**FINAL ENGINEERING REPORT**

**CHAMPION PRODUCTS COMPANY**
**PERRY, NEW YORK**

**DEC SITE NO.: V000189-9**
**DELTA PROJECT NO.: S098-009**

# FINAL ENGINEERING REPORT

**CHAMPION PRODUCTS COMPANY**
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**DELTA PROJECT NO.: S098-009**

Prepared by:

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Allison Park, PA 15101
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March 2001

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# FINAL ENGINEERING REPORT

**CHAMPION PRODUCTS COMPANY**
**PERRY, NEW YORK**

**DEC SITE NO.: V000189-9**
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Effective March 9, 2000, the New York Department of Environmental Conservation (Department) and Champion Products, Inc. entered into a Remedial Voluntary Cleanup Agreement (the Agreement) for the above-referenced facility. In accordance with the Agreement, Champion is implementing the Final Remediation Workplan (Workplan). The remedial strategy presented in the Workplan includes the installation, operation and maintenance of a dual phase vapor extraction system, and excavation and off-site disposal of certain soil from the former empty drum storage area.

The purposes of preparing and submitting this document are to:

- satisfy requirement I.B.1 of the Agreement; and,
- provide the Department with "as-built" drawings that show the changes made during and after construction.

## 1.0 OVERVIEW

Operation of the soil and ground water remediation system began in July 2000. Since initial system start up, various modifications were made to the remediation system due to increases in the amount and type of volatile and semi-volatile organic compounds and volume of water extracted from the subsurface. The following is a brief summary of modifications made to the remediation system:

- Upgrading the original vapor liquid separator (VLS) transfer pump with a larger pump capable of handling the "slugs" of ground water and overcoming increased subsurface vacuums.
- Adding an additional tray to the air stripper to increase removal efficiencies due to the presence of liquid phase hydrocarbons.
- Adding two 1000-pound granular activated carbon (GAC) units to the ground water effluent stream to ensure discharge limitations were being satisfied.
- Upgrading the existing air stripper transfer pump with a vertical multistage transfer pump in order to overcome the higher back pressures associated with discharging the water through the GAC units.

These changes were discussed in various written correspondences provided to the Department between August 8 and November 9, 2000.

### 1.1 Extraction Process

All ground water and soil vapor is generated from seven extraction wells as illustrated in Figure 1. The extraction wells are constructed of 4-inch diameter, schedule 40 PVC well pipe, completed to various depths ranging from 18 to 20 feet below ground surface, and are constructed with a 12 to 15 feet section of 0.020 slot well screen fitted to the appropriate length of well riser pipe. A ground water/soil vapor extraction line is fitted to each extraction well and manifolded to the rotary vane pump. The average ground water removal rate from each of the extraction wells typically does not exceed 2 to 3 gallons per minute (gpm) or 8 to 10 gpm from all wells simultaneously. Average air flow ranges from 35 to 45 cubic feet per minute (cfm), depending on which wells are operating.

### 1.2 Treatment Equipment

Extracted soil vapor and ground water are discharged to the vapor/ liquid separator (VLS) and then physically separated. Soil vapors are then drawn through two 1000-pound vapor-phase GAC units, plumbed in series, and then discharged to the atmosphere. Ground water that accumulates in the VLS is pumped through two 50-micron

sediment filters and then to the air stripper using the VLS transfer pump. The aerated ground water is then passed through the two 1,000-pound granular activated carbon units prior to discharge to an unnamed tributary of the Silver Lake Outlet. The air stripper off gas is passed through two 500-pound vapor phase GAC units, plumbed in series and then discharged to the atmosphere. Schematics that present the piping and instrumentation diagram (P&ID), equipment layout, facility piping layout, cross-section presenting a typical outdoor trench and electrical flow diagram are presented in Figures 2 through 7. Cut sheets for all equipment within the remediation system are attached as Appendix A. Modifications to the remediation system are highlighted in red in Figure 2.

The following is a description of the treatment equipment and auxiliary components as they appear at the remediation system:

### 1.2.1 Codes and Regulations

The installation of the treatment equipment was completed to conform to the National Electric Code (NEC) of the National Fire Protection Association and all governing state and local regulations.

### 1.2.2 Dual Phase Manifold

The dual phase manifold is constructed with 3-inch schedule 40 PVC.

### 1.2.3 Vacuum Pump

The vacuum pump is an oil cooled aluminum rotary vane vacuum pump capable of continuous operation at vacuums of 0 to 29.53 inches of mercury (Hg). The flow rate shall be up to 95 actual cfm at 26 inches of Hg measured at the pump inlet. The motor on the pump is rated for use on 230-volt three-phase power. An appropriate vacuum relief valve, particulate filter is included in the flow stream to minimize damage to the vacuum pump.

### 1.2.4 Vapor Liquid Separator (VLS)

The VLS has a minimum capacity of 60 gallons prior to activation of the pump out cycle and a maximum capacity of 120 gallons. The VLS contains coalescing demister media to filter solid particles to 5 microns and to agglomerate and remove liquid droplets to 10 microns. The VLS is equipped with a site glass to allow visual confirmation of the internal liquid level and is equipped with an 8 inch threaded PVC cap to allow cleaning of internal components.

The VLS is equipped with intrinsically safe level switches as shown in Figure 2 (LSHH, LSH, and LSL) to control pump operation and to shut down the system in the event of a high liquid level. All wetted parts of the VLS and attached appurtenances are rated for the vacuum of the system, and contact with chlorinated and non-chlorinated volatile organic compounds (VOCs).

### 1.2.5 VLS Transfer Pump

The VLS is equipped with an electric pump to allow removal of accumulated liquids. The pump is rated to pump against the vacuum in the VLS separator and provisions have be made to lower the vacuum in the separator to allow the pump to remove the accumulated liquid. The VLS transfer pump is designed such that it will not lose prime between pump out cycles. The minimum pump capacity is 12 gpm. The pumps wetted parts are rated for contact with chlorinated and non-chlorinated VOCs.

### 1.2.6 Air Stripper and Transfer Pump

Recovered groundwater is pumped from the VLS to the air stripper. The air stripper is used to remove 90-99% of the dissolved phase VOCs and the minimum hydraulic capacity is 10 gpm.

The air stripper is constructed such that a single operator easily removes the trays for maintenance. The air stripper sump is equipped with a sight glass to allow visual confirmation of the water level with in the sump. All seals and wetted parts are designed for contact with chlorinated and non-chlorinated VOCs.

The air stripper is equipped with a high efficiency demister. The demister will effectively remove water droplets at airflow velocity greater than stripper blower maximum capacity with 98% removal of droplets 10μm of greater in size.

The air stripper blower motor is rated for use with 230v three-phase power. The blower is equipped with an air flow meter to confirm that sufficient air is provided to treat water as specified above.

The air stripper sump is equipped with intrinsically safe liquid level controls. The sump is equipped with a pump, activated by the level controls, to pump the treated water from the air stripper sump through two carbon vessels to an unnamed tributary of the Silver Lake Outlet. This pump has the capacity to pump 30 gpm at a pressure of up to 79 pounds per square inch (psi).

### 1.2.7 Carbon Filters (Ground Water)

Two 1,000-pound carbon canisters (C-5 and C-6) were installed, in series, to serve as a final "polishing" agent for the treated ground water, and to ensure the effluent discharge criteria will continue to be met. The carbon vessels have a minimum hydraulic capacity of 30 gpm and rated use at pressures of up to 100 psi.

The carbon vessels were installed in a manner that permits the order in which water flows through the vessels to be changed without moving the vessels or altering any hard piped plumbing. This enables alternating the vessels as primary and secondary as carbon usage and fouling with suspended sediment occurs. Flexible hoses and cam lock fittings facilitate the rapid ability to alternate carbons. The hoses are rated for contact with chlorinated and non-chlorinated VOCs and for pressures of up to 100 psi. The carbon vessels and related plumbing are equipped with sample valves and pressure gauges as shown in Figure 2.

The vessels are mounted within a prefabricated building in order to prevent freezing and to allow for accessibility from the outside for ease of changeout.

### 1.2.8 Carbon Filters (Vapor)

Two sets of vapor carbon units (C-1 through C-4) were installed to treat effluent vapors from the air stripper and the rotary vane pump. Each set of two carbon vessels is plumped in series. The carbon vessels will have a minimum vapor flow capacity of 50 cfm and rated use at pressures of up to 10 psi.

The vessels are mounted within the remediation system building and in the enclosed area outside of the treatment shed.

The carbon vessels and related plumbing are equipped with sample valves and pressure gauges, as shown in Figure 2.

### 1.2.9 Temperature Gages

Two temperature gages are located on the process piping, as shown in Figure 2. The temperature indicators shall have a scale of 0 to 300° Fahrenheit, and have a full-scale accuracy of +/-1 percent. All temperature gauges are installed in an appropriate thermo well.

### 1.2.10 Vacuum Pressure Indicators

Vacuum pressure gauges are located throughout the process piping as shown in Figure 2. The vacuum gauges are glycerin filled and have a full-scale accuracy of +/- 2 percent.

### 1.2.11 Temperature Switches

One temperature switch is located in the process piping associated with the vacuum pump. This switch sends a digital signal to the panel programmable logic controller (PLC) to shut down the system in the event of the process stream temperature exceeding system limits. The temperature switch has a span appropriate to the required limit of the vacuum pump and will reset upon decreasing temperature.

### 1.2.12 Valves

Various ball valves are located throughout the process piping. Ball valves are full port, sized to match process-piping diameter, and wetted parts are for contact with chlorinated and non-chlorinated VOCs.

## 2.0 DUAL PHASE CONTROL PANEL

The intrinsically safe control panel is located inside of the equipment building at the location shown in Figure 3. The panel controls operation of all pumps, solenoids, the air stripper blower and exhaust fan. A single line electrical drawing showing all major electrical equipment and controls that interface with the panel is shown as Figure 7.

The control system interface is set up to allow programming of each individual solenoid's cycle and cycle duration by direct input to the supplied interface. The programming is prompted with on screen directions such that minimal training is required to allow programming the solenoid sequences. The interface also has the ability to display the currently operating solenoids and hours and cycles each solenoid has operated.

A UL #508 panel shop has assembled the control panel with all components installed according to manufacturer specifications. The control panel is housed in a NEMA type 4X enclosure and includes:

- Circuit breaker and motor starter for the following:
  - Vacuum pump motor
  - VLS discharge pump motor
  - Air stripper blower motor
  - Air stripper discharge pump motor
- Hand, Off and Auto (HOA) switches for the following:
  - Vacuum pump
  - VLS discharge pump
  - Air stripper blower
  - Air stripper discharge pump
- Individual labeled green running lights which illuminate for each of the following:
  - Vacuum pump operating
  - VLS transfer pump operating
  - Air stripper blower operating

  - Air stripper transfer pump operating
- A Maple Systems alphanumeric interface with the following capabilities:
  - Readout of the various fault conditions with the ability to reset and stop the system
  - Control of the seven dual phase point and the VLS air bleed solenoid valves
  - Display hours and cycles of operation for the pumps, blower and each extraction well
- PLC Direct #205 that permits system shutdown and restart

The manufacturer prior to installation programmed the control panel PLC and the PLC interface. A telemetry program number (DRC-Chester 98 MMI Software) is used for remote system monitoring. In addition, an auto dialer (sensaphone model 1104) is provided. The auto dialer will notify Delta in the event that any fault condition exists. The manufacturer has provided the required control panel programming and telemetry training to Delta, thus enabling field personnel the ability to trouble shoot and/or make operational changes to the control system.

## 3.0 REMEDIAL ACTIVITIES IN FORMER EMPTY DRUM STORAGE AREA

The Report of Remedial Activities - Former Empty Drum Storage Area (February 23, 2001) is incorporated into this report (Appendix B), and made a part of it.

## 4.0 SIGNATURES

The information contained in this report reflects the final "as-built" conditions of the remediation system (as illustrated in Figures 2 through 7) and also includes the changes made during system construction. None of these changes required a modification to the Workplan. The design was implemented and all construction activities were completed in accordance with the Department-approved remedial design.

This Final Engineering Report has been prepared by:

**DELTA ENVIRONMENTAL CONSULTANTS, INC.**

FOR _____ 3-8-01

Ron Jenkins — Date
Staff Scientist

_____ 3/8/01

Stephen A. Zbur, P.G. — Date
Project Manager

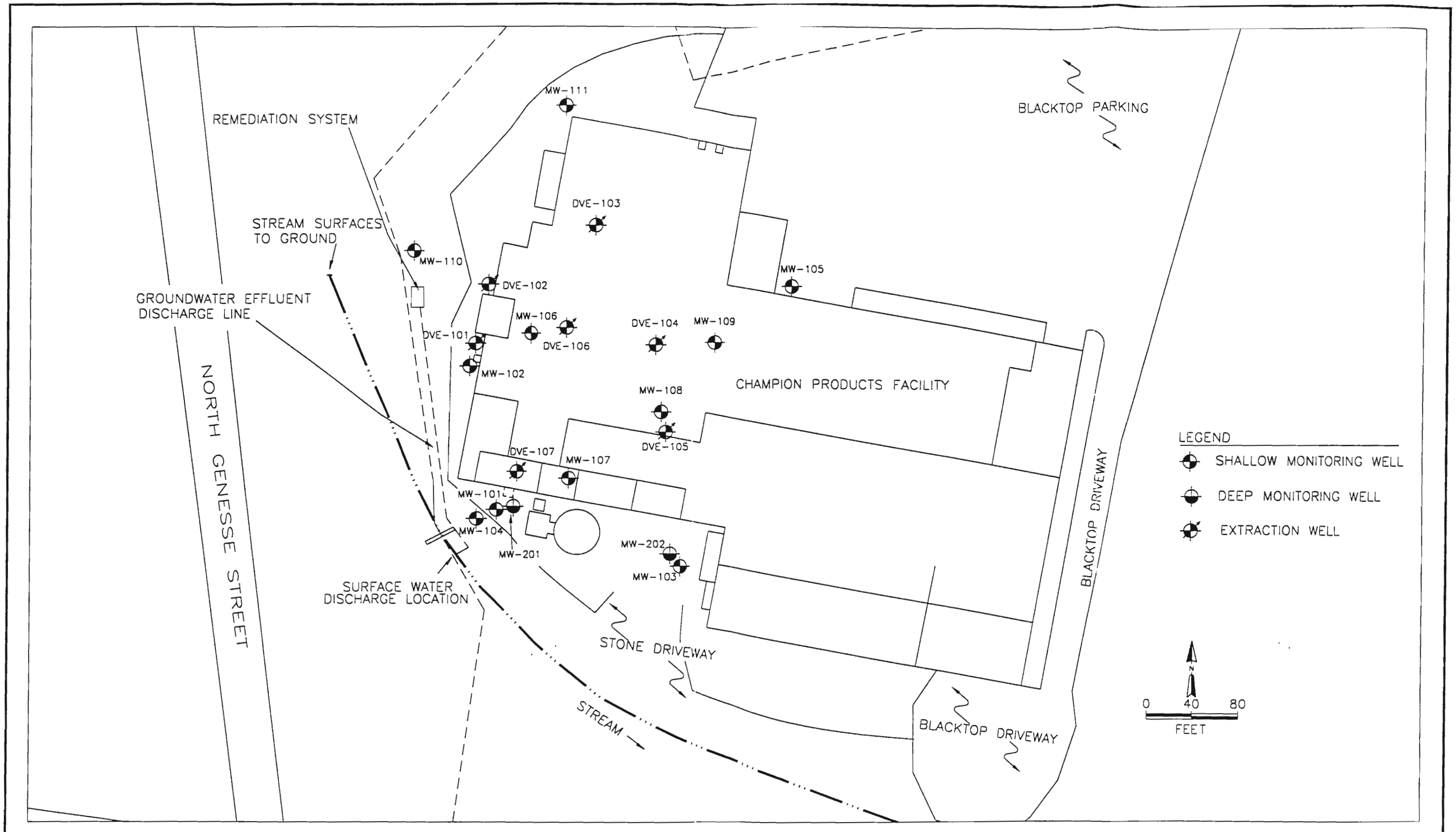
The Final Engineering Report was reviewed by:

_____ 3/7/2001

Robert J. Elliott, P.E. — Date
Vice President
Lu Engineers

LICENSED PROFESSIONAL ENGINEER
ROBERT JAMES ELLIOTT
No. 61038
STATE OF NEW YORK

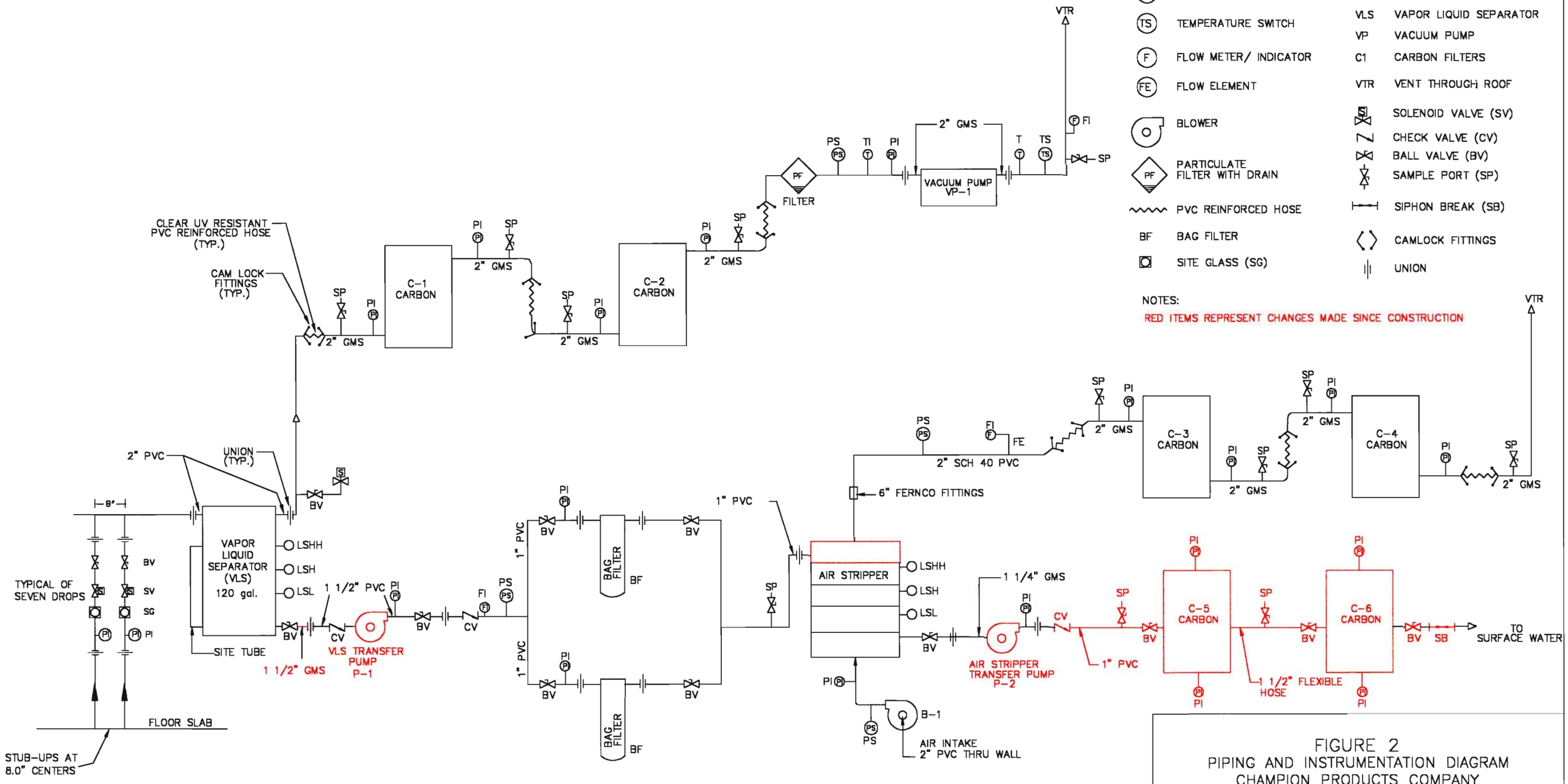
**FIGURES**




Delta Environmental Consultants, Inc.

TITLE:
SITE MAP
CHAMPION PRODUCTS COMPANY
PERRY, NEW YORK

| | | | |
|---|---|---|---|
| DWN: HLW | DES.: | PROJECT NO.: S098-009 | |
| CHKD: | APPD: | | |
| DATE: 2/6/01 | REV.: | FIGURE NO.: 1 | |




LEGEND:

| | | | |
|---|---|---|---|
| PI | PRESSURE/VACUUM INDICATOR | LSHH | LEVEL SWITCH HIGH, HIGH |
| T | TEMPERATURE GAUGE | LSH | LEVEL SWITCH HIGH |
| PS | PRESSURE/VACUUM SWITCH | LSL | LEVEL SWITCH LOW |
| TS | TEMPERATURE SWITCH | VLS | VAPOR LIQUID SEPARATOR |
| | | VP | VACUUM PUMP |
| F | FLOW METER/ INDICATOR | C1 | CARBON FILTERS |
| FE | FLOW ELEMENT | VTR | VENT THROUGH ROOF |
| | BLOWER | SV | SOLENOID VALVE (SV) |
| | | | CHECK VALVE (CV) |
| PF | PARTICULATE FILTER WITH DRAIN | | BALL VALVE (BV) |
| | | SP | SAMPLE PORT (SP) |
| | PVC REINFORCED HOSE | | SIPHON BREAK (SB) |
| BF | BAG FILTER | | CAMLOCK FITTINGS |
| SG | SITE GLASS (SG) | | UNION |

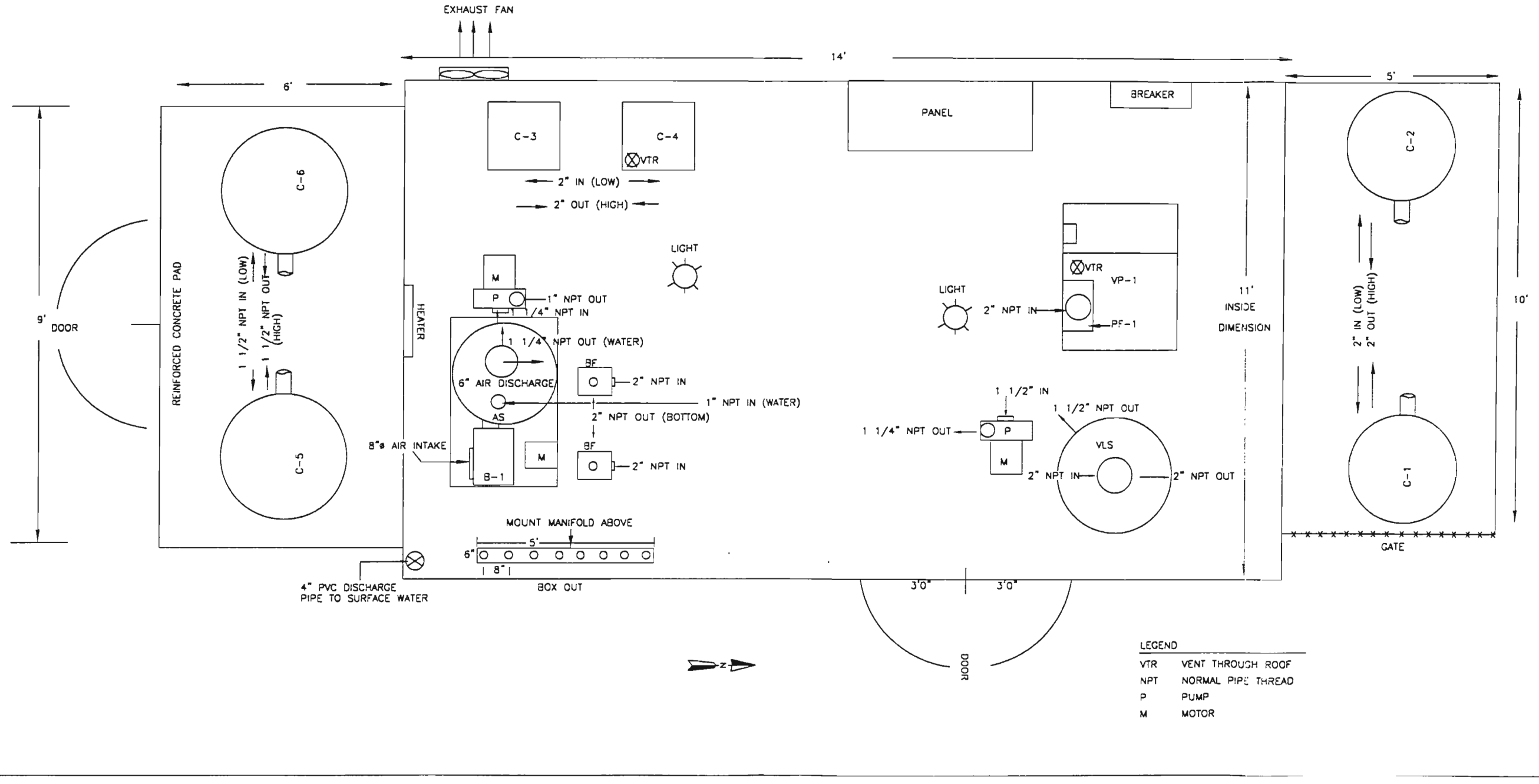
NOTES:

RED ITEMS REPRESENT CHANGES MADE SINCE CONSTRUCTION

# FIGURE 2
## PIPING AND INSTRUMENTATION DIAGRAM
## CHAMPION PRODUCTS COMPANY
## PERRY, NEW YORK

| PROJECT NO. | PREPARED BY | DRAWN BY |
|---|---|---|
| S098-009 | DK | DD |
| DATE | REVIEWED BY | FILE NAME |
| 12/27/99 | | 009-PIDB |

Delta Environmental Consultants, Inc.




Delta Environmental Consultants, Inc.

TITLE:
EQUIPMENT LAYOUT
CHAMPION PRODUCTS COMPANY
PERRY, NEW YORK

| | | | |
|---|---|---|---|
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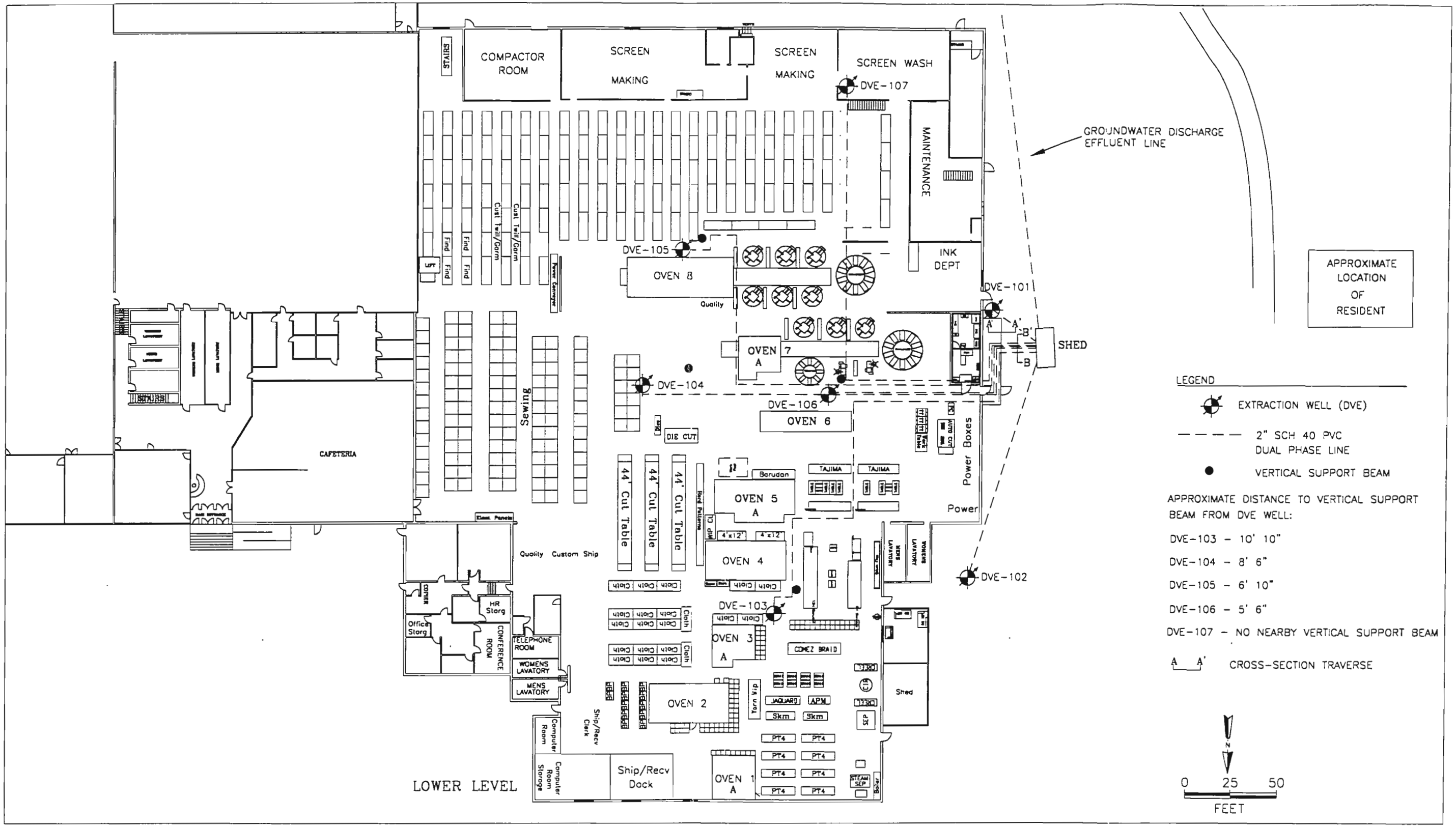
| CHKD: | APPD: | | |
| DATE: 1/22/01 | REV.: | FIGURE NO.: 3 | |




Delta Environmental Consultants, Inc.

TITLE:
PIPING LAYOUT AND EXTRACTION WELL LOCATIONS
CHAMPION PRODUCTS FACILITY
PERRY, NEW YORK

| | | | |
|---|---|---|---|
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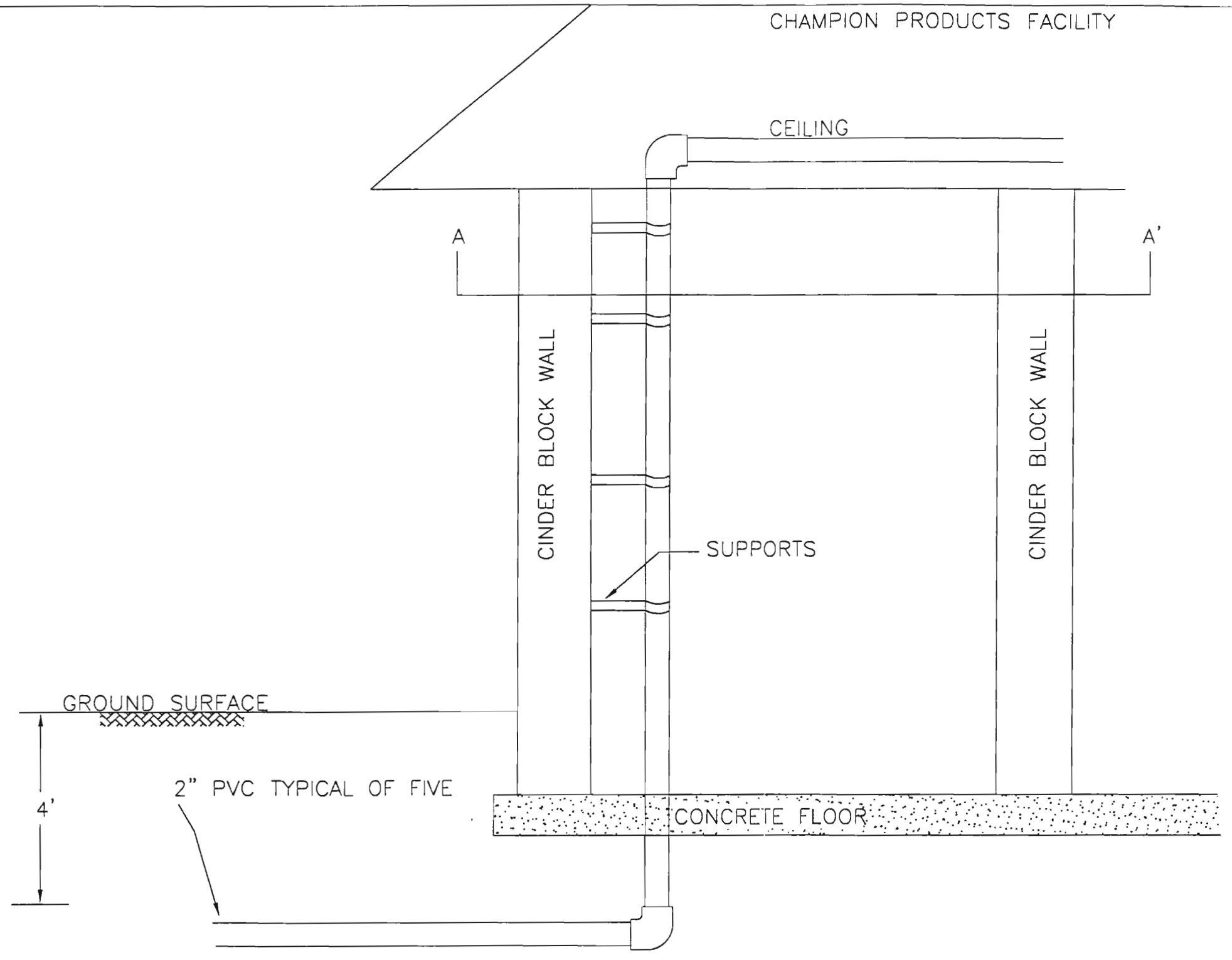
| CHKD: | APPD: | | |
| DATE: 10/13/99 | REV.: | FIGURE NO.: 4 | |




Delta Environmental Consultants, Inc.

TITLE:
FACILITY PIPING LAYOUT (A–A')
CHAMPION PRODUCTS COMPANY
PERRY, NEW YORK

| | | | |
|---|---|---|---|
| DWN: HLW | DES.: | PROJECT NO.: S098-009 | |
| CHKD: | APPD: | FIGURE NO.: 5 | |
| DATE: 12/15/00 | REV.: | | |

NOTES:

1.) SITE CONTRACTOR RESPONSIBLE FOR CONNECTIONS TO DUAL PHASE POINTS.

2.) BACKFILLING: PLACE AND COMPACT MATERIALS IN CONTINUOUS LAYERS NOT EXCEEDING 8 INCHES UNCOMPACTED DEPTH AND COMPACTED TO 95%. OF MAXIMUM DENSITY.

3.) 2" MINIMUM SAND BEDDING OVER AND UNDER LATERAL PIPING.

4.) REPLACE ALL SURFACE COVER TO ITS ORIGINAL CONDITION.




TYPICAL OUTDOOR TRENCH DIAGRAM-CROSS SECTION
NOT TO SCALE

Delta Environmental Consultants, Inc.

TITLE:
UNDERGROUND CROSS-SECTION (B-B')
CHAMPION PRODUCTS COMPANY
PERRY, NEW YORK

| | | | |
|---|---|---|---|
| DWN: HLW | DES.: | PROJECT NO.: S098-009 | |
| CHK'D: | APP'D: | | |
| DATE: 12/06/99 | REV.: | FIGURE NO.: 6 | |

# APPENDIX A

## EQUIPMENT CUT SHEETS

# Installation, Startup, and Maintenance Manual
# MaxiVac™ 200 Multi-Phase Extraction System

# Delta Environmental Consultants

Perry, NY

July, 2000

DRC # 6154

**DIVERSIFIED REMEDIATION & CONTROLS**

21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660

# ROTARY VANE PUMP

SN 2096847

DRC # 6154

**DIVERSIFIED REMEDIATION & CONTROLS**

21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660

# Operating instructions

CE

Rietschle

## Vacuum pumps

VC

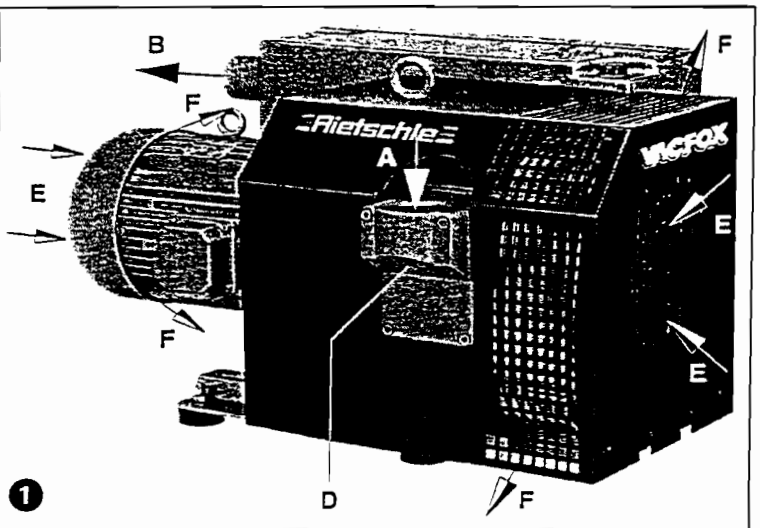
VACFOX

VC 200

VC 300

### Pump ranges

These operating instructions concern the following oil flooded rotary vane vacuum pumps: VC 200 and VC 300 The nominal vacuum capacities at atmosphere are 200 and 300 m³/hr operating on 50 cycles. The pumping curves showing capacity against vacuum can be seen in data sheet D 232.



1

### Description

VC 200 and VC 300 vacuum pumps are fitted with a mesh filter on the pump inlet. On the exhaust side of the pump an oil mist eliminator is fitted which has the function of re-circulating oil back into the circulation system, as well as providing high efficiency separation on the pump exhaust. Situated between the pump housing and the motor, a high efficiency cooling fan pulls cooling air in through the fan cover. A further fan inside of the oil cooler results in the cooling of the re-circulating oil.

