max. Temperature (F)	240	240	240	240	240	240
Flow Range (CFM x 100)*	2-9	3-15	3-15	3-15	5-36	10-48
Carbon Capacity (Lbs.)	500	1000	1500	2000	3000	5000
Shipping Weight (Lbs.)	900	1450	1950	2500	4500	7100

* *Flow based on 40 to 100 CFM / SQ FT*

BISCO Environmental
60 Stergis Way, Dedham, MA 02026
Tel: 800-225-8006 • Fax: (617) 461-1152

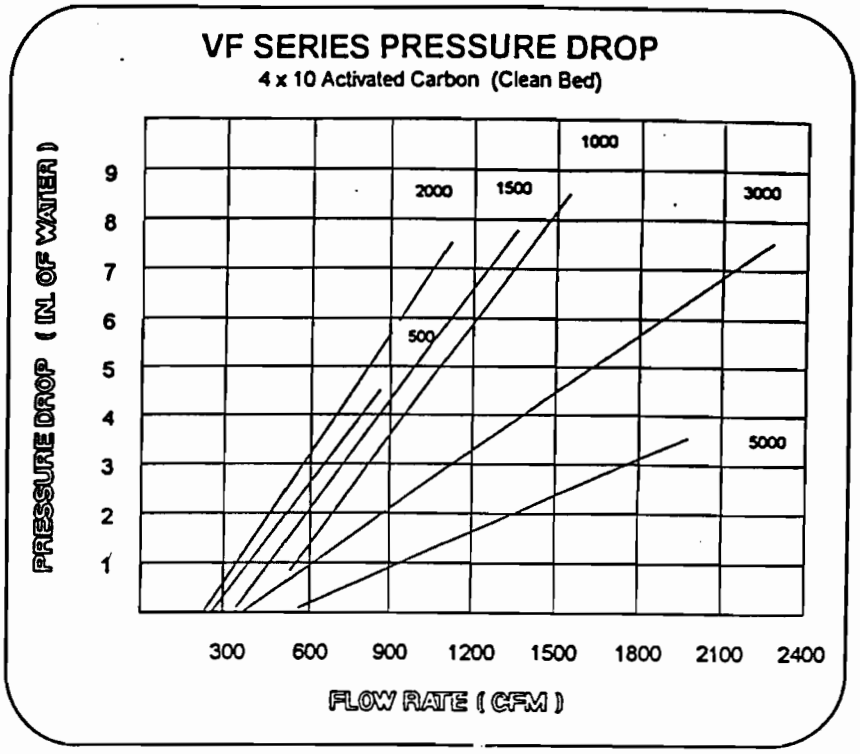
MEDIAS

Low Pressure Drop Series filters are available with the following medias:

- ~~Re-activated and~~ virgin coal carbon
- Virgin coconut shell carbon
- Impregnated carbons
- Paper and fabric medias

The standard media supplied is re-activated 4 x 10 coal based carbon. Call for pricing on alternate medias.

Many other medias are available and our sales staff suggest a media which would best meet the needs of your application.

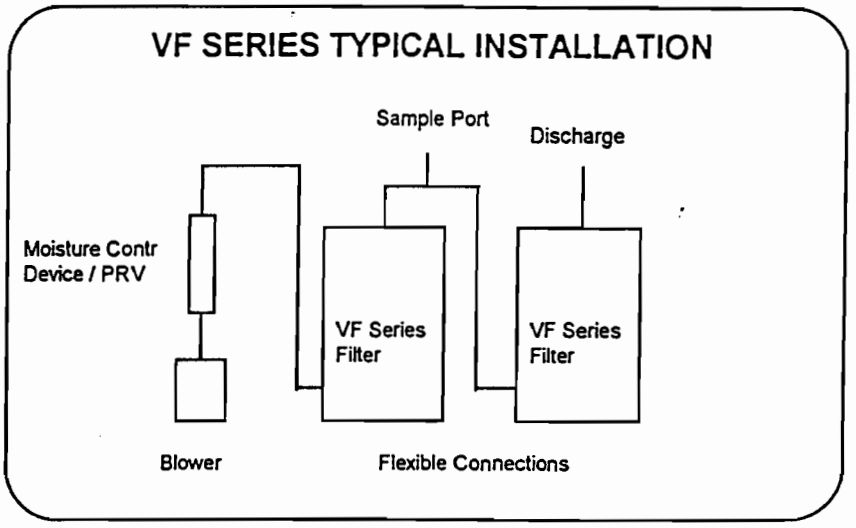


INSTALLATION

Filters should be installed on a level surface capable of supporting the filter at operational weight. Connect the filter to the process line. Two filters in 'series' operation is generally recommended.

Additional accessories such as pressure relief valves are recommended where pressure may exceed the design limitations. Moisture control devices such as separators and duct heaters may also be necessary. In general we recommend an influent relative humidity of no greater than 50% as optimum. As always we recommend you review the specific installation with a sales representative.

High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehyde, organic acids or sulfur may cause severe temperature rises.



OPERATION

Operation of the Low Pressure Drop Series filters requires little more than periodic monitoring of the following:

Pressure reading at primary and secondary influent. The pressure drop in the filters should generally remain consistent throughout the operation period.

Inspection of the Low Pressure Drop Series filters for leaking and stress. In extreme environments the filter may be suspect to interior or exterior corrosion.

Additional monitoring of accessories may be necessary, please refer to your operational manual.

BISCO Environmental
60 Stergis Way, Dedham, MA 02026
Tel: 800-225-8006 • Fax: (617) 461-1152

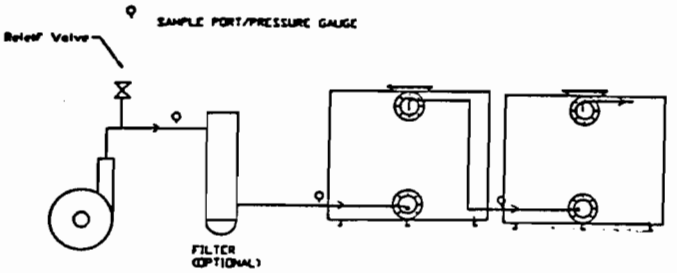
VAPOR FILTERS - STEEL SQUARE LOW PRESSURE DROP SERIES INSTALLATION & OPERATION INSTRUCTIONS

Vapor Steel Square Series Adsorbers are constructed of casrbon steel with vinyl ester lining.

The specific Square series data sheet with drawing may be referred to in these instructions.

SHIPMENT

Vapor Square Series Adsorbers are shipped when possible upright with GAC pre-loaded. Certain special systems may be pre-plumbed and skid mounted and may require specific shipment methods. Contact your sales representative if you have any questions regarding shipment.



TYPICAL VAPOR LOW PRESSURE SERIES INSTALLATION

INSTALLATION

The Adsorber(s) should be set on a flat surface, capable of supporting the operating weight of the unit or system. Operating weights are listed on the specification sheet.

If the filter(s) is supplied individually the inlet and outlet piping should be connected to the unit using either flexible hose or hard piped.

If the supply blower is capable of producing pressure greater than the design limitation of the filter it is recommended that a rupture disk or pressure relief valve be installed

Carbon filters can be manifolded in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

If vapor conditions such as high humidity, free water or debris exist a filter and or duct heater should be installed prior to the Adsorber. A simple cartridge or screen filter helps prevent pressure buildup in the GAC bed.

OPERATION

Vapor enters through the inlet connection, flows upward through the carbon bed and exits through the outlet connection.

Flowrates to the Adsorber should be determined based upon the required contact time between the vapor and the carbon media. The required contact time normally is determined prior to installation and operation of the Adsorber.

MONITORING

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

1) Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate build-up of filtered solids. Never exceed maximum design pressure of filter.

2) Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

ADSORBER SERVICING

The Adsorber may be serviced on-site using vacuum removal methods. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber should also be checked thoroughly and any minor maintenance conducted.

The filter may also be shipped complete to our spent

FAX TRANSMISSION

BISCO Environmental

Groundwater and Soil Remediation Equipment

BISCO Environmental
60 Stergis Way
Dedham, MA 02026

Phone: (781) 461-1560
Toll Free: (800) 225-8006
Fax: (781) 461-1152
E-Mail: JHAAS@BISCOENV.COM

Date: 7-29-98

Pages: 3 (including this one)

Pumps
- Groundwater Recovery
- Product Recovery
- Transfer/Booster
- Pneumatic / Electric

Air Strippers
- Low Profile
- Packed Tower

Soil Vapor Extraction Systems
- Skid Mounted
- Regenerative Blowers
- Positive Displacement Blowers

Air Sparging Systems
- Skid Mounted
- Positive Displacement Blowers
- Compressors (Rotary Vane/Rotary Screw)

Dual Phase Extraction Systems
- Liquid Ring Pumps
- Positive Displacement Blowers

Oil Water Separators

Carbon Adsorbers

Catalytic/Thermal Oxidizers

Custom Control Panels & Instrumentation Systems

Turnkey Containerized Remediation Systems

TO: Tom West
Company: LBG
Fax: 203-452-3111

From: JOHN HAAS

RE: - Rowe Industries
- Vapor GAC "info"

Message:

→ pls let me know if you need anything else —

THANK YOU !!!

BISCO IRRIGATION/ENVIRONMENTAL PURCHASE ORDER

60 Stergis Way *** NEW ORDER ***
Dedham, MA 02026 617-461-1560 Page 1

The Following number must appear on all invoices, bills of lading, and acknowledgements relating to this PO:

PURCHASE ORDER: 3425

P.O. DATE 02/12/98
TERMS 02.00/10
F.O.B.
SHIP VIA Best Way

TO:
TETRASOLV
484 E. CARMEL DR. #339
CARMEL, IN 46032

VENDOR FAX #

ADDRESS CORRESPONDENCE TO:
Name
BISCO
60 Stergis Way
Dedham, MA 02026
Phone 617-461-1560
FAX # 617-461-1152
ID JAD

QTY	UNIT	ITEM	DESCRIPTION
2	EA	NON-INVENTORY	MODEL VF-1500 ADSORBER W/ ** VIRGIN**
	EA	NON-INVENTORY	CARBON

PROJECT NO. 10118
SHIP TO BISCO FAB SHOP
75 COMMERCIAL CIRCLE
DEDHAM, MA 02026

########## FAX TRANSMISSION ##########

FROM: Jeffrey Barbour
TetraSolv, Inc.
36 Taylor Ave.
Plymouth, MA 02360 508-224-1784 FAX 508-224-5997

TO : John Dunn
FAX #: 617-461-1152

COMMENT:

##########

****** ORDER ACKNOWLEDGMENT ******

ORDER DATE : 1998/02/13
DUE BY : Will Advise
SALES ORDER #: 1504JB

BILL TO	SHIP TO
Bisco Environmental	Bisco Fab Shop
60 Stergis Way	75 Commercial Cr.
Dedham, MA 02026	Dedham MA 02026
att. Accounts Payable	att. John Dunn
617-461-1560 617-461-1152	

SALESPERSON: Jeff CUSTOMER ORDER NO.: 3425
DATE SHIPPED: SHIPPED VIA: Best Way
F.O.B. POINT: Dedham MA TERMS: 2% Net-10
PRODUCT CODE(S): Carbon

QTY. ORDERED	DESCRIPTION
2.....	VF-1500 Vapor Phase GAC filters with 1,500 lbs
.....	Virgin GAC in each 6" Inlet/Outlet.....

NOTE: DO NOT PUT ANY TETRASOLV LABLES ON VESSELS

DO PUT ON INLET/OUTLET/PRESSURE RATING LABLES

NOTE: Bisco project #10118

APPENDIX II

SAMPLING AND MONITORING SCHEDULE

TABLE 1

SVE O&M PLAN
ROWE INDUSTRIES SUPERFUND SITE
SAG HARBOR, NEW YORK

Operation Scenarios

Operation* Scenario	Active SVE Wells[1/]	Active Impoundment Screen	Impoundment Screens Open to Ambient Air
Week 4	6 & 8	Front-South, North	Middle
Week 5	9 & 11	Back-South, North	Middle
Week 6	13 & 14	Front-Middle	South & North
Week 7	6 & 8	Back-Middle	South & North

1/ Only the wells identified will have vacuum applied to them.
* Weeks 1 through 3 were completed January 28, 1999 to February 18, 1999.

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TABLE 2

SVE O&M PLAN
ROWE INDUSTRIES SUPERFUND SITE
SAG HARBOR, NEW YORK

Sampling and Monitoring Schedule

	WEEK 4			
Day (elapsed time after start-up):	**THUR (30 min)**	**THUR (2 hr)**	**THUR (8 hr)**	**FOLLOWING THUR**
Sample/Monitoring Locations				
Manifold B (SVE 6)	L/P/G	P/G	P/G	P/G
Manifold C (SVE 8)	L/P/G	P/G	P/G	P/G
Soil Impoundment Manifold	L/P/G	P/G	P/G	P/G
Pre-Carbon	L/P/G	P/G	P/G	L/P/G
Mid-Carbon	L/P/G	P/G	P/G	L/P/G
Post-Carbon	L/P/G	P/G	P/G	L/P/G
Ambient Air (1-UW, 2-DW)				P
Vacuum - All SVE Well Gages				X
Vacuum - All VP Gages				X
Vacuum - All Monitor Well Gages				X
Vacuum - All Active Manifolds			X	X
Vacuum - Pre-blowers				X
Pressure - Carbon Gages			X	X
Pressure - Post-blowers				X
Pressure - All Venturi Meters			X	X
Temperature - Ambient	X	X	X	X
Temperature - All Active Manifolds			X	X

L: Laboratory Analysis. P: Field Screening Using a PID. G: Portable Gas Chromatograph (analysis of PCE only). H:\NABIS\1999\SAMPSCH.TBL

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TABLE 2

SVE O&M PLAN
ROWE INDUSTRIES SUPERFUND SITE
SAG HARBOR, NEW YORK

Sampling and Monitoring Schedule

	WEEK 5			
Day (elapsed time after start-up):	**THUR (30 min)**	**THUR (2 hr)**	**THUR (8 hr)**	**FOLLOWING THUR**
Sample/Monitoring Locations				
Manifold B (SVE 6)	L/P/G	P/G	P/G	P/G
Manifold A (SVE 11)	L/P/G	P/G	P/G	P/G
Soil Impoundment Manifold	L/P/G	P/G	P/G	P/G
Pre-Carbon	L/P/G	P/G	P/G	L/P/G
Mid-Carbon	L/P/G	P/G	P/G	L/P/G
Post-Carbon	L/P/G	P/G	P/G	L/P/G
Ambient Air (1-UW, 2-DW) (1-DW)				P
Vacuum - All SVE Well Gages				X
Vacuum - All VP Gages				X
Vacuum - All Monitor Well Gages				X
Vacuum - All Active Manifolds			X	X
Vacuum - Pre-blowers				X
Pressure - Carbon Gages			X	X
Pressure - Post-blowers				X
Pressure - All Venturi Meters			X	X
Temperature - Ambient	X	X	X	X
Temperature - All Active Manifolds			X	X

L: Laboratory Analysis. P: Field Screening Using a PID. G: Portable Gas Chromatograph (analysis of PCE only). H:\NABIS\1999\SAMPSCH.TBL