A standard built-in non return valve on the inlet of the pump seals the pump from the process when the pump is stopped. This prevents oil moving into the pumping cylinder when the pump is stationary. Excessive oil in the cylinder could cause an hydraulic lock when the pump is started and hence undue stress on the rotor blades.

The gas ballast valve which is fitted as standard avoids any condensation of a small amount of water vapour inside the pump and hence emulsification of the oil. The gas ballast vapour handling capacity can be increased if required to tolerate higher vapour loads than normal.

All the pumps are driven by a direct flanged three phase, standard TEFV motor via a pin and bush coupling.

Optional extras: The following standard optional extras can be supplied if required: Vacuum regulating valve (ZRV), additional non return valve (ZRK), dust inlet filter (ZFP), high vacuum suction filter (ZVF), direct on line (DOL) motor starter (ZMS) and various vacuum gauges.

### Suitability

⚠ **The units VC 200 and VC 300 are suitable for the use in the industrial field i.e. the protection equipments corresponds to EN DIN 294 table 4, for people aged 14 and above.**

The ultimate vacuum can be user selected at either 0.5 mbar (abs.) for fine vacuum or 10 mbar (abs.) for coarse vacuum (see adjusting bolt (X)).

These models can be used for the evacuation of a closed system or for a permanent vacuum from:

Fine vacuum → 0.5 to 100 mbar (abs.) • Coarse vacuum → 10 to 500 mbar (abs.)

When these pumps are operated permanently outside the ranges listed above, there may be oil seepage at the exhaust port. If closed systems are evacuated from atmospheric pressure down to a suction pressure close to the ultimate vacuum there will be no problem with the oil system, provided the vacuum limit is achieved within a 10 minute pump down time.

⚠ **Amounts of water vapour may be handled. Water, other liquids, aggressive or inflammable gases and vapours may not be handled. For water vapour tolerance, see information I 200.**

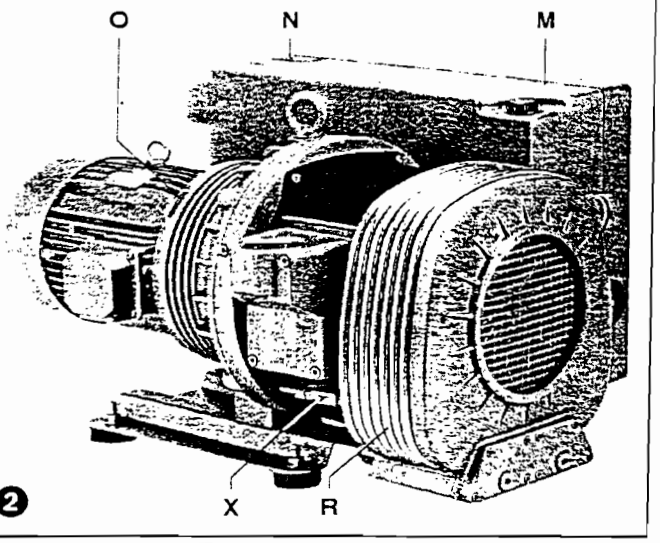
**Handling of inflammable or aggressive gases and vapours is only possible with special versions, if the safety instructions XE 2 are noted.**

⚠ **The ambient and suction temperatures must be between 5 and 40°C. For temperatures outside this range please contact your supplier.**

The standard versions may not be used in hazardous areas. Special versions with Ex-proof motors can be supplied.

The back pressure on the exhaust port must not exceed + 0.1 bar.

⚠ **All applications where an unplanned shut down of the vacuum pump could possibly cause harm to persons or installations, then the corresponding safety backup system must be installed.**



2

BE 232

1.6.99


Werner Rietschle GmbH + Co. KG
Postfach 1260
D-79642 Schopfheim
☎ 07622/392-0
Fax 07622/392300
e-mail: info@rietschle.co
http://www.rietschle.com

Rietschle (UK) Ltd.
P.W.D.C.
Paddock Wood
Kent TN12 6UU.
☎ 01892/835237
Fax 01892/834643

## Maintenance and Servicing

**When maintaining these units and having such situations where personnel could be hurt by moving parts or by live electrical parts the pump must be isolated by totally disconnecting the electrical supply. It is imperative that the unit cannot be re-started during the maintenance operation.**

**Do not work on a pump that is at its normal operating temperature as there is a danger from hot parts or hot lubricant.**

### 1. Air filtration

**The capacity of the pump can become reduced if the air inlet filters are not maintained correctly.**

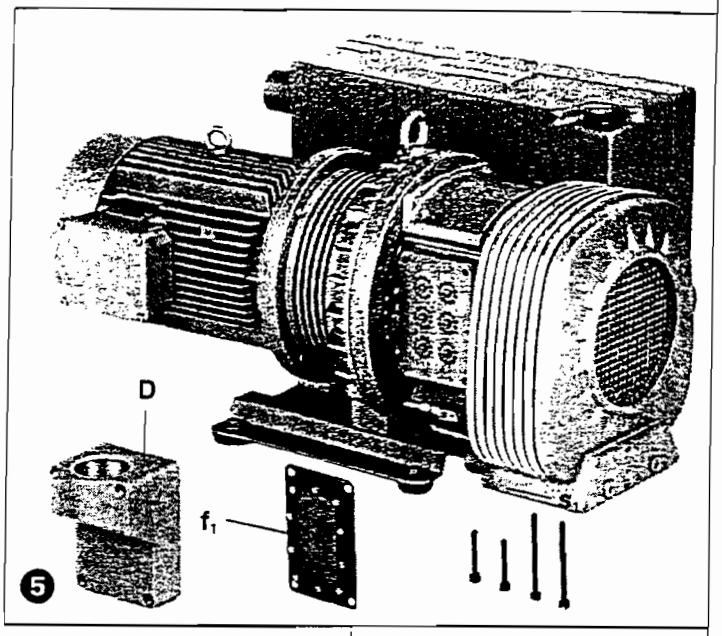
Filters on the suction side: Mesh filter ($f_1$) must be cleaned regularly depending upon the amount of contamination. Cleaning can be carried out by washing out or by blowing out with compressed air. Replace filters if contaminated completely.

The mesh filter ($f_1$) can be dismantled by removing screws ($s_1$) on the filter housing (D) (picture ❺).

Filter for Gas ballast: All pumps are equipped with a gas ballast valve (U).

The built in filter cartridge ($f_2$) must be cleaned regularly depending upon the amount of contamination by blowing out with compressed air. By removing the screw ($g_2$) and plastic cap ($h_2$) the filter elements can be removed for cleaning. Re-assemble in reverse order (picture ❻).

Filter Cartridge (Optional Extras): The filter cartridge of the vacuum tight suction filter (ZVF) or dust separator (ZFP) must be cleaned regularly again depending upon the amount of contamination. Cleaning can be achieved by washing or by blowing out with compressed air. Replace the filter cartridge if necessary. The cartridge can be removed completely by undoing the relevant retaining clips.



❺

### 2. Lubrication (picture ❸)

Check the oil level regularly depending upon the operating hours.

First oil change after 500 operating hours (see oil drain plug (K)). Further changes every 500-2000 operating hours. The oil change times should be shortened if the application is dusty. Drain the oil also from the oil cooler (R) (see oil drain plug ($K_1$)).

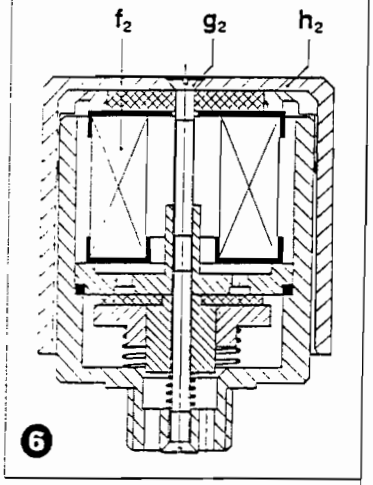
Only oils corresponding to DIN 51506 group VC/VCL or a synthetic oil (obtainable from Rietschle) should be used. The viscosity must correspond to ISO-VG 100 according to DIN 51519.

The recommended Rietschle Oil types are: MULTI-LUBE 100 (mineral oil); SUPER-LUBE 100 (synthetic oil) (see oil type plate (M)).

When the oil is under a high thermal load, e.g. ambient or suction temperatures over 30°C, unfavourable cooling or operating with increased speed etc., the oil change time can be extended by using the recommended synthetic oil.

**Old and used oil must be disposed of corresponding with the relevant health, safety and environmental laws.**

**If the oil brand is changed, the old oil must be drained completely from oil separator housing and the oil cooler.**



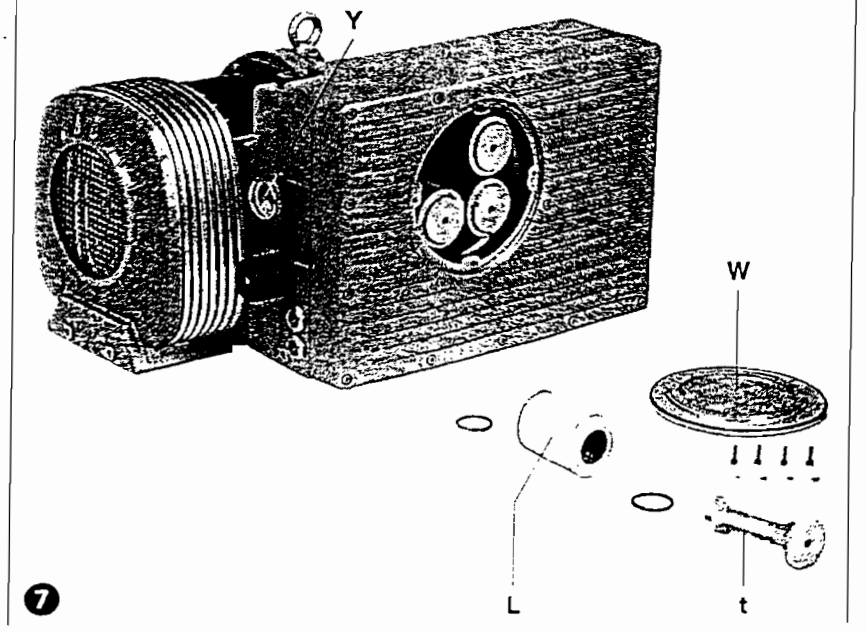
❻

### 3. Oil separation (picture ❼)

**Extremely blocked filter elements will result in an increased pump temperature and will cause discolouration of the lubricant.**

The oil separator elements may become contaminated after a long period of operation which can result in high pump temperature and motor overload. We therefore recommend to change the filter elements (L) every 2000 operating hours or when the filter back pressure is in excess of 0.7 bar (see back pressure gauge (Y) → optional extra). It is not possible to clean these elements.

To change filters: Remove maintenance cover (W). Remove plastic fixings (t) and exchange the elements (L). If possible re-use the o-ring for reassembly. Re-assemble in reverse order.



❼

**Handling and Setting up** (pictures ❶ and ❷)

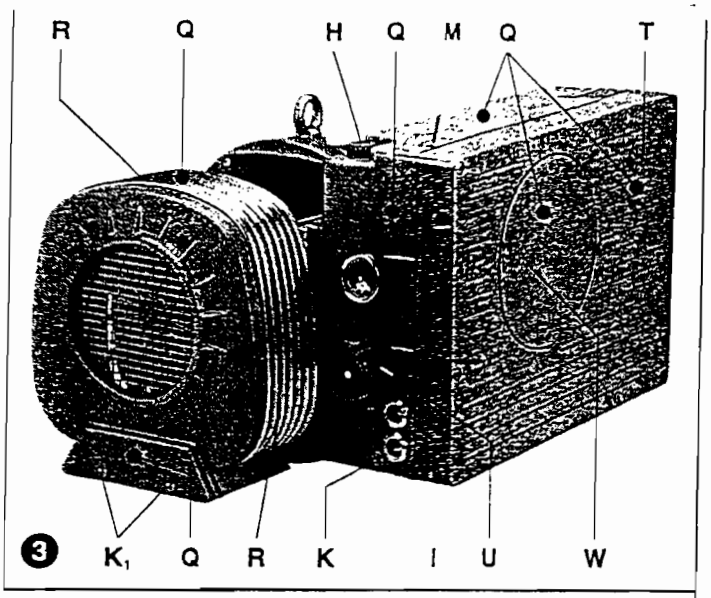
**Pumps that have reached operating temperature may have a surface temperature at position (Q) of more than 70°C. WARNING! Do Not Touch.**

Filter housing (D), oil filler ports (H, $H_1$), oil sight glass (I), oil drain plugs (K, $K_1$), gas ballast (U) and oil separator housing (T) must all be easily accessible. The cooling air entries (E) and the cooling air exits (F) must have a minimum distance of 20 cm from any obstruction. The discharged cooling air must not be re-circulated. For maintenance purposes we recommend a space of 0.5 m in front of the filter housing and oil separator.

**The VC 200 and VC 300 pumps can only be operated reliably if they are installed horizontally.**

**For installations that are higher than 1000 m above sea level there will be a loss in capacity. For further advice please contact your supplier.**

When installed on a solid base, the pumps may be installed without fixing down. If the pumps are installed on a base plate we would recommend fitting anti vibration mounts. This range of vacuum pumps are almost vibration free in operation.



❸

**Installation** (pictures ❶ and ❷)

**For operating and installation follow any relevant national standards that are in operation.**

1. The vacuum connection (A) is situated on the filter housing (D).
   The air handled can be emitted into the atmosphere through the exhaust port (B) or by utilising an exhaust pipe.
   **Long and/or small bore pipework should be avoided as this tends to reduce the capacity of the pump.**
   **The exhaust port (B) must not be obstructed or partly obscured.**
2. The lubricating oil (for recommended brands see under servicing) can be put into the pump at the oil filler port (H) of the oil separator housing, until the oil level shows at the upper mark of the oil sight glass (I). After filling, make sure the oil filler port is closed.
3. The electrical data can be found on the data plate (N) or the motor data plate. The motors correspond to DIN/VDE 0530 and have IP 54 protection and insulation class B or F. The connection diagram can be found in the terminal box on the motor (unless a special plug connection is fitted). Check the electrical data of the motor for compatibility with your available supply (voltage, frequency, permissible current etc.).
4. Connect the motor via a motor starter. It is advisable to use thermal overload motor starters to protect the motor and wiring. All cabling used on starters should be secured with good quality cable clamps.
   We recommend that motor starters should be used that are fitted with a time delayed trip resulting from running beyond the amperage setting. When the unit is started cold, overamperage may occur for a short time.

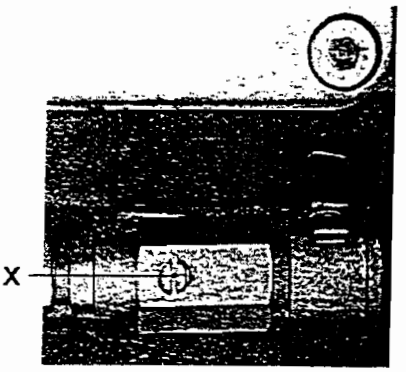
**The electrical installation may only be made by a qualified electrician under the observance of EN 60204. The main switch must be provided by the operator.**

**nitial Operation** (pictures ❶ and ❷)

1. Initially switch the pump on and off for a few seconds to check the direction of rotation against the direction arrow (O).
2. Connect the suction pipe at (A).
3. Run the pump for two minutes using the correct rotation. Stop pump and top up the oil using the oil filler port (H) to the correct level (see sight glass (I)). Repeat this process until the oil cooler is completely full.
   On no account open the oil filler port when the pump is operating.
4. The operating range can be adjusted by turning off the adjusting bolt (X) (see picture ❹)
5. Vacuum regulating valve (optional extra):
   The vacuum can be adjusted by turning the regulating valve according to the symbols as indicated on the top of the regulating valve.

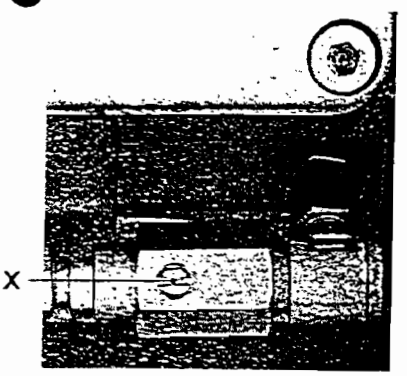
**Potential risks for operating personnel**

1. Noise Emission: The worst noise levels considering direction and intensity measured according to DIN 45635 part 3 (as per 3. GSGV) are shown in the table at the back. When working permanently in the vicinity of an operating pump we recommend wearing ear protection to avoid any damage to hearing.
2. Oil mist in the Exhaust Stream: Even with the high efficiency oil mist eliminator the exhausted air could still contain extremely low amounts of oil mist which can occasionally be detected by smell. Permanent inhalation of these mists may result in health problems, therefore it is extremely important to make sure that the installation area is well ventilated.



Fine vacuum: 0.5 to 100 mbar (abs.)

❹



Coarse vacuum: 10 to 500 mbar (abs.)

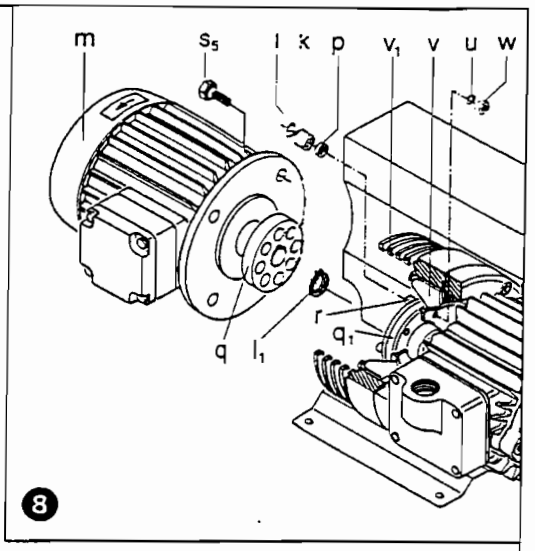
4. **Coupling** (picture ❽)

The coupling rubbers (k) are wearing parts and should be checked regularly. When the coupling rubbers are worn this can be detected by a knocking sound when the vacuum pump is started.

⚠ **Defective coupling rubbers can cause extensive damage and even in some extreme cases break the rotor shaft.**

To check the coupling, stop the motor (m) and isolate. Remove the screws ($s_5$). Pull off the motor together with the motor side coupling half (q). If the coupling rubbers (k) are damaged remove the circlips (l) from the coupling bolt (r) and exchange the coupling rubbers (k). Leave the spacer (p) in place, check the coupling bolts (r) for any wear and replace if necessary. To replace remove fan cover ($v_1$), remove the circlip ($l_1$), pull off the coupling and fan (v) complete from the pumpshaft, remove the nut (w) with washer (u) and exchange the coupling bolts.

Re-assemble in reverse order.



❽

## Trouble Shooting

1. **Motor starter cuts out vacuum pump:**
1.1 Check that the incoming voltage and frequency corresponds with the motor data plate.
1.2 Check the connections on the motor terminal block.
1.3 Incorrect setting on the motor starter.
1.4 Motor starter trips too fast.
Solution: Use a motor starter with a time delay trip (version as per IEC 947-4).
1.5 The vacuum pump or the lubricating oil is too cold.
1.6 The viscosity of lubricant is too high.
1.7 Oil mist eliminator elements are blocked or contaminated.
1.8 Back pressure on the exhaust pipework is excessive.

2. **Insufficient suction capacity:**
2.1 Inlet filters or meshes are obscured.
2.2 Suction pipe work is too long or too small.

3. **Vacuum pump does not reach ultimate vacuum:**
3.1 Check for leaks on the suction side of the pump or on the system.
3.2 Viscosity of lubricant incorrect.

4. **Vacuum pump operates at an abnormally high temperature:**
4.1 Ambient or suction temperature too high.
4.2 Cooling air flow is restricted.
4.3 Problem as per 1.6, 1.7 and 1.8.

5. **Exhausted air contains visible oil mist:**
5.1 Oil separator elements are fitted incorrectly.
5.2 Incorrect oil brand is used.
5.3 Problem as per 1.7, 1.8, 4.1 and 4.2.

6. **Unit emits abnormal noise:**
Note: A knocking noise from the rotor blades is normal when starting from cold, as long as it disappears within two minutes with increasing operating temperature.
6.1 The coupling rubbers are worn (see under "servicing").
6.2 The pump cylinder is worn.
Solution: send your complete unit off for repair to the supplier or approved service agent.
6.3 The vacuum regulating valve is noisy.
Solution: replace valve.
6.4 Blades are damaged.
6.5 Problem as per 1.5 and 1.6.

7. **Water in lubricant i.e. Emulsification:**
7.1 Pump pulls in water because of the application.
Solution: Fit water separators on to the vacuum side.
7.2 Unit handles more water vapour than the gas ballast is designed for.
Solution: Consult supplier for the provision of an increased gas ballast capability.
7.3 Pump operates only for a short time and does not reach normal operating temperature.
Solution: Run the pump with closed suction until the oil has been cleaned.

## Appendix:

Repair on Site: For all repairs on site an electrician must disconnect the motor so that an accidental start of the unit cannot happen. All engineers are recommended to consult the original manufacturer or one of the subsidiaries, agents or service agents. The address of the nearest repair workshop can be obtained from the manufacturer on application.
After a repair or before re-installation, follow the instructions as shown under the headings "Installation and Initial Operation".

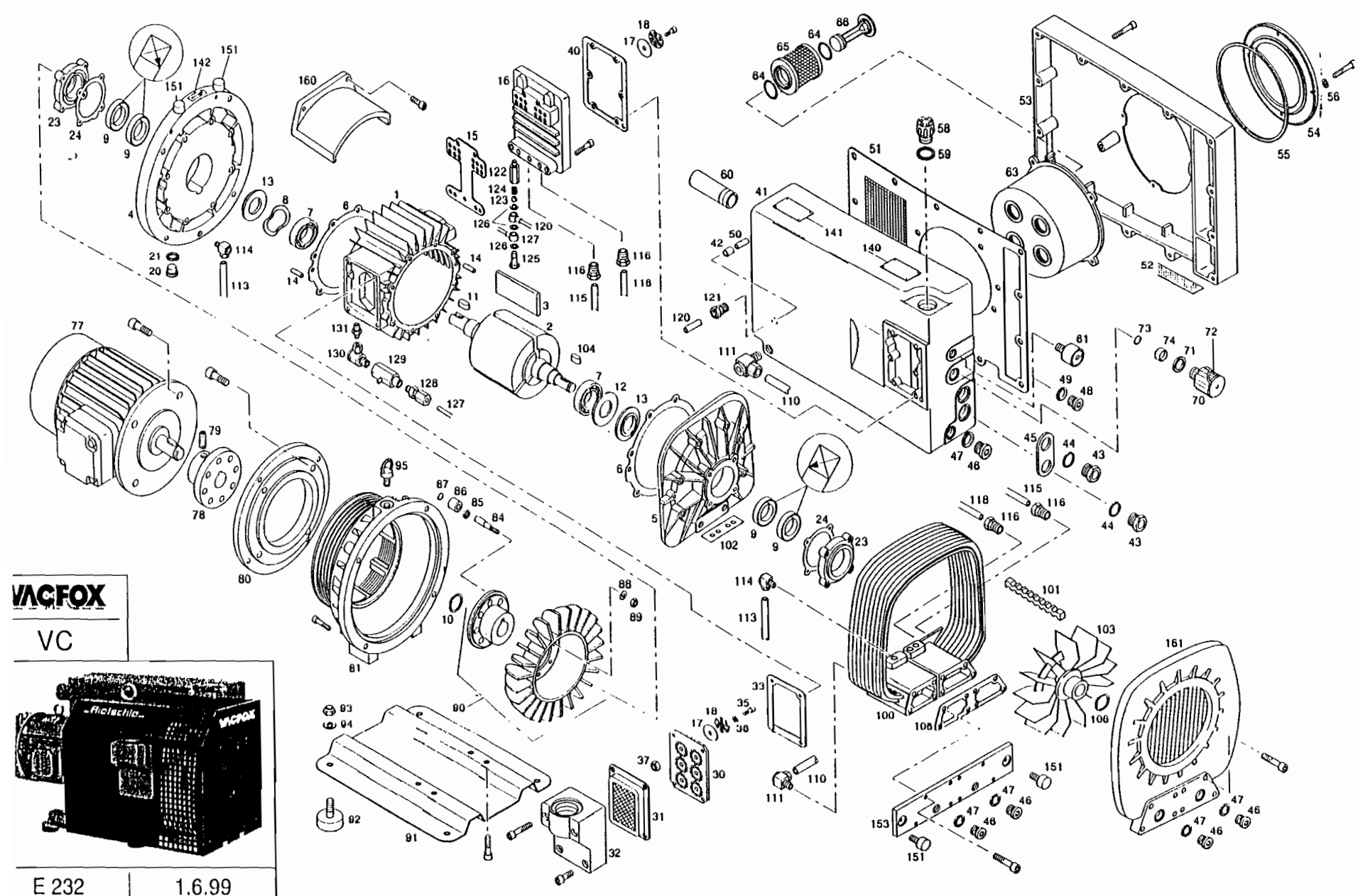
Lifting and Transport: To lift and transport the vacuum pump the eye bolts on the pump and motor must be used. If an eye bolt is missing use suitably rated strops. The weight of the pumps is given in the accompanying table.

Storage: VCAH and VCEH units must be stored in dry ambient conditions with normal humidity. If a pump needs to be stocked for a period longer than 3 months we would recommend using an anticorrosion oil rather than the normal lubricant.

Disposal: The wearing parts (as listed in the spare parts lists) should be disposed of with due regard to health and safety regulations.

Spare parts lists: E 232 → VC 200 / VC 300

| VC | | | 200 | 300 |
|---|---|---|---|---|
| Noise level (max.) | dB(A) | 50 Hz | 75 | 81 |
| | | 60 Hz | 79 | 83 |
| Weight (max.) | kg | 50 Hz | 144 | 204 |
| | | 60 Hz | 161 | 209 |
| Length | mm | 50 Hz | 775 | 950 |
| | | 60 Hz | 880 | 950 |
| Width | mm | | 584 | 632 |
| Height | mm | | 425 | 425 |

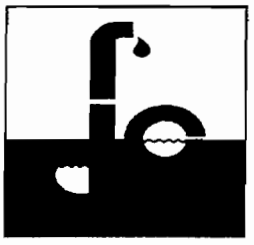


VACFOX

VC

# Transfer Pumps

DRC # 6154



**DIVERSIFIED REMEDIATION & CONTROLS**

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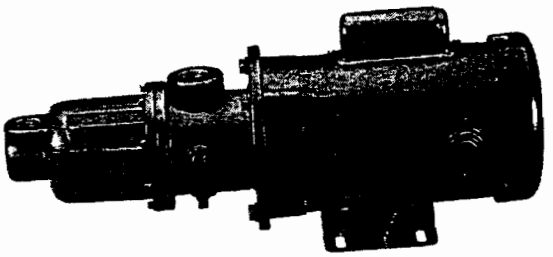
MOYNO

*Always the Right Solution™*

# SERVICE MANUAL
# MOYNO® 500 PUMPS
## 300 SERIES MOTORIZED
### 331, 332, 333, AND 344 MODELS

### DESIGN FEATURES

| | |
|---|---|
| Housing: | Cast iron/316 SS |
| Pump Rotor: | Chrome plated AISI 416 stainless steel/Chrome plated 316 stainless steel |
| Pump Stator: | NBR (Nitrile) |
| Seal: | Mechanical (carbon/ceramic) |
| Motor Shaft: | AISI 416 stainless steel/ANSI 316 stainless steel |
| Motor: | 1/2 HP, 60 Hertz, 1725 rpm, totally enclosed, fan cooled (TEFC) C-Faced, 1 phase 115/230V or 3 phase 230/460V (other motor options available; consult sales representative) |



Note: Alternate elastomers available. Refer to Repair/Conversion Kit Numbers, pages 3 and 4.

## INSTALLATION

**Mounting Position.** Pump may be mounted in any position. When mounting vertically, it is necessary to keep bearings above seals to prevent possible seal leakage into bearings.

**Pre-Wetting.** Prior to connecting pump, wet pump elements and mechanical seal by adding fluid to be pumped into suction and discharge ports. Turn pump over several times in a clockwise direction to work fluid into pump elements.

**Piping.** Piping to pump should be self-supporting to avoid excessive strain on pump housings. See Table 1 for suction and discharge port sizes of each pump model. Use pipe "dope" or tape to facilitate disassembly and to provide seal on pipe connections.

**Electrical.** Follow the wiring diagram on the motor nameplate or inside the terminal box for the proper connections. The wiring should be direct and conform to local electrical codes. Check power connections for proper voltage. Voltage variations must not exceed ±10% of nameplate voltage. Motor is provided with internal automatic overload protection.

To prevent damage to pump, pump rotation must be clockwise when facing pump from motor end.

## OPERATION

**Self-Priming.** With wetted pumping elements, the pump is capable of 25 feet of suction lift with pipe size equal to port size. Be sure suction lines are air tight or pump will not self prime. Self-priming capabilities will vary due to fluid viscosity.

DO NOT RUN DRY. Unit depends on liquid pumped for lubrication. For proper lubrication, flow rate should be at least 10% of rated capacity.

**Pressure and Temperature Limits.** See Table 1 for maximum discharge pressure of each model. Unit is suitable for service at temperatures shown in Table 2.

**Storage.** Always drain pump for extended storage periods by removing bottom drain plug in pump body.

**Caution: Suction pressure should never be greater than discharge pressure.**

**Table 1. Pump Data**

| Pump Model | Suction Port (NPT) | Discharge Port (NPT) | Voltage Rating (VAC) | Discharge Pressure (psig) |
|---|---|---|---|---|
| 331 | 3/4 | 3/4 | See Motor Name Plate For Voltage Ratings | 150 |
| 332 | 3/4 | 3/4 | See Motor Name Plate For Voltage Ratings | 100 |
| 333 | 3/4 | 3/4 | See Motor Name Plate For Voltage Ratings | 50 |
| 344 | 3/4 | 3/4 | See Motor Name Plate For Voltage Ratings | †30 |

†With 3/4 HP motor, pressure is 40 psig.

**Table 2. Temperature Limits**

| Elastomer | Temperature Limits |
|---|---|
| *NBR | 10°-160°F |
| *EPDM | 10°-210°F |
| *FPM | 10°-240°F |

*NBR = Nitrile
EPDM = Ethylene-Propylene-Diene Terpolymer
FPM = Fluoroelastomer

## TROUBLESHOOTING

**WARNING: Before making adjustments, disconnect power source and thoroughly bleed pressure from system prior to disassembly. Failure to do so could lead to electric shock or serious bodily harm.**

**Failure To Pump.**

1. Motor will not start: Check power supply. Voltage must be ± 10% of nameplate rating when motor is in locked rotor condition. Check for faulty capacitor on 1 phase Models.
2. Motor runs and thermally kicks out: Check for excessive discharge pressure. Check for defective centrifugal switch on 1 phase Models. Increase ventilation to motor. Do not use less than #14 wire size.
3. Stator torn; possible excessive pressure: Replace stator, check pressure at discharge port.
4. Flexible joint broken; possible excessive pressure: Replace joint, check pressure at discharge port.
5. Wrong rotation (3 phase only): Rotation must be clockwise when facing pump from motor end. Reverse the connections of any two line leads to the motor.
6. Excessive suction lift or vacuum.

**Pump Overloads.**

1. Excessive discharge pressure: Check pressure at discharge port for maximum ratings given in Table 1.
2. Fluid viscosity too high: Limit fluid viscosity to 100 CP or 500 SSU.

**Noisy Operation.**

1. Excessive suction lift or vacuum: Maximum suction lift is 25 feet for water.
2. Suction line too small: Check pipe size. Be sure lines are free from obstructions.
3. Pump cavitates: Pump speed is 1725 rpm. Viscosity of fluid should not exceed 100 CP or 500 SSU.
4. Flexible joint worn: Replace joint. Check pressure at discharge port.
5. Insufficient mounting: Mount securely to a firm base. Vibration induced noise can be reduced by using mount pads and short sections of hose on suction and discharge ports.

**Seal Leakage.**

1. Leakage at startup: If leakage is slight, allow pump to run several hours to let faces run in.
2. Persistent seal leakage: Faces may be cracked from freezing or thermal shock. Replace seal.

**Pump Will Not Prime.**

1. Air leak on suction side: Check pipe connections.

**PUMP DISASSEMBLY**

**WARNING: Before disassembling pump, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.**

1. Remove suction and discharge piping. Drain pump body by removing drain plug (261B).
2. Remove screws (112) holding suction housing (2) to discharge housing (1). Remove suction housing (2) and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning counterclockwise (RH thread). On pinned, 3 phase models, remove rotor pin (45) with suitable punch.
4. Flexible joint (24) can be removed from motor shaft by using a 3/16 allen wrench in end of joint and turning counterclockwise. On 3 phase motors, remove motor pin (46) with suitable punch, then remove joint:
5. Slide mechanical seal (69) off motor shaft.
6. Remove discharge housing (1) from adaptor flange (12) by removing screws (1 12B).
7. Carefully pry seal seat out of discharge housing (1). If any parts of mechanical seal are worn or broken, the complete seal assembly should be replaced. Seal components are matched parts and are not interchangeable.
8. Remove adapter flange (12) from motor (70) by removing screws (112A).
9. Remove slinger ring (77).

**PUMP ASSEMBLY**

1. Install slinger ring (77).
2. Attach adaptor flange (12) to motor housing using screws (112A).
3. Attach discharge housing (1) to adaptor flange (12) using screws (1128). Be sure to center seal bore on shaft.
4. Install mechanical seal (69) in discharge housing (1) using the following procedure:
   a. Clean and oil sealing faces using clean oil (not grease).

**Caution: Do not use oil on EPDM parts. Substitute glycerin or soap and water.**

   b. Oil outer surfaces of the seal seat, and push assembly over the motor shaft and into the discharge housing (1) seating it firmly and squarely.
   c. After cleaning and oiling the shaft, slide the seal body along the motor shaft until it meets the seal seat.
   d. Install seal spring and spring retainer on shaft.
5. Thread flexible joint (24) into motor shaft in a clockwise direction (RH thread). Tighten with 3/16 allen wrench. On 3 phase models, install motor pin (46).
6. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread). On 3 phase models, install rotor pin (45).
7. Slide stator (21) on rotor (22). On 331 & 332 models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
8. Secure stator (21) and suction housing (2) to discharge housing (1) using screws (112).
9. Lubricate rotor and stator by filling suction housing and discharge housing with fluid to be pumped.
10. Connect suction and discharge piping and power source.

## PARTS LIST

To determine part numbers for all parts except standard motors, enter table with item number from pump illustration. Then locate part number under applicable model number (first three digits). Parts listed down the center are applicable to all pump models.

To determine part numbers for standard motor (item 70), enter table at item 70 with the last two digits of model number: motor description and part number are on that line.

| Item No. | Description | Pump Model Numbers | | | |
|---|---|---|---|---|---|
| | | 331 | 332 | 333 | 344 |
| 1 | Discharge Housing | Cast Iron 350-1016-000/Stainless Steel 350-1016-007 | | | |
| 2 | Suction Housing | Cast Iron 330-1064-002/Stainless Steel 330-1911-002 | | | |
| *21 | Stator | 340-3501-120 | 340-3502-120 | 340-3503-120 | 340-3504-120 |
| *22 □ | Rotor (Threaded) 416 SS | 320-2729-000 | 330-0906-000 | 320-1394-000 | 320-1841-000 |
| *22 | Rotor (Pinned) 416 SS | 320-2729-004 | 320-4559-004 | 320-1584-002 | 320-1569-002 |
| 24 | Flexible Joint (Threaded) | Carbon Steel 320-1511-000/Stainless Steel 320-3759-000 | | | |
| 24 | Flexible Joint (Pinned) | Carbon Steel 320-1612-000/Stainless Steel 320-4415-000 | | | |
| *45 □ | Shaft Pin (2 req.) | 320-4069-002 | | | |
| *69 | Mechanical Seal | 320-2424-000 | | | |
| 70 | Standard Motor | | | | |
| | -59 1PH TEFC 1750 RPM | 330-4529-000 | | | |
| □ | -60 3PH TEFC 1750 RPM, Pin | 330-4528-100 | | | |
| | -52 1PH TEFC 1750 RPM | 330-4529-100 | | | |
| □ | -50 3PH TEFC 1750 RPM | 330-4528-003 | | | |
| 77 | Slinger Ring | 320-6382-000 | | | |
| 112 | Screw, Cap (8 req.) | Carbon Steel 619-1430-103 (10-24 x 5/8)/Stainless Steel 619-1432-120 (10-24 x 3/4) | | | |
| 112A | Screw, Hex Hd (4 req.) | Carbon Steel 619-1530-161 (3/8-16 x 1)/Stainless Steel 320-6715-005 (3/8-16 x 1) | | | |
| 135 | Stator Ring | Carbon Steel 320-7812-000 /Stainless Steel 362-1774-000 | | | |
| 215 | Lock Washer (8 req.) | 320-6464-000 | | | |
| 215A | Lock Washer (4 req.) | Carbon Steel 623-0010-411/Stainless Steel 320-6717-002 | | | |
| 261 | Pipe Plug, 1/4 NPT | Carbon Steel 610-0120-021/Stainless Steel 610-0420-020 | | | |
| | Rotor (Threaded) 316 SS | 320-2933-000 | 320-2942-000 | 320-2936-000 | 320-2934-000 |
| | Rotor (Pinned) 316 SS | 320-2933-002 | | | |

* Recommended spare parts.
□ Used on 3 phase models.

## REPAIR/CONVERSION KIT NUMBERS

| Item No. | Description | All 331 Models (Threaded Only) | | | All 332 Models (Threaded Only) | | |
|---|---|---|---|---|---|---|---|
| | | NBR | EPDM | FPM | NBR | EPDM | FPM |
| — | Kit No. | 311-9026-000 | 311-9025-000 | 311-9054-000 | 311-9027-000 | 311-9038-000 | 311-9055-000 |
| 21 | • Stator | 340-3501-120 | 340-3501-320 | 340-3501-520 | 340-3502-120 | 340-3502-320 | 340-3502-520 |
| 24 | • Joint | * 320-1511-000 | 320-6367-000 | 320-4670-000 | * 320-1511-000 | 320-6367-000 | 320-4670-000 |
| 69 | • Seal | 320-2424-000 | 320-6379-000 | 320-6501-000 | 320-2424-000 | 320-6379-000 | 320-6501-000 |

| Item No. | Description | All 333 Models (Threaded Only) | | | All 344 Models (Threaded Only) | | |
|---|---|---|---|---|---|---|---|
| | | NBR | EPDM | FPM | NBR | EPDM | FPM |
| — | Kit No. | 311-9029-000 | 311-9028-000 | 311-9056-000 | 311-9031-000 | 311-9030-000 | 311-9057-000 |
| 21 | • Stator | 340-3503-120 | 340-3503-320 | 340-3503-520 | 340-3504-120 | 340-3504-320 | 340-3504-520 |
| 24 | • Joint | * 320-1511-000 | 320-6367-000 | 320-4670-000 | * 320-1511-000 | 320-6367-000 | 320-4670-000 |
| 69 | • Seal | 320-2424-000 | 320-6379-000 | 320-6501-000 | 320-2424-000 | 320-6379-000 | 320-6501-000 |

NBR = Nitrile
EPDM = Ethylene-Propylene-Diene Terpolymer
FPM = Fluoroelastomer

*Carbon steel joint, for 316 SS joint use 320-3759-000.

## REPAIR/CONVERSION KIT NUMBERS (CONT.)

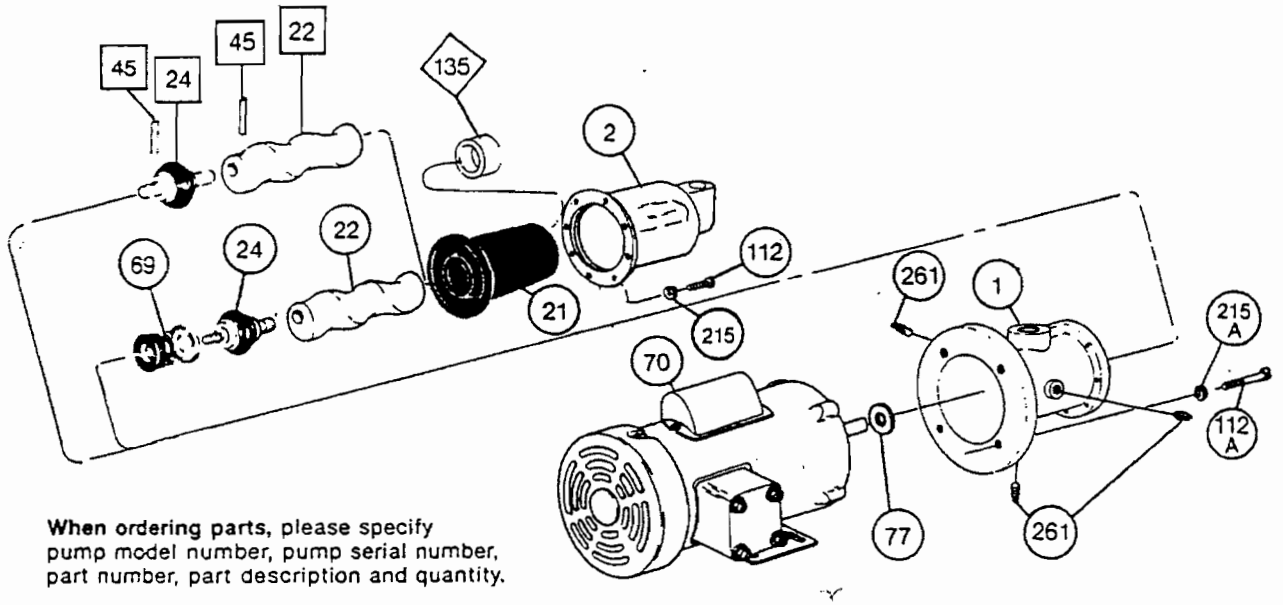
| Item No. | Description | All 331 Models (Pinned Only) NBR | EPDM | FPM | All 332 Models (Pinned Only) NBR | EPDM | FPM |
|---|---|---|---|---|---|---|---|
| – | Kit No. | 311-9104-000 | 311-9108-000 | 311-9112-000 | 311-9105-000 | 311-9109-000 | 311-9113-000 |
| 21 | • Stator | 340-3501-120 | 340-3501-320 | 340-3501-520 | 340-3502-120 | 340-3502-320 | 340-3502-520 |
| 24 | • Joint | * 320-1612-000 | 320-6973-000 | 320-6984-000 | * 320-1612-000 | 320-6973-000 | 320-6984-000 |
| 69 | • Seal | 320-2424-000 | 320-6379-000 | 320-6501-000 | 320-2424-000 | 320-6379-000 | 320-6501-000 |
| 45 | • Pin (2 req.) | 320-4069-002 | | | 320-4069-002 | | |

| Item No. | Description | All 333 Models (Pinned Only) NBR | EPDM | FPM | All 344 Models (Pinned Only) NBR | EPDM | FPM |
|---|---|---|---|---|---|---|---|
| – | • Kit No. | 311-9106-000 | 311-9110-000 | 311-9114-000 | 311-9107-000 | 311-9111-000 | 311-9115-000 |
| 21 | • Stator | 340-3503-120 | 340-3503-320 | 340-3503-520 | 340-3504-120 | 340-3504-320 | 340-3504-520 |
| 24 | • Joint | * 320-1612-000 | 320-6973-000 | 320-6984-000 | * 320-1612-000 | 320-6973-000 | 320-6984-000 |
| 69 | • Seal | 320-2424-000 | 320-6379-000 | 320-6501-000 | 320-2424-000 | 320-6379-000 | 320-6501-000 |
| 45 | Pin (2 req.) | 320-4069-002 | | | 320-4069-002 | | |

### ABRASION RESISTANT SEALS

| Elastomer | All 331 – 334 Models |
|---|---|
| NBR | 320-6460-000 |
| EPDM | 320-6502-000 |
| FPM | 320-6503-000 |

NBR = Nitrile
EPDM = Ethylene-Propylene-Diene Terpolymer
FPM = Fluoroelastomer
*Carbon steel joint, for 316 SS joint use 320-4415-000.




**When ordering parts,** please specify pump model number, pump serial number, part number, part description and quantity.

◇ Used only on 331 & 332 Models.

□ Used on 3 Phase Models



Printed in U.S.A.

Installation and service instructions

# Myers®

# CENTRIFUGAL PUMPS

## INSTALLATION

**PACKAGE CONTENTS**

1. Each pump is carefully tested and packaged at the factory.
2. The catalog lists all parts included with package. A packing list packed with pump, also lists contents.
3. Be sure all parts have been furnished and that nothing has been damaged in shipment.
4. OPEN PACKAGES AND MAKE THIS CHECK BEFORE GOING ON JOB.

**PIPING** - Pipes must line up and not be forced into position by unions. **Piping should be independently supported near the pump so that no strain will be placed on the pump casing.** Where any noise is objectionable, pump should be insulated from the piping with rubber connections. Always keep pipe size as large as possible and use a minimum of fittings to reduce friction losses.

**SUCTION PIPING** - Suction pipe should be direct and as short as possible. It should be at least one size larger than suction inlet tapping and should have a minimum of elbows and fittings. The piping should be laid out so that it slopes upward to pump without dips or high points so that air pockets are eliminated. The highest point in the suction piping should be the pump inlet except where liquid flows to the pump inlet under pressure. A foot valve must be used to keep pump primed. Where liquid flows to the pump, it may be desirable to use a check valve in the suction line or discharge line to keep pump primed.

To prevent air from being drawn into suction pipe due to a suction whirlpool, the foot valve should be submerged at least three feet below the low water level. The suction pipe must be tight and free of air leaks or pump will not operate properly.

**DISCHARGE PIPING** - Discharge piping should never be smaller than pump tapping and should preferably be one size larger. A gate valve should always be installed in discharge line to serve as a shut-off for throttling if capacity is not correct. To protect the pump and foot valve from water hammer and to prevent backflow, a check valve should be installed in the discharge line between the pump and gate valve.

**ELECTRICAL CONNECTIONS** - Be sure motor wiring is connected for voltage being used. Unit should be connected to a separate circuit, direct from main switch. A fused disconnect switch or circuit breaker must be used in this circuit. Wire of sufficient size should be used to keep voltage drop to a maximum of 5%. All motors, unless provided with built-in overload protection, must be protected with an overload switch, either manual or magnetic. Three phase motors require overload protection. Single phase motors equipped with built-in overload protection. **Never install a pump without proper overload protection.** A flexible metallic conduit should be used to protect the motor leads.

**PRIMING** - The pump must be primed before starting. The pump casing and suction piping must be filled with water before starting motor. Remove vent plug in top of casing while pouring in priming water. A hand pump or ejector can be used for priming when desired. When water is poured into pump to prime, use care to remove all air before starting motor.

If pump does not start immediately, stop and re-prime.

**STARTING** - It is good practice to close the discharge valve when starting the pump as it puts less starting load on the motor. When the pump is up to operating speed, open the discharge valve to obtain desired capacity or pressure. Do not allow the pump to run for long periods with the discharge valve tightly closed. If the pump runs for an extended period of time without liquid being discharged, the liquid in the pump case can get extremely hot.

**ROTATION** - The pump must run in direction of arrow on pump case. All single phase motors are single rotation and leave factory with proper rotation. Three phase motors may run either direction. If rotation is wrong when first starting motor, interchange any two line leads to change rotation.

**STOPPING** - Before stopping pump, close the discharge valve. This will prevent water hammer and is especially important on high head pumps.

**FREEZING** - Care should be taken to prevent the pump from freezing during cold weather. It may be necessary, when there is any possibility of this, to drain the pump casing when not in operation. Drain by removing the pipe plug in the bottom of the casing.

**ROTARY SEAL** - Centrifugal pumps are fitted only with rotary seal. This seal is recommended for water free from abrasives. If liquid contains abrasives, the Centrifugal pump should not be used.

**BEARINGS** - Lubricate motor bearings in accordance with motor manufacturer's instructions.

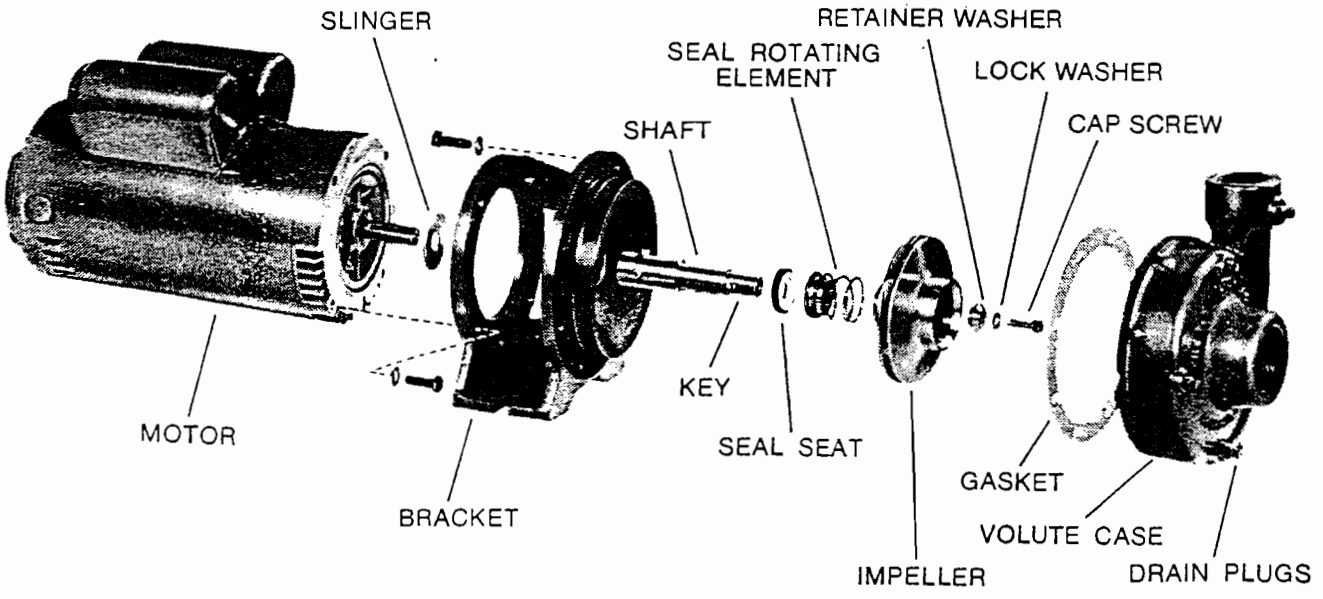
Single seal ball bearings are used on 125B, 150B, 200B bearing bracket units. Proper amount of grease has been provided in the bracket cavity between the bearings. This should be sufficient grease for 4000 hour operation. After this usage the old grease should be cleaned out and new grease added. Use only best grade ball bearing greases.

**BELT DRIVES** - On V-belt drives, if possible, the tight side of the belt should be at the bottom. Adjust belt tension just tight enough to prevent slippage; excess tension unnecessarily loads the bearings. Normally the belt speed should not exceed 5000 feet per minute and the pulley ratio should not exceed 5 to 1. The distance between the shaft centers should be at least twice the diameter of the larger pulley.

## SERVICE

TROUBLE SHOOTING GUIDE

| | | | | | |
|---|---|---|---|---|---|
| A | No water delivered | | | | |
| B | Not enough water delivered | | | | |
| C | Not enough pressure | | | | |
| D | Pump runs for short while; then loses prime | | | | |
| | **POSSIBLE CAUSE OF PROBLEM** | **D** | **C** | **B** | **A** |
| 1. | Pump not properly primed; repeat priming operation | | | | X |
| 2. | Discharge head too high. Check total head with gauge at pump inlet and discharge. (With no water, the gauge at discharge would show shut-off pressure.) | | | X | X |
| 3. | Excessive volume being discharged. Throttle discharge valve. | | X | | |
| 4. | Speed too low. Check pump drive belts for slippage. If hot, tighten belts. Check motor voltage and speed. | | X | X | |
| 5. | Rotation wrong. Change shaft rotation. | | X | X | X |
| 6. | Suction lift too high. Check with vacuum gauge. This should not exceed 15 feet. | X | | X | X |
| 7. | Air leak in suction line. Check line under pressure to find leak. | X | X | X | X |
| 8. | Air pocket in suction line. Check line for proper slope. | X | | | X |
| 9. | Insufficient submergence of suction pipe. Foot valve should be three feet below lowest water level. | X | | X | |
| 10. | Sediment chamber clogged. Remove and clean thoroughly. Make sure gsket is in good condition and sealing surfaces clean before reassembly of sediment chamber cap. | | X | | |
| 11. | Impeller or suction line plugged. | | X | X | X |
| 12. | Impeller and volute case badly worn. Disassemble pump; if clearance on diameter is over .030", replace worn impeller and worn volute case. | | X | X | |
| 13. | Suction strainer plugged. Clean strainer. | X | | | |
| 14. | Impeller diameter too small for condition required. | | X | X | |
| 15. | Seal leaking - seal is worn or seal face cocked. Replace with new seal and carefully follow directions. | | | | |



## DISASSEMBLY INSTRUCTIONS

All pumping parts can be removed from case without disturbing the piping.

**POWER SUPPLY** - Open the power supply switch contacts and remove fuses. Disconnect the electrical wiring from the motor.

**VOLUTE CASE**

(a) Drain pump case by removing drain plugs.
(b) Remove the bolts securing volute case to pump bracket.
(c) To pry components apart, use two screwdrivers - opposite each other - in openings provided between the bracket and case. (Fig. 1)

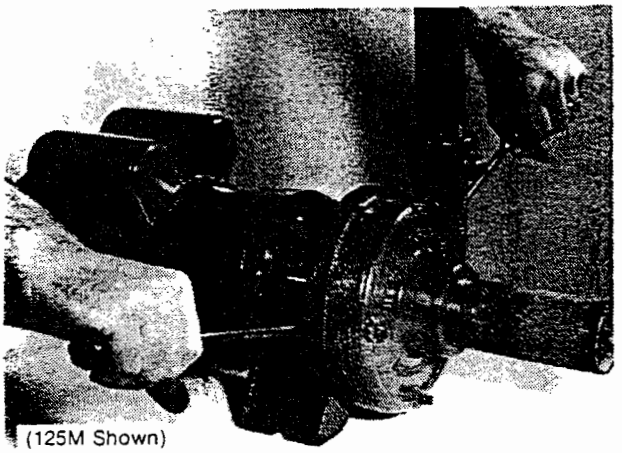

(125M Shown)

FIG. 1

**IMPELLER**

(a) Remove impeller by holding stub shaft with water pump pliers and unscrewing capscrew. (Fig. 2)

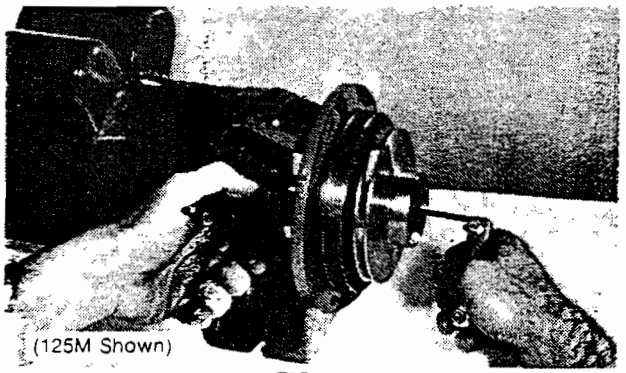

(125M Shown)

FIG. 2

**SEAL**

(a) The seal used on 125M, 125B, 150M, 200M, is $^{7}/_{8}$".
(b) Always replace both rotating assembly and stationary ceramic seat. DO NOT USE OLD STATIONARY SEAT WITH NEW ROTATING SEAL ASSEMBLY.
(c) Using two screwdrivers, pry out rotating assembly of shaft seal. (Fig. 3)
(d) Old ceramic ring can be removed from housing by cracking with a chisel or screwdriver without removing the pump shaft.
(e) A new shaft seal should always be used when rebuilding a pump. All pump parts should be cleaned thoroughly before being reassembled.

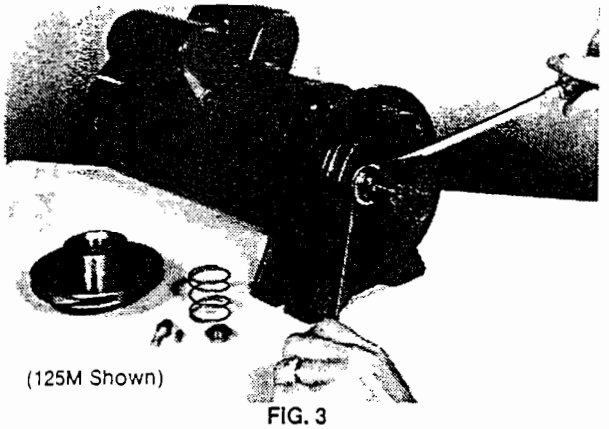

(125M Shown)

FIG. 3

**MOTOR**

(a) Remove four bolts holding bracket to motor and remove motor. (Fig. 4)
(b) Remove set screw in stub shaft coupling to disconnect motor pump shaft.

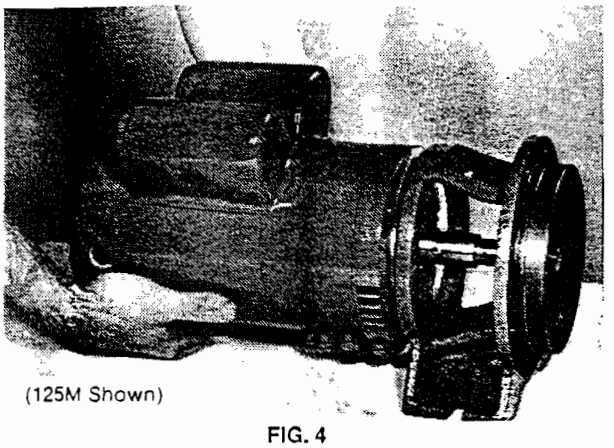

(125M Shown)

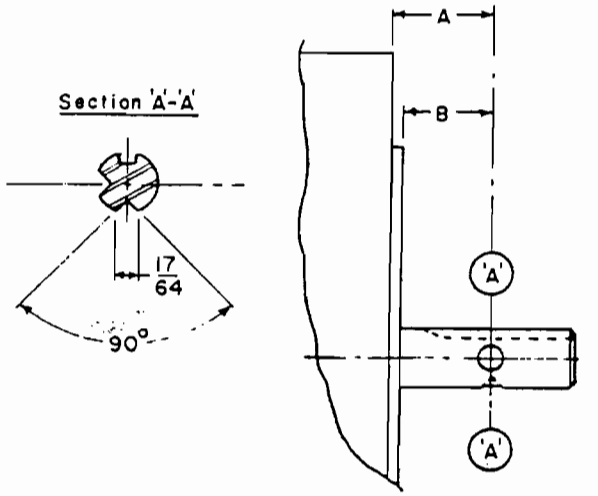
FIG. 4

| | H.P. | IMPELLER NUMBER | IMPELLER O.D. |
|---|---|---|---|
| 125m | 2 | 11725B2 | $5^{3}/_{8}$ |
| | 3 | 11725B3 | $5^{13}/_{15}$ |
| 150M | 2 | 12935B2 | $4^{5}/_{8}$ |
| | 3 | 12935B1 | $5^{1}/_{8}$ |
| | 5 | 12935B3 | $5^{15}/_{16}$ |
| 200M | 3 | 12936B2 | $4^{7}/_{16}$ |
| | 5 | 12936B1 | $5^{1}/_{8}$ |
| | $7^{1}/_{2}$ | 12936B3 | $5^{3}/_{4}$ |
| 125B | | 11725B3 | $5^{13}/_{16}$ |
| 150B | | 12935B3 | $5^{15}/_{16}$ |
| 200B | | 12936B3 | $5^{3}/_{4}$ |

FIG. 5

# ASSEMBLY INSTRUCTIONS

**SPOTTING MOTOR SHAFT** - Locate "Spotting Position" from motor mounting face to center of spot. A drilling guide and locating fixture is recommended for uniform and accurate spotting. Make two spots with a drill point, at 90 degrees apart - must be on motor shaft keyway. (Fig. 6)




| CATALOG NO. | A | B |
|---|---|---|
| 125M | 1.125 ± .005 | --- |
| 150M2 & 3 | 1.125 ± .005 | --- |
| 150M5 | --- | 1.562 ± .005 |
| 200M3 | 1.125 ± .005 | --- |
| 200M5 & 7½ | --- | 1.562 ± .005 |

FIG. 6

**MOTOR**

(a) Place rubber deflector over motor shaft, slide shaft extension into positon and tighten set screws.

(b) Assemble motor and shaft onto bracket, using (4) 3/8-16 UNC Hex Head Cap Screws, 1 1/8" long on all except the 150M5, 200M3, 200M5 & 7½. On these units use (4) ½-13UNC Hex Head Cap Screws, 1¼" long.

**SEAL INSTALLATION**

(a) Insert seal seat in position by using finger pressure to press firmly and squarely until it bottoms. The use of light oil (SAE10) on the rubber element will facilitate assembly. Care must be taken to keep oil, grease and dirt off face areas of seal. Be sure the seal faces are not damaged during assembly (cracked, scratched or chipped) or the seal will leak during operation.

(b) Check dimension from face of ceramic seat to shaft shoulder. This distance should be as noted in Figure 7 within a tolerance of ± 1/64.

(c) Install rotating element of seal on shaft (Fig. 8), be sure the lapped sealing surface is toward seal seat, and assemble impeller. Check diameter of impeller against motor horsepower rating to insure proper performance (Fig. 5).

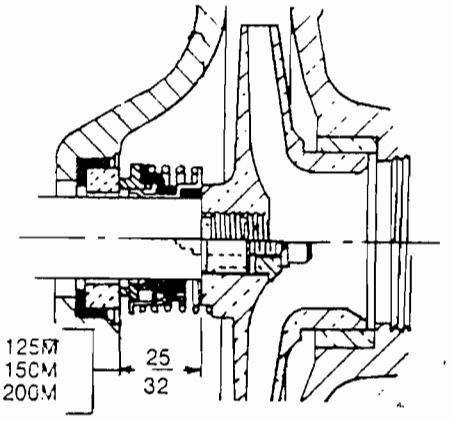



FIG. 7

**IMPELLER**

(a) Secure impeller using Key (3/16 square x 21/32" log), impeller retainer washer, 5/16 stainless steel helical spring lockwasher and 5/16-18UNC socket head cap screw, 1" long (stainless steel). It is also recommended that a locking type sealant be applied to both cap screw thread prior to assembly.

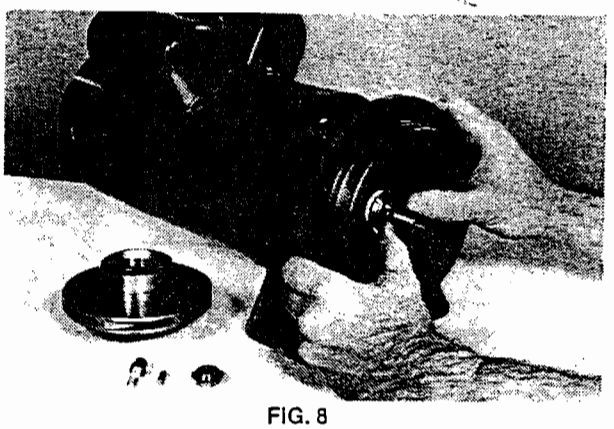


FIG. 8

**VOLUTE CASE**

(a) Worn volute case will cause excessive leakage with a new impeller, thereby reducing the amount of service obtained from a new impeller.

(b) Assemble gasket and volute case with 3/8-16UNC Hex Head Cap Screws 1 1/8" long.

Rotate pump shaft with fingers, being sure that there is no tight spot or binding of assembly. A uniform drag of the seal faces will be present.


Myers®

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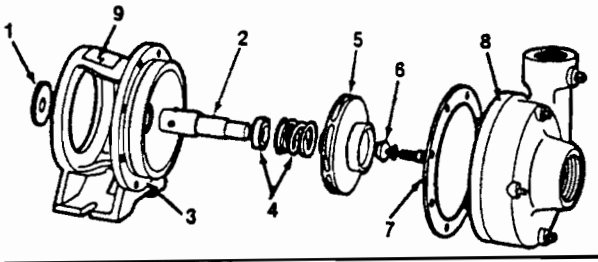
Myers Canada), 269 Trillium Drive, Kitchener, Ontario N2G 4W5
519/748-5470, FAX: 519/748-2553

# Centri-Thrift Field Assembly Kits Parts List

## 125M-FA Series
## 150M-FA Series
## 200M-FA Series




| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| | 16837A2 | Kit, Cat. No. 125M-2FA |
| | 16837A14 | Kit, Cat. No. 125M-3FA |
| | 16837A5 | Kit, Cat. No. 150M-2FA |
| | 16837A15 | Kit, Cat. No. 150M-3FA |
| | 16837A8 | Kit, Cat. No. 150M-5FA |
| | 16837A16 | Kit, Cat. No. 200M-3FA |
| | 16837A11 | Kit, Cat. No. 200M-5FA |
| | 16837A12 | Kit, Cat. No. 200M-7½FA |
| | | -- Kits consist of all listed |
| 1 | 5059A318 | Slinger - All units except 150M-5FA, 200M-5FA, 200M-7½FA |
| 1 | 5059A321 | Slinger - 150M-5FA, 200M-5FA, 200M-7½FA |
| 2 | 11714B1 | Shaft w/Set Screws -- 125M-2FA, 125M-3FA, 150M-2FA, 150M-3FA, 200M-3FA |
| 2 | 11914B1 | Shaft w/Set Screws -- 150M-5FA, 200M-5FA, 200M-7½FA |
| | 5013A15 | Screw, Set 5/16-18UNC x 5/16" long -- 2 Used on all units except 150M-5FA 200M-5FA, 200M-7½FA |
| | 6024A1 | Screw, Set 3/8-16UNC x 3/8" long -- 2 Used on 150M-5FA, 200M-5FA, 200M-7½FA |
| 3 | 11715D | Bracket - All 125M units, 150M-2FA, 150M-3FA, 200M-3FA |
| 3 | 11912D | Bracket -- 150M-5FA, 200M-5FA, 200M-7½FA |
| | 19101A16 | Screw, Cap 3/8-16UNC x 1-1/8" -- 4 required on all units except 150M-5FA 200M-5FA, 200M-7½FA |
| | 19103A4 | Screw, Cap 1/2-13UNC x 1-1/4" -- 4 required on 150M-5FA, 200M-5FA, 200M-7½FA |
| 4 | 11716A1 | Seal -- All units |

| REF. NO. | PART NO. | DESCRIPTION |
|---|---|---|
| 5 | 11725B2 | Impeller - 125M-2FA |
| 5 | 11725B3 | Impeller - 125M-3FA |
| 5 | 12935B2 | Impeller - 150M-2FA |
| 5 | 12935B1 | Impeller - 150M-3FA |
| 5 | 12935B3 | Impeller - 150M-5FA |
| 5 | 12936B2 | Impeller - 200M-3FA |
| 5 | 12936B1 | Impeller - 200M-5FA |
| 5 | 12936B3 | Impeller - 200M-7½FA |
| | 5818A25 | Key - 3/16 Sq. x 21/32" Long -- All units |
| 6 | 11718A | Washer - All 125M units |
| 6 | 12933A | Washer - All 150M, 200M units |
| | 19100A4 | Screw, Cap SST 5/16-18UNC x 3/4" -- All 125M units |
| | 6106A8 | Screw, Scoket Head SST 5/16-18UNC x 1" long -- All 150M, 200M units |
| | 5454A14 | Lockwasher, 5/16 SST -- All units |
| 7 | 5863A13 | Gasket - 125M, 150M, 200M units |
| 8 | 11726D1 | Case, Volute - All 125M units |
| 8 | 12937D1 | Case, Volute - All 150M units |
| 8 | 12938D1 | Case, Volute - All 200M units |
| | 11720A | Ring, Wearing -- For 125M units w/wearing ring |
| | 12934A | Ring, Wearing -- For 150M, 200M units w/wearing ring |
| | 19101A16 | Screw, Cap 3/8-16UNC x 1-1/8" -- 8 required on all units |
| | 5022A4 | Plug, Pipe 1/8" NPT -- 4 required on all units |
| | 5022A9 | Plug, Pipe 1/4" NPT -- 1 required on all units |
| 9 | 22005A | Nameplate, Blank |
| | 5160A1 | Screw, Drive 1/8" x 1/4" - 2 required |

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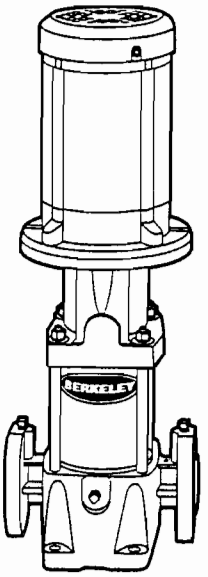
BERKELEY®

# OWNER'S MANUAL

## INSTALLATION AND OPERATING INSTRUCTIONS

# VERTICAL MULTISTAGE PUMPS

Single and Three Phase 60 Cycle



Record the following information from the motor and pump nameplates for future reference:

Pump Model No. _____

Bill of Material No. _____

Motor Model No. _____

Motor Serial No. _____

H.P. _____ Volts/Hz/Ph _____

Rated Amp Draw _____


**United States**
**Berkeley Pumps, 293 Wright St., Delavan, WI 53115**

***WICOR*** **Canada Co.**
**1800 Courtney Park Drive East, Unit 5-7, Mississauga, Ontario, L5T 1W1**



Printed in U.S.A.

**BE473** (Rev. 1/17/00)

# TABLE OF CONTENTS



## Carefully read and follow all safety instructions in this manual or on pump.

⚠ **This is the safety-alert.** When you see this symbol on your pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury.

**⚠ DANGER** warns about hazards that **will** cause serious personal injury, death or major property damage if ignored.

**⚠ WARNING** warns about hazards that **can** cause serious personal injury, death or major property damage if ignored.

**⚠ CAUTION** warns about hazards that **will** or **can** cause minor personal injury or property damage if ignored.

The word **NOTICE** indicates special instructions which are important but not related to hazards.

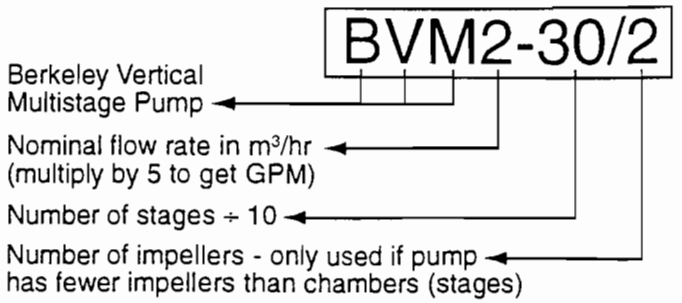
**To avoid serious or fatal personal injury and possible property damage, carefully read and follow the safety instructions.**

1. **Install pump according to all code requirements.**
2. **Compare pump nameplate data with desired operating range.**
3. **Pump only liquids compatible with pump component materials (that is, liquids that will not attack the pump).**
4. **Make sure plumbing is adequate to handle system pressure.**
5. **Periodically perform maintenance inspection on pump and system components.**
6. **Wear safety glasses at all times when working on pumps.**

# INSPECT THE SHIPMENT

The vertical multistage centrifugal inline pump has been carefully inspected and packaged to assure safe delivery. Inspect the pump and fittings and report to the carrier any items which are damaged or missing.

# CONFIRM YOU HAVE THE RIGHT PUMP




| | | | | | |
|---|---|---|---|---|---|
| MODEL # | | PART # | | MFG. DATE | |
| GPM | | FEET | | RPM | |
| HP | | PRESS. MAX (PSI) | | TEMP. MAX (F) | |

BERKELEY PUMPS, GRAND ISLAND, NE 68801

**FIGURE 1 - Model Plate Information**

# APPLICATIONS AND OPERATING RANGES

Berkeley multistage in-line centrifugal pumps are designed for liquid transfer, circulation, and pressure boosting of hot or cold clean water or other thin, non-explosive liquids, not containing solid particles or fibers, which will not chemically attack the pump materials.

Typical applications include:

- Municipal water supply and pressure boosting
- Boiler feed and condensate systems
- Cooling water systems
- Irrigation
- Fire fighting

Maximum Ambient Temperature ..... 104° F(40° C)

Liquid Temperature Range ..... 5° F to 250° F (-15° C to +121° C)

Maximum Permissible Operating Pressure Curves ..... See Figure 4

Maximum Inlet Pressure: ..... Table II shows the maximum permissible inlet pressure. However, the actual inlet pressure plus the pressure when the pump is running against a closed valve must always be lower than the *"Maximum Permissible Operating Pressure"*.