TABLE 2

ROWE INDUSTRIES SUPERFUND SITE
SAG HARBOR, NEW YORK

Sampling and Monitoring Schedule

	WEEK 6			
Day (elapsed time after start-up):	**THUR (30 min)**	**THUR (2 hr)**	**THUR (8 hr)**	**FOLLOWING THUR**
Sample/Monitoring Locations				
Manifold A (SVE 13)	L/P/G	P/G	P/G	P/G
Manifold C (SVE 14)	L/P/G	P/G	P/G	P/G
Soil Impoundment Manifold	L/P/G	P/G	P/G	P/G
Pre-Carbon	L/P/G	P/G	P/G	L/P/G
Mid-Carbon	L/P/G	P/G	P/G	L/P/G
Post-Carbon	L/P/G	P/G	P/G	L/P/G
Ambient Air (1-UW, 2-DW) (1-DW)				P
Vacuum - All SVE Well Gages				X
Vacuum - All VP Gages				X
Vacuum - All Monitor Well Gages				X
Vacuum - All Active Manifolds			X	X
Vacuum - Pre-blowers				X
Pressure - Carbon Gages			X	X
Pressure - Post-blowers				X
Pressure - All Venturi Meters			X	X
Temperature - Ambient	X	X	X	X
Temperature - All Active Manifolds			X	X

L: Laboratory Analysis. P: Field Screening Using a PID. G: Portable Gas Chromatograph (analysis of PCE only). H:\NABIS\1999\SAMPSCH.TBL

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TABLE 2

SVE O&M PLAN
ROWE INDUSTRIES SUPERFUND SITE
SAG HARBOR, NEW YORK

Sampling and Monitoring Schedule

	WEEK 7			
Day (elapsed time after start-up):	**THUR (30 min)**	**THUR (2 hr)**	**THUR (8 hr)**	**FOLLOWING THUR**
Sample/Monitoring Locations				
Manifold B (SVE 6)	L/P/G	P/G	P/G	P/G
Manifold C (SVE 8)	L/P/G	P/G	P/G	P/G
Soil Impoundment Manifold	L/P/G	P/G	P/G	P/G
Pre-Carbon	L/P/G	P/G	P/G	L/P/G
Mid-Carbon	L/P/G	P/G	P/G	L/P/G
Post-Carbon	L/P/G	P/G	P/G	L/P/G
Ambient Air (1-UW, 2-DW)				P
Vacuum - All SVE Well Gages				X
Vacuum - All VP Gages				X
Vacuum - All Monitor Well Gages				X
Vacuum - All Active Manifolds			X	X
Vacuum - Pre-blowers				X
Pressure - Carbon Gages			X	X
Pressure - Post-blowers				X
Pressure - All Venturi Meters			X	X
Temperature - Ambient	X	X	X	X
Temperature - All Active Manifolds			X	X

L: Laboratory Analysis. P: Field Screening Using a PID. G: Portable Gas Chromatograph (analysis of PCE only). H:\NABIS\1999\SAMPSCH.TBL

APPENDIX III

O & M DATA SHEETS

O&M DATA SHEET
SAG HARBOR, NEW YORK

DATA SHEET SET _____ OF _____

Name of Inspector: _____ Date: _____

Weather Conditions (Raining/Sunny): _____

Barometric Pressure: _____ Ambient Air Temperature: _____ Relative Humidity: _____

CGI Calibration Completed: _____ (Y/N) PID Calibration Completed: _____ (Y/N)

Ambient Air Concentration: _____ ppm eq Wind Direction: _____ Wind Speed: _____

Description of Activities: _____

_____

SOIL VAPOR EXTRACTION SYSTEM OPERATIONAL DATA

Location		Active (Y/N)	Screened Interval (ft bg)	Time	Vacuum (" of WC)	Vapor Stream Temperature (degrees F)	Vapor Differential Pressure (" of WC)	Calculated Airflow	
								(acfm)	(scfm)
A (Offsite Wells)	SVE-11		5 - 15				NA		
	SVE-13		6.5 -16.5				NA		
	SVE-15		7 - 17				NA		
Manifold A (FM 3)									
B (Onsite Wells)	SVE-6		4 - 14				NA		
	SVE-9		4.5 - 14.5				NA		
	SVE-12		6 - 16				NA		
Manifold B (FM 4)									
C (Offsite Wells)	SVE-7		4 - 14				NA		
	SVE-8		4 - 14				NA		
	SVE-10		5 - 15				NA		
	SVE-14		5 - 15				NA		
Manifold C (FM 2)									
D (Offsite Wells)	SVE-3		4.5 - 14.5				NA		
	SVE-4		4 - 14				NA		
	SVE-5		4.5 - 14.5				NA		
Manifold D (FM 6)									

Location		Active (Y/N)	Screened Interval (ft bg)	Time	Vacuum (" of WC)	Vapor Stream Temperature (degrees F)	Vapor Differential Pressure (" of WC)	Calculated Airflow	
								(acfm)	(scfm)
E (Onsite Wells)	SVE-1		5 - 15				NA		
	SVE-2		6 - 16				NA		
Manifold E (FM 5)									
Impoundment Manifold (FM 1)									
20 HP SVE Blower Inlet *						NA	NA		
3 HP Impoundment Blower Inlet *						NA	NA		

*: The calculated airflow will be the summation of the manifold airflow rates.

POST BLOWER, HEAT EXCHANGER, CARBON UNIT AND MOISTURE SEPARATOR OPERATIONAL DATA

Location	Operating (Y/N)	Time	Pressure (" of W.C.)	Vapor Stream Temperature (degrees F)	Vapor Differential Pressure (" of W.C.)	Calculated Airflow	
						(ACFM)	(SCFM)
20 HP SVE Blower Outlet				NA	NA	NA	NA
3 HP Impoundment Blower Outlet				NA	NA	NA	NA
Pre Heat Exchanger			NA		NA	NA	NA
Pre-Carbon (FM 7)							
Mid-Carbon					NA	NA	NA
Post-Carbon			NA		NA	NA	NA

Location	Moisture in Sight Glass (Y/N)	Moisture Level (inches)
20 HP Blower Moisture Separator		
3 HP Blower Moisture Separator		

Moisture pumped out of 20 HP Blower Moisture Separator: Yes:_____ No:_____
Amount of moisture removed (gallons):_____

Moisture pumped out of 3 HP Blower Moisture Separator: Yes:_____ No:_____
Amount of moisture removed (gallons):_____

SOIL IMPOUNDMENT OPERATION

Soil Inpoundment Manifold	Operating (Y/N)	Time	Vacuum (" of W.C.)	Vapor Stream Temperature (degrees F)	Vapor Differential Pressure (" of W.C.)	Calculated Airflow	
						(ACFM)	(SCFM)
North							
Middle							
South							

Is the Impoundment Cover Properly Secured: Yes:____ No:____
Explain: _____
Condition of Extraction Piping: Operational:_____ Not Operational:_____
Explain: _____
Condition of the Impoundment: Adequate:_____ Not Adequate:_____
Explain: _____

VAPOR POINT MONITORING DATA

Vapor Point	Time	Screened Interval (ft bg)	Vacuum (" of W.C.)
VP-1		11 - 21	
VP-2		9 - 19	
VP-3		6 - 16	
VP-5		5 - 15	
VP-6		6 - 16	
VP-7		3 - 13	
VP-8		3 - 13	
VP-9		3 - 13	
VP-10		3 - 13	
VP-11		3 - 13	