Electrical Data: ..... See Motor Nameplate

Dimensions and Port to Port Lengths : ..... See Figures 2 and 3, Page 3

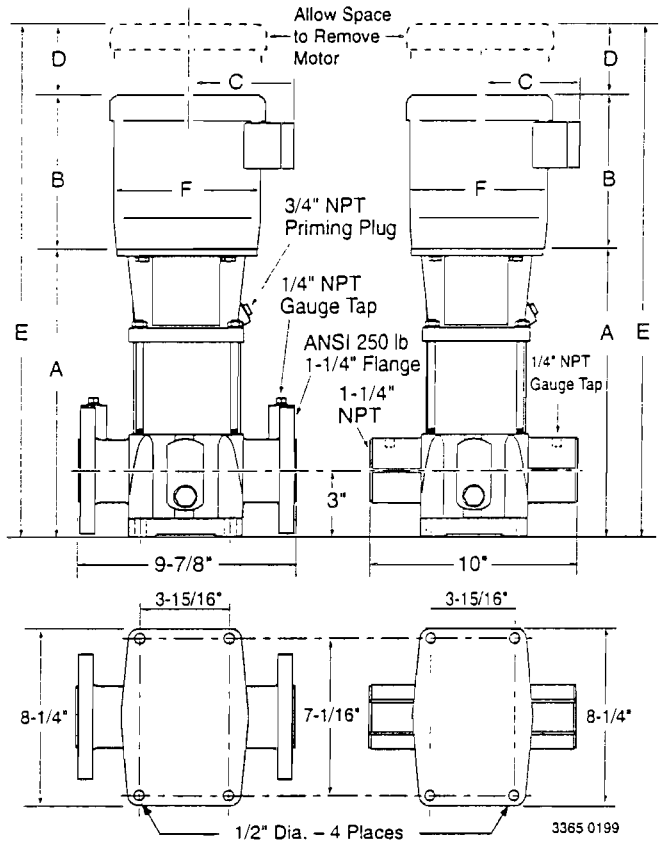



FIGURE 2 - Height, width and baseplate dimensions for BVM2 and BVM4 Series pumps

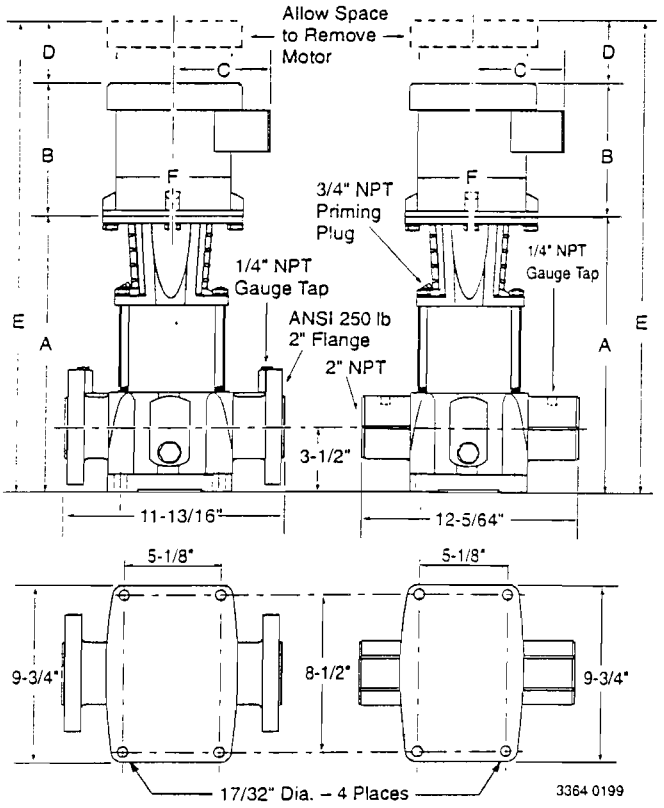



FIGURE 3 - Height, width, and baseplate dimensions for BVM8 and BVM16 Series pumps

TABLE I – Maximum Height and Width Dimensions*

| Model Number | Dimension in Inches | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| BVM2-30/2 | 11-3/8 | 9-1/4 | 4-7/8 | 2 | 22-5/8 | 6 |
| BVM2-30 | 11-3/8 | 9-7/8 | 4-7/8 | 2 | 23-1/4 | 6 |
| BVM2-40 | 12 | 11-1/8 | 5-1/4 | 2 | 25-1/4 | 7-1/8 |
| BVM2-50 | 12-3/4 | 11-1/8 | 5-3/4 | 2-1/8 | 26 | 7-1/4 |
| BVM2-60 | 13-1/2 | 11-1/8 | 5-3/4 | 2-1/8 | 26-5/8 | 7-1/4 |
| BVM2-70 | 14-1/8 | 12-1/8 | 5-3/4 | 2-1/8 | 28-1/4 | 7-1/4 |
| BVM2-80 | 14-7/8 | 12-1/8 | 5-3/4 | 2-1/8 | 29 | 7-1/4 |
| BVM2-100 | 16-5/8 | 13-5/8 | 6-7/8 | 2-7/8 | 33-1/4 | 8-1/2 |
| BVM2-120 | 18-1/8 | 13-5/8 | 6-7/8 | 2-7/8 | 34-5/8 | 8-1/2 |
| BVM2-150 | 20-1/4 | 15-1/4 | 8 | 3-3/8 | 38-7/8 | 10-5/8 |
| BVM2-180 | 22-3/8 | 15-1/4 | 8 | 3-3/8 | 41 | 10-5/8 |
| BVM4-20/1 | 11-3/8 | 9-1/4 | 4-7/8 | 2 | 22-5/8 | 6 |
| BVM4-20 | 11-3/8 | 9-7/8 | 4-7/8 | 2 | 23-1/4 | 6 |
| BVM4-30 | 12-3/8 | 11-1/8 | 5-1/4 | 2 | 25-5/8 | 7-1/8 |
| BVM4-40 | 13-1/2 | 11-1/8 | 5-3/4 | 2-1/8 | 26-5/8 | 7-1/4 |
| BVM4-50 | 14-1/2 | 12 | 5-3/4 | 2-1/8 | 28-5/8 | 7-1/4 |
| BVM4-60 | 16 | 13-5/8 | 6-7/8 | 2-7/8 | 32-1/2 | 8-1/2 |
| BVM4-80/7 | 18-1/8 | 13-5/8 | 6-7/8 | 2-7/8 | 34-5/8 | 8-1/2 |
| BVM4-80 | 18-1/8 | 13-5/8 | 6-7/8 | 2-7/8 | 34-5/8 | 8-1/2 |
| BVM4-100 | 20-1/4 | 15-1/4 | 8 | 3-3/8 | 38-7/8 | 10-5/8 |
| BVM4-120 | 22-3/8 | 15-1/4 | 8 | 3-3/8 | 41 | 10-5/8 |
| BVM4-140 | 24-1/2 | 15-1/4 | 8 | 3-3/8 | 43-1/8 | 10-5/8 |
| BVM4-160 | 26-5/8 | 15-1/4 | 8 | 3-3/8 | 45-1/4 | 10-5/8 |
| BVM8-20/1 | 15 | 9-7/8 | 4-7/8 | 2 | 27 | 6 |
| BVM8-20 | 15 | 11-1/8 | 5-3/4 | 2-1/8 | 28-1/4 | 7-1/4 |
| BVM8-30 | 17-3/4 | 13-5/8 | 6-7/8 | 2-7/8 | 34-1/4 | 8-1/2 |
| BVM8-40 | 18-7/8 | 13-5/8 | 6-7/8 | 2-7/8 | 35-1/2 | 8-1/2 |
| BVM8-50 | 20-1/8 | 15-1/4 | 8 | 3-3/8 | 38-3/4 | 10-5/8 |
| BVM8-60 | 21-1/4 | 15-1/4 | 8 | 3-3/8 | 40 | 10-5/8 |
| BVM8-80 | 23-5/8 | 15-1/4 | 8 | 3-3/8 | 42-1/4 | 10-5/8 |
| BVM8-100 | 26 | 15-1/4 | 8 | 3-3/8 | 44-5/8 | 10-5/8 |
| BVM8-120 | 28-3/8 | 16-1/2 | 8-3/4 | 3-3/8 | 48-1/4 | 10-5/8 |
| BVM8-140 | 30-3/4 | 16-3/8 | 8-3/4 | 3-3/8 | 50-1/2 | 10-5/8 |
| BVM8-160 | 33-5/8 | 19-5/8 | 9-1/2 | 4-1/4 | 57-1/2 | 13 |
| BVM16-30/2 | 19-1/2 | 15-1/4 | 8 | 3-3/8 | 38-1/4 | 10-5/8 |
| BVM16-30 | 19-1/2 | 15-1/4 | 8 | 3-3/8 | 38-1/4 | 10-5/8 |
| BVM16-40 | 21-3/8 | 15-1/4 | 8 | 3-3/8 | 40 | 10-5/8 |
| BVM16-50 | 23-1/8 | 16-3/8 | 8-3/4 | 3-3/8 | 42-7/8 | 10-5/8 |
| BVM16-60 | 25-3/8 | 19-5/8 | 9-1/2 | 4-1/4 | 49-1/4 | 13 |
| BVM16-70 | 27-1/8 | 19-5/8 | 9-1/2 | 4-1/4 | 51 | 13 |
| BVM16-80 | 28-7/8 | 19-5/8 | 9-1/2 | 4-1/4 | 52-7/8 | 13 |
| BVM16-100 | 32 | 21-3/4 | 9-1/8 | 4 | 57-3/4 | 11-1/2 |
| BVM16-120 | 35-3/8 | 21-3/4 | 9-1/2 | 3-1/4 | 60-3/8 | 13 |

* Measurements represent the largest number possible for each Model.

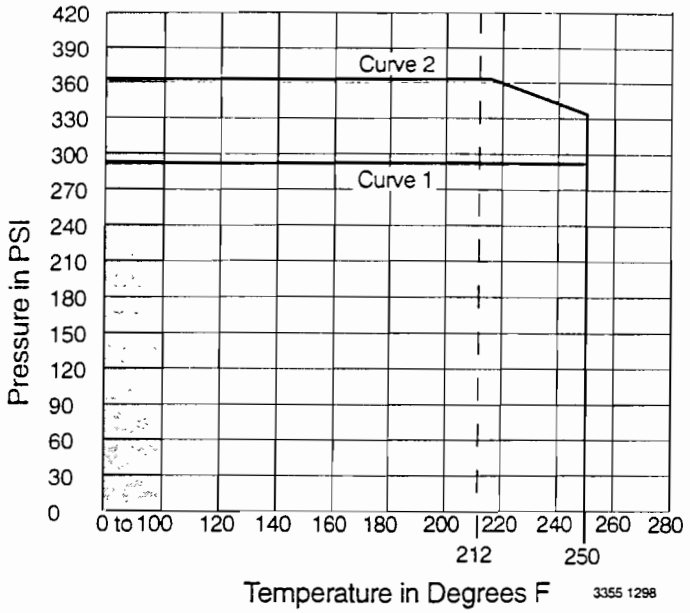



**FIGURE 4 - Maximum Inlet Pressure and Maximum Permissible Operating Pressure Curves**

**TABLE II – Permissible Operating Pressure Curves**

| Curve 1 | Curve 2 |
|---|---|
| BVM2-30/2 to BVM2-130 | BVM2-150 to BVM2-180 |
| BVM4-20/1 to BVM4-120 | BVM4-140 to BVM4-160 |
| BVM8-20/1 to BVM8-120 | BVM8-140 to BVM8-160 |
| BVM16-30/2 to BVM16-80 | BVM16-100 to BVM16-120 |

| Model Number | | Maximum Inlet Pressure (PSI) |
|---|---|---|
| BVM2 | 30/2 - 60 | 145 |
| | 70 - 80 | 220 |
| BVM4 | 20/1 - 20 | 90 |
| | 30 - 80/7 | 145 |
| | 80 - 160 | 220 |
| BVM8 | 20/1 - 40 | 90 |
| | 50 - 160 | 145 |
| BVM16 | 30/2 - 30 | 90 |
| | 40 - 120 | 145 |

# INSTALLATION

**⚠WARNING Hazardous voltage. Voltage can shock, burn, or cause death.** Ground pump motor correctly before connecting to power supply, per article 250-80 of the National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable.

## Location

Locate pump in a dry, well ventilated area, not subject to freezing or extreme variations in temperature.

Mount pump a minimum of 6" from any obstruction or hot surface. Install the pump with the motor shaft vertical. Make sure that an adequate supply of cool air reaches the motor cooling fan. Maximum ambient air temperature is 104° F (40° C).

For open systems requiring suction lift, locate the pump as close to the water source as possible.

**TABLE III – Minimum Pumping Rates**

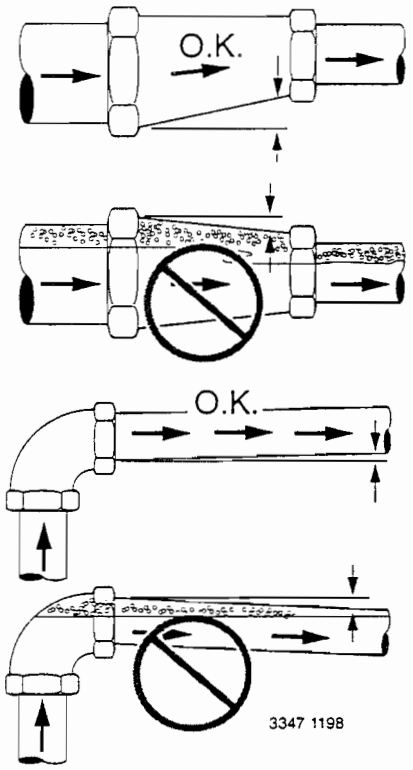
| Type | Liquid Temperature +5° F to +250° F |
|---|---|
| BVM2 | 1 GPM |
| BVM4 | 2 GPM |
| BVM8 | 4 GPM |
| BVM16 | 8 GPM |

**TABLE IV – Minimum Suction Pipe Sizes**

| Type | Pipe Size |
|---|---|
| BVM2 | 1-1/4" Nominal Diameter, Schedule 40 Pipe |
| BVM4 | 1-1/4" Nominal Diameter, Schedule 40 Pipe |
| BVM8 | 2" Nominal Diameter, Schedule 40 Pipe |
| BVM16 | 2" Nominal Diameter, Schedule 40 Pipe |

If the system pressure is greater than the pumps maximum
et pressure the limits of the pump can be exceeded if the
charge pressure backs up to the inlet side of the pump.
Installation of a check valve in the discharge pipe is
:ommended to prevent this condition.

ake sure, especially on the inlet side of the pump, that there are no airlocks in the system. See Figure 5 for correct
)e work to avoid airlocks. The suction pipe should be
el or slightly rising.




GURE 5 - Install Pipe Correctly to Prevent Air Locks

Support all piping independently of the pump so the weight the piping system does not strain the pump case. Make re that the expansion and contraction of the piping system from temperature variations cannot put a strain on the pump.

the system or pump must be drained periodically (especially if the discharge pipe is horizontal or slopes downward away from the pump), install a loop and icuum valve as shown in Figure 6 to protect the pump against running dry. The highest point of the loop should be at least as high as the lowest point of the motor. This op/valve combination will allow the pump and the stem to be drained independently of one another.

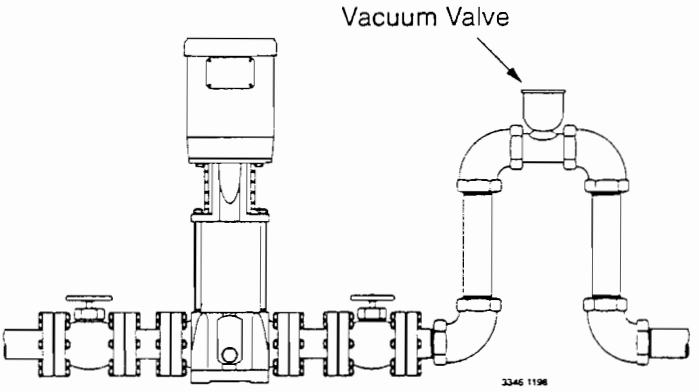



FIGURE 6 - Loop and Vacuum Valve Installation

# ELECTRICAL

**⚠WARNING** **Hazardous voltage. Can shock, burn or cause death.** All electrical work should be performed by a qualified electrician in accordance with the National Electrical Code and all local codes and regulations. Make sure that the motor voltage, phase, and frequency match the incoming electrical supply. The proper operating voltage and other electrical information can be found on the motor nameplate. These motors are designed to run up to ±10% of the nameplate-rated voltage. The wiring connection diagram can be found on either a plate attached to the motor or on a diagram inside the terminal box cover.

- **If voltage variations are greater than ±10% do not operate the pump.**
- Incorrect voltage can cause fire or serious damage to the motor and voids warranty.
- Ground the pump motor correctly before connecting it to the power supply.
- Follow the wiring instructions when connecting the motor to the power lines.

## Position of Terminal Box

To turn the motor so that the terminal box faces the right direction, proceed as follows:

1. Disconnect the power to the pump motor.
2. Remove the coupling guards (use a screwdriver).
3. Remove the couplings.
4. Remove the bolts that fasten the motor to the pump.
5. Turn the motor to the required position (in quarter-turn increments).
6. Follow steps 10 - 20 under "Motor Replacement", on Page 8.

## Field Wiring

All wiring connections and wiring sizes must meet National Electrical Code and local requirements.

## Motor Protection

See the motor nameplate for electrical connection/wiring diagram.

Berkeley pumps must be used with the proper size and type of motor starter to ensure protection against damage from low voltage, phase failure, current imbalances, and overloads. The overload should be sized to trip at the full-load current rating of the motor.

# OPERATION

## Priming

**⚠WARNING** **Hazardous pressure.** Do not run the pump with the discharge valve closed; the water in the pump may boil, causing risk of explosion and steam burns to anyone nearby.

**⚠WARNING** **Hazardous voltage.** Disconnect all power to the pump before servicing or working on the pump. Make sure that the power is locked out and that the pump cannot be accidentally started.

**NOTICE:** Under no circumstances should the pump be operated without flow through the pump. **Never** operate the pump dry.

**Operation of closed systems or open systems with the liquid level above the pump priming plug:**

1. Close the discharge isolating valve and loosen the priming plug in the pump head (Figure 7).

**⚠WARNING** **Risk of water damage and injury. Watch the direction of the priming plug and make sure that the liquid escaping from it does not injure persons nearby or damage the motor or other components. In hot water installations, pay particular attention to the risk of injury from scalding hot water.**

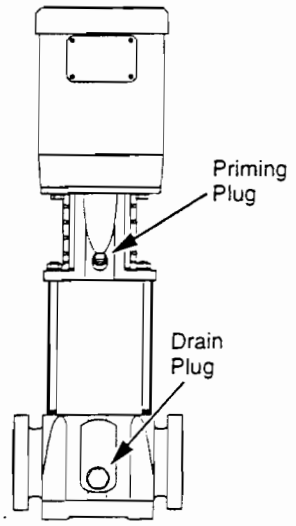



FIGURE 7 - Priming and Drain Plugs

2. Slowly open the isolation valve in the suction pipe until a steady stream of liquid runs out the priming port.
3. Reinstall the priming plug and securely tighten. Completely open isolation valves.

**Operation of open systems with the liquid level below the top of the pump:**

**NOTICE:** The suction pipe requires a check valve or isolation valve.

1. Close the discharge isolation valve.
2. Remove the priming plug.
3. Pour liquid through the priming port until the suction pipe and the pump are completely filled with liquid.
4. Replace the priming plug and tighten it securely.
5. Repeat steps 1-4 until the pump is primed.

## Checking Direction of Rotation

**NOTICE:** Do not disconnect the motor from the shaft to check the direction of rotation. If you remove the coupling, then you must adjust the shaft position when you reinstall it. This must be done before starting the pump.

Arrows on the pump head show the correct direction of rotation. When seen from the motor fan, the pump should rotate *counterclockwise* (↶). For pump motors without a fan remove one of the coupling guards and look at the coupling to determine the direction of rotation. Turn off the pump and replace coupling guard.

**NOTICE:** Do not check the direction of rotation until the pump has been filled with liquid. See "Priming", at left and above.

1. Switch power off.
2. Remove the coupling guard and rotate the pump shaft to be certain it can turn freely. Replace the coupling guard.
3. Verify that the electrical connections are in accordance with the wiring diagram on the motor.
4. If the fan is visible, turn on and off to verify rotation.
5. To reverse the direction of rotation, first switch OFF the power supply.
6. On three-phase motors, switch 2 of the 3 power leads on the load side of the starter. On single-phase motors, see the connection diagram on the motor nameplate. Change the wiring as indicated.

**⚠WARNING** **Hazardous voltage.** Voltage can shock, burn or cause death. Ground the pump motor correctly before connecting to power supply per article 250-80 of National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable.

7. Switch on the power supply and recheck the direction of motor rotation.

## Starting

1. If a suction line isolation valve has been installed, check to be sure that it is completely opened.
2. For initial starting, the isolation valve in the discharge pipe should be almost closed.

3. Start the pump.
4. When the piping system has been filled with liquid, slowly open the discharge isolation valve until it is completely open. Opening the valve too fast may result in water hammer in the discharge pipe. If the pump or system start to rattle, the pump is cavitating; to avoid damage to the pump, reduce the flow through the discharge isolation valve until the rattling stops. If this does not give adequate flow for your installation, call your installer or system designer.
5. Record the voltage and amperage of the motor. Adjust the motor overloads if required.
6. If pressure gauges have been installed, check and record operating pressures.
7. Check all controls for proper operation.

## Motor Bearings

For the greasing schedule and greasing procedure of the motor bearings follow the motor manufacturers recommendations.

## Calculating Minimum Inlet Pressure:

Minimum inlet pressure is required to avoid cavitation in the pump and is calculated as follows:

$H = Pb - NPSHR - H_f - H_v - H_s$

H = Minimum Inlet Pressure in Feet of Head

Pb = Barometric Pressure in Feet

1 Bar = 29.92 inches of Mercury (Hg)

1 PSI = 2.31 Ft of Head

1 Bar = 33.5 Ft. of Head

NPSHR = Net Positive suction head required. To be read from the NPSHR curve, Figure 8, at the highest flow the pump will be delivering.

$H_f$ = Friction Loss in suction pipe in ft of head

$H_v$ = Vapor pressure in feet of head (See Table V).

$H_s$ = A safety margin of 1.64 ft of head

## Example for BVM8:

**If:** Flow = 60 GPM

Pb = 1 Bar = 29.92 Inches of Mercury*

(Convert from Bar to Feet of Head)

Inches of mercury = 1.33′ inches of mercury

T = 100° F

NPSHR = 10′ (See Figure 7)

$H_f$ = 10′ of 2″ Steel Pipe @ 11.9′ of loss per 100′ of Pipe ($H_f$ = 11.9′/10′ = 1.19′)

$H_v$ = 2.195′ (from Table V)

$H_s$ = 1.64′ (safety factor from above)

**Then:** $H = 33.5'^{*} - NPSHR^{**} - H_f - H_v - H_s$

H = 33.5′ - 10′ - 1.19′ - 2.195′ - 1.64 = 18.475′

H = 18.475′ = Minimum Inlet Pressure

* 1 Bar = 14.5 PSI x 2.31 Ft of Head = 33.5′

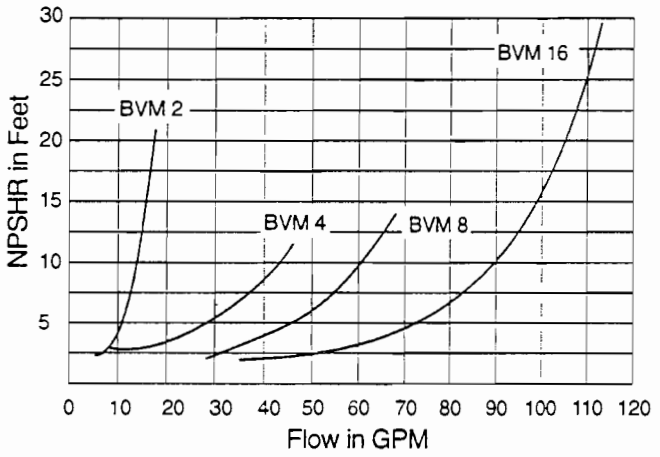



**FIGURE 8 - BVM2 through BVM16**
**Net Positive Suction Head Requirement (NPSHR)**

**TABLE V – Vapor Pressure of Water**

| Temperature in °F (°C) | Vapor Pressure in PSIA (kPa) | Absolute Pressure in Feet (M) of Water |
|---|---|---|
| **32 (0)** | 0.089 (.61) | 0.205 (.062) |
| 40 (4.4) | 0.122 (.84) | 0.281 (.086) |
| 60 (15.6) | 0.256 (1.77) | 0.592 (.180) |
| 80 (26.7) | 0.507 (3.50) | 1.172 (.358) |
| 100 (37.8) | 0.95 (6.55) | 2.195 (.669) |
| 120 (48.9) | 1.695 (11.69) | 3.914 (1.193) |
| 140 (60.0) | 2.892 (19.94) | 6.681 (2.036) |
| 160 (71.1) | 4.745 (32.72) | 10.961 (3.341) |
| 180 (82.2) | 7.515 (51.84) | 17.36 (5.291) |
| 200 (93.3) | 11.529 (79.49) | 26.632 (8.117) |
| 210 (98.9) | 14.125 (97.39) | 32.629 (9.945) |
| **212 (100)** | 14.698 (101.34) | 33.952 (10.349) |
| 220 (104.4) | 17.188 (118.51) | 39.704 (12.102) |
| 230 (110.0) | 20.78 (143.28) | 48.002 (14.631) |
| 240 (115.6) | 24.97 (172.17) | 57.681 (17.581) |
| **248 (120.0)** | 28.79 (188.51) | 66.505 (20.271) |

# MAINTENANCE

## Motor Replacement

For Key Numbers, refer to the Exploded View, Figure 14, for BVM2 and BVM4 Series Models and to Figure 15 for BVM8 and BVM16 Series Models.

**⚠WARNING Hazardous voltage.** Disconnect all power to the pump before servicing or working on pump. Make sure that power is locked out and that pump cannot be accidentally started.

1. Disconnect the power to the pump motor.
2. Close the nearest suction and discharge valves.
3. Remove the coupling guards (Key No. 4) by prying them loose with a screw driver.
4. Remove the socket head screws (Key No. 3) and the coupling halves (Key No. 2) from the shaft (Key No. 16A). For additional reference, see Figure 12, Page 9.

   **NOTICE:** Socket head screws are metric. See Table VII on Page 11 for specific metric driver sizes.
5. Remove the shaft pin (Key No. 5).
6. Remove the capscrews (Key No. 12), flatwashers (Key No.10), and lockwashers (Key No.11) that hold the motor (Key No. 1) and the motor bracket (Key No. 7) together.
7. Pull the old motor up and off of the motor bracket. **NOTICE:** Note the location of the conduit box on the motor.
8. Thoroughly clean the surfaces of the mounting flanges on the new motor and the pump end.
9. Install the new motor on the pump with the conduit box in the desired position.
10. Lubricate the capscrews (Key No. 12) with oil.
11. Reinstall the lockwashers, flatwashers, and capscrews that hold the motor and the motor bracket together, then tighten evenly and diagonally. See Table VII, Page 11 for torque specifications.
12. Reinstall the shaft pin (Key No. 5) in the shaft.
13. Reinstall the coupling halves (Key No. 2) on the pump and motor shaft. Make sure to engage the shaft pin (Key No. 5).

    **NOTICE:** Be sure coupling surfaces are thoroughly clean prior to assembly.
14. Snug up the socket head screws (Key No. 3) until the coupling begins to bind and then loosen 1/2 turn the shaft.
15. Draw up the capscrews evenly so the gap between the coupling halves is equal on both sides (See Figure 9).

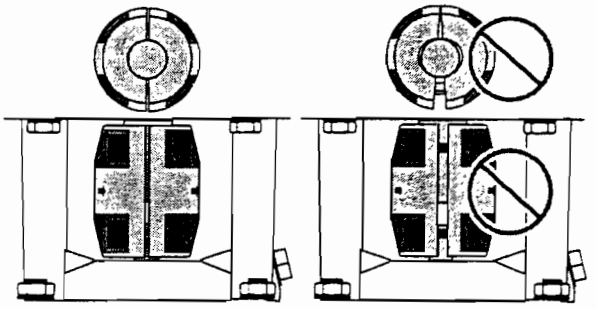


**FIGURE 9 - Make Sure that the Coupling Halves are Evenly Tightened**

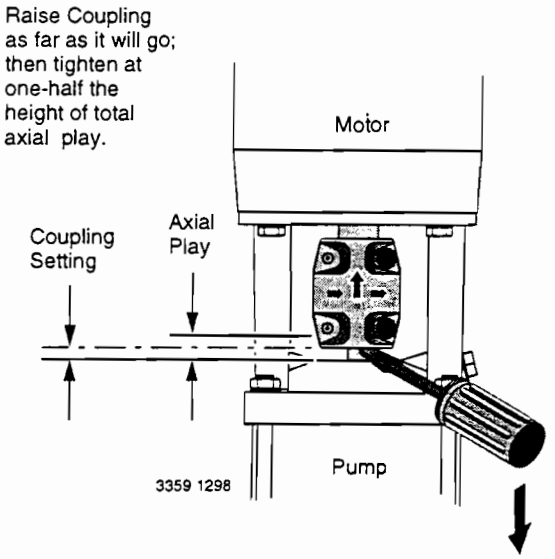



**FIGURE 10 - Vertically (axial) Centering the Coupling**

16. Insert a screw driver under the coupling (See Figure 10).
17. Raise the pump shaft to its highest point.
18. Lower the shaft halfway back down the distance you just raised it and retighten the capscrews. See Figure 10.

    **NOTICE:** Torque settings are critical to prevent coupling movement. Refer to Table VII, Page 11 for torque specifications.
19. Rotate the shaft to make sure that there is no interference. If rubbing is noted repeat steps 16, 17, and 18 above and readjust pump shaft height.
20. Reinstall the coupling guards by snapping them into place.

    **NOTICE:** The guards should be in place before the unit is run.
21. Open the suction and discharge valves. Turn the power back on.

## Replacing Pump Stack

For Key Numbers, refer to the Exploded View, Figure 14 on Page 12, for the BVM2 and BVM4 Series Models and Figure 15 on Page 13 for BVM8 and BVM16 Series Models.

**⚠WARNING Hazardous pressure.** Do not run pump with discharge valve closed; the water in the pump may boil, causing risk of explosion and steam burns to anyone nearby.

1. Follow steps 1-8 under "Motor Replacement" section on Page 8; then proceed with step 2 below.
2. Remove the four staybolt nuts, flatwashers, and lockwashers (Key Nos. 8, 9A, and 9B) from the staybolts (Key No. 19).

   **NOTICE:** It is not necessary to remove the staybolts when replacing the stack.
3. Lift the motor bracket (Key No. 7) off of the pump body.

   **NOTICE:** Note the position of the priming plug. The priming plug must be returned to its original position during reassembly.
4. Remove and discard upper sleeve gasket (Key No. 17).
5. Clean gasket seat.
6. Remove and replace round spring ring (BVM2 and BVM4) or stack spring (BVM8 and BVM16) (Key No. 13).
7. Pull the old stack (16A through 16L) out of the stainless steel sleeve (Key No. 18) by pulling straight up on the pump shaft (Key No. 16A).
8. Remove the stainless steel sleeve (Key No. 18).
9. Remove and discard the bottom sleeve gasket (Key No. 17).
10. Clean the gasket seat.
11. Remove and discard the O-Ring (Key No. 21A) from the suction/discharge (Key No. 21 BVM2 and BVM4 only).
12. Clean the O-Ring seat and install a new O-Ring (Key No. 21A).
13. Install a new lower sleeve gasket.
14. Install the new stack without the stainless steel sleeve.

    **NOTICE:** Be sure to align either the small priming hole or the suction interconnector pin hole, located on the bottom stage of the stack properly in the base of the Suction/Discharge (Key No. 21). See Figure 11.
15. Use a rubber mallet to tap the stainless steel sleeve (Key No. 18) into place.
16. Install a new mechanical shaft seal (Key Nos. 14A and 14B, or Key Nos 15A through 15G). Refer to "Mechanical Seal Disassembly and Mechanical Seal Reassembly" sections, Page 10.
17. Install a new upper sleeve gasket (Key No. 17).
18. Install a new round spring ring or stack spring (Key No. 13).
19. Reinstall the motor bracket (Key No. 7) on the pump body. Align the priming plug (Key No. 6) to its original position.
20. Oil the threads on the staybolts (Key No. 19).
21. Replace the lockwashers, flatwashers, and staybolt nuts (Key Nos. 8, 9A and 9B) and cross-torque the staybolts. See Table VII, Page 11, for torque specifications.
22. Reinstall the motor (Key No. 1) on the motor bracket (Key No. 7) and turn the motor to the desired terminal box position.
23. Follow steps 10 - 21 under "Motor Replacement", Page 8. You have now finished changing out the impeller stack.

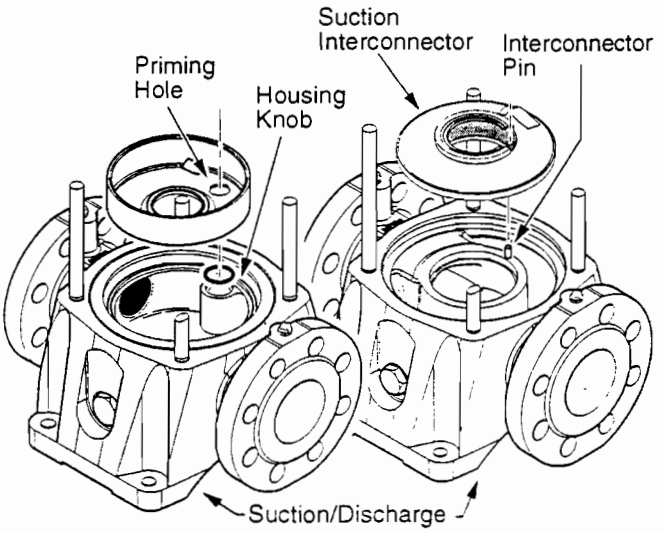



**FIGURE 11 - BVM2, BVM4 – Align Small Priming Port. BVM8, BVM16 – Align Interconnector Pin**

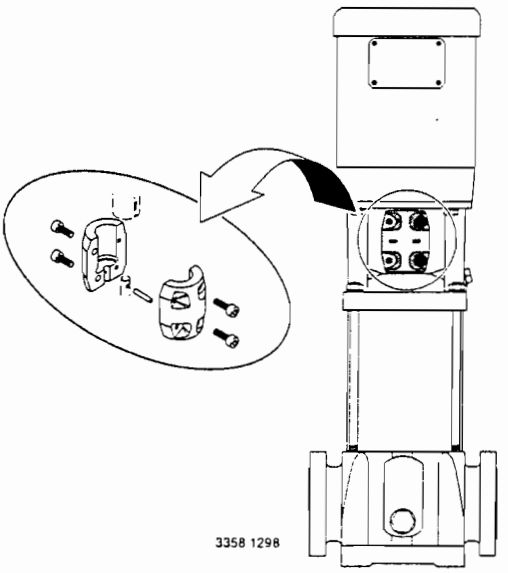



**FIGURE 12 - Remove the Socket Head Screws and the Coupling Halves**

## Two Part Mechanical Seal/Disassembly:

See Table VI to determine which seal your model has.

**TABLE VI – Seal Type Identification**

| 2 Part<br>Low Pressure Seal | 7 Part<br>High Pressure Seal |
|---|---|
| **B78038** | **B78039** |
| BVM2-30/2 through BVM2-120<br>BVM4-20/2 through BVM4-120 | BVM2-150, BVM2-180<br>BVM4-140, BVM4-1606 |
| **B78040** | **B78040** |
| BVM8-20/1 through BVM8-120<br>BVM16-30/2 through BVM16-80 | BVM8-140, BVM8-160<br>BVM16-100, BVM16-120 |

See Figure 14 for BVM2 and BVM4 Series Models, and Figure 15 for BVM8 and BVM16 Series Models, for Key Numbers.

**NOTICE:** The assembly and disassembly procedure for this seal does not require extraordinary force.

**⚠WARNING Hazardous voltage. Can Shock, burn or cause death. Disconnect power to pump before disassembly.**

1. Follow Steps 1-8 under "Motor Replacement" Page 8, and proceed with step 2 below.
2. Remove the four nuts, lockwashers, and washers (Key Nos. 8, 9A, and 9B) from the staybolts (Key No. 19).
3. The shaft seal consists of a stationary half (Key No. 14A) and a rotating half (Key No. 14B). Turn the motor bracket upside down and remove the stationary part of the seal (Key No. 14B) from the seal seat in the base of the motor bracket.

   **NOTICE:** Use care not to chip or scratch the seal seat during disassembly and assembly.
4. Clean the seal seat with a wet cloth.
5. Remove and discard the rotating parts of the seal by twisting and pulling up on them until they come off of the shaft.

## Two Part Mechanical Seal Reassembly:

**NOTICE: Before assembly** check and clean all sealing and gasket surfaces with a clean wet cloth. Replace all seals, gaskets and O-Rings.

1. Turn the motor bracket upside down.
2. Moisten the seal seat (in the motor bracket) and the O-ring (cup seal) portion of the stationary half of the mechanical seal (Key No. 14A) with a small amount of water.
3. Press the cup-seal onto the stationary half of the shaft seal and then press the shaft seal into the seal seat of the pump head (Cup-seal portion first), using finger pressure only. **NOTICE:** If a tool is used, protect the seal face from tool with a clean cloth.

   **NOTICE:** The cup-seal must be placed evenly on the seal and the seal must be installed evenly in the seal seat to avoid pinching the cup-seal.
4. Moisten the internal parts of the rotating portion of the mechanical seal (14B).
5. Install the rotating half of the seal onto the shaft. Push and twist the seal onto the shaft to the stop ring.

   **NOTICE:** Use care when installing the new seal on the shaft. Do not to scratch or mar seal on the shaft shoulder.
6. Follow Steps 11 - 23 under "Replacing Pump Stack", Page 9.

## Seven Part Mechanical Seal/Disassembly:

See Figure 14 for BVM2 and BVM4 Series Models, and Figure 15 for BVM8 and BVM16 Series Models, for Key Numbers.

**⚠WARNING Hazardous voltage.** Can Shock, burn or cause death. Disconnect power to pump before disassembly.

1. Follow Steps 1-8 under "Motor Replacement" Page 8, and proceed with step 2 below.
2. Remove the four nuts, lockwashers, and washers (Key Nos. 8, 9A, and 9B) from the staybolts (Key No. 19).
3. The shaft seal consists of an O-Ring (Key No. 15A), the stationary half of the mechanical seal (Key No. 15B), the rotating half of the mechanical seal (Key No. 15C), a second O-Ring (Key No. 15D - inside No. 15C), a flat washer (Key No. 15E), a spring (Key No. 15F), and a mechanical drive ring (Key No. 15G), in that order, see Figure 13, below. Turn the pump head upside down and remove the stationary part of the seal (Key No. 15B) from the seal seat in the base of the motor bracket.

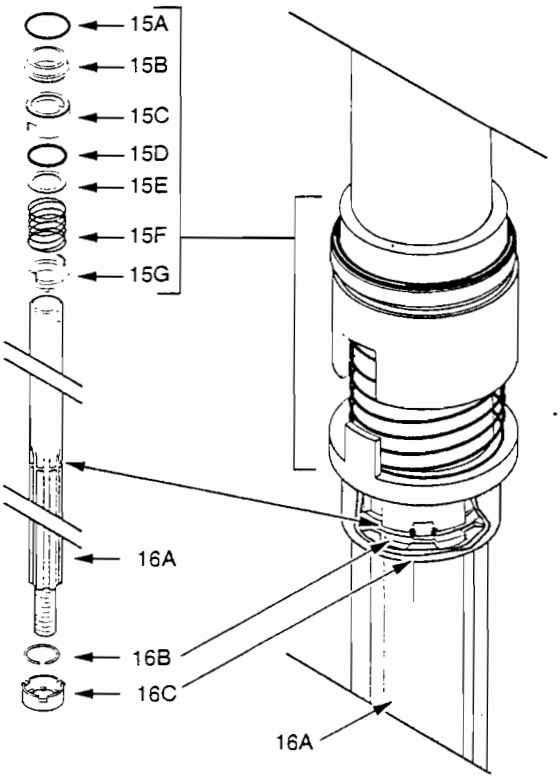



FIGURE 13

**NOTICE:** Use care not to chip or scratch the seal seat during disassembly and assembly.

4. Clean the seal seat with a wet cloth.
5. Remove the rotating parts of the seal by twisting and pulling up on them until they come off of the shaft (Key Nos.15C and 15D, 15E, 15F, and 15G). Discard the old seal.

## Seven Part Mechanical Seal Reassembly:

**NOTICE:** Before assembly check and clean all sealing and gasket surfaces with a clean wet cloth. Replace all seals, gaskets, and O-Rings.

1. Turn the motor bracket (Key No.7) upside down.
2. Moisten the seal seat (in the motor bracket) with a small amount of water.
3. Lubricate the larger diameter O-Ring (Key No. 15A) with a small amount of water and install it on the stationary half of mechanical seal (Key No. 15B).
4. Press the stationary half of the shaft seal (Key No. 15B) with O-Ring (Key Nos. 15A and 15B) into the seal seat of the motor bracket. Use finger pressure only. If a tool is used, protect the seal face from tools with a clean cloth.

   **NOTICE:** Be sure the seal is installed evenly to avoid pinching the O-Ring.
5. Lubricate smaller diameter O-Ring (Key No. 15D) with water and press it into the rotating half of the mechanical seal (Key No.15C).
6. Install the mechanical drive ring (Key No. 15G) on the shaft (Key No. 16A). Be sure the drive ring butts up against the mechanical seal spacer (Key No. 16C).
7. Install the spring (Key No.15F) up against the drive ring on the shaft .
8. Install the flatwasher (Key No.15E) on the shaft, against the spring.
9. Install the rotating half of the mechanical seal (Key No.15C) on the shaft. Align the grooves on the rotating half of the mechanical seal with the teeth on the mechanical drive ring (Key No. 15G).
10. Follow Steps 11 - 23 under "Replacing Pump Stack", Page 9.

## Frequency of Starts and Stops

Check pump cycling frequency and make sure that the pump is not starting more than:

**TABLE VIII – Maximum Number of Cycles**

| Cycles | Motor HP Rating |
|---|---|
| 20 times per hour | 1/2 - 5 HP motors |
| 15 times per hour | 7- 1/2 - 15 HP motors |
| 10 times per hour | 20 and 25 HP motors |

## Frost Protection

1. If you do not use your pump during seasons of frost, drain it and add a glycol based antifreeze (50/50 mixture) to avoid damage.

**⚠ CAUTION Risk of water damage and injury. Watch the direction of the priming plug and make sure that liquid escaping from it does not injure persons nearby or damage the motor or other components. In hot water installations, pay particular attention to the risk of injury from scalding hot water.**

2. Upon restart dispose of spent antifreeze properly.
3. Do not replace the drain plug or tighten the priming plug until you put the pump back in service again.

## Regular Maintenance Checks

The following checks should be made at regular intervals:

1. The pump meets required performance and is operating smoothly and quietly.
2. There are no leaks.
3. The motor is not overheating.
4. Remove and clean all strainers and filters in the system.
5. Verify amp draw – check motor amperage.
6. Pump wear rings and shaft require no regular maintenance.

**TABLE VII – Torque Specifications (foot-lbs.)**

| | Coupling | | | Motor | | Staybolt | | Stack Nut | |
|---|---|---|---|---|---|---|---|---|---|
| | Socket Head Screw M6 x 20 | Socket Head Screw M8 x 25 | Socket Head Screw M10 x 25 | Capscrew Hex Head 3/8 x 1-1/2 | Capscrew Hex Head 1/2 x 1-1/2 | Hex Nut 1/2 - 13 | Hex Nut 5/8 - 11 | Hex Nut M8 | Hex Nut M12 |
| **Hardware Part Numbers** | M11369 | M11398 | M11491 | S23568 | S23623 | S26460 | S26462 | M11385 | M11419 |
| **Pump Model Number** | | | | | | | | | |
| BVM2 Series | 20 | 35 | – | 30 | 35 | 45 | – | 10 | – |
| BVM4 Series | 20 | 35 | – | 30 | 35 | 45 | – | 10 | – |
| BVM8 Series | 20 | 35 | 45 | 30 | 35 | – | 75 | – | 30 |
| BVM16 Series | – | 35 | 45 | – | 35 | – | 75 | – | 30 |

# BVM2
# BVM4

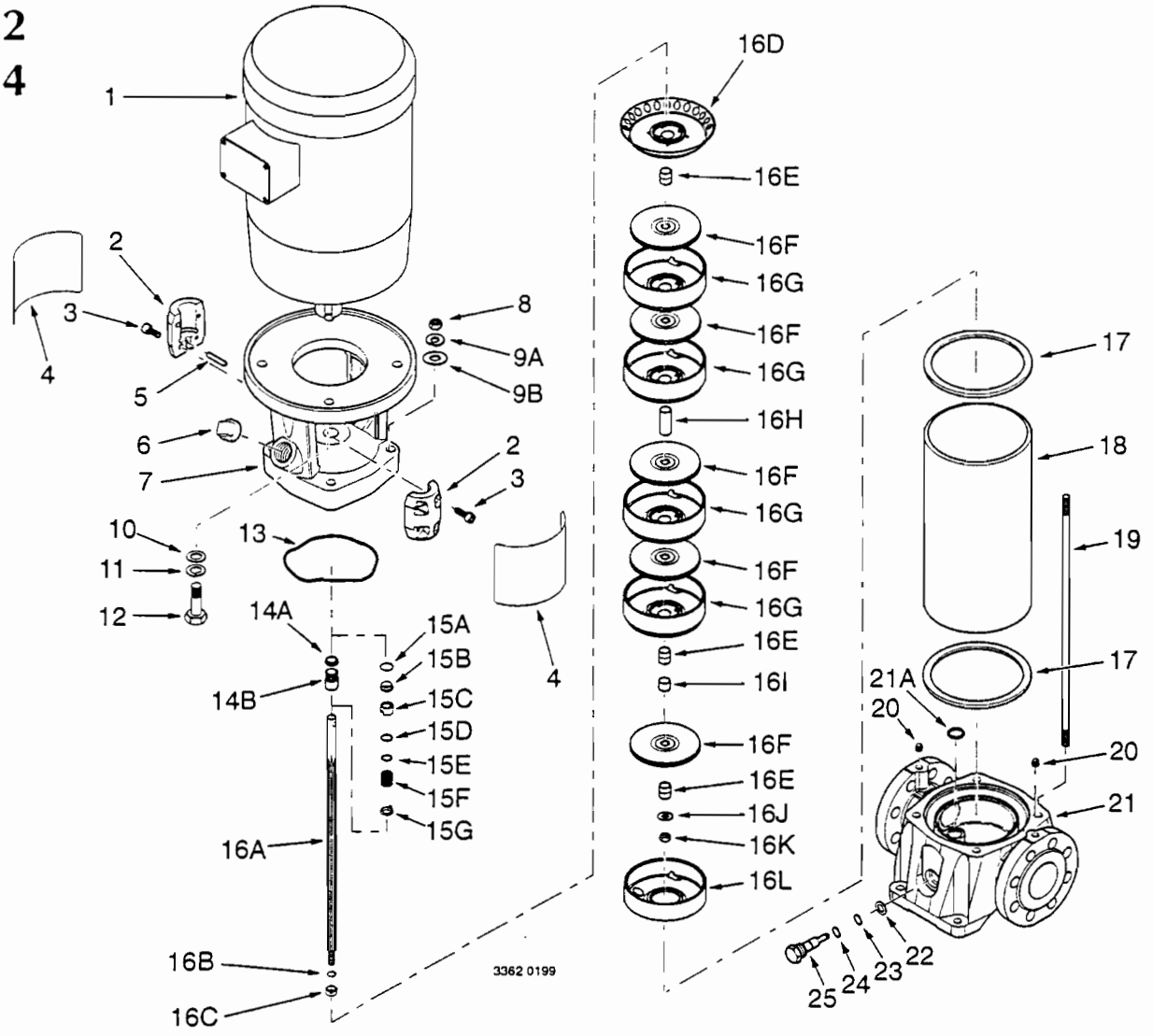



**FIGURE 14 - Exploded View BVM2 and BVM4**

## REPAIR PARTS LIST FOR BVM2 AND BVM4 SERIES MODELS

| Key No. | Description | Key No. | Description |
|---|---|---|---|
| 1 | Motor | 15G | Mechanical Drive Ring |
| 2 | Coupling Half | 16 | Replacement Stack Kit (Incl. Key Nos. 16A thru 16L) |
| 3 | Socket Head Screw | 16A | Shaft |
| 4 | Coupling Guard | 16B | Stop Ring |
| 5 | Coupling Pin | 16C | Mechanical Seal Spacer |
| 6 | Priming Plug | 16D | Upper Intermediate Chamber |
| 7 | Motor Bracket | 16E | Spacer |
| 8 | Staybolt Nut | 16F | Impeller |
| 9A | Staybolt Lockwasher | 16G | Diffuser |
| 9B | Staybolt Flat Washer | 16H | Spacer |
| 10 | Flatwasher | 16I | Bearing |
| 11 | Lockwasher | 16J | Shaft Washer |
| 12 | Capscrew | 16K | Nut |
| 13 | Spring Ring | 16L | Chamber without Diffuser |
| 14 | Two part Mechanical Seal (Includes 14A and 14B) | 17 | Sleeve Gasket |
| 14A | Stationary Half of Mechanical Seal | 18 | Stainless Steel Sleeve |
| 14B | Rotating Half of Mechanical Seal | 19 | Staybolt |
| 15 | Seven Part Mechanical Seal (Includes 15A thru 15G) | 20 | Pipe Plug |
| 15A | O-Ring, Larger Diameter | 21 | Suction/Dishcarge |
| 15B | Stationary Half of Mechanical Seal | 21A | O-Ring (Bottom Chamber) |
| 15C | Rotating Half of Mechanical Seal | 22 | Drain Plug Gasket |
| 15D | O-Ring, Smaller Diameter | 23 | O-Ring |
| 15E | Flat Washer | 24 | O-Ring |
| 15F | Spring | 25 | Drain Plug |

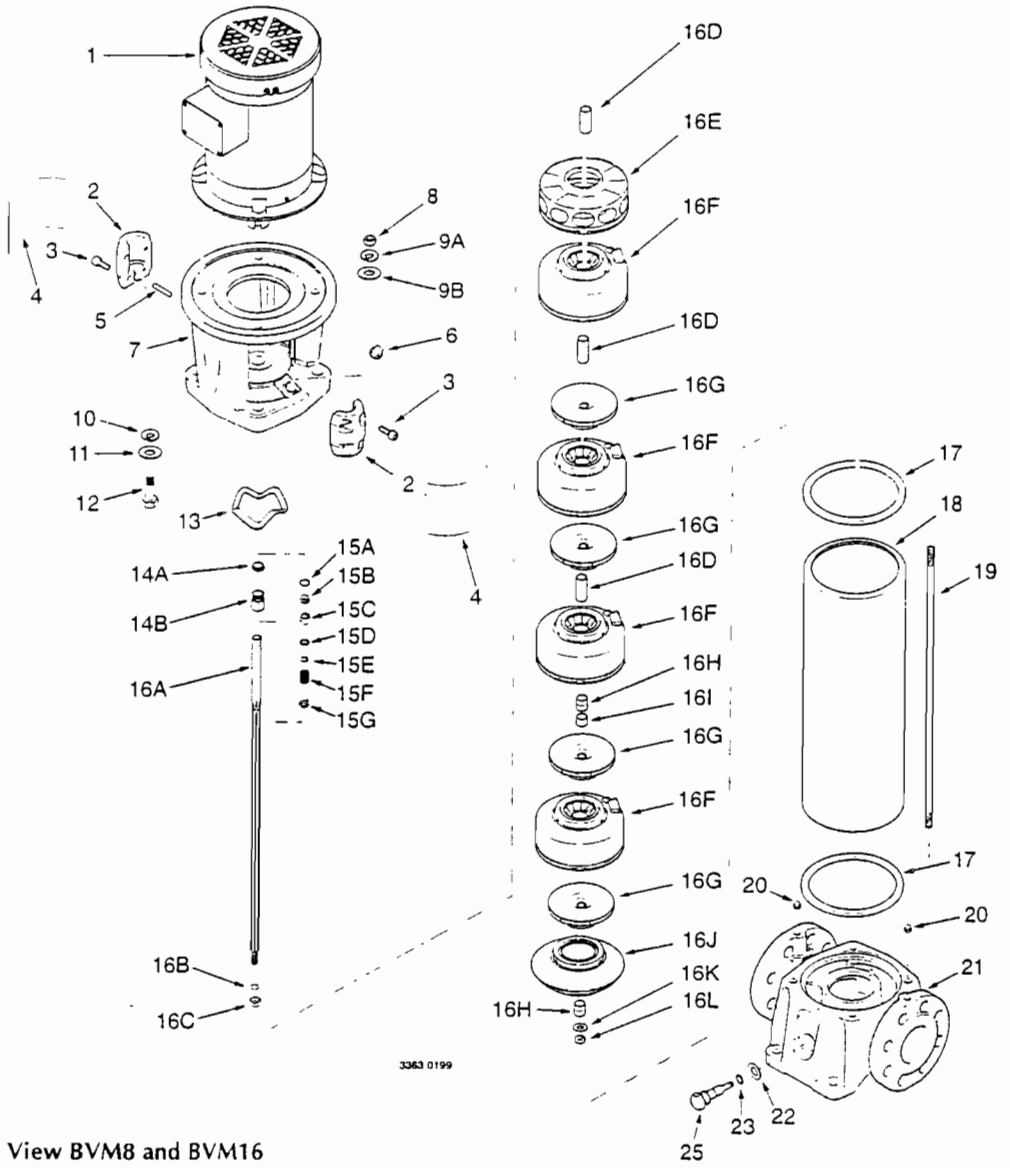



Figure 15 - Exploded View BVM8 and BVM16

## REPAIR PARTS LIST FOR BVM8 AND BVM16 SERIES MODELS

| Key No. | Description | Key No. | Description |
|---|---|---|---|
| 1 | Motor | 15G | Mechanical Drive Ring |
| 2 | Coupling Half | 16 | Replacement Stack Kit (Incl.16A thru 16L) |
| 3 | Socket Head Screw | 16A | Shaft |
| 4 | Coupling Guard | 16B | Stop Ring |
| 5 | Coupling Pin | 16C | Mechanical Seal Spacer |
| 6 | Priming Plug | 16D | Upper Intermediate Chamber |
| 7 | Motor Bracket | 16E | Spacer |
| 8 | Staybolt Nut | 16F | Impeller |
| 9A | Staybolt Lockwasher | 16G | Diffuser |
| 9B | Staybolt Flat Washer | 16H | Spacer |
| 10 | Flat Washer | 16I | Bearing |
| 11 | Lock Washer | 16J | Shaft Washer |
| 12 | Capscrew | 16K | Nut |
| 13 | Spring Ring | 16L | Chamber without Diffuser |
| 14 | Two Part Mechanical Seal (Includes 14A and 14B) | 17 | Sleeve Gasket |
| 14A | Stationary Half of Shaft Seal | 18 | Stainless Steel Sleeve |
| 14B | Rotating Half of Shaft Seal | 19 | Staybolt |
| 15 | Seven Part Mechanical Seal (Includes 15A thru 15G) | 20 | Pipe Plug |
| 15A | O-Ring, Larger Diameter | 21 | Suction/Discharge |
| 15B | Stationary Half of Mechanical Seal | 21A | O-Ring (Bottom Chamber) |
| 15C | Rotating Half of Mechanical Seal | 22 | Drain Plug Gasket |
| 15D | O-Ring, Smaller Diameter | 23 | O-Ring |
| 15E | Flat Washer | 24 | O-Ring |
| 15F | Spring | 25 | Drain Plug |

# TROUBLESHOOTING GUIDE

**⚠WARNING Hazardous voltage and risk of sudden starts. Disconnect all power to the pump before servicing or working on pump. Make sure that power is locked out and that pump cannot be accidentally started.**

| PROBLEM | CAUSE |
|---|---|
| 1. Motor does not run when started | A. Power failure<br>B. Fuses blown<br>C. Motor starter overload has tripped out<br>D. Main contacts in motor starter are not making contact or the coil is faulty<br>E Control circuit fuses are defective<br>F. Motor is defective |
| 2. Motor starter overload trips out immediately when power supply is switched on | A. One fuse has blown<br>B. Contacts in motor overload relay are faulty<br>C. Cable connections are loose or faulty<br>D. Motor winding is defective<br>E. Pump mechanically blocked<br>F. Overload setting is too low |
| 3. Motor starter overload trips out occasionally | A. Overload setting is too low<br>B. Low voltage at peak times |
| 4. Motor starter has not tripped out but the motor does not run | A. Check 1 A), B), D,) and E) |
| 5. Pump capacity is not constant | A. Pump inlet pressure is too low<br>B. Suction pipe/pump partly blocked<br>C. Pump is sucking air |
| 6. Pump runs but gives no water | A. Suction pipe/pump blocked<br>B. Foot or non-return valve is blocked in closed position<br>C. Leakage in suction pipe<br>D. Air in suction pipe or pump<br>E. Motor rotates in the wrong direction |
| 7. Pump runs backwards when switched off | A. Leakage in suction pipe<br>B. Foot or non-return valve is defective<br>C. Foot valve is blocked in open or partly open position<br>D. Non return valve leaks or is blocked in open or partly open position<br>E. Discharge valve is defective |
| 8. Leakage from shaft seal | A. Pump shaft position is incorrect<br>B. Shaft seal is defective |
| 9. Noise | A. Cavitation is occurring in the pump<br>B. Pump does not rotate freely (That is, there is increased frictional resistance) because of incorrect shaft position |

## BERKELEY LIMITED WARRANTY

Berkeley/Wicor Canada Company ("Wicor") warrants to the original consumer purchaser ("Purchaser") of its products that they are free from defects in material or workmanship.

If within twelve (12) months from the date of installation or twenty-four (24) months from the date of manufacture any such product shall prove to be defective, it shall be repaired or replaced at Berkeley's/Wicor's option, subject to the terms and conditions set forth below.

**General Terms and Conditions**

Purchaser must pay all labor and shipping charges necessary to replace product covered by this warranty. This warranty shall not apply to products which, in the sole judgement of Berkeley/Wicor, have been subject to negligence, abuse, accident, misapplication, tampering, alteration; nor due to improper installation, operation, maintenance or storage; nor to other than normal application, use or service, including but not limited to, operational failures caused by corrosion, rust or other foreign materials in the system, or operation at pressures in excess of recommended maximums.

Requests for service under this warranty shall be made by contacting the installing Berkeley/Wicor dealer as soon as possible after the discovery of any alleged defect. Berkeley/Wicor will subsequently take corrective action as promptly as reasonably possible. No requests for service under this warranty will be accepted if received more than 30 days after the term of the warranty.

The warranty on all three phase submersible motors is void if three-leg overload protection of recommended size is not used.

This warranty sets forth Berkeley's/Wicor's sole obligation and purchaser's exclusive remedy for defective products.

BERKELEY/WICOR SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL NOT EXTEND BEYOND THE DURATION OF THE APPLICABLE EXPRESS WARRANTIES PROVIDED HEREIN.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

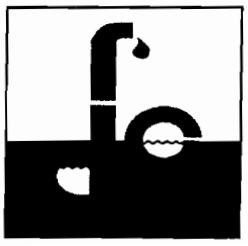
**In the U.S.: Berkeley, 293 Wright St., Delavan, WI 53115**

**In Canada: Wicor Canada Company, 1800 Courtney Park Drive East, Unit 5-7, Mississauga, Ontario L5T 1W1**

**Wicor Canada Company, 200-E, Rue St-Louis, St-Jean-Sur-Richelieu, Québec J3B 1Y1**

# FLOW METERS

DRC # 6154



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Fluid Flow Meters

# INSTALLATION & OPERATION MANUAL
# MODEL 1100 TURBINE FLOW METER
# WITH MODEL B2200 FLOW MONITOR
# Rev A

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Intrinsically Safe for use
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Class I, Division 1, Groups: A,B,C and D

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## OPERATING LIMITATIONS OF FLOW METERS AND MONITOR

**1. U.L., C.U.L. and C.S.A. Intrinsically Safe Approval:** The Model 1100 fluid flow turbine meter and B-2200 flow monitor are intrinsically safe and approved for hazardous location by U.L., C.U.L. and C.S.A. (Class I, Division 1, Groups: A,B,C and D) when installed per this Installation Instruction (part no. 228900) and Installation Drawing BEP48-06 (see Appendix D)

**WARNING: Any alterations to the circuitry will nullify the intrinsically safe rating.**

**2. TEMPERATURE:** Do not subject the meter to temperatures above 325° F (163° C), or below -150° F (-101° C) or the freezing point of the metered liquid. Higher temperatures will damage the pick-up, and lower temperatures will limit the rotation of the rotor.

**3. PRESSURE:** Part numbers: B110-375, B110-500, B110-750, B110-875, B111-110, B111-115, B111-121 and B111-120: **5,000 psi max.**

Part numbers: B111-130, B111-140, B111-160, B111-180 and B111-200: **800 psi max.**

**WARNING: Pressure in excess of allowable rating may cause the housing to burst and cause serious personal injury.**

**4. CORROSION:** The internal parts of the meter are constructed of stainless steel and tungsten carbide. Be sure that the operating fluid is compatible with these materials. Incompatible fluids will deteriorate internal parts, and cause the meter to read inaccurately.

**5. PULSATION:** Severe pulsation will affect accuracy, and shorten the life of the meter.

**6. VIBRATION AND SHOCK:** Severe mechanical vibration may decrease service life of the meter.

**7. FILTRATION:** A strainer should be installed upstream of the meter if small particles are present (see Table 1 for filtration requirements).

**8. LITHIUM BATTERY DISPOSAL:** For proper disposal of lithium batteries, consult local authorities.

## GENERAL DESCRIPTION: MODEL B2200 FLOW MONITOR

The B-2200 flow monitor can be directly mounted on a model 1100 turbine meter or remotely located. The monitor provides continuous digital display of flow rate and totalization. The electronic circuit of the monitor processes the turbine meter's input in a signal conditioning circuit, where it is shaped and amplified. This input circuit is protected from high voltage transients by a diode network. The battery powered unit utilizes low power CMOS integrated circuits with liquid crystal displays, that enables it to operate 3 to 5 years on two lithium batteries. The unit has the ability to display almost any desired volumetric units. The monitor comes factory adjusted to match its companion turbine flow meter, which makes field calibration unnecessary. However, if calibration adjustment is required, it can be performed on the job site. The field calibration process is described in Appendix A.

## SPECIFICATIONS:

**Enclosure:** Fiber glass reinforced polyester (light gray color).

**Size:** 6.75 in. (171 mm) wide X 6.50 in. (165 mm) high X 4.25 in. (108 mm) deep.

**Power Supply:** Two (2) 3.6 volt lithium batteries (supplied with instrument).

**Accuracy:** ±1% of actual and totalized flow.

**Digital Displays:** Six (6) digits (customer set decimal point on flow rate), 0.35 inch (9 mm) high.

**Temperature:** -35°F (-37°C) to 160° F (71°C).

**Mounting:** Standard - Enclosure mounts directly to Turbine Meter.
Optional - Remote, according to customer specifications.

**Electronics Approvals:** U.L., C.U.L. and C.S.A. Intrinsically Safe

**Optional Cables for Remote Output:** Standard length 10 ft, or as specified.

## GENERAL DESCRIPTION: TURBINE FLOW METER

The Model 1100 turbine flow meter is designed with wear resistant moving parts to provide trouble free operation and long service life. The model 1100 Turbine Meter Repair Kit is designed for easy field service of a damaged flow meter, rather than replacing the entire flow meter. Repair parts are constructed of stainless steel alloy and tungsten carbide.

Fluid moving through the turbine flow meter causes the rotor to turn at a speed proportional to the flow rate. The rotor blade cuts the magnetic field of the magnetic pick-up, which in turn generates a frequency output signal that is directly proportional to the speed. This signal is used to represent flow rate and/or totalization of fluid passing through the turbine flow meter and is always expressed as the number of electric pulses that the meter produces per US gallon. This value is constant over each flow meter's range and is unique to the meter.

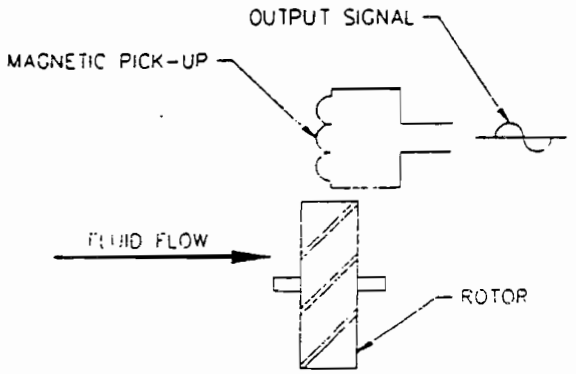



**Fig. 1** Schematic illustration of electric signal generated by rotor movement.

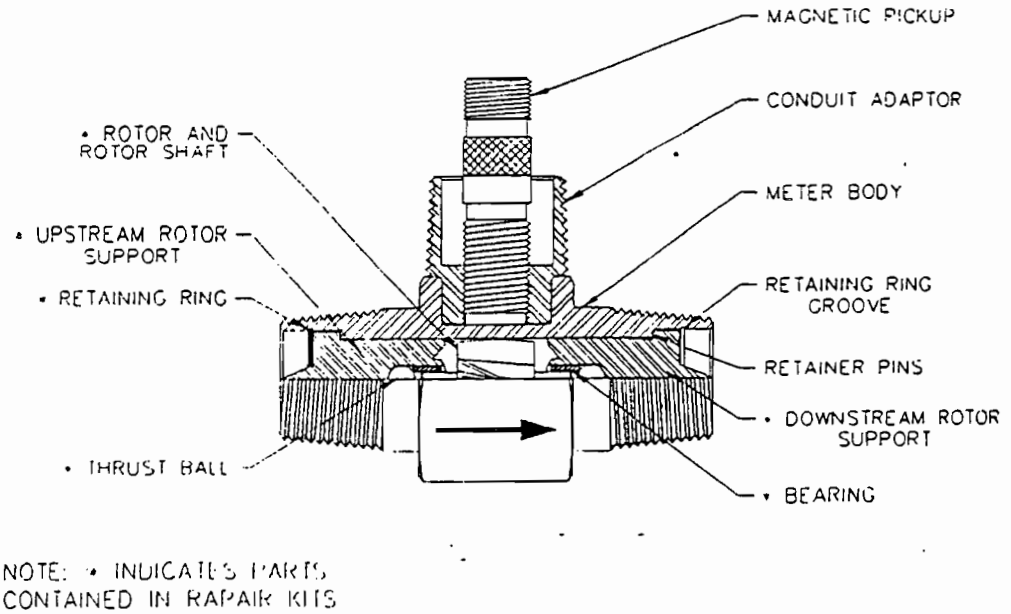



**Fig. 2** Typical cross-section of B110-375 through B111-121 turbine flow meter.

# INSTALLATION INSTRUCTIONS: TURBINE FLOW METER

Before installation, the flow meter should be checked internally for foreign material and to be sure that the rotor spins freely. Fluid lines should also be cleared of all debris. The flow meter must be installed with the flow indication arrow, etched on the exterior of the meter body, pointing in the correct direction of flow. The preferred mounting orientation is to have the meter installed in horizontal piping, with the pick-up facing upward. However, the meter will function in any position.

The liquid that is to be measured must be free from any large particles that may obstruct rotation of the rotor. If particles are present, a mesh strainer should be installed upstream before operation of the flow meter. (See Table 1)

## TABLE 1

| MODEL NUMBER | PART NUMBER | STRAINER MESH | CLEARANCE |
|---|---|---|---|
| W11.375 | B110-375 | 60 X 60 | .0092 |
| W11.500 | B110-500 | 60 X 60 | .0092 |
| W11.750 | B110-750 | 60 X 60 | .0092 |
| W11.875 | B110-875 | 60 X60 | .0092 |
| W1110 | B111-110 | 60 X 60 | .0092 |
| W1115 | B111-115 | 20 X 20 | .0340 |
| W1120 | B111-120 | 10 X10 | .0650 |
| W1121 | B111-121 | 20 X 20 | .0340 |
| W1130 | B111-130 | 8 X 8 | .0900 |
| W1140 | B111-140 | 10 X 10 | .0650 |
| W1160 | B111-160 | 4 X 4 | .1875 |
| W1180 | B111-180 | 8 X 8 | .0900 |
| W1200 | B111-200 | 4 X 4 | .1875 |

The preferred plumbing setup is one containing a by-pass line (Fig. 3) that allows meter inspection and repair without interrupting flow. If a by-pass line is not utilized, it is important that all control valves be located down-stream of the flow meter (Fig. 4).

**CAUTION: Damage can be caused by striking an empty meter with a high velocity flow stream.**

This is true with any restriction in the flow line that may cause the liquid to flash. If necessary, air eliminators should be installed to ensure that the meter is not incorrectly measuring entrained air or gas.

It is recommended that a minimum length, equal to ten (10) pipe diameters of straight pipe, be installed on the up-stream side and five (5) diameters on the down-stream side of the flow meter. Otherwise meter accuracy may be affected. Piping should be the same size as the meter bore or threaded port size.

Do not locate the flow meter or connection cable close to electric motors, transformers, sparking devices, high voltage lines, or place connecting cable in conduit with wires furnishing power for such devices. These devices can induce false signals in the flow meter coil or cable, causing the meter to read inaccurately.

If problems arise with the flow meter and monitor consult Appendix B (Trouble Shooting Guide). If further problems arise, consult the factory. Turbine Meter Repair Kits are also available, see Appendix C. If the internal components of the turbine flow meter are damaged beyond repair, these repair kits are available. Information pertaining the turbine meter repair kits are referenced in Appendix C.

## OPERATIONAL START UP: TURBINE FLOW METER

The following practices should be observed when installing and starting the meter.

**WARNING: Make sure that fluid flow has been shut off and pressure in the line released before attempting to install the meter in an existing system.**

**1.** After meter installation, close the isolation valves, and open the by-pass valve. Flow liquid through the by-pass valve for sufficient time to eliminate any air or gas in the flow line.

**CAUTION: High velocity air or gas may damage the internal components of the meter.**

**2.** Open up-stream isolating valve slowly to eliminate hydraulic shock while charging the meter with the liquid. Open the valve to full open.

**3.** Open down-stream isolating valve to permit meter to operate.

**4.** Close the bypass valve to a full closed position.

**5.** Adjust the downstream valve to provide the required flow rate through the meter. Note: The downstream valve may be used as a control valve.

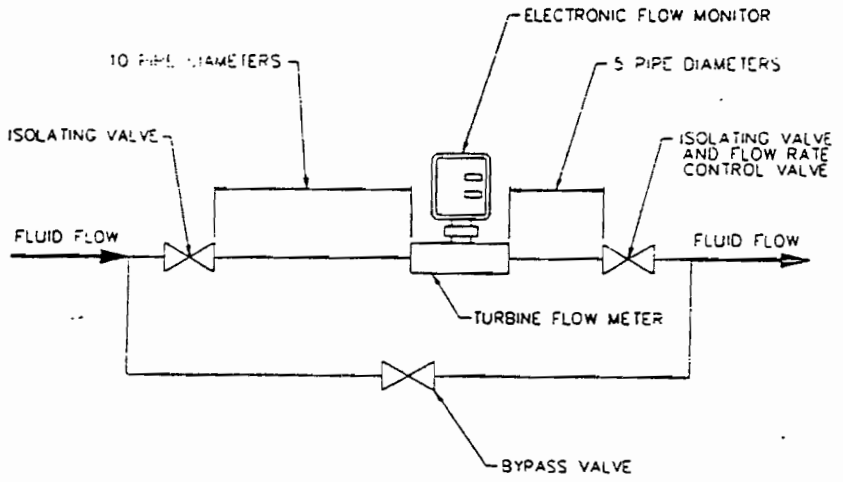



**Fig. 3** Meter installation utilizing a bypass line

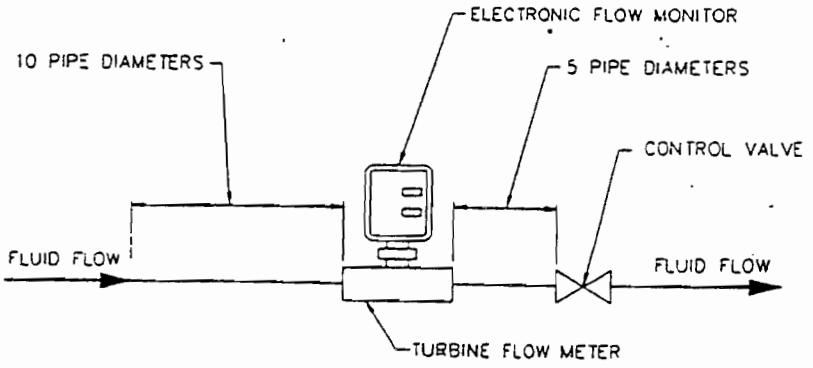



**Fig. 4** Meter installation without utilizing a bypass line

# APPENDIX A

## FLOW RATE AND TOTALIZATION CALIBRATION

The monitor comes from the factory set to the purchaser's specification. However, recalibration would be required when the flow meter is repaired, or when the monitor is used with a different flow meter, or a change in the units of measure is required. Flow rate and totalizer displays do not have to be set in the same units of measure. Recalibration is accomplished by calculating a totalizing time base and then setting 17 binary DIP switches located on the printed circuit board (Fig. 5). The calculated time base is referred to as the scaler, or divisor. The value of the number depends on both the desired totalizing units of measure, e.g. barrels, gallons, liters, cubic meters, etc. and the K-factor of the turbine meter selected for use with the monitor. Once set, this circuit updates the totalizer each time it receives a quantity of input pulses equal to the scaler number. These output pulses increment the totalizer one unit. Thus, the totalizer may represent any unit of measure for any turbine meter. Since the 17 binary DIP switches are binary encoders, the maximum count cannot exceed 131,071 ($\sim 2^{17}$ ).

**Step 1:** The scaler is calculated using two factors. They are the turbine meter's K-factor, which is always expressed in the number of pulses it produces per US gallon of water flowing through it, and the volumetric relationship between US gallons and the desired units of measure for the totalizer display. These factors are used to determine the DIP switch settings. Sample calculations are set forth in the following examples in the event that the factory calibration needs to be changed.

### Calculate Scaler

**Given:** A model B111-115, 1-1/2 inch turbine flow meter with a K-factor of 309.2 per US gallon.

**Find:** The scaler needed to increment the totalizing counter in 42 US gallon barrels.

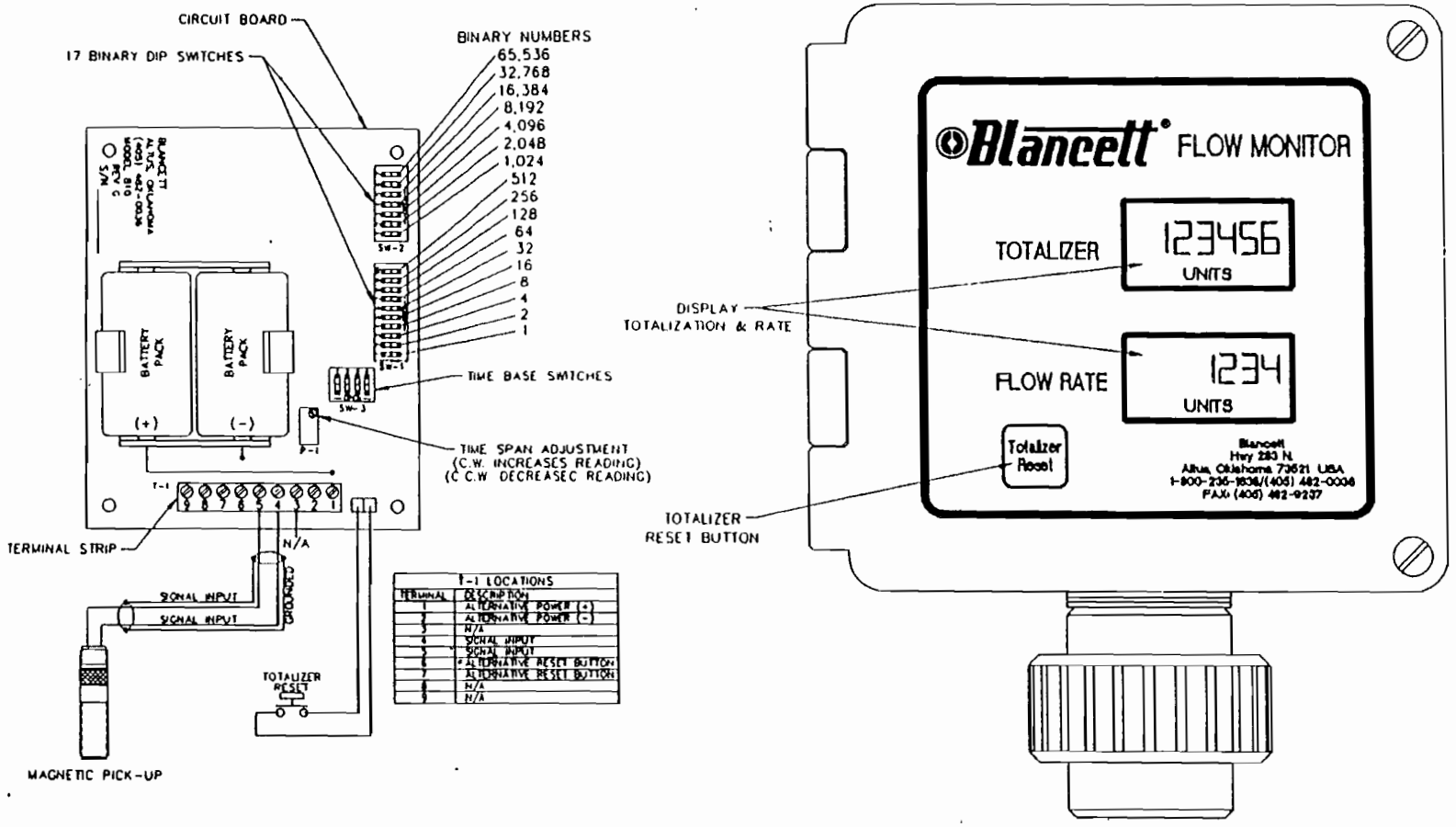
**Calculation:** 309.2 pulses / US gallon X 42 US gallons / barrel = 12,986.4 pulses per barrel, which is rounded off to 12,986 pulses per barrel.