GROUND WATER MONITOR WELL DATA

Monitor Well	Time	Screened Interval (ft bg)	"hold" - "cut" (ft)	Depth To Water (ft bg)	Vacuum (" of W.C.)
MW-28B		38 - 48			
MW-45A		13 -28			
MW-45B		40.5 - 50.5			
MW-51A		18 - 28			
MW-52A		19 - 29			
MW-98-01A		17 - 27			
MW-98-01B		35 - 45			
MW-098-02A		16.5 - 26.5			
MW-098-02B		35 - 45			
MW-98-3A		19 - 29			
MW-98-04		15 - 25			
MW-98-05A		17.5 - 27.5			
MW-98-05B		32.5 - 42.5			
MW-98-06A					
MW-98-06B		35 - 45			
MW-98-07		19 - 29			
MW-98-08		22.5 - 32.5			

PID / LABORATORY SAMPLE ANALYSIS

Chain of Custody Number	Sample Location	PID (ppm eq)	Date	Time	Sample Matrix	Analysis Requested	Comments

SMP 1: Sample port soil impoundment manifold
SMP 2: Sample port manifold "C"
SMP 3: Sample port manifold "A"
SMP 4: Sample port manifold "B"
SMP 5: Sample port manifold "E"
SMP 6: Sample port manifold "D"
SMP 7: Sample port mid-carbon*
SMP 8: Sample port pre-carbon*
SMP 9: Sample port post-carbon

* PLEASE NOTE CARBON UNIT CONFIGURATION WHEN SAMPLING
With Carbon Unit No. 1 as lead unit SMP 8 is the Pre-Carbon sample port and SMP 7 is the Mid-Carbon sample port.
With Carbon Unit No. 2 as lead unit SMP 7 is the Pre-Carbon sample port and SMP 8 is the Mid-Carbon sample port

Additional Comments or Notes: _____

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APPENDIX IV

STANDARD OPERATING PROCEDURES

1.0 Objective

The objective of these guidelines is to provide general reference information and technical guidance on the measurement of ground-water levels.

2.0 Limitations

Cascading water within a borehole or monitor well can cause false readings with some types of electrical measuring devices. Oil layers may also cause problems in determining the true water level in a well.

All water level measurements at a site should be made on the same day or on consecutive days.

Ground water contaminated by organic compounds may release toxic vapors into the airspace inside the well casing. The release of this air when the well is initially opened may be a health/safety hazard which must be considered.

3.0 Definitions

Hydraulic head – In terms of groundwater, the hydraulic head is a summation of the pressure head and elevation head with reference to a particular subsurface location. Also referred to as piezometric head. Units typically in feet.

Water table – The surface in an unconfined zone of saturation where ground-water pressure is equal to atmospheric pressure.

Potentiometric surface -- A theoretical surface which defines the maximum height to which groundwater will rise within cased well, given a particular hydraulic head at the well screen subsurface location. As might be expected, the potentiometric surface is equivalent to the water table surface in unconfined aquifers.

4.0 General Guidelines

In measuring ground-water levels, there should be a clearly established reference point of known elevation, which is normally the top of the well casing. The recorded field notes should clearly

describe the reference used. To be useful, the reference point should be tied in with a U. S. Geological Survey Benchmark or a local datum. An arbitrary datum could be used for an isolated group of wells, if necessary. All ground-water level measurements should be done in duplicate and recorded to the nearest 0.01 foot. After the ground water monitor well has been installed or the cased borehole completed and left open, the initial depth to the water should be measured and recorded. The date and time of the reading should also be recorded. Information related to precipitation should be included in the data. The depth of the ground water should be recorded on appropriate forms.

Appropriate remarks describing the construction of the monitor well or open-cased borehole should be recorded along with the name of the individual who has measured the ground-water level in the monitor well.

Readings should be taken regularly, as required by the site hydrogeologist. Monitor wells or open-cased boreholes that are subject to tidal fluctuations should be read in conjunction with a tidal chart; the frequency of such readings should be established by the site hydrogeologist.

5.0 Specific Ground Water Level Measuring Techniques

There are several methods for determining water levels in boreholes and monitoring wells. Certain methods have particular advantages and disadvantages depending upon the diameter of the borehole or casing, ground-water quality, and hydraulic conductivity of the formation. A general guideline for obtaining static water level and changes in water level during testing is presented along with a listing of various advantages and disadvantages of each technique. An effective technique should be selected for the particular site conditions by the on-site hydrogeologist. The following procedure may be followed:

- check operation of equipment above ground
- record well number, top of casing elevation and surface elevation, if available; water levels should be taken from top of the well casing, protective casing or a reference point at the ground surface for borehole measurements
- record water level to the nearest 0.01 foot

- record the time and day of the measurement

5.1 *Chalked Steel Tape*

Water level is measured by chalking a weighted steel tape and lowering it a known distance ("hold") into the well or borehole. Water level is determined by subtracting the wetted chalked (or "cut") mark from the total length lowered into the well or borehole. All measurements should be done in duplicate to achieve better accuracy.

The tape should be withdrawn quickly from the well because water has a tendency to rise up the chalk due to capillary action. A water finder paste may be used in place of chalk. The paste is spread on the tape the same way as the chalk, but the part that gets wet turns red. Disadvantages include the following: a) Ineffective if borehole wall or well casing is wet or inflow is occurring above the water level; b) chalking or pasting the tape is time consuming and difficult to use during periods of precipitation.

5.2 *Electric Water-Level Indicators*

This method consists of a spool of small-diameter cable with a probe attached to the end. When the probe comes in contact with the water, the circuit is closed and a meter, light, and/or buzzer attached to the spool will signal the contact. Batteries are normally used for a power source.

There are a number of commercial electric indicators available, none of which is entirely reliable all of the time. When there is oil on the water, low specific conductance, water cascading into the well, or a turbulent water surface in the well, measuring with an electric indicator may be difficult. Most commonly used are E-tapes which are marked at 0.01 ft. intervals. Before lowering the probe into the well, the circuitry can be checked by dipping the probe in water and observing the indicator. The probe should be lowered slowly into the well. When near the water surface, the tape should be lowered and raised several times to confirm the air/water interface, e.g., wait one minute and repeat measurement. The electric cable is "held" at the point where contact with the water surface was indicated.

5.3 *Float Recorder*

A float or an eletromechanically actuated water-seeking probe may be used to detect changes of the water surface in a well. Older models are comprised of a recording chart drum, which is rotated as water levels fluctuate by a system of floats and cables or by electronic probes located in the well. A clock drives a recording pen horizontally across the chart in a period of hours, days or weeks depending upon the gears used. Newer recorders have shaft encoders which record electrically generated signals on data packs. To ensure continuous records, the device should be inspected, maintained, and adjusted periodically.

5.4 *Air Line*

An air line may be useful in pumping wells where water turbulence makes the use of other devices difficult. A small-diameter tube of known length is installed from the surface to a depth below the lowest water level expected. Compressed air (from a compressor, bottled air, or air pump) is used to purge the water from the tube. The pressure needed to purge the water from the air line multiplied by 2.31 (feet of water for 1 pound per square inch) equals the length in feet of submerged air line. The depth to water below the center of the pressure gauge can be calculated by subtracting the length of air line below the water surface from the total length of the air line. This method is accurate at best to the nearest foot, due to the sensitivity of the pressure gauge, which should be calibrated before each test.

5.5 *Capillary Tubing*

In very small diameter wells or piezometers, water levels are determined by using a capillary tube. Colored or clear water is added to one end of the tube and looped. The other end of the tube is placed in the small diameter well until the water in the loop moves. This point on the tube is marked where it intersects the top of the casing. This point is then measured from the bottom of the capillary tube or recorded if the capillary tube is calibrated.