Scalers for other units of measure are calculated in the same manner. The following table contains multipliers for the most common fluid measures.

| FLOW UNITS | MULTIPLIER |
|---|---|
| Barrels, Oil | 42 |
| Cubic Feet | 7.48052 |
| Cubic Meters | 264.17 |
| Imperial Gallons | 1.20095 |
| Liters | 0.26417 |
| US Gallons | 1 |

**Step 2:** The scaler is set by opening or closing the 17 binary DIP switches in a predetermined order. The switches are located on the left hand side of the circuit board shown in Fig. 5. They are arranged in two groups, one containing a ten (10) switch bank (SW-1) and the other containing a seven (7) switch bank (SW-2). Individual switch positions are respectively numbered 1 through 10 and 1 through 7 on the switch body. The open position is labeled on the switch, and is open when depressed toward that side. A switch is closed when it is depressed toward the number side.

To set the scaler, each switch must be individually opened or closed in a certain pattern. The sum of the binary number selected by the closed switch order equals the desired scaler. Fig. 5 shows which binary number is associated with each rocker switch. To determine which switches to close, locate the largest binary number corresponding to a switch that is equal to or less than the required divisor. Subtract that number from the divisor and locate the next largest binary number that is equal to or less than the remainder. Subtract the second number from the remainder and repeat this process until the remainder is zero. The following example demonstrates the method of selecting which switches are to be closed




INSIDE VIEW OF MONITOR
SHOWING ELECTRONIC CONNECTIONS

FRONT VIEW OF MONITOR

**Fig. 5** Inside view of monitor PCB and front view of monitor box

## Setting 17 Position Binary DIP Switches

Find: Switch positions for the divisor of 12,986 calculated in Example 1.

12,986 desired devisor
- 8,192 largest binary number equal or less than divisor - Switch 4 of the 7 switch bank.
4,794

4,794 remainder
- 4,096 largest binary number equal or less than divisor - Switch 3 of the 7 switch bank
698

698 remainder
- 512 largest binary number equal or less than divisor - Switch 10 of the 10 switch bank
186

186 remainder
- 128 largest binary number equal or less than divisor - Switch 8 of the 10 switch bank
58

58 remainder
- 32 largest binary number equal or less than divisor - Switch 6 of the 10 switch bank
26

26 remainder
- 16 largest binary number equal or less than divisor - Switch 5 of the 10 switch bank
10

10 remainder
- 8 largest binary number equal or less than divisor - Switch 4 of the 10 switch bank
2

2 remainder
- 2 largest binary number equal or less than divisor - Switch 2 of the 10 switch bank
0

**The sum of the binary numbers selected should equal the divisor.**
8,192 + 4,096 + 512 + 128 + 32 + 16 + 8 + 2 = 12,986

Close the switch corresponding to each of the binary numbers selected. All the remaining switches must be set to the open position.

**Step 3** The four (4) bank DIP switch, identified as SW-3 in Fig. 5, is used to set the time span range over which the flow pulses are counted for the flow rate display. It also determines if the time base measure will be minutes, hours or days. The switch positions have been predetermined for US gallons per minute (GPM), barrels (42 US gallons) per hour (BPH), barrels (42 US gallons) per day (BPD), cubic meters per day ($M^3PD$) and liters per minute (LPM). These values are shown in Table 2 and Table 3.

## Setting DIP Switch SW-3

Find: The switch positions for SW-3 that will set the flow rate in barrels per hour (BPH) for the model B111-115 flow meter described in Step 1.

Enter Table 2 for BPH and follow down the SW-3 column until the row for flow meter W1115 is reached. The table indicates that switches 2 and 3 are closed and 1 and 4 are open.

**Step 4** The time span range set in Step 3 must now be more closely adjusted. The initial setting is made by adjusting potentiometer P-1 according to the data in Table 2. The potentiometer has an total adjusting range of 25 turns. P-1 must be reset by turning clockwise (cw) until a pop is heard or felt through the screw driver. If it is difficult to determine the fully closed point, then turn the screw at least 25 turns cw. The potentiometer cannot be damaged by over-rotation.

### Set Potentiometer P-1

**Find:** The number of counter clockwise (ccw) turns that should be made to P-1 for the model B111-115 flow meter from Step 1, set to monitor flow in BPH.

Enter the table for BPH and follow down the P-1 column until the row for flow meter W1115 is reached. The table specifies 5 turns. Turn the P-1 adjusting screw cw. until a pop is heard or felt. Turn a full 25 turns if there is any question regarding whether the pop was heard or felt. The adjusting screw must now be turned counter-clockwise (ccw) 5 turns. Count the number of turns carefully. This will position P-1 adjustment within a few turns of its final position. This final adjustment is described in Step 5.

**Step 5** Final calibration of the flow rate is accomplished by further adjustment to P-1. A stop watch or other time piece that produces a reliable, accurate reading and a calculator are needed for this step. The procedure requires that the flow rate be reasonably stable and flowing within the range shown in Table 2. Stable flow is achieved if the flow rate display is constant for 10 seconds. An adjustment to the control valve or downstream isolating valve may be necessary to stabilize flow. The time it takes for the totalizing display to increment one unit is measured to the nearest second. This value, measured in seconds, is then divided into the time base: 60 seconds for a minute; 3,600 seconds for a hour or 86,400 seconds for a day. The result is the actual flow rate through the meter. The flow rate display must now be made to agree with the calculated value. If they do not agree, further fine adjustment to P-1 must be made as described below.

### Final Adjustment of P-1

**Find:** The time, in seconds, for one additional unit to increment on the totalizer display, calculate the actual flow rate and make final adjustment to P-1 so that displayed flow rate is correct. Assume that the time measured between counts on the totalizer display was 31.36 seconds. The flow meter is the model B111-115 flow meter described in Step 1, monitoring flow in barrels per hour (BPH).

The 31.36 second interval must be converted to a flow rate. Since the time span selected in Step 3 was BPH, the number of seconds in an hour (3,600) is divided by the 31.36 second interval:

$$\frac{3{,}600 \text{ sec./min.}}{31.36 \text{ sec/barrel}} = 114.796$$ the flow rate display should be set to read 114.80

Assume that the display actually reads 111.3. Since the calculated, actual value is larger than the display value, P-1 should be turned 1/2 turn cw. Wait at least ten seconds and read the flow rate display again. If the flow rate is still high, turn the adjusting screw another 1/2 turn cw. Repeat as necessary until the display reads exactly the same as the calculated value. A very small rotation of the screw may be required for fine tuning. If the desired flow is passed by, then turn the screw in the opposite direction. Allow at least 10 seconds for the display to stabilize after each adjustment.

If the calculated, actual value is smaller than the display value, P-1 should be turned 1/2 turn counter clockwise (ccw). Continue as previously described until the display reads correctly.

**Table 2.** PCB switch and potentiometer settings for non-metric units of measure.

| Flow Meter | | Gallons per Minute | | | | | | Barrels per Hour | | | | | | Barrels per Day | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | Nominal Range GPM | Display GPM | SW-3 * 1 | 2 | 3 | 4 | P-1 ccw | Display BPH | SW-3 * 1 | 2 | 3 | 4 | P-1 ccw | Display BPD | SW-3 * 1 | 2 | 3 | 4 | P-1 ccw |
| B110-375 | .3 - 3 | .30 - 3.00 | □ | ■ | □ | □ | 24 | .40 - 4.00 | □ | ■ | □ | □ | 24 | 10.0 - 100.0 | □ | □ | ■ | □ | 21 |
| B110600 | .75 - 7.5 | .75 - 7.50 | □ | ■ | □ | □ | 23 | 1.00 - 10.00 | □ | ■ | □ | □ | 17 | 25.0 - 250.0 | □ | □ | ■ | □ | 11 |
| B110-750 | 2 - 15 | 2.00 - 15.00 | □ | ■ | ■ | □ | 14 | 2.85 - 21.42 | ■ | □ | □ | □ | 15 | 68 - 514 | □ | ■ | □ | □ | 12 |
| B110-875 | 3 -30 | 3.00 - 30.00 | ■ | □ | □ | □ | 22 | 4.28 - 42.85 | ■ | □ | □ | □ | 14 | 102 - 1028 | □ | □ | ■ | □ | 11 |
| B111-110 | 5 - 50 | 5.0 - 50.0 | □ | ■ | □ | □ | 14 | 7.0 - 70.0 | □ | □ | ■ | □ | 17 | 170 - 1700 | □ | ■ | ■ | □ | 7 |
| B111-115 B111-121 | 15 - 180 | 15.0 - 180.0 | □ | ■ | ■ | □ | 16 | 21.0 - 250.0 | □ | ■ | ■ | □ | 5 | 51 - 600 X10 | □ | ■ | □ | □ | 13 |
| B111-120 | 40 - 400 | 40 - 400 | □ | □ | ■ | □ | 18 | 54 - 540 | □ | ■ | ■ | □ | 16 | 130 - 1300 X10 | ■ | □ | ■ | □ | 14 |
| B111-130 | 60 - 600 | 60 - 600 | □ | □ | ■ | □ | 20 | 88 - 880 | □ | □ | ■ | □ | 7 | 210 - 2100 X10 | ■ | ■ | □ | □ | 10 |
| B111-140 | 100 - 1200 | 100 - 1200 | ■ | □ | □ | □ | 23 | 142 - 1708 | ■ | □ | □ | □ | 11 | 34 - 410 X100 | □ | ■ | □ | □ | 9 |
| B111-160 | 200 - 2500 | 20 - 250 X10 | □ | □ | ■ | □ | 23 | 28 - 357 X10 | □ | □ | ■ | □ | 13 | 68 - 860 X100 | ■ | □ | □ | □ | 11 |
| B111-180 | 350 - 3500 | 35 - 350 X10 | ■ | □ | □ | □ | 21 | 50 - 500 X10 | ■ | □ | □ | □ | 12 | 12 - 120 X1000 | □ | ■ | □ | □ | 10 |
| B111-200 | 500-5000 | 50 - 500 X10 | ■ | □ | □ | □ | 5 | 71 - 714 X10 | ■ | ■ | ■ | □ | 12 | 17 - 272 X1000 | □ | □ | ■ | □ | 13 |

* ■ Closed □ Open

**Table 3.** PCB switch and potentiometer settings for metric flow units of measure.

| Flow Meter | | Cubic Meters per Day | | | | | | Liters per Minute | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | Nominal Flow Range GPM | Display $M^3PD$ | SW-3 * 1 | 2 | 3 | 4 | P-1 ccw | Display LPM | SW-3 * 1 | 2 | 3 | 4 | P-1 ccw |
| B110-375 | .3 - 3 | 1.60 - 16.00 | □ | □ | ■ | □ | 10 | 1.13 - 11.35 | □ | □ | ■ | □ | 16 |
| B110-500 | .75 - 7.5 | 4.0 - 40.0 | ■ | □ | □ | □ | 19 | 2.83 - 28.38 | □ | □ | ■ | □ | 6 |
| B110-750 | 2 - 15 | 10.9 - 81.7 | □ | □ | ■ | □ | 19 | 7.6 - 56.7 | □ | ■ | □ | □ | 6 |
| B110-875 | 3 -30 | 16.0 - 160.0 | □ | □ | □ | □ | 18 | 11.3 - 113.5 | □ | □ | ■ | □ | 19 |
| B111-110 | 5 - 50 | 27 - 270 | □ | ■ | □ | □ | 21 | 18.9 - 189.2 | □ | ■ | ■ | □ | 8 |
| B111-115 B111-121 | 15 - 180 | 80 - 1000 | □ | □ | ■ | □ | 17 | 56 - 681 | □ | ■ | □ | □ | 11 |
| B111-120 | 40 - 400 | 21 - 210 X10 | □ | ■ | □ | □ | 12 | 151 - 1514 | ■ | □ | ■ | □ | 13 |
| B111-130 | 60 - 600 | 33 - 330 X10 | □ | ■ | □ | □ | 13 | 227 - 2271 | ■ | ■ | □ | □ | 15 |
| B111-140 | 100 - 1200 | 54 - 650 X10 | □ | □ | ■ | □ | 15 | 38 - 454 | □ | ■ | □ | □ | 7 |
| B111-160 | 200 - 2500 | 10 - 140 X100 | □ | ■ | □ | □ | 17 | 76 - 946 X10 | ■ | □ | □ | □ | 11 |
| B111-180 | 350 - 3500 | 19 - 190 X100 | □ | □ | ■ | □ | 19 | 13 - 132 X100 | ■ | □ | □ | □ | 7 |
| B111-200 | 500-5000 | 27 - 272 X100 | ■ | □ | □ | □ | 16 | 19 - 189 X100 | □ | □ | ■ | □ | 11 |

* ■ Closed □ Open

# APPENDIX B

## TROUBLE SHOOTING GUIDE

| TROUBLE | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Meter indicates higher than actual flow rate | Cavitation | Increase back pressure |
| | Debris on rotor support | Clean meter |
| | Build up of foreign material on meter bore. | Clean meter |
| | Gas in liquid | Install gas eliminator ahead of meter |
| Meter indicates lower than actual flow rate | Debris on rotor | Clean meter and add filter |
| | Worn bearing | Clean meter and add filter |
| | Viscosity higher than calibrated | Recalibrate monitor ( Appendix A ) |
| Erratic system indication, meter alone works well ( remote monitor application only) | Ground loop in shielding | Ground shield one place only. Look for internal electronic instrument ground. Reroute cables away from electrical noise. |
| Indicator shows flow when shut off. | Mechanical vibration causes rotor to oscillate without turning | Isolate meter |
| No flow indication. Full or partial open position | Fluid shock, full flow into dry meter or impact caused bearing separation or broken rotor shaft. | Rebuild meter with repair kit and recalibrate monitor. Move to location where meter is full on start-up or add downstream flow control valve. |
| Erratic indication at low flow, good indication at high flow | Rotor has foreign material wrapped around it. | Clean meter and add filter |
| No flow indication | Faulty pick-up | Replace pick-up. |
| System works perfect, except indicates lower flow over entire range | Bypass flow, leak | Repair or replace bypass valves, or faulty solenoid valves. |
| Meter indicating high flow, upstream piping at meter smaller than meter bore | Fluid jet impingement on rotor. | Change piping. |

# APPENDIX C
## REPAIR KIT INFORMATION

| Flow Meter Size | Repair Kit Fits Meter Model No. | Repair Kit Fits Meter Part No. | Repair Kit Part Number |
|---|---|---|---|
| 3/8" | W11.375 | B110-375 | B251-103 |
| 1/2" | W11.500 | B110-500 | B251-105 |
| 3/4" | W11.750 | B110-750 | B251-108 |
| 7/8" | W11.875 | B110-875 | B251-109 |
| 1" | W1110 | B111-110 | B251-112 |
| 1-1/2" | W1115 | B111-115 | B251-116 |
| 2" Low | W1121 | B111-121 | B251-116 |
| 2" | W1120 | B111-120 | B251-120 |
| 3" | W1130 | B111-130 | B251-131 |
| 4" | W1140 | B111-140 | B251-141 |
| 6" | W1160 | B111-160 | B251-161 |
| 8" | W1180 | B111-180 | B251-181 |
| 10" | W1200 | B111-200 | B251-200 |
| Standard Magnetic Pick-up | All Meter Sizes | All Meter Sizes | B111109 |

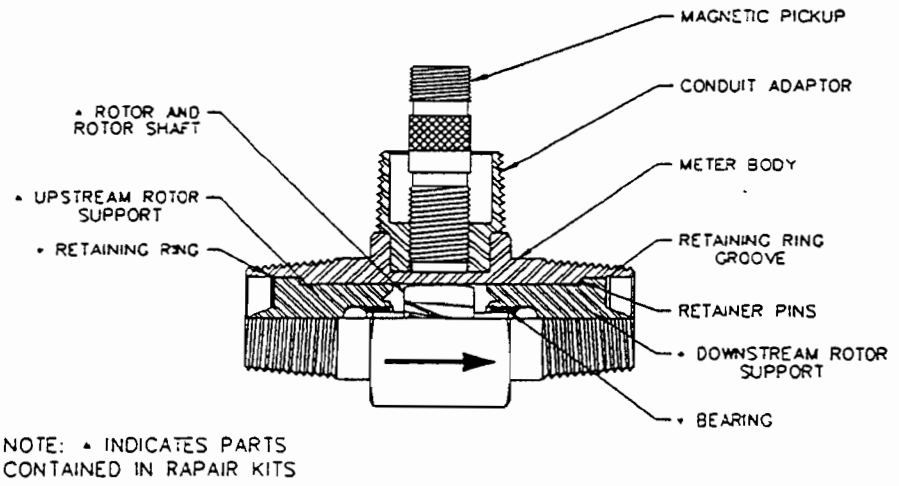
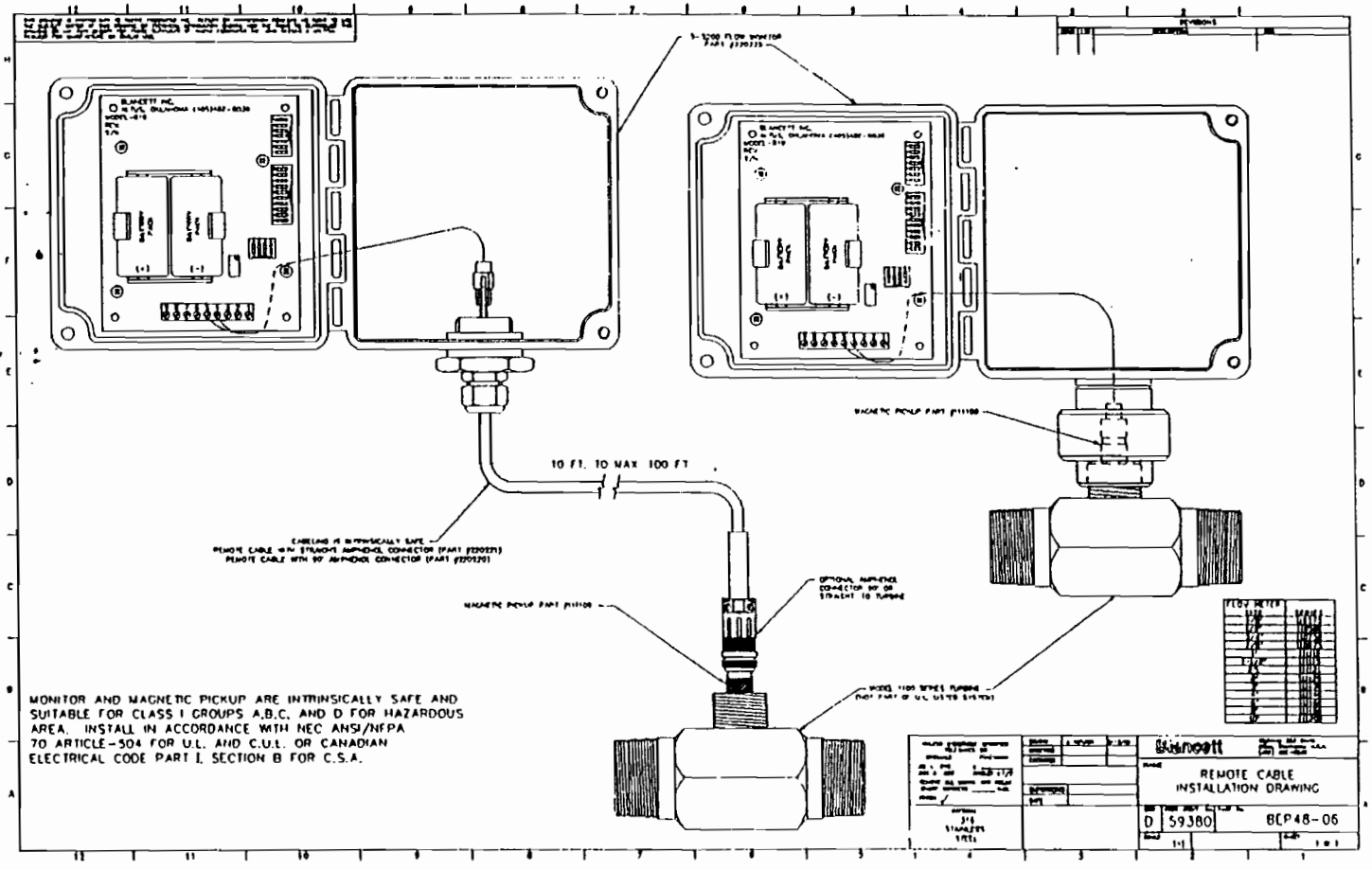



**Fig. 6** Cross sectional view of a typical turbine flow meter

**CAUTION: Always reassemble rotor supports, rotor, and meter body are all marked with flow arrows, which must all point in the same direction.**

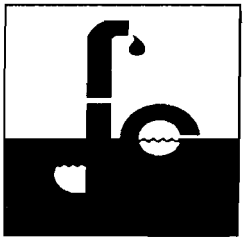
Note:
UL is a registered trademark of Underwriters Laboratories
Blancett is a registered trademark of Racine Federated Inc.

# Appendix D


10 FT. TO MAX 100 FT
MONITOR AND MAGNETIC PICKUP ARE INTRINSICALLY SAFE AND SUITABLE FOR CLASS I GROUPS A,B,C, AND D FOR HAZARDOUS AREA. INSTALL IN ACCORDANCE WITH NEC ANSI/NFPA 70 ARTICLE-504 FOR U.L. AND C.U.L. OR CANADIAN ELECTRICAL CODE PART I, SECTION 18 FOR C.S.A.
Barnett
REMOTE CABLE INSTALLATION DRAWING
D 59380
BCP48-06

# Instrumentation

DRC # 6154



**DIVERSIFIED REMEDIATION & CONTROLS**

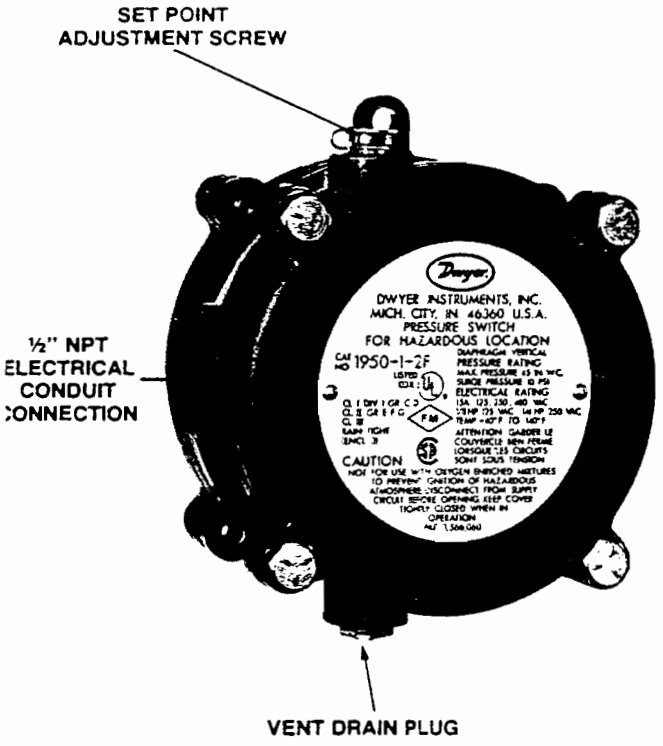
21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660

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.

**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.

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.

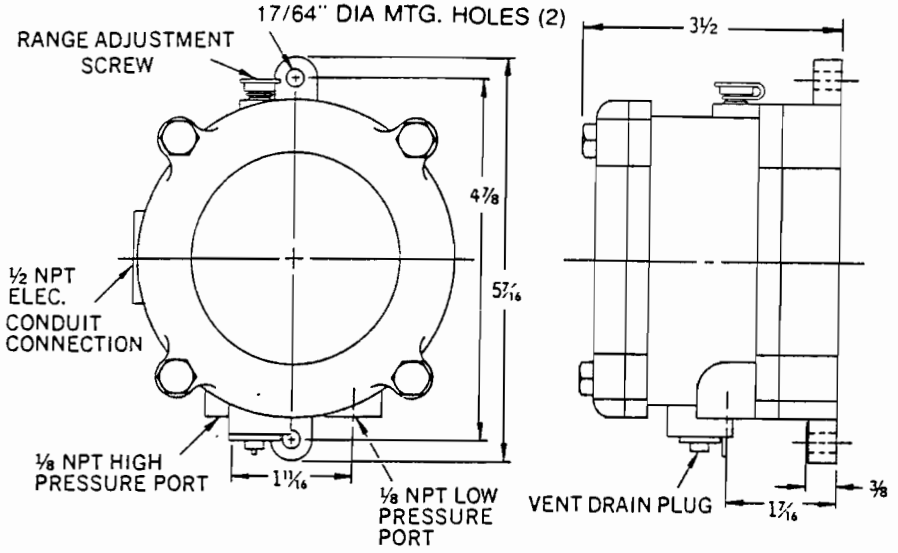
The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

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.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Phone 219/879-8000
Fax 219/872-9057

# 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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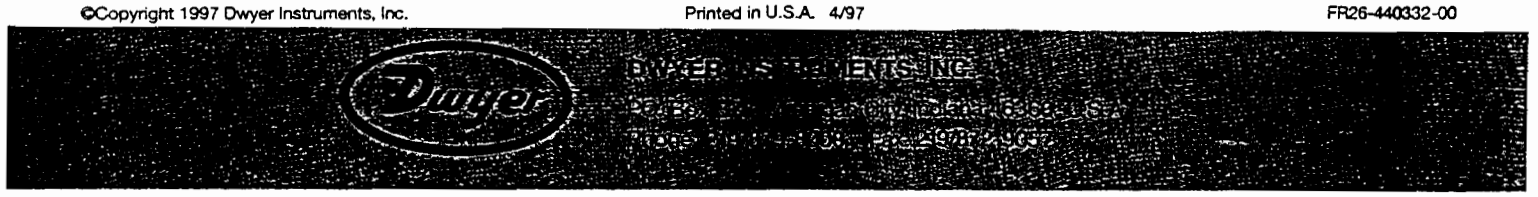
FR26-440332-00



# Installation & Maintenance Sheet Supplement for CE mark on Ashcroft® switches Low Voltage Directive 73/23/EEC

## Installation requirements

- To minimize the risk of injury, the switch enclosure must be selected according to the area classification and installed according to the required safety and electrical codes.
- Before operating the switch all conduit entries and/or junction boxes need to be closed according to the required safety and electrical codes.
- To attain the degree of protection listed on the switch it may be necessary to add required conduit fittings.
- The switch must be protected from moisture, shock and/or extreme vibration.
- The ambient temperature limits for switches are -20 to 150°F, (-28 to 65°C).

## Cautions

- Always install the cover after wiring the switch and before power is supplied.
- Before removing the cover in hazardous areas be sure there is no explosive atmosphere present and the power supply is turned off.
- For CENELEC approved switches all safety locking devices and electrical earthing must be installed or connected before operating.
- Never carry a temperature switch by holding only the stem, bulb or capillary.
- Do not exceed ranges, current and/or voltage limits.
- The protection degree of the switch is only valid when the switch is installed in accordance with all safety and electrical codes and regulations.

## Cleaning

- Never use aggressive solvents.
- Do not use high pressure water to clean the switch.

## Maintenance / Trouble shooting

- All Ashcroft switches require little or no maintenance.
- Be sure that the case is closed at all times.
- When the switch is exposed to process media that may harden and/or build up in the pressure port, the switch should be removed and cleaned as needed.
- If the switch does not function, only trained and skilled personnel should check on the wiring, power supply and/or mounting.
- If the problem can not be solved, please contact one of the Dresser affiliates or distributors.

## Electrical connections

- Only trained and skilled personnel are allowed to install the wires to the electrical terminals of the switch.
- Cable couplers, glands and conduit connectors must have the correct electrical approvals.
- Always follow safety and electrical regulations when connecting these devices.
- The system ground of the device is marked with a green colored screw and/or by the ground symbol.
- CENELEC approved switches have an external ground screw that must be connected.
- Micro switch terminals and wire color codes:

  **NO** (Normally Open), blue
  **NC** (Normally Closed), red
  **C** (Common), white
  Ground, green (F-Series only)

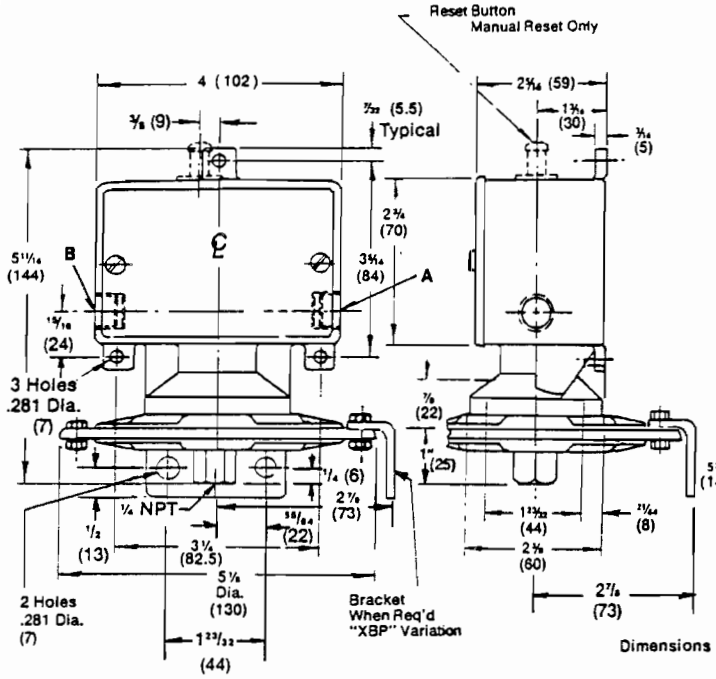
Table 1: Micro switch electrical ratings

| Micro Switch Code | | | | Electrical Rating | |
|---|---|---|---|---|---|
| Single | Dual | Single | Dual | Vac | Vdc |
| K | KK | 20 | 61 | 15A, 250V | 0.4A, 120V |
| W | WW | 21 | 65 | 5A, 250V | |
| P | PP | 22 | 67 | 5A, 250V | 2.5A, 28V |
| C | n/a | 23 | n/a | 22A, 250V | |
| G | GG | 24 | 64 | 15A, 480V | 0.25A, 250V |
| S | N/A | 25 | n/a | 10A, 250V | 10A, 250V |
| F | FF | 26 | 62 | 15A, 250V | 0.4A, 120V |
| Y | YY | 27 | 63 | 15A, 250V | |
| U | UU | 28 | n/a | 15A, 250V | |
| E | EE | 29 | n/a | 15A, 250V | |
| M | MM | 31 | 70 | 1A, 250V | 50mA, 60V |
| J | JJ | 32 | 68 | 11A, 250V | 5A, 30V |
| L | LL | 42 | 71 | 1A, 125V | |
| n/a | n/a | 50 | n/a | 15A, 250V | |
| H | HH | 35 | n/a | 10A, 250V | 0.3A, 250V |

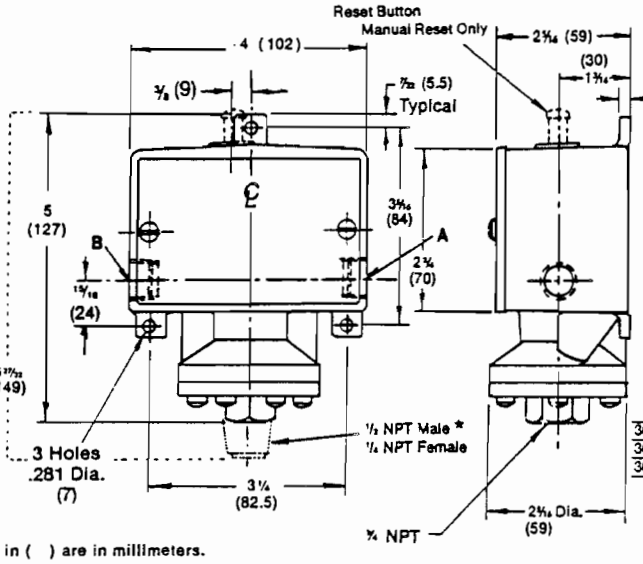
# INSTALLATION AND MAINTENANCE B400 & B700 SERIES
# ASHCROFT® SNAP ACTION SWITCHES FOR PRESSURE CONTROL

| HOLE | TYPE | |
|---|---|---|
| | STANDARD B400 | VARIATION XJK |
| A | ¼ NPT | ¼ NPT |
| B | OMIT | ¼ NPT |

## B400




Ranges: 10, 30, 60, 100 & 150" Water



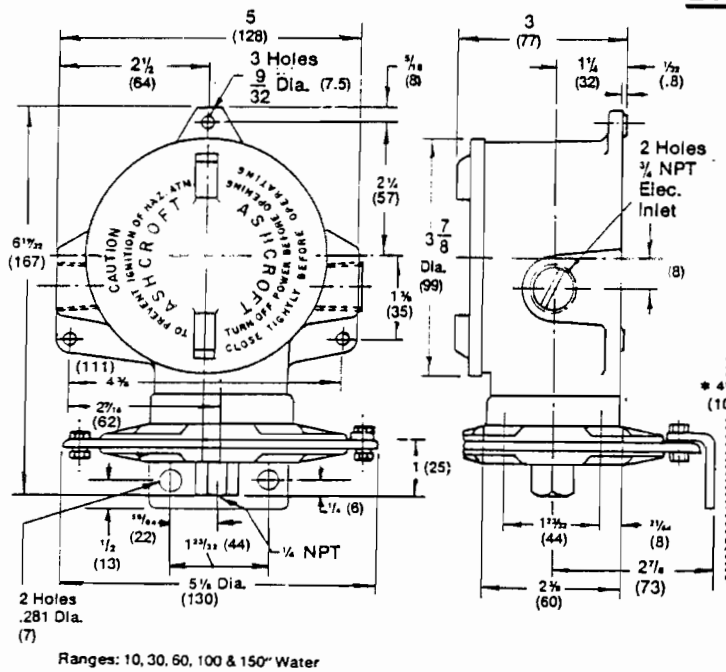

| Standard Ranges P.S.I. |
|---|
| 0/15 |
| 0/20 |
| 0/30 |
| 0/60 |
| 0/100 |
| 0/200 |
| 0/400 |
| 0/600 |
| * 0/1000 |
| * 0/3000 |

| Vacuum Std. Ranges |
|---|
| 30" Hg VAC. 15 P.S.I. |
| 30" Hg VAC. 30 P.S.I. |
| 30" Hg VAC. 60 P.S.I. |

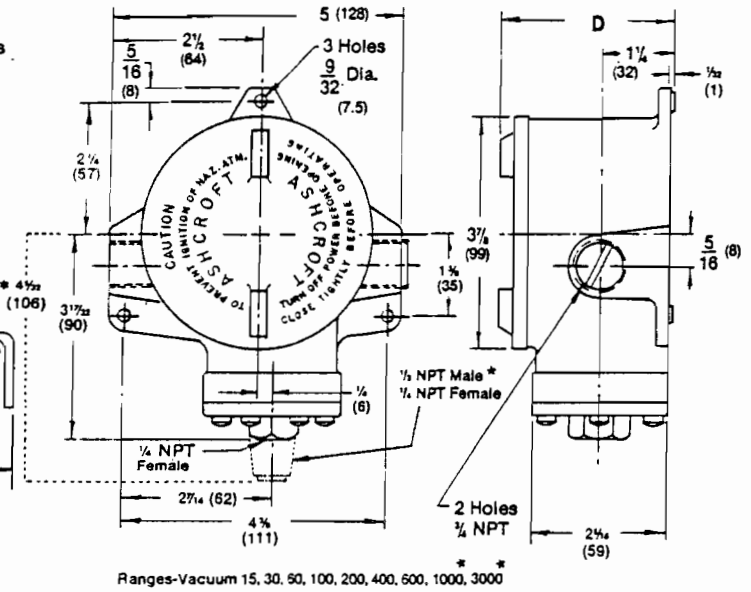
Dimensions in ( ) are in millimeters.

## B700

| TYPE | "D" DIM. |
|---|---|
| SPDT | 3 (76) |
| 2-SPDT | 3⅞ (99) |




Ranges: 10, 30, 60, 100 & 150" Water




Ranges-Vacuum 15, 30, 60, 100, 200, 400, 600, 1000, 3000

Dimensions in ( ) are in millimeters.

## INTRODUCTION

The Ashcroft pressure switch is a precision built U.L. and F.M. approved control device which features a mechanical snap action switch. Controllers are available for operation on pressure or vacuum with fixed or variable differential. Also manual reset types for operation on increasing or decreasing pressure. The manual reset types remain tripped until reset by pressing a button on top of the enclosure. Standard electrical switch is SPDT, available with various electrical characteristics. Two SPDT switch elements mounted together are available except on variable Deadband and manual reset types. Various wetted material constructions for compatibility with a range of pressure media may be obtained.

The Ashcroft snap action pressure switch is furnished in the standard NEMA 4 and explosion-proof NEMA 7 & 9 enclosure styles. Both enclosures are epoxy coated aluminum castings.

## INSTALLATION

These controls are precision instruments and should never be left with internal components exposed. During installation insure that covers are in place and conduit openings are closed except when actually working on the control.

## MOUNTING B400 AND B700 SERIES

Three holes external to the enclosure for surface mounting. Location of these holes is shown on the general dimension drawing. They may also be mounted directly on pressure line using the pressure connection. **When tightening control to pressure line, always use the wrench flats or hex on the lower housing.**

## ELECTRICAL CONNECTIONS

Remove cover
B400 Series — two screws hold cover to enclosure
B700 Series — cover unscrews

## CONDUIT CONNECTIONS

NOTE — It is recommended that Teflon tape or other sealant be used on conduit, bushing or plug threads to ensure integrity of the enclosure.

B400 series standard — one ¾" NPT conduit hole right side.

B700 series standard — two ¾" NPT conduit holes with one permanent plug. NEMA 7 & 9 enclosures require proper conduit seals and breathers as per the National Electrical Code.

B400 & B700 series — XJL variation — two ¾" NPT conduit holes with two ¾" to ½" NPT reducing bushings.

B400 series — XJK variation — two ¾" NPT conduit holes.

## B400 SERIES

**SPDT** — Wire directly to the switch according to circuit requirements. On controls with pilot lights wire lights according to circuit diagram on inside of cover. See special wiring instruction tag for single switches with two pilot lights and dual switches with one or more lights.

**2-SPDT** — Dual switching elements consist of two SPDT switches mounted together in a bracket. Switches are calibrated to have simultaneous operation within 1% of range either on increasing or decreasing pressure but not in both directions. Wire directly to the front and rear switch according to circuit requirements. Leads are provided on rear switch color coded as follows:

| | |
|---|---|
| Common | — White |
| Normally Closed | — Red |
| Normally Open | — Blue |

See SPDT instructions for pilot light hook-up.

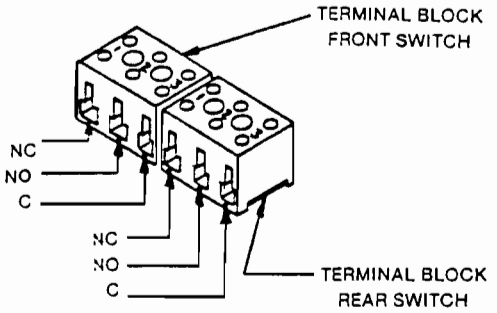
When hermetically sealed switch elements (s) are supplied, the lead color coding is as follows:

| | |
|---|---|
| Common | — White |
| Normally Closed | — Red |
| Normally Open | — Blue |

## B700 SERIES

**SPDT** — Wire directly to the switch according to circuit requirements.

**2-SPDT** — Wire to front switch terminal block (left) and rear switch terminal block (right) as marked. Strip insulation 5/16", insert in proper terminal connector and tighten clamping screw to secure.




## ADJUSTMENT OF SET POINT

B400 & B700 Series — A single set point adjustment nut (7/8") is located centrally at the bottom on the inside of the enclosure.

For accurate set point calibration, mount the switch on a calibration stand, a pump or catalog No. 1305 deadweight gauge tester. A suitable reference standard such as an Ashcroft Duragauge or Test Gauge is necessary to observe convenient changes in pressure.

As received, the pressure switch will normally be set to approximately 90% of the indicated range. Pressurize the system to required set point and turn the adjustment nut until switch changes mode. Direction of turning is indicated on a label affixed to the inside of the control enclosure. When set point has been achieved raise and lower pressure to insure that set point is correct.

After installation of the control replace cover to insure electrical safety and to protect internal parts from the environment.

## B450 and B750 VARIABLE DEADBAND SWITCHES

Deadband is varied by rotating the wheel on the precision switch. When viewed from the front of the enclosure, rotation to the left increases deadband—rotation to the right decreases deadband. Letters on the wheel may be used as a reference. Deadbands obtainable will vary from 0.5% to 9% of pressure range depending on range segment and type of diaphragm.

## ADJUSTMENT OF SET POINT

As received, the pressure switch will normally be set to approximately 90% of range. Rotate the wheel on the MICRO SWITCH all the way to the right; this will provide smallest deadband. Pressurize the system to the required set point and turn the adjustment nut until the switch changes mode. Lower the pressure to reset the switch. Rotate the wheel on the MICRO SWITCH until the desired deadband is obtained. The upper set point will be changing upward with this adjustment. Lower the pressure to reset the switch. Then increase the pressure to the desired set point and turn the adjusting nut until the switch changes mode. Lower the pressure and check reset point and deadband.

**NOTE**—As indicated above, adjustment of set point is made by use of 7/8" nut. Precision switch element mounting screws and bracket adjusting screw are factory sealed and should not be tampered with.

DRESSER INSTRUMENT

INSTRUMENT DIVISION
DRESSER EQUIPMENT GROUP, INC.
MILFORD, CONNECTICUT 06460
PHONE: 203-878-5641 • FAX: 203-877-8519

Form No. 250-2246-E

Printed in U.S.A.

# Installation & Maintenance Instructions

2-WAY INTERNAL PILOT-OPERATED SOLENOID VALVES

NORMALLY CLOSED OPERATION - 3/4", 1", 1-1/4", 1-1/2" OR 2" NPT

SERIES

8215

Form No.V5996R3

**IMPORTANT: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Causes of Improper Operation, and Coil Replacement.**

## DESCRIPTION

Series 8215 valves are 2-way normally closed internal pilot-operated solenoid valves. Valve bodies are made of rugged aluminum with trim and internal parts made of steel and stainless steel. Series 8215 valves may be provided with a general purpose or explosionproof solenoid enclosure.

## OPERATION

**Normally Closed:** Valve is closed when solenoid is de-energized; open when energized.

**Note: No minimum operating pressure differential required.**

## INSTALLATION

**⚠ CAUTION: Not all valves are approved for fuel gas service. Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.**

### Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

### Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number prefix on nameplate to determine maximum temperatures.

| Construction | Coil Class | Catalog Number Prefix | Max. Ambient Temp°F | Max. Fluid Temp°F |
|---|---|---|---|---|
| AC Construction | F | FT | 125 | 125 |
| | H | HT | 140 | 140 |
| DC Construction | B or H | None or HT | 77 | 77 |

*Dupont's Registered Trademark

### Positioning

Valve must be mounted with solenoid vertical and upright.

### Piping

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

**⚠ CAUTION: To avoid damage to the valve body, DO NOT OVERTIGHTEN PIPE CONNECTIONS. If Teflon* tape, paste, spray or similar lubricant is used, use extra care when tightening due to reduced friction.**

**IMPORTANT: To protect the solenoid valve, install a strainer or filter, suitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.**

## MAINTENANCE

**⚠ WARNING: To prevent the possibility of severe personal injury or property damage, turn off electrical power, depressurize valve, extinguish all open flames and avoid any type of sparking or ignition. Vent hazardous or combustible fluid to a safe area before servicing the valve.**

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

### Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean valve strainer or filter when cleaning the valve.

## Preventive Maintenance

- Keep the medium flowing through the valve as free from dirt and foreign material as possible.
- While in service, the valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

## Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

## Valve Disassembly

**⚠ WARNING: To prevent the possibility of severe personal injury or property damage, turn off electrical power, depressurize valve, extinguish all open flames and avoid any type of sparking or ignition. Vent hazardous or combustible fluid to a safe area before servicing the valve.**

NOTE: Determine valve construction AC (Figure 1 on page 4) or DC (Figure 2 on page 4) then proceed as follows:

1. Remove solenoid enclosure, see separate installation and maintenance instructions.
2. For AC Construction, unscrew solenoid base sub-assembly. For DC Construction, unscrew solenoid base sub-assembly with special wrench adapter provided in ASCO Rebuild Kit. For wrench adapter only, order kit No.K218-949. NOTE: For alternate type open end wrench, order kit No.K168-146-1 which is available for solenoid base sub-assembly removal or replacement.
3. Remove bonnet screws, valve bonnet, bonnet gasket, core/diaphragm sub-assembly and body gasket.
4. All parts are now accessible to clean or replace. If parts are worn or damaged, install a complete ASCO Rebuild kit.

## Valve Reassembly

1. Lubricate bonnet gasket and body gasket with a light coat of DOW CORNING® 200 Fluid lubricant or an equivalent high-grade silicone fluid.
2. Apply a light coat of RemGrit TFL 50® Dry Lubricant to:
   - Valve seat
   - Valve body flange where diaphragm assembly contacts the valve body and body gasket.
   - Internal surface of valve bonnet where diaphragm assembly contacts bonnet when valve is in the energized (open position).

**IMPORTANT: If valve has been disassembled for inspection and cleaning only and a Rebuild Kit is not being installed, lubricate the following with RemGrit TFL 50® Dry Lubricant:**

- Diaphragm assembly on both sides.
- Main disc at base of core/diaphragm sub-assembly.
- Pilot disc at base of core assembly.

**⚠ CAUTION: Do not distort hanger spring between core assembly and diaphragm assembly when lubricating pilot disc.**

3. Replace body gasket and core/diaphragm sub-assembly with closing spring attached. Locate bleed hole in core/diaphragm sub-assembly approximately 30° from the valve inlet.
4. Replace valve bonnet and bonnet screws (6). Torque screws in a crisscross manner to 100 ± 10 in-lbs [11,3 ± 1,1 Nm].
5. For AC construction, replace bonnet gasket and solenoid base sub-assembly. For DC construction refer to separate "Solenoid Installation and Maintenance Instructions" for lubrication instructions; then install bonnet gasket, housing and solenoid base sub-assembly. Torque solenoid base sub-assembly to 175 ± 25 in-lbs [19,8 ± 2,8 Nm].
6. Replace solenoid (see separate instructions) and make electrical hookup.

**⚠ WARNING: To prevent the possibility of severe personal injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.**

7. Restore line pressure and electrical power supply to valve.
8. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* signifies the solenoid is operating.

### ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded views are supplied in Rebuild Kits.

• When Ordering Rebuild Kits for ASCO Valves, order the Rebuild Kit number stamped on the valve nameplate.+

+ If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

## Torque Chart

| Part Name | Torque Value In Inch-Pounds | Torque Value In Newton-Meters |
|---|---|---|
| Solenoid Base Sub-Assembly | 175 ± 25 | 19,8 ± 2,8 |
| Bonnet Screws | 100 ± 10 | 11,3 ±1,1 |

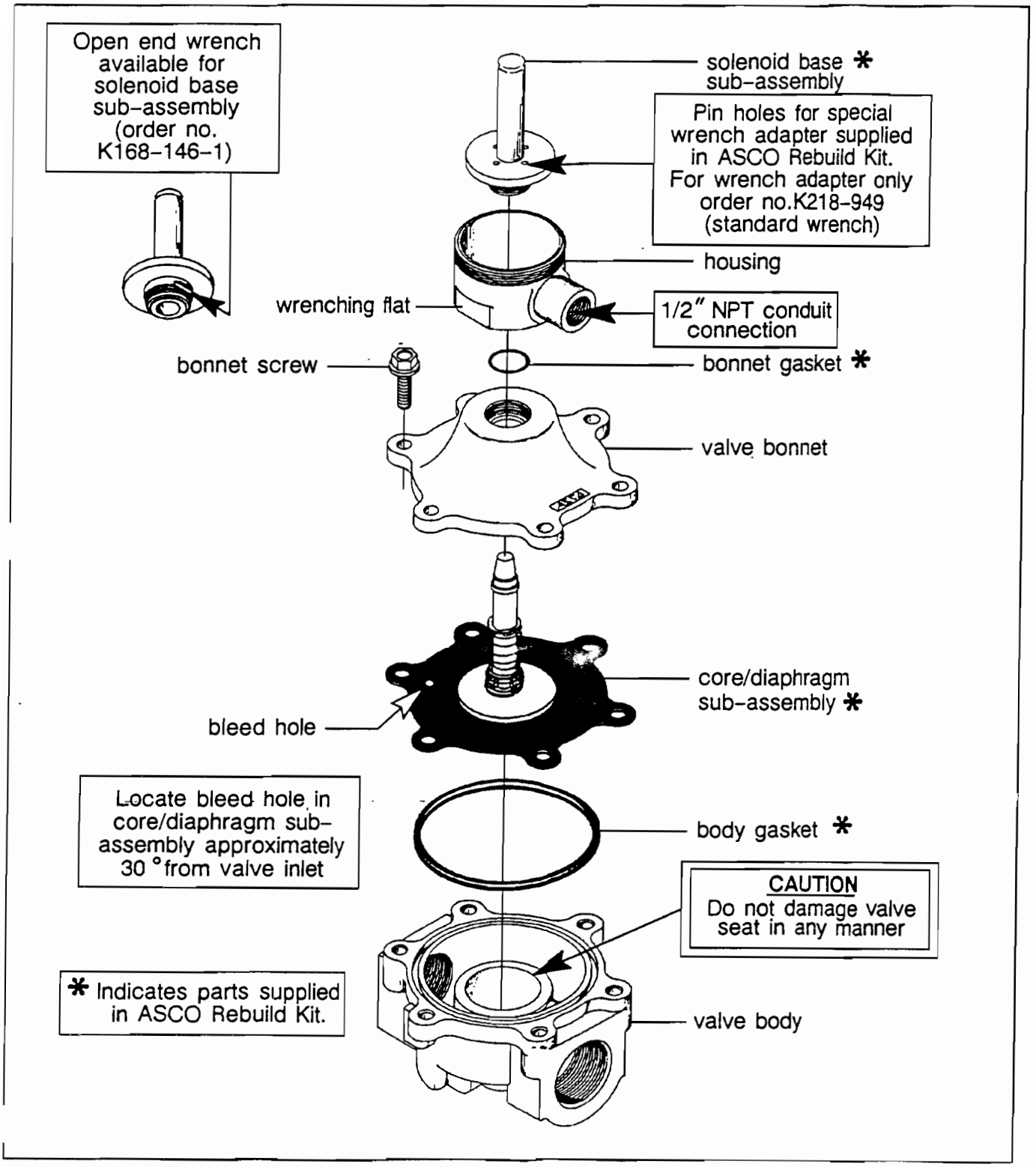



Figure 2. Series 8215 valves without solenoid, DC Construction.

## Torque Chart

| Part Name | Torque Value in Inch-Pounds | Torque Value in Newton-Meters |
|---|---|---|
| Solenoid Base Sub-Assembly | 175 ± 25 | 19,8 ± 2,8 |
| Bonnet Screws | 100 ± 10 | 11,3 ±1,1 |

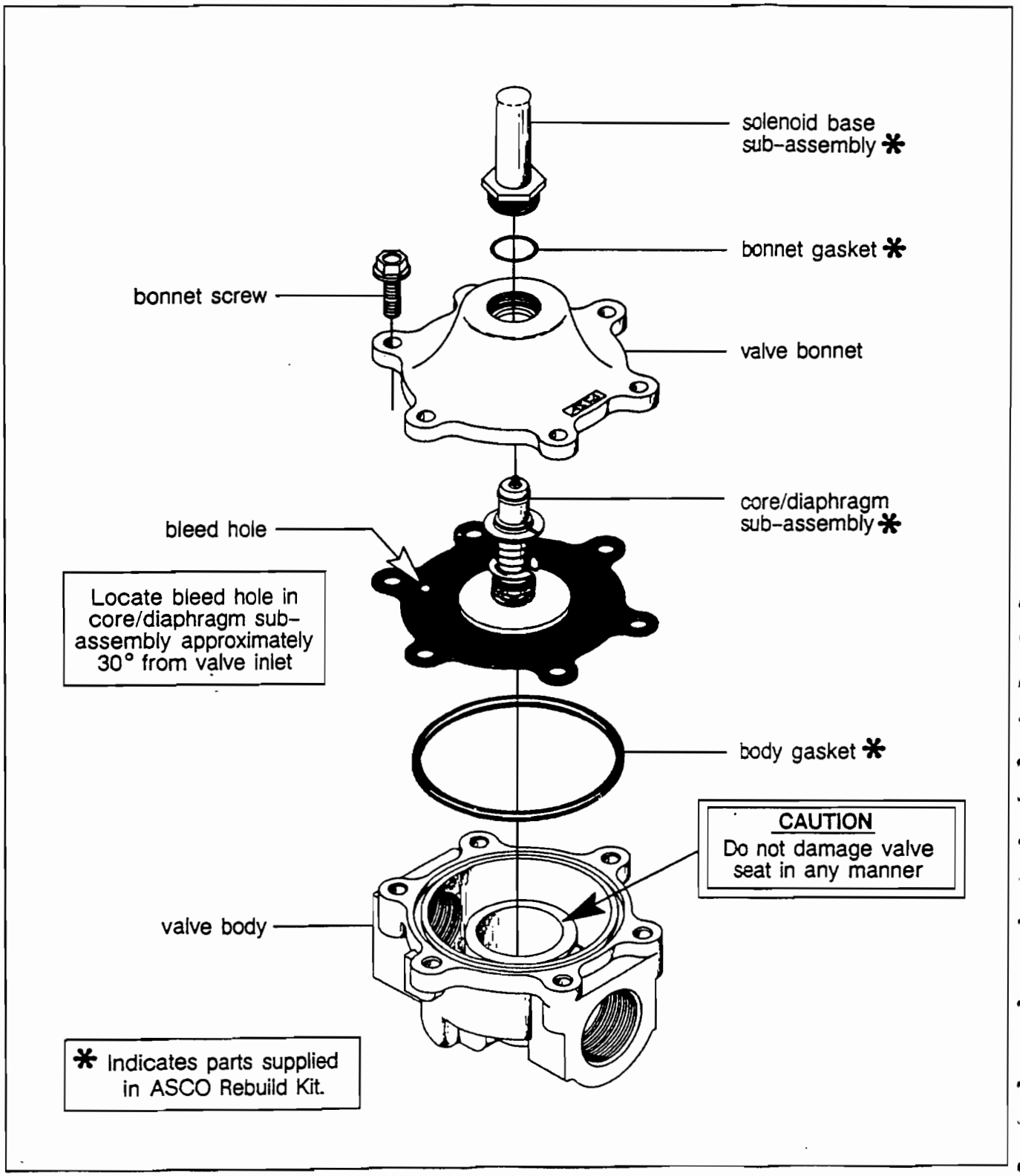



Figure 1. Series 8215 valves without solenoid, AC Construction.

# Installation & Maintenance Instructions

## GENERAL PURPOSE AND RAINTIGHT/WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

SERIES 8017

Form No.V5381R6

IMPORTANT: **See separate valve installation and maintenance instructions for information on: Operation, Positioning, Mounting, Cleaning, Preventive Maintenance, Causes of Improper Operation, Disassembly and Reassembly of basic valve.**

## DESCRIPTION

Solenoid Catalog Numbers 80171 and 80172 have a Type 1, General Purpose Solenoid Enclosure. Solenoid Catalog Numbers EF80171, EF80172, 80173, and 80174 meet the requirements of Enclosure Type 3 – Raintight, Type 7 (C & D) Explosionproof, and Type 9 (E, F, & G) Dust – Ignitionproof. When constructed with a cover gasket and solenoid bonnet gasket they also meet the requirement of Enclosure Type 4 – Watertight. Series 8017 solenoids (when installed as a solenoid and not as part of an ASCO valve) are supplied with a core which has a 0.250–28 UNF–2B tapped hole, with 0.38 inch minimum full thread.

## OPERATION

When the solenoid is energized, the core is drawn into the solenoid base sub–assembly.

IMPORTANT: **When the solenoid is de–energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 1 pound, 12 ounces and 5 ounces for DC construction.**

## INSTALLATION

Check nameplate for correct catalog number, voltage, frequency, wattage, and service.

### Enclosure Types 3, 4, 7, and 9

⚠ CAUTION: **To prevent fire or explosion, do not install solenoid enclosure and/or valve where ignition temperature of hazardous atmosphere is less than 160° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180°C. See nameplate for service.**

### Enclosure Types 3,4,7, and 9 Used in –40°C Ambient Temperature Applications

⚠ **WARNING: To prevent fire or explosion, use only conduit runs 1/2" in size with a sealing fitting connected within 3 feet of the solenoid enclosure.**

IMPORTANT: **To protect the solenoid operator or valve, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions.**

**Positioning**

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

**Wiring**

Wiring must comply with local codes and the National Electrical Code.

⚠ CAUTION: **Do not use the solenoid enclosure as a splice box.**

The general purpose solenoid housing has a 7/8" diameter hole to accommodate 1/2" conduit. To facilitate wiring, the general purpose solenoid enclosure may be rotated 360° by removing the retaining cap or clip.

⚠ CAUTION: **When metal retaining clip disengages, it will spring upward.**

Rotate solenoid enclosure to desired position. Then replace retaining cap or clip before operating. On some solenoids, a grounding wire which is green or green with yellow stripes is provided. Use rigid metallic conduit to ground all enclosures not provided with a green grounding wire. For the raintight/watertight/ explosionproof solenoid enclosure, electrical fittings must be approved for use in hazardous locations. This enclosure has a 1/2" conduit connection and may be rotated 360° to facilitate wiring.

⚠ **WARNING: To prevent the possibility of personal injury or property damage from accidental disengagement of solenoid from valve body, hold housing securely by wrenching flats while removing or replacing housing cover.**

To rotate enclosure, loosen housing cover using a 1" socket wrench. Two wrenching flats are provided on the housing to hold it securely in place while the cover is being loosened or tightened. Rotate housing to desired position and tighten cover before operating. Torque cover to 135 ± 15 in–lbs [15,3 ± 1,7 Nm].

NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it is necessary to change the complete solenoid including the core and solenoid base sub–assembly, not just the coil. Consult ASCO.

**Solenoid Enclosure Assembly**

Solenoid Catalog Numbers 80171 and 80172 may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid enclosure.

Solenoid Catalog Numbers EF80171, EF80172, 80173, and 80174 must be assembled in the following manner:

1. The solenoid enclosure must be completely disassembled. For disassembly, see the instructions given in ***Coil Replacement*** section.
2. After disassembly, the solenoid base sub–assembly is placed inside the housing over the assembly location.
3. The assembly is then tightened in place by means of two (2) slots in the bonnet adjacent to the tube on the solenoid base sub–assembly. Use special adapter wrench provided with solenoid. For ASCO wrench kit only, Order No.K218950. Exercise care during tightening procedure to prevent deforming or raising of bonnet surface adjacent to slots.
4. Reassemble solenoid, follow instructions in ***Coil Replacement*** section.

**Solenoid Temperature**

Standard solenoids are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched by hand only for an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

## MAINTENANCE

⚠ **WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize solenoid operator or valve, and vent fluid to a safe area before servicing.**

**Cleaning**

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

**Preventive Maintenance**

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to ensure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any parts that are worn or damaged.

**Causes of Improper Operation**

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded coil, broken lead wires or splice connections.
- **Burned-Out Coil:** Check for open-circuited coil. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate and as marked on the coil.
- **Low Voltage:** Check voltage across the coil leads. Voltage must be at least 85% of nameplate rating.

**Coil Replacement for Solenoid Catalog Numbers 80171 and 80172 General Purpose Enclosure**

1. Disconnect coil lead wires and grounding wire if present.
2. Remove retaining cap or clip from top of solenoid.

⚠ **CAUTION: When metal retaining clip disengages, it will spring upward.**

3. Remove nameplate (if present), cover, and spring washer (alternate construction only).
4. For AC construction, slip yoke containing coil, sleeves, insulating washers, and grounding wire (if present,) off solenoid base sub-assembly. For DC construction, slip grounding wire (if present), flux washer and coil off the solenoid base sub-assembly.
   NOTE: Insulating washers are omitted when a molded coil is used.
5. Coil is now accessible for replacement.

⚠ **CAUTION: Solenoid must be fully reassembled because the housing and internal parts complete the magnetic circuit. Place an insulating washer at each end of non-molded coil.**

**Coil Replacement for Solenoid Catalog Numbers EF80171, EF80172, 80173, and 80174 Raintight/ Watertight/Explosionproof Enclosure**

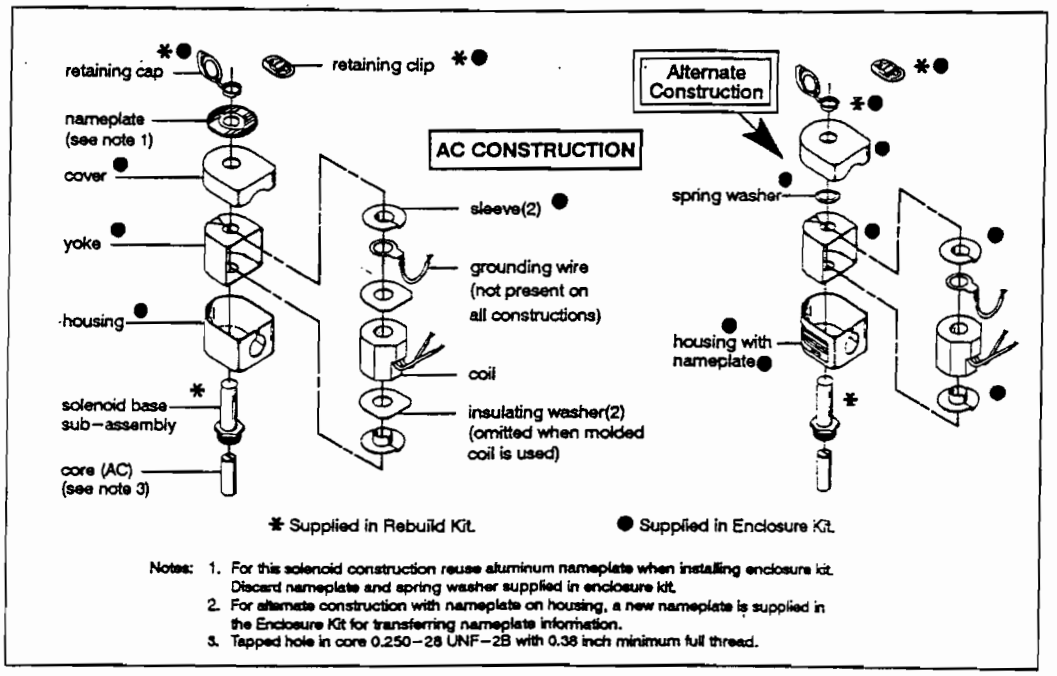
1. Disconnect coil lead wires and grounding wire if present.

⚠ **WARNING: To prevent the possibility of personal injury or property damage from accidental disengagement of solenoid from valve body, hold housing securely by wrenching flats while removing or replacing housing cover.**

2. Unscrew housing cover with cover gasket and nameplate attached. Two wrenching flats are provided to hold the housing securely in place while the cover is being loosened or tightened.
   NOTE: Some older solenoid constructions do not have a cover gasket or solenoid bonnet gasket present.
3. Remove retainer from top of solenoid base sub-assembly.
4. For AC construction, slip yoke containing coil, sleeves, insulating washers, and grounding wire, (if present) off the solenoid base sub-assembly. For DC construction, remove grounding wire (if present), yoke, insulating washer, coil and insulating washer.
   NOTE: Insulating washers are omitted when a molded coil is used.
5. Coil is now accessible for replacement.
6. If additional disassembly is required, unscrew solenoid base sub-assembly using special wrench adapter supplied in ASCO Enclosure or Rebuild Kit. For ASCO wrench kit only, Order No.K218950.
7. Remove solenoid base sub-assembly with solenoid bonnet gasket.
8. Reassemble using exploded view for identification and placement of parts. Before reassembly, see note below for cleaning and greasing requirements.
9. Torque solenoid base sub-assembly to 175 ± 25 in-lbs [19,8 ± 2,8 Nm].
10. Torque housing cover to 135 ± 15 in-lbs [15,3 ± 1,7 Nm].

⚠ **CAUTION: Solenoid must be fully reassembled because the housing and internal parts complete the magnetic circuit. Place an insulating washer at each end of non-molded coil.**

NOTE: Solenoid Catalog Numbers EF80171, EF80172, 80173, and 80174—Installation and maintenance of raintight/watertight/explosionproof equipment requires more than ordinary care to insure safe performance. All finished surfaces of the solenoid are constructed to provide flame-proof seal. Be sure that the surfaces are wiped clean before reassembling. Grease the cover gasket, solenoid bonnet gasket, and the joints of the raintight/watertight/explosionproof solenoid enclosure with DOW CORNING® 111 Compound lubricant or an equivalent high-grade silicone grease. Grease all joints thoroughly including the underside of the solenoid base sub-assembly flange and internal threads of the housing cover.




Notes:
1. For this solenoid construction reuse aluminum nameplate when installing enclosure kit. Discard nameplate and spring washer supplied in enclosure kit.
2. For alternate construction with nameplate on housing, a new nameplate is supplied in the Enclosure Kit for transferring nameplate information.
3. Tapped hole in core 0.250-28 UNF-2B with 0.38 inch minimum full thread.

Figure 1. Catalog Nos. 80171 and 80172 General Purpose Solenoid Enclosure, AC Construction.



ASCO Valves Automatic Switch Co. 50-60 Hanover Road, Florham Park, New Jersey 07932

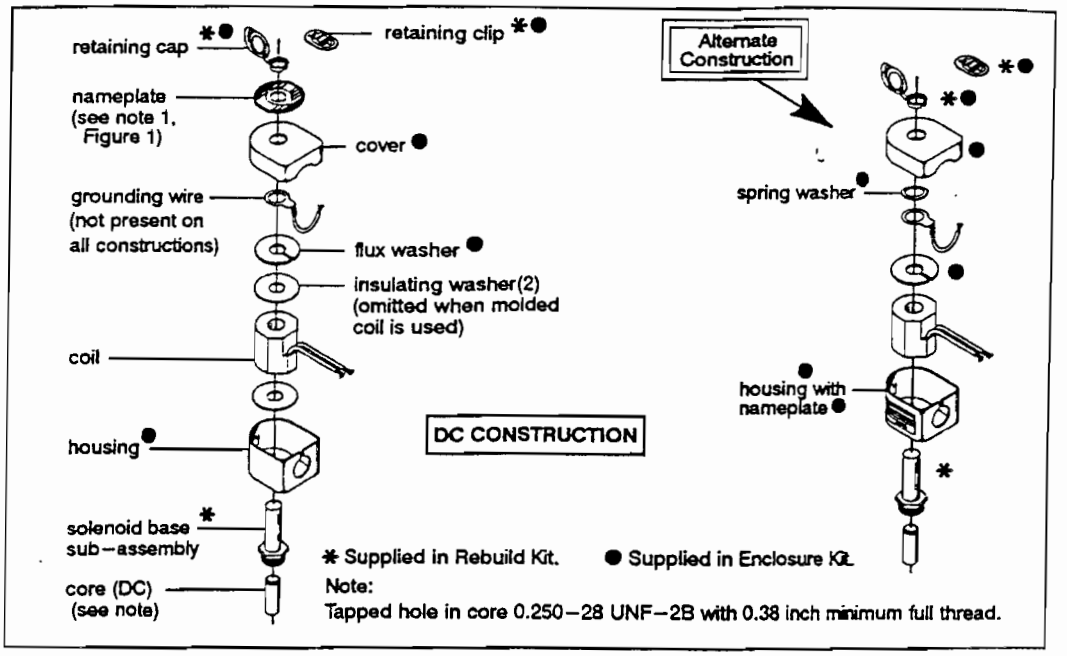



Figure 2. Catalog Nos. 80171 and 80172 General Purpose Solenoid Enclosure, DC Construction.

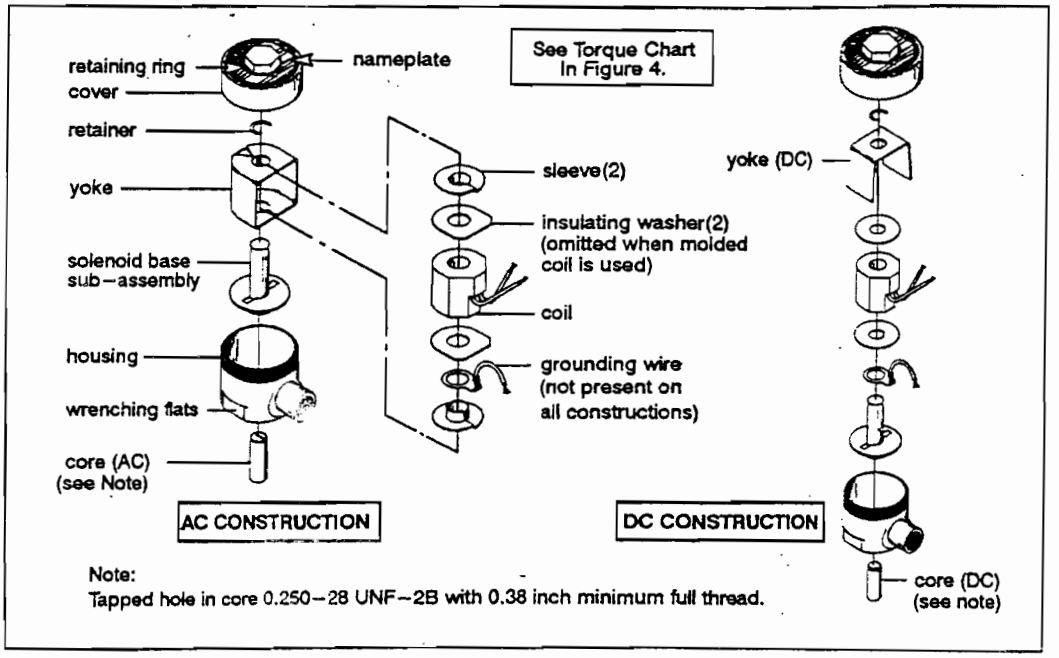



Figure 3. Catalog Nos. EF80171, EF 80172, 80173 and 80174 Raintight/Explosionproof Solenoid Enclosure.

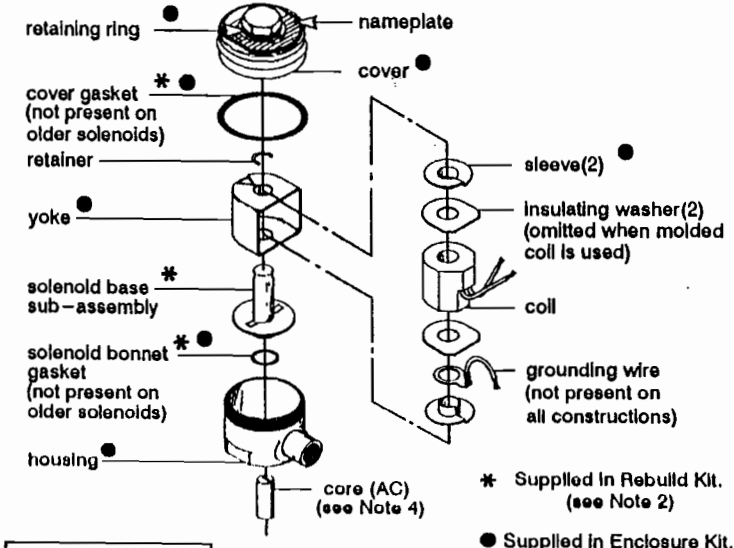
ASCO Valves
Automatic Switch Co. 50–60 Hanover Road, Florham Park, New Jersey 07932
Form No. V5381R6

Notes:

1. These Catalog Nos. meet watertight requirements only when cover gasket and solenoid bonnet gasket are used.
2. A solenoid base sub–assembly with a solenoid bonnet gasket are supplied in the Rebuild Kit. These two parts are a direct replacement for the existing solenoid base sub–assembly.
   The cover gasket is also supplied in Rebuild Kit, but may be omitted if cover does not use a gasket.
3. Install all parts supplied in Enclosure Kit except omit the solenoid bonnet gasket if the existing solenoid base sub–assembly does not use a gasket.
4. Tapped hole in core 0.250–28 UNF–2B with 0.38 inch minimum full thread.
5. Special wrench adapter for solenoid base sub–assembly is supplied in Rebuild Kit and Enclosure Kit.

| Torque Chart | | |
|---|---|---|
| Part Name | Inch–Pounds | Newton–Meters |
| cover | 135 ± 15 | 15,3 ± 1,7 |
| solenoid base sub–assembly ▲ | 175 ± 25 | 19,8 ± 2,8 |

▲ To order special wrench adapter for solenoid base sub–assembly, specify Kit No. K218950



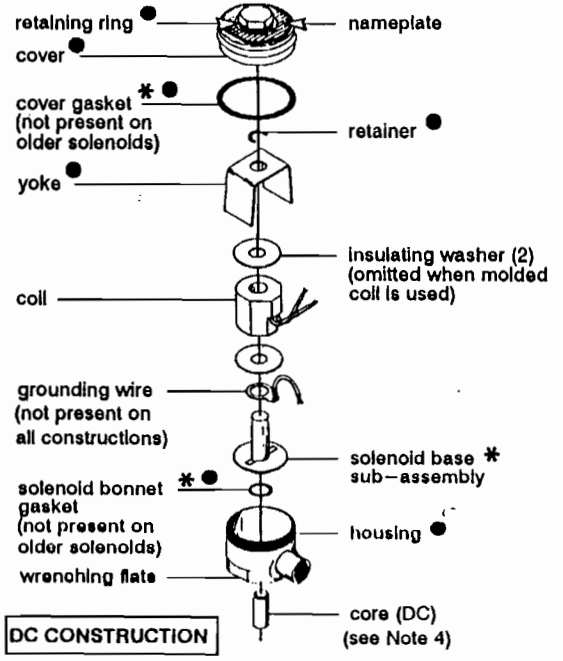
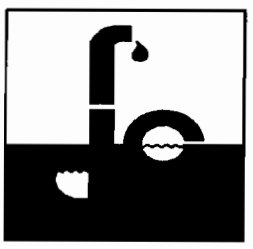




Figure 4. Catalog Nos. EF80171, EF80172, 80173, and 80174 Raintight/Watertight/Explosionproof Solenoid Enclosure.