5.6 *Pressure Transducer*

Pressure transducers measure the pressure of water on the transducer. The transducer is lowered into a well or borehole below the water surface. The transducer is wired into a recorder at the surface to record changes in water level with time. The recorder digitizes the

information and can transfer the information to a computer for evaluation. The pressure transducer must be initially calibrated with another water level measurement technique to ensure accuracy. This technique is very useful for hydraulic conductivity testing in highly permeable material where repeated accurate water level measurements are required in a very short period of time.

5.7 *Recording Data*

Examples of ground-water level measurement sheets, (see attached), should be filled out for each round of water-level measurements at a site. All pertinent data should be recorded as shown on the sheets. The elevation of the reference point is generally the elevation of the top of the well casing. The measuring device mark or "hold" is the actual reading on the measuring device. The "cut" or correction reading is subtracted (or added) from/to the measuring device mark or "hold" to obtain the depth to ground water. The depth to ground water is then subtracted from the reference point elevation to calculate the ground-water elevation.

6.0 Specific Quality Control Procedures

All devices used to measure ground-water levels should be calibrated against a steel tape. These devices should be calibrated to 0.01-foot accuracy periodically. Before each use, these devices should be prepared according to the manufacturer's instructions (if appropriate) and checked for obvious damage. All ground-water level measurement devices must be properly decontaminated, before and after each use, to prevent cross contamination of wells. If appropriate an instrument calibration sheet should be completed after each time an electric water-level indicator is checked.

GROUND WATER LEVEL MEASUREMENT SHEET

(Example)

Project Name _____ Local Municipality _____

Project No. _____ County _____

Personnel _____ State _____

Date _____

Equipment No. _____ Latest Calibration Date _____

Well No.	Time	Elevation of Measuring Point (ft)	Description of Measuring Point (ft)	Height (+/-) of MP Above Land Surface (ft)	Elevation of Land Surface (ft)	Measuring Device Mark or "hold" (ft)	"Cut" or Correction Reading (ft)	Depth to Ground Water (ft)	Ground-Water Elevation (ft)

Repeat each measurement at least twice.
* Record reading to the nearest 0.01 foot.
* Referred to an established or arbitrary datum.

1.0 Objective

To obtain air quality data which is characteristic of the types and amounts of chemicals present at a particular location and time. To ensure that collected air samples are representative, a general reference is provided here for the procedures and equipment involved in proper collection, documentation and transportation of air sampling for environmental analysis.

2.0 Applicability

Wherever monitoring of air pollutant parameters, is required.

3.0 Associated SOPs

Check the Table of Contents for SOP documents if information regarding a specific type of analytical test or equipment is needed. In general, the following list of SOPs should be consulted whenever a Sampling Plan is under development:

Site Visits, SOP 1-1
Equipment Scheduling, SOP 1-2
Chain of Custody, SOP 1-5
Equipment Decontamination, SOP 1-7

4.0 Sampling Plan

It is the responsibility of both the project manager and the QA/QC Officer to design an effective sampling strategy for a particular project. Both the sampling plan and the health and safety plan may be developed in consultation with the interested parties. The contents of a sampling plan could consist of the following:

- background and objective of sampling
- selection of sampling location, with map or sketch
- sampling equipment to be used
- intended number and volumes of samples
- working schedule
- list of team members
- list of observers
- list of contacts
- chain-of-custody procedures

5.0 Methodology

Air sampling is done under a wide variety of situations. Sampling devices and procedures must fit the specific site and parameter conditions. Obtaining a representative sample depends greatly upon the Sampling Plan which should include the specification of proper equipment and optimum sampling locations.

6.0 Equipment

Ideally, sample collection equipment should be completely inert; economical to manufacture; easily cleaned, sterilized, and reused; and operational at remote sites in the absence of power sources.

6.1 *Suggested Gear*

The following general list contains items used in air sampling:

- map of sampling locations
- surgical gloves
- chain-of-custody
- tedlar sample bags (1-liter)
- tygon tubing
- camera and film
- decontamination equipment - deionized water, Alconox
- peristaltic pump

6.2 *Sampling Equipment*

Appropriate sample bags should be selected for the contaminants present, with most bags composed of tedlar. The following equipment may be required when sampling air:

SAMPLING EQUIPMENT	APPLICATIONS	LIMITATIONS	COMMENTS
clear tedlar sample bag	useful whenever samples are taken	light sensitive contaminants should not be sampled in clear bags	do not sample unstable or highly reactive compounds
black tedlar sample bag	useful when contaminants are light sensitive	do not sample unstable or highly reactive compounds	should have clear tedlar liner
peristaltic pump	useful when samples must be pumped into bags	must be able to overcome any vacuum on sample ports	new tubing should be used for each sample

7.0 Procedure

7.1 Prior to Mobilization

Order recommended sample bags from laboratory.

7.2 Field Sampling

When taking grab samples, record the date, temperature, sampling location, and time of sampling. Do not introduce foreign material inadvertently or deliberately during sample collection. This may result in unrepresentative data and misleading interpretation of the same. The actual field sampling procedure may be conducted in the following way:

- collect grab sample avoid filling the sample bag more than 80 % of the maximum capacity
- label all bags properly
- complete chain-of-custody information and any shipping paperwork
- samples should not be transported by air unless cabin is pressurized
- samples should be taken to laboratory as quickly as possible so contaminants do not absorb to sample bag

8.0 Documentation

Field personnel are responsible not only for collecting samples, but for initiating chain-of-custody forms, and generating the required sample documents. All sampling documents must be properly completed and attached to the appropriate item(s). Document copies must be placed in their respective job files following field sampling activities.

9.0 Decontamination

Equipment decontamination procedures are outlined in SOP 1-7 and are contaminant specific.

APPENDIX V

HEALTH AND SAFETY PLAN

APPENDIX V
HEALTH AND SAFETY AND CONTINGENCY PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Prepared For

Nabisco Inc.

January 1999

LBG ENGINEERING SERVICES, P.C.
Professional Environmental Engineering Services
126 Monroe Turnpike
Trumbull, CT 06611

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FIGURE
(At end of report)

Figure	
HS-1	Organization Chart

APPENDIX V
HEALTH AND SAFETY AND CONTINGENCY PLAN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

1.0 INTRODUCTION

This Health and Safety and Contingency Plan (HSP) is intended to provide a basic framework for the safe conduct of the operation and maintenance of the soil vapor extraction (SVE) system at the Rowe Industries site in Sag Harbor, New York. The procedures provided herein are intended as a guide for LBG Engineering Services, P.C. (LBGES) and subcontractor employees who will be involved in the performance of the project. At a minimum, all precautions taken to safeguard the employees health and welfare shall be in accordance with 29 CFR Parts 1900 through 1910, inclusive, and any applicable local rules and regulations. Copies of 29 CFR Parts 1900 through 1910 and Part 1926 are to be maintained at the site for reference. The operation and maintenance (O&M) includes vapor quality sampling, maintaining the system components, and operating the SVE system.

1.2 Objectives

The primary objective of the Health and Safety Plan (HSP) is to establish work-safety guidelines, requirements and procedures. The following information was prepared specifically for field operations by personnel to enforce and adhere to the established rules as specified in the HSP. The approved HSP will be provided to all personnel to aid in accomplishing the following objectives:

- monitoring the effectiveness of the HSP as it is conducted in the field by performing field operation audits;
- following up on any necessary corrective actions;
- interacting with United States Environmental Protection Agency (EPA) field representatives regarding modifications of health and safety actions; and
- stopping work should work-site conditions warrant such action.

1.3 Responsibility for Implementation

An organizational chart for LBG Engineering Services, P.C. (LBGES) personnel and its subcontractors with regard to health and safety operations is presented in figure HS-1. The organization and responsibilities for implementing safe site investigation procedures, and specifically for the requirements contained in this manual, are described in this section.

1.3.1 Project Manager

The LBGES Project Manager, Alfred N. Kovalik, will be responsible for the overall implementation and monitoring of the health and safety program by:

- ensuring appropriate and sufficient protective equipment is available and properly used by all personnel, in accordance with the HSP;
- ensuring personnel health and safety awareness by providing them with proper training and familiarity with procedures and contingency plans;
- ensuring all personnel are apprised of potential hazards associated with the site conditions and operations;
- supervising and monitoring the safety performance of all personnel to ensure their work practices are conducted in accordance with the HSP;
- correcting any work practices or conditions that would expose personnel to possible injury or hazardous conditions;
- communications with the onsite Health and Safety Officer (HSO);
- promptly initiating emergency alerts; and

- communicating with the client and/or regulatory agency representatives.

1.3.2 Onsite HSO

The onsite HSO will be onsite during O&M activities and will also supervise portions of the field program. Monitoring technicians may be designated, as required, to supplement the HSO. The HSO will be accountable for the direct supervision of personnel from the subcontractors and other LBGES personnel with regard to:

- assuring compliance with the provisions of the HSP as presented herein;
- assuring compliance with the rules and regulations of OSHA, particularly 29 CFR Subpart 1910.120;
- maintaining a high level of health and safety consciousness among employees at the work site; and
- reporting accidents within LBGES jurisdiction and undertaking corrective action.

1.3.3 Field Personnel

All field personnel will report directly to the onsite HSO with regard to all health and safety matters, and will be required to:

- be familiar with, and conform to, provisions of the HSP;
- ensure that they are well informed of potential hazards at the work site and exercise informed consent in their work;
- report any accidents, hazardous conditions or uncontrolled air emissions to the onsite HSO; and
- have complete familiarity with their job requirements and the health and safety procedures involved.

2.0 HAZARD EVALUATION

The onsite HSO is responsible for determining the level of personal protective equipment (PPE) required. The HSO will perform a hazard assessment in accordance with OSHA regulations to determine personal protective equipment requirements once the site has been entered. When work site conditions warrant, the onsite HSO will modify the level of protection to be utilized. The existence of a situation more hazardous than anticipated will result in the suspension of work until the Project Manager and client's representative have been notified and appropriate instructions have been provided to the field team.

2.1 Chemicals

The presence of 1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, 1,1-dichloroethane, 1,2-dichloroethylene and 1,1-dichloroethylene at the site comprise the major chemical concerns for personal health. The protection of personnel from exposure to these substances by inhalation, oral ingestion, dermal absorption or eye contact is the primary purpose of this plan.

The potential inhalation and explosive hazards for chemicals likely to be encountered on the site are shown on table HS-1. Also shown in this table are the Permissible Exposure Limit (PEL), Immediately Dangerous to Life or Health (IDLH) Level, Lower Explosive Limit (LEL), and Upper Explosive Limit (UEL), as applicable, for the chemicals identified on site. Table HS-2 shows the selected chemical and physical properties and health hazards associated with overexposure of the identified hazardous substances.

2.2 Physical & Biological

In addition to the chemical hazards onsite, there are physical and biological hazards as well. All field work will be performed outdoors and, therefore, is dependent on weather conditions.

The site area is approximately five acres, but the majority of the work will be conducted in the former drum storage area and the parking area on the eastern side of the SHI building. The entire area likely has ticks which may harbor the virus responsible for Lyme disease. These biological hazards can be alleviated by wearing protective clothing and utilizing insect repellent.

3.0 INCLEMENT WEATHER CONDITIONS

The HSO will watch for inclement weather conditions which could create a risk of injury to site personnel by monitoring local radio broadcasts and consulting the National Weather Service, as appropriate and presented below.

- National Weather Service: 516-924-0259
- Broadcast: 162.475 Megahertz

4.0 LEVELS OF PROTECTION

The level of protection anticipated during O&M activities is Level D for skin protection. Only protective equipment deemed suitable by the onsite HSO for use at the work site will be worn. Any changes in protection levels shall be determined and documented by the onsite HSO. Field personnel should exercise informed judgment on protective equipment requirements at active work sites or at work sites that have been repeatedly entered or occupied without apparent harm. In any case where doubt exists, the safest course of action must be taken.

For the compounds associated with the site, the 8-hour exposure limits range between 25 and 350 ppm. Accordingly, PPE will be selected based on PID readings at the lower end of this range in the absence of speciated monitoring. IN THE ABSENCE OF SPECIATED DATA, ALL PID READINGS WILL BE CORRELATED TO PCE BASED ON THE CALIBRATION GAS USED AND THE MANUFACTURER'S RELEVANT RESPONSE DATA. The onsite HSO will direct when the protective clothing and respirators will be utilized based on the conditions encountered at the work site. The levels of protection available to the HSO, and the conditions under which they shall be employed, are detailed below. Variations of the detailed levels of protection may be employed by the HSO only after consultation with the Project Manager. All changes and the rationale for such changes will be duly recorded in the HSO's field log.

It is important that PPE and safety requirements be appropriate to protect against any potential physical hazards. As such, physical hazards will be identified, listed and marked. Therefore, at a minimum, protective equipment for personnel will include:

- safety boots/shoes;
- eye protection;
- gloves;
- emergency stop switches for machinery;
- hearing protection.

It shall be the responsibility of the HSO to dictate the use of any additional PPE which may be further required to protect workers under any of the levels of protection detailed in the following subsections.

4.1 Level D

Level D protection is the minimum protection required by workers on the site, whether in cold or hot zones. When work-site conditions dictate, additional PPE, such as protective gloves and chemical-resistant boots for personnel handling contaminated soils, water or vapors or hearing protection when working about heavy machinery, shall be employed. All PID readings will be recorded in the HSO's field log. Should sustained levels of organic vapor greater than 25 ppm above background levels as detected by the PID in the breathing zone, work will stop and all personnel will upgrade to Level C protection. The following minimum PPE is specified for Level D protection.

- hard hat;
- safety glasses, shatter-proof prescription glasses or chemical splash goggles;
- boots/shoes, leather or chemical-resistant,
- coveralls; and
- gloves, leather or chemical resistant.

The site hazards for which Level D PPE was selected include the presence of heavy equipment, the potential for excessive noises during treatment equipment operation, and the potential for soil

and small particles to enter the eyes. Ambient air monitoring of hazardous substances is not expected to exceed 25 ppm during any part of the O&M activities.

Prior to dressing in PPE, all of the material will be inspected for rips, tears or loose stitching that would not allow the PPE to function properly and create the potential for exposure. PPE will also be inspected periodically during use and immediately after use for the defects described above. Any indication that PPE will not function properly will be considered sufficient justification for replacement.

5.0 GENERAL SAFE WORK PRACTICES

In addition to the use of protective equipment, the following procedures will be followed to minimize risk:

- all consumptive activities including eating, drinking or smoking are prohibited in the work and decontamination areas;
- emergency eye washes will be located in the office trailer;
- all vehicles, except passenger vehicles, will be equipped with audible backup alarms;
- fire extinguishers will be available within the treatment shed and on all heavy equipment;
- an adequately stocked first-aid kit will be maintained in the office trailer;
- work during periods of sustained winds in excess of 20 mph, severe, sustained rain and electrical storms will be prohibited; and
- hand to mucous membrane (e.g., mouth and eyes) shall be restricted in the work area.

6.0 SITE CONTROLS

6.1 Site Security

All SVE wells, vapor monitoring points, and monitoring wells will be locked after the completion of daily system operation and maintenance activities. All trailers, sheds and fenced areas will be locked when personnel leave site.

6.2 Site Posting and Labeling

The following signages are posted at the site:

- All chain link fence enclosing the work zone bear signs warning personnel of the restricted nature of the area. Such signs bear, "Authorized Personnel Only." Furthermore, the signs are placed generally at eye level and in a number sufficient so that at least one sign is visible from anywhere along the fence line. Such signs are legible from a minimum distance of 25 feet during daylight.

6.3 Communications

Lines of communications shall be maintained at all times during the O&M activities to facilitate safe and efficient operations. The HSO shall establish communication protocols during site preparation, including those involved in emergency signaling, detail those protocols in his log, post those protocols in the support zone and brief all personnel entering the site on the established protocols.

Offsite communications shall consist of the provision of a dedicated facsimile transmission line and voice line.

6.4 Site Illumination

Night time activities are not anticipated during O&M activities. However, if activities must be conducted when it is dark, flashlights will be used to illuminate the area to minimize the potential for injury. Spare bulbs and batteries, dedicated for used during the O&M activities, will be kept in the office trailer. The office trailer will have interior lighting that supplies a minimum illumination of 10-foot candles.

7.0 DECONTAMINATION

Only VOCs have been identified onsite. Any contaminated machinery, tools, equipment and PPE will be readily cleaned with a water solution.

In consideration of the above, all decontamination strategies are based on the physical removal of contaminants with water. No cleaning solutions other than water are anticipated to enhance the decontamination process. All decontamination water will be contained and disposed of in accordance with RCRA provisions.

The following subsections present decontamination strategies based on the foregoing observations.

7.1 Personnel

7.1.1 Procedure for Level D Decontamination

Decontamination of Level D protective wear will consist of brushing heavily soiled boots to solely remove soils. Heavily soiled or stained clothing suspected of bearing contaminants will be placed in plastic bags before leaving the work zone.

7.2 Tools and Equipment

Tools and equipment exiting the work area will be inspected for contaminants. All contaminants found on tools and equipment will be removed with brushes and the residue removed with a water spray.

8.0 DISPOSAL OF REMEDIATION DERIVED WASTE

Materials which may require disposal during the execution of O&M activities include sample jars, bailers, rope, paper towels, and other miscellaneous sampling supplies. Used PPE which may require disposal include gloves, coveralls, booties and organic vapor cartridges. All liquid and solid waste materials and PPE waste will be stored in drums (30- or 55-gallon capacities, as needed). The drums will be stored at SHI no longer than 90 days until their transportation offsite and disposal. The waste stored in drums will be sampled and analyzed for waste characterization for subsequent disposal at a New York State Department of Environmental Conservation (NYSDEC) approved disposal facility. The results of the waste characterization

samples will dictate whether these drums are disposed of as hazardous waste or non-hazardous, regulated waste. Only a NYSDEC approved disposal facility will be used for disposal of these wastes.

9.0 CONTINGENCY PLAN

It is the sole responsibility of the HSO to ensure, minimally, that the O&M is conducted in conformance with the provisions of the site HSP. A copy of this plan, adequate for posting and review, along with all pertinent drawings, maps, and lists, to include address and phone number, of all concerned emergency agencies shall be conspicuously posted at the facility.

9.1 Emergency Site Contacts

In the event of a safety or health emergency, appropriate corrective measures must immediately be taken to assist those who have been injured or exposed and to protect the health and welfare of the public at large as well as the site workers. The HSO shall be responsible for responding to all emergency situations and notifying all appropriate personnel and agencies. Should, for any reason, the HSO be unavailable, the following are listed as emergency contacts, as appropriate.

- Sag Harbor Industries
  1668 Sag Harbor Turnpike
  Sag Harbor, NY 11963
  (516) 725-0440
  President: Paul Scheerer

- Leggette, Brashears & Graham, Inc.
  126 Monroe Turnpike
  Trumbull, CT 06611
  (203) 452-3100
  (203) 452-3110
  Principal-in-Charge: Robert Lamonica
  Project Manager: Alfred N. Kovalik

- Nabisco, Inc.
  7 Campus Drive
  Parsippany, NJ 07054
  (973) 503 -4435
  Project Manager: Assim Hanna

- United States Environmental Protection Agency, Region II
  Emergency and Remedial Response Division
  26 Federal Plaza
  New York, NY 10278
  (212) 637-4255
  Project Manager: Pamela Tames, P.E.

- New York State Department of Environmental Conservation
  Office of Environmental Remediation
  50 Wolf Road
  Albany, NY 12233-7010
  (518) 457-3976
  Project Manager: James Quinn

9.2 Emergency Services

In the event of an emergency, contacts are provided for reference in the following subsections. In general, any emergency can usually be handled by dialing a centralized number, instead of contacting the sources listed in the following subsections. This general number is presented below.

- General Emergency: 911

9.2.1 Hospital & Ambulance

Directions to Southampton Hospital are as follows. Turn left out of site onto Sag Harbor/Bridgehampton Turnpike Go south on Sag Harbor/Bridgehampton Turnpike for about 3.5 miles (turn left out of the facility). At Montauk Highway (Route 27), turn right. After about 5.5 miles, turn left on Town Road. The Hospital is about 1/3-mile down the road on the right hand side.

2420 Meeting House Lane
Southampton, NY 11968
Emergency Room: (516) 726-8420
General Information: (516) 726-8200

- Sag Harbor Volunteer Ambulance Corp.
  2725 Columbia Street
  Sag Harbor, NY 11963
  (516) 324-6550

9.2.2 Police

- Town of Southampton Police Department
  110 Old Riverhead Road
  Hampton Bays, NY 11946
  (516) 728-3400

- New York State Police, Troop L
  State Route 24
  Hampton Bays, NY 11946
  (516) 727-2727

9.2.3 Fire

- Sag Harbor Fire Department
  Brick Kiln Road
  Sag Harbor, NY 11963
  Emergency: (516) 324-6550
  General Information: (516) 725-0252

9.3 Spills

Spills or incidents involving reportable quantities of hazardous or toxic waste or materials (as defined in 40 CFR Subpart 172.101) will be reported, without delay, to the agencies presented below.

- NYSDEC Spill Response
  Region I: (516) 444-0320
  24-Hour Line: (800) 457-7362

- Suffolk County Spill Response
  Otto Rennenburg (9AM-5PM): (516) 854-2537
  Medical Examiner (5PM-9AM): (516) 853-5555

- Miller Environmental Group
  538 Edwards Avenue
  P.O. Box 610
  Calverton, NY 11933
  (516) 369-4900

In the event of a substantive release of a hazardous substance, MEG will be notified to assist site employees in hazardous waste cleanup. MEG is located approximately 20 miles from Sag Harbor. Appendix HS-4 presents MEG's current status and capabilities with respect to hazardous waste spill response.

9.4 Electric Utility

- Long Island Lighting Company
  117 Doctor's Path
  Riverhead, NY 11901
  Emergency: (516) 755-6000

9.5 Equipment Breakdown and Maintenance

In the event of equipment malfunction, several alternatives are available depending on the magnitude of the malfunction. The following actions listed for each piece of equipment to be operated at the facility are prioritized; that is, the first recourse listed is the first action to be attempted. Should a certain action be inadequate to address the malfunction, the next action listed will be attempted. The following actions will be taken, as appropriate, to remedy equipment malfunctions:

- troubleshoot and repair; and
- procure alternate equipment.

9.6 Site Evacuation

In the event that the emergency response gear maintained at the facility is inadequate for the task at hand and the nature of the emergency is such that there is a real and present risk of injury to the site personnel, the site will be evacuated. Appropriate agencies, specifically the

police, shall be immediately notified of such a decision so that any dangers to the public at large may be promptly and adequately assessed. The senior person at the site will make the decision to evacuate the site and will, at that time, indicate his decision by verbally notifying all personnel, should such action be possible, and activating an alarm dedicated to such an evacuation. The evacuation will proceed according to posted evacuation routes, personnel will assemble in predesignated assembly areas, and roll calls will be performed at the assembly areas so that all personnel may be accounted for.

10.0 TRAINING & CERTIFICATION REQUIREMENTS

Any process that increases the skills and abilities of the employees to do a specific job is referred to as "training." Training is usually distinguished from "education," the process of increasing one's understanding. Obviously, there are overlaps between the two processes. It will be the responsibility of the Project Team Leader to assure that all personnel, old and new, know how to perform in a manner that will promote the establishment and maintenance of a safe working environment. Institution of new techniques or modification of procedures will be accompanied by careful consideration of the training required to perform safely. All personnel will be adequately trained to safely carry out their designated on site duties. Training of personnel will be both intramural and extramural as required by law.

Intramural training will be provided on the job and may range from working closely with a person familiar with the facility operations and safety requirements to formally structured Health and Safety presentations. Specifically, intramural training will cover and instruct employees in the following areas:

1. the facility layout; specifically the location of exits, eyewash stations, and first aid and safety equipment.

2. the correct use of safety equipment, including, but not limited to, gloves, masks, eye protection, and safety boots;

3. the site HSP;

4. specific workplace practices, specifically:

   a. hand washing;
   b. working around heavy equipment;
   c. routine examinations of equipment;
   d. disposal of contaminated materials;
   e. decontamination and cleaning of equipment and machinery; and
   f. the correct and safe operation of all on site fire fighting equipment; and

5. the particular hazardous substances which could be encountered during the O&M.

Extramural training occurs outside of the general work environment. Specifically, extramural training consists of, but is not limited to, attending seminars, receiving first aid training, and attending safety courses. All site workers, including site managers, will provide documentation to the onsite HSO that the field personnel have been trained in the proper use of protective clothing and equipment in accordance with 29 CFR Part 1 Personnel Protective Equipment 1910.132 , and 29 CFR Part 1910.120. All site workers, including site managers, will provide, minimally, documentation to the onsite HSO that they have been properly trained in accordance with the OSHA Interim Final Standard 29 CFR 1910 or as may be amended. The HSO will maintain copies of all presented training and fitness certifications, including, but not limited to:

- certification of 40-hour training as required under HAZWOPER regulations;
- fit tests;
- certification of enrollment in an ongoing medical surveillance program which includes baseline and annual physicals; and
- medical certification of fitness.

11.0 MEDICAL SURVEILLANCE

A medical surveillance program shall be instituted by the employer for the following employees:

- all employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits, or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;

- all employees who wear a respirator as required by 1910.134; and

- all employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.

Medical examinations and consultations shall be made available by the employer to each employee covered under this standard on the following schedules:

- prior to assignment;
- at least once every twelve months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is appropriate;
- at termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months;
- as soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation;
- at more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.

All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

The employer shall provide one copy of this standard and its appendices to the attending physician, and in addition the following for each employee:

- a description of the employee's duties as they relate to the employee's exposures;
- the employee's exposure levels or anticipated exposure levels;
- a description of any PPE used or to be used;
- information from previous medical examinations of the employee which is not readily available to the examining physician; and
- information required by 1910.134.

The employer shall obtain and furnish the employee with a copy of a written opinion from the attending physician containing the following:

- the physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use;

- the physician recommended limitations upon the employee's assigned work;

- the result of the medical examination and tests if requested by the employee; and

- a statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

TABLE HS-1

SOIL REMEDIATION DESIGN
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

NIOSH[1]/OSHA[2] Exposure Limits for
Compounds Likely to be Encountered During the Remedial Action

	PCE	TCE	1,1,1-TCA	1,2-DCE	Methylene chloride	1,1-DCA	Xylenes	Toluene	Ethyl-benzene
NIOSH-REL[3]	Ca[4]	Ca		*	Ca	*	*	*	*
TWA_1[5]	25 ppm	25 ppm	NL[6]	200 ppm	NL	100 ppm	100 ppm	100 ppm	NL
STEL[7]			NL	NL	NL	NL	150 ppm	150 ppm	NL
Ceiling			350 ppm (15 min.)	NL	NL	NL	NL	NL	NL
OSHA-PEL[8]									
TWA_2[9]	100 ppm[2]	100 ppm[2]	350 ppm	NL	500	NL	100 ppm	200 ppm[2]	100 ppm
STEL[7]	NL	200 ppm	450 ppm	NL	NL	NL	150 ppm	500 ppm	125 ppm
Ceiling	200 ppm	200 ppm	NL	NL	1,000	NL	NL	300 ppm	NL
1 ppm = X $\frac{mg}{m^3}$	6.89	5.4	5.55	4.03	3.53	4.12	4.41	3.83	4.41
IDLH[10]	500 ppm	1,000 ppm	1,000 ppm	4,000 ppm	5,000 ppm	4,000 ppm	1,000 ppm	2,000 ppm	2,000 ppm
UEL	NA	10.5%	12.5%	12.8%	22%	11.4%[11]	7.0%	7.1%	6.8%[11]
LEL	NA	8%	7.5%	5.6%	14%	5.6%	1.0%	1.2%	1.2%[11]

1/ National Institute for Occupational Safety and Health.
2/ Occupational Safety and Health Administration.
3/ Recommended Exposure Limits.
4/ Carcinogen.
5/ Time-weighted average for up to a 10-hour work day for a 40-hour work week.
6/ Not listed.
7/ Short-term exposure limit for a 15-minute TWA.
8/ Permissible exposure limit.
9/ Time-weighted average for up to a 8-hour work day for a 40-hour work week.
10/ Immediately dangerous to life or health.
11/ Sax, 1984.

hsp.tbl/h:lbgrl/soil

Revised 03/25/97

TABLE HS-2

SOIL REMEDIATION ACTION
SVE OPERATION AND MAINTENANCE
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Physical Properties and Associated Health Effects of Overexposure to Compounds Likely to be Encountered During the Remedial Action

	PCE	TCE	1,1,1-TCA	1,2-DCE	Methylene chloride	1,1-DCA	Xylenes	Toluene	Ethyl-benzene
Vapor pressure[1/]	14 mm Hg	58 mm Hg	100 mm Hg	180 mm Hg	350 mm	230 mm Hg	9 mm Hg	20 mm Hg	7 mm Hg
Ionization potential[1/]	9.32 eV	9.45 eV	11.00 eV	9.65 eV	11.32 eV	11.06 eV	8.56 eV	8.82 eV	8.76 eV
Odor threshold[2/]	4.68 ppm[7/]	18.5 ppm[6/]	12.6 ppm[6/]	272.95 ppm[8/]	79.3 ppm[6/]	120 ppm[5/]	0.4 to 20 ppm[4/]	40 ppm[4/]	0.45 to 0.59 ppm[5/]
Target organs[3/]	Central nervous system Kidney Liver Skin						Blood Bone marrow Eyes Skin Liver Kidney	Respiratory system Central nervous system	
Potential health effects[3/]	Central nervous system: depression, decreased alertness, headache, sleepiness, loss of consciousness, defatting dermatitis. Kidney changes: decreased urine flow, swelling around eyes, anemia. Liver changes: fatigue, malaise, dark urine, liver enlargement, jaundice.						Central nervous system: depression, decreased alertness, headaches, sleepiness, loss of consciousness, defatting dermatitis.		

1/ Source: National Institute for Occupational Health and Safety.
2/ Source: Handbook of Environmental Data on Organic Chemicals, Second Edition.
3/ Source: OSHA Guidance Manual for Hazardous Waste Site Activities, 1985.
4/ 100 Percent Recognition Concentration.
5/ Threshold Concentration.
6/ Recognition Concentration.
7/ 100 Percent Population Identification Threshold.
8/ 50 Percent Recognition Threshold.

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