# Air Stripper

DRC # 6154



**DIVERSIFIED REMEDIATION & CONTROLS**

21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660

# QED Environmental Systems

6155 Jackson Ave. Ann Arbor, MI 48103 Phone: 800-624-2026 Fax:734-995-1170

## QED EZ-Stacker™ Air Stripper
## Operations and Maintenance Manual

**QED Treatment Equipment, P.O.Box 3726, Ann Arbor, MI 48106**
**Phone: (800)-624-2026, Fax: (734)-995-1170**
**QED p/n 95164 February 16, 1996 Rev 3/19/99**

## QED EZ-Stacker™ Operations and Maintenance Manual

### Introduction

This manual contains instructions for installing, start-up and operation of a QED EZ-Stacker™ Air Stripper for the treatment of dissolved-VOC-contaminated waters. The EZ-Stacker™ Air Stripper is a sieve tray type of stripper which accomplishes mass transfer by creating a large amount of fine air bubbles into which volatile organics are stripped. Efficient stripping with this type of a unit is affected by:

- Water temperature-- higher temperature allows better stripping
- Specific compound being stripped--higher Henry's Law constant equals better stripping
- Air to water ratio--the higher the air to water ratio (air flow for a given water flow) the better the stripping
- Stripper efficiency--certain design elements, such as tray design affect stripping efficiency
- Surfactants (soaps, cleaning agents, etc.) and oil/grease can negatively impact stripping efficiency

From an operation standpoint the single most important factor is ensuring that the recommended amount of clean air is flowing through the stripper. Air flow is most affected by tray fouling (typically with precipitated iron oxides) which creates back pressure on the blower and causes it to operate at a lower air flow point on its curve. Maintaining clean trays and using the excess capacity on the blower can help control fouling conditions. Occasional gasket replacement can be anticipated depending on the frequency of stripper disassembly and reassembly. The stripper blowers and any transfer pumps should be regularly maintained based upon the manufacturer's maintenance schedule. All other stripper components are largely maintenance free. Please refer to Figure 1 at the end of this manual for understanding terminology.

### Installation

Installing Skid Mounted Systems

Complete skid mounted systems arrive at your site as shown in Figure 1. A system of this type is mounted, piped and optionally wired at the factory. All components and functions are 100% wet checked.

**Influent piping**. Connect system influent piping to the influent feed pump or directly to the stripper at the piping connection located on the top of the stripper. Factory piped influent feed pump systems use flexible pressure hose between the pump and the stripper influent piping connection and includes a check valve to prevent air backup into a transfer tanks or oil water separator. If the stripper

influent is plumbed directly on site, a flexible hose connection is recommended to ease stripper disassembly and reassembly during use.

**Effluent piping**. Factory piped effluent discharge pump systems use flexible pressure hose between the stripper discharge piping connection, located at the bottom of the stripper sump and the effluent discharge pump. Factory installed gravity discharge piping connects at the same discharge point on the stripper sump and utilizes a gravity drain kit which includes a siphon break and water head seal. If the stripper is plumbed on site connect the discharge pump to the stripper sump at the discharge connector. Gravity drain piping should be a minimum of 2-3" in diameter (depends on the model) and designed as shown in Figures 4 or 5.

**Blower piping**. *Important! Total sump pressures should never exceed 50" WC! This will void QED Warranty.* The blower piping that connects the blower to the air stripper are typically of an inverted-U shape, with a high leg to reduce the chance of flooding the blower in the event of an unforeseen flood condition.

On EZ-2.xP models, QED typically use regenerative blowers sized so that they do not require much, if any, throttling of the airflow. Regenerative blowers are limited in the amount of throttling that can be applied, since added backpressures may cause the blower motor to run above full-load-amp condition and cause the blower motor to overheat. If customer is installing their own piping kit on an oversized regenerative blower, it is recommended that an air dilution/bleed valve be installed in the blower piping to provide flexibility in controlling airflow.

Stripper Air **Discharge Stack**. The stripper discharge pipe is located on top of the air stripper and is 4"or 6" in diameter (depending upon model). The wider section of the discharge porting contains the demister element which removes entrained water droplets from the air exiting the stripper. Coalesced water droplets collect on the demister and then fall back into the stripper top tray. Piping or ducting for the stripper discharge stack should be of equal diameter or larger to avoid creating excess back pressure on the stripper blower. A flexible coupling, such as a Fernco brand, is recommended to connect the discharge pipe to the stripper air discharge stack to ease unit disassembly for cleaning. It is also important to pipe the air stripper air discharge such that it is not in proximity with the air stripper blower inlet; this minimizes the risk of sending already-contaminated air back into the air stripper and reducing stripper performance.

**Sensors**. Normal sensors used with this type of air stripper include a sump high level alarm float sensor, sump low air pressure sensor and optional discharge pump on-off float sensor. If these sensors are supplied with the stripper they will be installed in the stripper sump and piping. Often the system control panel must be mounted in a remote location from the stripper (in cases where the location is classified as an explosion hazard area.) If the panel is to be remotely-mounted a licensed electrician should hook the stripper sensors up to the panel. It is

important that these sensors be tested prior to operating the stripper. A frequent cause of improperly operating systems are float sensors which act in the opposite sense of that which the control panel expects (normally-open vs. normally-closed). It is also important to conform to electrical code requirements for classified areas; sensors may require intrinsically safe barriers.

Installing Bare Stripper Sump and Tray Systems

Bare stripper sump and tray systems are provided in cases where the contractor will mount the stripper to a user supplied skid or concrete pad. These systems are supplied with a second gasket compression ring that anchors the gasket compression rods at the bottom of the stripper. The bottom gasket compression ring has tabs protruding around its circumference which allow mounting of the ring to a skid or concrete pad.

If the blower is purchased from the factory it is recommended that the blower piping package also be purchased. If the contractor is supplying their own blower it must meet the typical performance specifications listed below to achieve the desired contaminant removals. If the air stripper is built to non-standard parameters, the performance specifications below may not apply.

| | |
|---|---|
| Air Flow: | 140 cfm (for EZ-2.xP) or 280 cfm (for EZ-4.xP) at maximum system back pressure |
| Pressure: | Sufficient to over come tray, piping and air treatment process back pressures at a flow rate of 140cfm. *Important! Total sump pressures should never exceed 50" WC! This will void QED Warranty.* |
| Tray Back Pressures | 16-20"$H_2O$ for 4-trays; 24-30"$H_2O$ for 6-trays (assuming no add'l pressure from equipment downstream of air stack). |

The blower piping should include a high leg which acts to reduce the risk of flooding the blower if the high sump level sensor was to malfunction in the stripper sump. See Figures 2 and 3 (for models EZ-2.xP and EZ-4.xP, respectively) for examples of proper blower piping configurations.

The EZ-2.xP models typically use regenerative blowers sized so that they do not require much, if any, throttling of the airflow. Regenerative blowers are limited in the amount of throttling that can be applied, since added backpressures can cause the blower motor to run above full-load-amp conditions and overheat. If customer is installing their own piping kit on an oversized regenerative blower, it is recommended that an air dilution/bleed valve be installed in the blower piping to provide flexibility in controlling airflow. A throttle valve is shown in Figure 1; a dilution/bleed valve is not shown.

Influent and effluent piping and sensor hook-up should be as described in the section on skid mounted systems, above.

**Startup**

The EZ-Stacker™ stripper is designed to start up dry without priming the sealpot or throttling the blower. The stripper blower should be running before water is introduced to the stripper. Water flows into the top tray and proceeds tray by tray to the stripper sump. Stripper seal pots fill with water and allow complete start up during intermittent operation. IMPORTANT: Before starting the system verify correct blower motor rotation (plus any other motors within the treatment system).

Verify that the sump air pressure is 16-20" $H_2O$ for 4-tray systems or 24-30" $H_2O$ for 6-tray systems (it is normal to see lower sump pressures at the very start of operation before the seal pots and trays fill with water.) Sump pressures lower than these values may indicate either a blower throttle which is not sufficiently open or insufficiently-compressed tray seal gaskets. *If the system configuration includes additional backpressure (from vapor phase carbon, for example), the sump pressures will be greater than these values. it is important that the blower is sized to accommodate the added pressures, being careful that air stripper sump pressures never exceed 50" WC. Total sump pressures exceeding 50" WC will void QED Warranty!* Check the blower piping throttle valve and make sure the hold-down rods are tightened firmly, but not over tightened. The hold-down tensioning springs should be compressed to a length of 3-1/2 inches for proper gasket sealing.

Step by step startup includes:

1. Power the main control panel on.
2. Turn the blower on: For QED supplied control panels set the motor operation switch to AUTO.
3. Turn the stripper feed pump on (allow water to enter the stripper for gravity feed systems.) For QED supplied control panels set the motor operation switch to AUTO (some systems have a delay timer on the feed pump--check control panel documentation for details.)
4. Turn the discharge pump on. For QED supplied control panels set the motor operation switch to AUTO.
5. Open or close the blower air flow throttle and air dilution valve (if required) to produce a sump pressure reading of 16-20"$H_2O$ for 4-tray systems or 24-30"$H_2O$ for 6-tray systems (these are typical values, but these may differ depending whether any other pressures need to be accounted for. NOTE: It is normal to see lower sump pressures at the very start of operation due to sealpots and trays filling with water.

## Operation

Stripper operation is normally automatic. One option for QED supplied control panels is a blower time-out relay which continues to run the blower for several minutes after the feed pump stops. Continued blower operation insures that any residual water left on the stripper trays has sufficient time to strip before the blower shuts down. A time of at least 15 minutes is recommended. Strippers with start-stop cycles of more than 2-4 times per hour should be set to run continuously.

For sites with high dissolved iron content stripper cleaning may be required. Tray fouling is evidenced by increasing sump back pressure. Opening the blower air flow throttle will allow continued operation in some situations and will lengthen the time between tray cleanings. It is most important to maintain an air flow of 140cfm through the unit. If the stripper air flow decreases the stripping efficiency decreases. Below 100 cfm air flow the stripper will start begin to "weep" water through the tray holes from upper trays to lower trays before the water has had sufficient residence time for removal. If stripper performance falls off, check for tray fouling or a blower air flow throttle that is not opened sufficiently.

## Maintenance

Tray fouling due to iron precipitation, solids loading, or bio-fouling is evidenced by increased sump pressures, decreased stripper performance (removal rates not being met) or noticeable discoloration on the trays. Stripper cleaning is required when trays are fouled.

Step by step cleaning includes:

1. Before working on any equipment lock-out power to the unit.
2. Disconnect the stripper discharge pipe from the stripper exhaust stack piping.
3. Unscrew the hold-down rod nuts (cranks) and remove the gasket hold-down ring.
4. Remove the stripper trays. Please note the tray seal pots will have some water remaining in them.
5. Using a pressure washer and medium bristle brush clean any residue from the trays surfaces, concentrating on the sieve holes. DO NOT USE SOAP or cleaning agents unless they will be thoroughly rinsed from the trays; soap residue can affect stripper performance.
6. For hard to remove scales and precipitates a dilute (5%-10%) muriatic acid and water solution can be used to rinse or soak the trays. Be certain to completely rinse the solution off the trays before reassembling the unit.

7. Reassemble the trays--note that they are numbered and that a mark is used to assist in proper alignment of the trays during reassembly. Check to make sure the gasket is still seated correctly and undamaged.
8. Reinstall the gasket hold-down ring and retension the hold-down rod nuts (cranks.) The hold-down tensioning springs should be compressed to a length of 3-1/2 inches for proper gasket sealing.
9. Reattach any pipe and exhaust stack connections.
10. Follow Start-Up instructions, above.

Other stripper maintenance items include:

1. Periodically check blower for vibration. Bearings may require eventual service or conditions of excessive motor start / stop cycles may lead to premature motor or blower failure.
2. Check gasket condition during disassembly for cleaning. The gasket is designed to allow numerous assembly and disassemblies before requiring replacement. Contact QED for information and pricing about gasket replacement kits.
3. The stripper demister element is essentially maintenance free, although dried inorganic residue can build up within the demister and affect demister operation. This condition is evidenced in water droplets not being removed by the demister and blowing out of the stripper exhaust stack--occasionally on start-up water is discharged from the stripper stack, which is normal. The demister may be cleaned with a dilute muriatic and water solution (5%-10%) as instructed for tray cleaning.
4. Solids may build up in the sump. These solids can be suctioned out during tray cleaning operations.
5. Periodically check the structural integrity of the stripper sump, trays and top. Check bulkhead nuts for snugness. Cracks or loose fittings will normally be evidenced by water leakage.

**Troubleshooting**

Some common problems include:

1. *Leaks*. Leaks around trays or at the sump indicate an insufficiently compressed tray gasket. Make sure the hold-down tensioning springs are compressed to a length of 3-1/2 inches for proper gasket sealing. Also check for damaged gaskets (over compressed gaskets, cut gaskets, loose gaskets, etc.) Damaged gaskets should be replaced with new gaskets. Contact QED for information and pricing about gasket replacement kits. For leaks at fittings, check for fitting tightness.
2. *Stripper not meeting removal requirements*. Contaminated stripper air is the most common reason for poor stripping performance within the low-ppb

concentration range--make sure that the stripper blower intake is drawing in clean, uncontaminated air. Check for sufficient air flow through the stripper. Check that trays are clean. Check that demister is not clogged or causing increased blower back pressure. Check any stripper air discharge treatment units for increased back pressure. Check that stripper influent flow or concentration has not increased beyond the design basis used to predict stripper performance. Make sure that the influent does not have surfactants (soaps, etc.), oils, grease, or other immiscible phases in the influent stream. Surfactants are evidenced by increased foaming through the stripper unit.

3. *Sump pressure not at recommended levels.* Check sump pressure gauge tubing for accumulated water that could impair gauge performance. Check gaskets for damage and proper seating. Check for proper hold-down spring tensioning. Check blower piping connections for leakage. Check blower for proper rotation. Check design of gravity drain piping if piping is not QED-supplied. Check blower intake filter / silencer (if included) for clogging. Order new filter elements from QED.

4. *Stripper cleaning frequency seems excessive.* At sites with high iron loading, consider iron sequestering agents or other technology which will reduce/prevent iron precipitation or allow for easier cleaning.

**Please investigate all the above-mentioned items while troubleshooting. For additional problem solving assistance contact QED Service at:**


| | |
|---|---|
| **Phone:** | **1-800-624-2026** |
| **FAX:** | **1-734-995-1170** |
| **24 Hour Service Hot Line:** | **1-800-272-9559** |


Please have the following information ready for the QED Service person:

1. Identify the product or system involved by QED order number.
2. Specify where, when, and from whom the product was purchased.
3. Describe the nature of the defect or malfunction.

## QED TREATMENT EQUIPMENT WARRANTY

QED Environmental Systems Inc. (QED) warrants to the original purchaser of its products that, subject to the limitations and conditions provided below, the products, materials and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in materials and workmanship. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

QED warrants the equipment components of its manufacture for a period of one (1) year from date of delivery. Our sole obligation during this warranty will be to repair or replace (at our option) the defective components. We are not responsible for consequential damages. Labor costs are not included.

Purchaser's exclusive remedy for breach of said warranty shall be as follows: if, and only if, QED is notified in writing within the applicable warranty period of the existence of any such defects in the said products, and QED upon examination of any such defects, shall find the same to be within the term of and covered by the warranty running from QED to Purchaser, QED will, at its option, as soon as reasonably possible, replace or repair any such product, without charge to Purchaser. If QED for any reason, cannot repair a product covered hereby within four (4) weeks after receipt of the original Purchaser's notification of a warranty claim, then QED's sole responsibility shall be, at its option, either to replace the defective product with a comparable new unit at no charge to the Purchaser, or to refund the full purchase price. In no event shall such allegedly defective products be returned to QED without its consent, and QED's obligations of repair, replacement or refund are conditioned upon the Purchaser's return of the defective product to QED.

**IN NO EVENT SHALL QED ENVIRONMENTAL SYSTEMS INC. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF SAID WARRANTY.**

The foregoing warranty does not apply to major subassemblies and other equipment, accessories, and other parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties supplied by their respective manufacturers. In the event of failure of any such product or accessory, QED will give assistance to Purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

**THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY,** and of any other obligations or liabilities on the part of QED, and QED neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products, materials and/or workmanship.

It is understood and agreed that QED shall in no event be liable for incidental or consequential damages resulting from its breach of any of the terms of this agreement, nor for special damages, nor for improper selection of any product described or referred to for a particular application.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use, or exposure to chemical or physical environment beyond the designated limits of materials and construction will also void this warranty.

The equipment is warranted to perform as specified under the conditions specified here and within the air stripper model or QED will make the necessary changes at no cost to the owner. Some restrictions apply. Requirements for warranty consideration include, (but are not limited to):

1. Current operating conditions do not differ from the previously-modeled conditions.
2. The system should be cleaned regularly to maintain system performance.
3. The equipment is installed, operated and maintained according to QED's instruction or non-QED manufactured subassembly manufacturer's instructions.
4. Air stripper influent air is not "dirty" (does not contain VOC's, etc.).
5. No surfactants, oils, greases, or other immiscible phases are present in the water.
6. Each influent contaminant does not exceed 25% of its maximum solubility under modeled conditions.

QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the consent of QED. If any product covered hereby is actually defective within the terms of this warranty, Purchaser must contact QED for determination of warranty coverage. If the return of a component is determined to be necessary, QED will authorize the return of the component, at owner's expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts and labor as authorized by owner hereunder shall be borne by the Purchaser.

In the event of air stripper performance issues, QED may require customer to conduct a variety of troubleshooting steps. These include, but are not limited to, modifying operational parameters, cleaning air stripper system, modifying (temporarily or permanently) process piping, and obtaining reasonable and necessary influent/effluent samples. These steps are the responsibility of the customer and will be conducted by customer prior to consideration by QED for a site visit. These steps and the associated costs incurred are the responsibility of the customer, regardless of future action. Should customer request a site visit by QED or accept a site visit offer by a QED-trained technician, the visit and associated costs: a) will be the responsibility of the customer at $500/day, plus travel, lodging, and meals, if the visit finds improper sampling, process piping installation or equipment operation inconsistent with QED's Operation and Maintenance Manual; or b) will be the responsibility of QED if the visit finds QED responsible for the performance issue(s) raised.

The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department of QED and:

1. Identify the product or system involved by QED order number.
2. Specify where, when, and from whom the product was purchased.
3. Describe the nature of the defect or malfunction covered by this warranty.
4. If applicable, send the malfunctioning component, ***after receiving a Return Authorization Code (RAC) Number by the QED Service Department, to:***

**QED Environmental Systems Inc.**
**6241 Jackson Road**
**Ann Arbor, MI 48103**
**Attn:** ***R.A.C. No.****(Return Authorization Code Number provided by QED Service Dept.)*

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## Figure 1. Typical Configuration of EZ-Stacker (actual configuration will vary with model size)

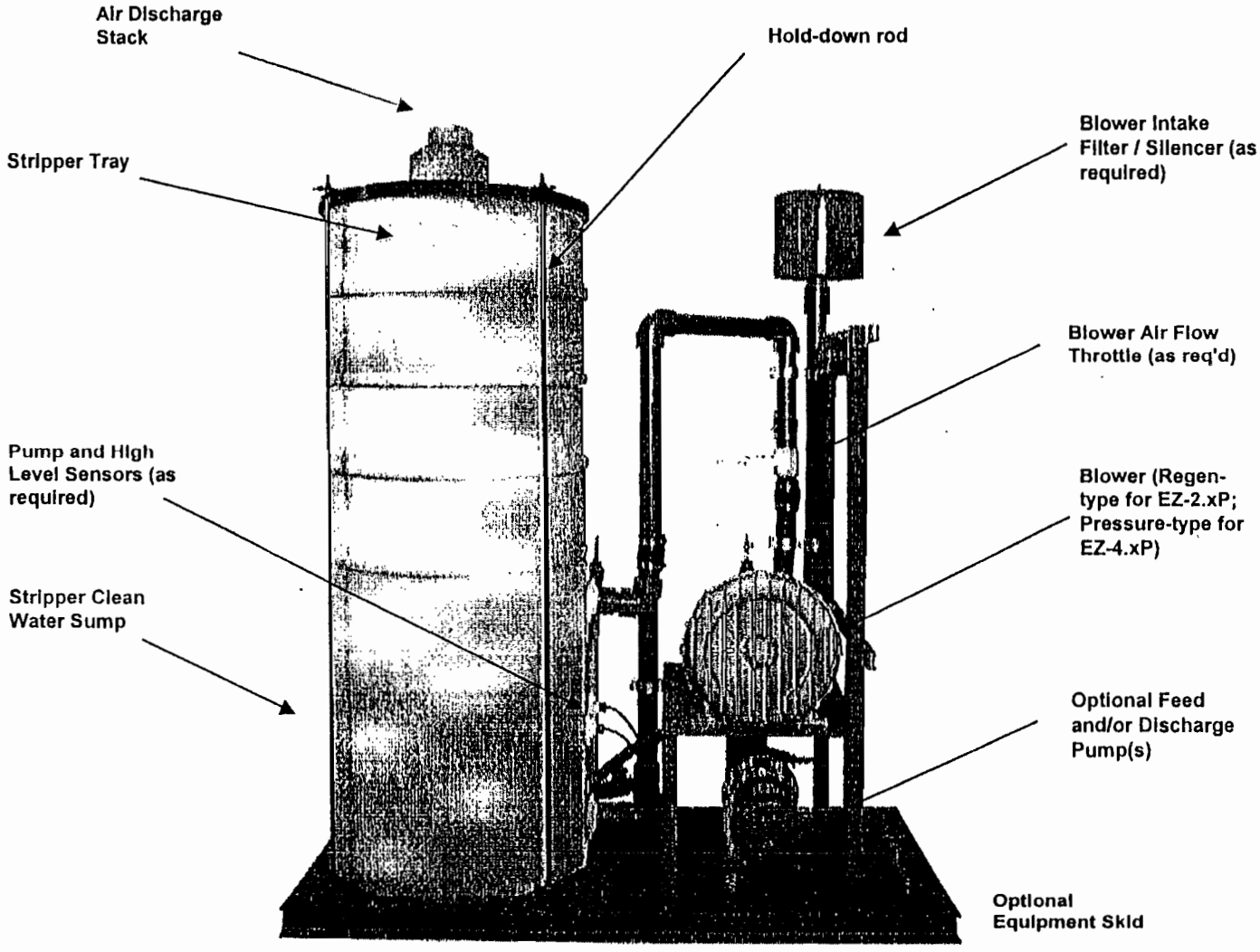
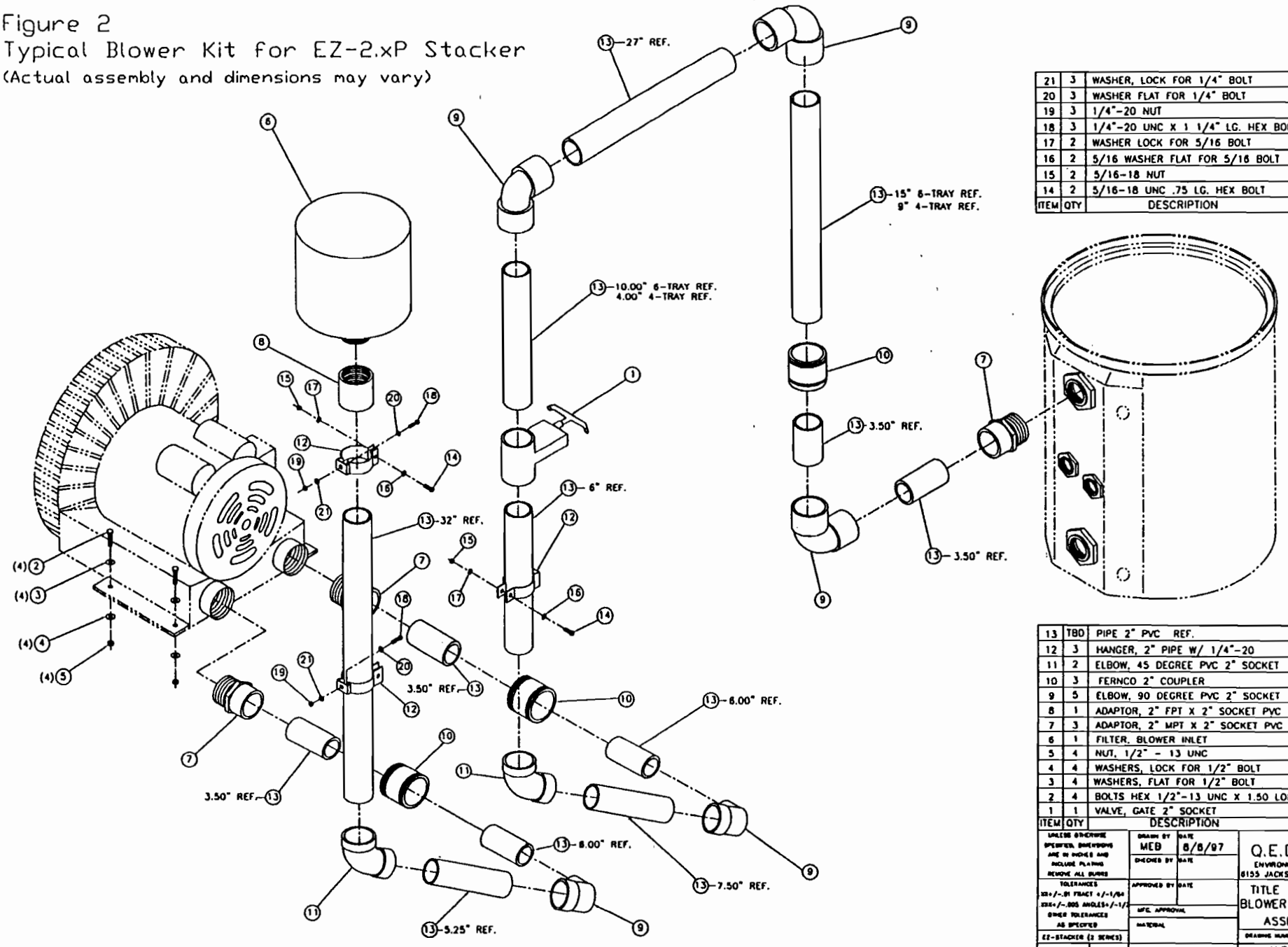


Figure 2
Typical Blower Kit for EZ-2.xP Stacker
(Actual assembly and dimensions may vary)




| ITEM | QTY | DESCRIPTION | PART # |
|---|---|---|---|
| 21 | 3 | WASHER, LOCK FOR 1/4" BOLT | |
| 20 | 3 | WASHER FLAT FOR 1/4" BOLT | |
| 19 | 3 | 1/4"-20 NUT | |
| 18 | 3 | 1/4"-20 UNC X 1 1/4" LG. HEX BOLT | |
| 17 | 2 | WASHER LOCK FOR 5/16 BOLT | |
| 16 | 2 | 5/16 WASHER FLAT FOR 5/16 BOLT | |
| 15 | 2 | 5/16-18 NUT | |
| 14 | 2 | 5/16-18 UNC .75 LG. HEX BOLT | |

| ITEM | QTY | DESCRIPTION | PART # |
|---|---|---|---|
| 13 | TBD | PIPE 2" PVC REF. | |
| 12 | 3 | HANGER, 2" PIPE W/ 1/4"-20 | |
| 11 | 2 | ELBOW, 45 DEGREE PVC 2" SOCKET | |
| 10 | 3 | FERNCO 2" COUPLER | |
| 9 | 5 | ELBOW, 90 DEGREE PVC 2" SOCKET | |
| 8 | 1 | ADAPTOR, 2" FPT X 2" SOCKET PVC | |
| 7 | 3 | ADAPTOR, 2" MPT X 2" SOCKET PVC | |
| 6 | 1 | FILTER, BLOWER INLET | |
| 5 | 4 | NUT, 1/2" - 13 UNC | |
| 4 | 4 | WASHERS, LOCK FOR 1/2" BOLT | |
| 3 | 4 | WASHERS, FLAT FOR 1/2" BOLT | |
| 2 | 4 | BOLTS HEX 1/2"-13 UNC X 1.50 LONG | |
| 1 | 1 | VALVE, GATE 2" SOCKET | |

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING. REMOVE ALL BURRS.
TOLERANCES: XX+/-.01 FRACT +/-1/64; XXX+/-.005 ANGLES+/-1/2°; OTHER TOLERANCES AS SPECIFIED
EZ-STACKER (2 SERIES)
NEXT ASSY | USED ON

DRAWN BY: MEB | DATE: 6/6/97
CHECKED BY | DATE
APPROVED BY | DATE
MFG. APPROVAL
MATERIAL
FINISH

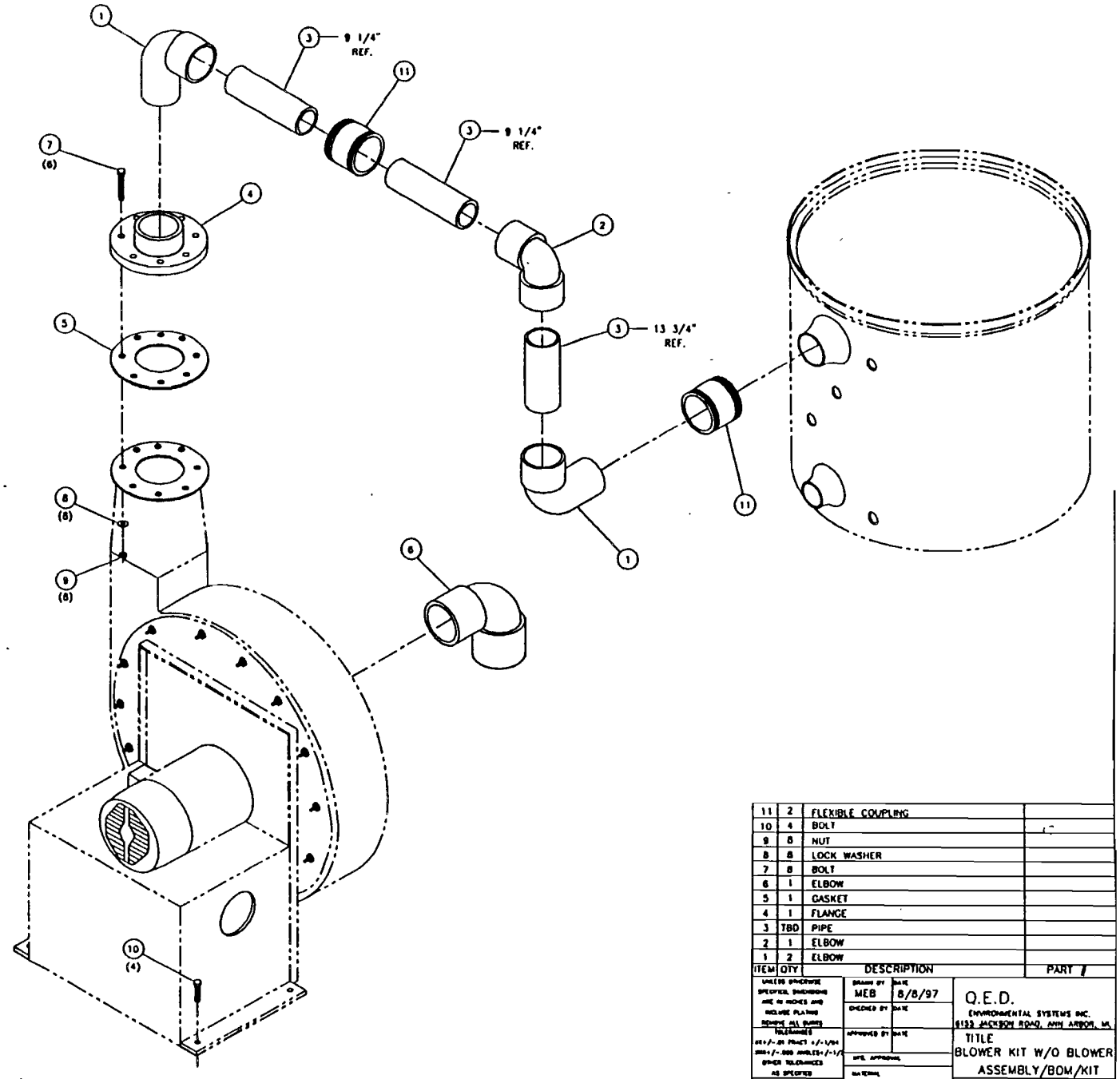
Q.E.D.
ENVIRONMENTAL SYSTEMS INC.
6155 JACKSON ROAD, ANN ARBOR, MI.

TITLE
BLOWER KIT W/O BLOWER
ASSEMBLY/BOM/KIT

DRAWING NUMBER ezs2blw.dwg | REV
SCALE N.T.S. | SHEET 1 OF 1

Figure 3

Typical Blower Kit Assembly for EZ-4.xP Stacker
(Actual assembly and dimensions may vary)




| ITEM | QTY | DESCRIPTION | PART # |
|---|---|---|---|
| 11 | 2 | FLEXIBLE COUPLING | |
| 10 | 4 | BOLT | |
| 9 | 8 | NUT | |
| 8 | 8 | LOCK WASHER | |
| 7 | 8 | BOLT | |
| 6 | 1 | ELBOW | |
| 5 | 1 | GASKET | |
| 4 | 1 | FLANGE | |
| 3 | TBD | PIPE | |
| 2 | 1 | ELBOW | |
| 1 | 2 | ELBOW | |

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND EXCLUDE PLATING. REMOVE ALL BURRS.
TOLERANCES
.XX +/-.01 FRACT +/-1/64
.XXX +/-.005 ANGLES +/-1/2°
OTHER TOLERANCES AS SPECIFIED
EZ-STACKER (4 SERIES)
NEXT ASSY | USED ON

DRAWN BY MEB 8/8/97
CHECKED BY
APPROVED BY
MFG. APPROVAL
MATERIAL
FINISH

Q.E.D.
ENVIRONMENTAL SYSTEMS INC.
6133 JACKSON ROAD, ANN ARBOR, MI.

TITLE
BLOWER KIT W/O BLOWER ASSEMBLY/BOM/KIT

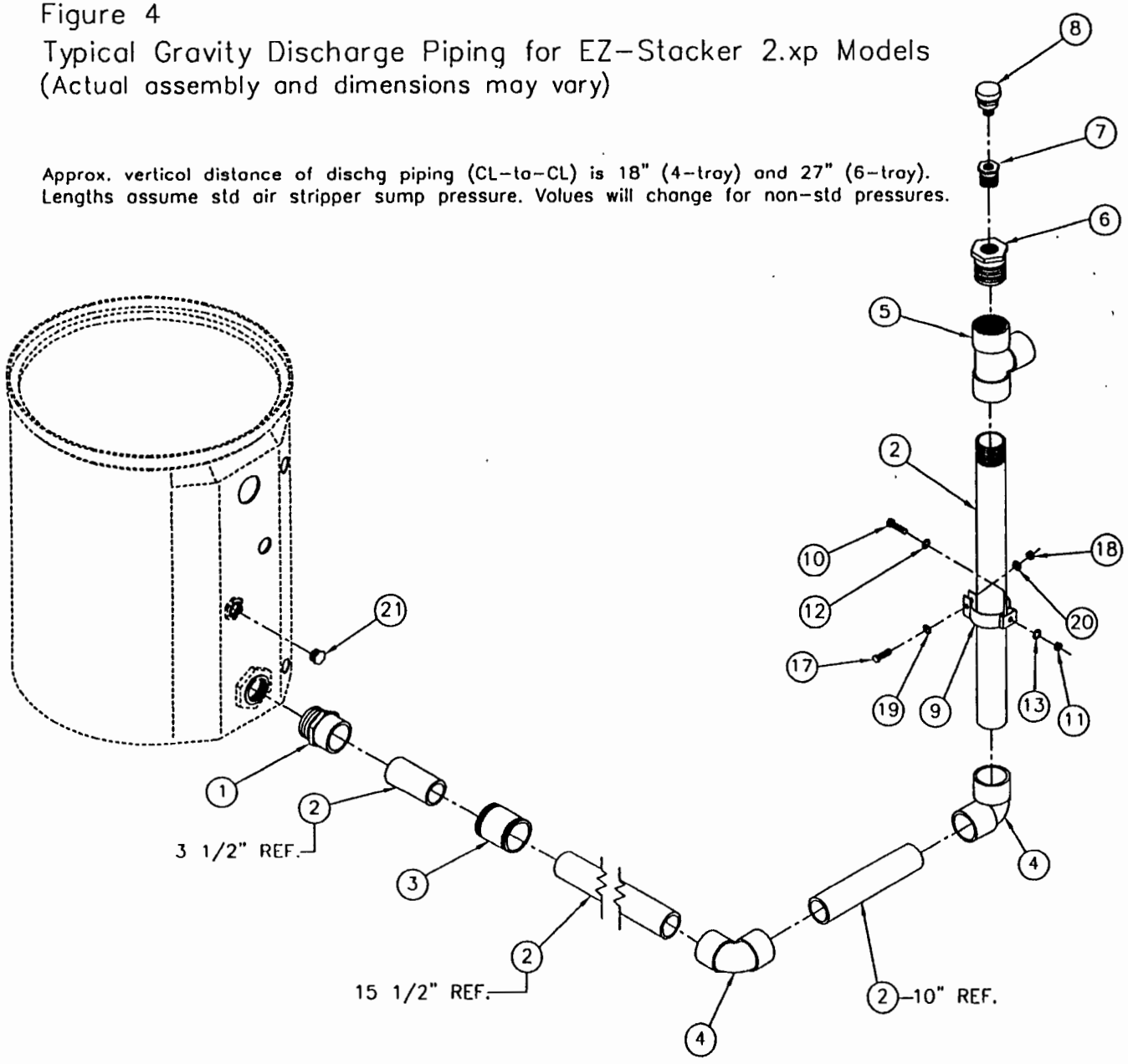
DRAWING NUMBER ezs4blw.dwg
SCALE N.T.S. | SHEET 1 OF 1

2/18/99, mab

Figure 4

Typical Gravity Discharge Piping for EZ-Stacker 2.xp Models
(Actual assembly and dimensions may vary)

Approx. verticol distance of dischg piping (CL-to-CL) is 18" (4-tray) and 27" (6-tray).
Lengths assume std air stripper sump pressure. Volues will change for non-std pressures.




| ITEM | QTY | DESCRIPTION | PART # |
|---|---|---|---|
| 21 | 1 | 1/2" PLUG SCH 80 | |
| 20 | 1 | LOCK WASHER FOR 1/4" BOLT | |
| 19 | 1 | FLAT WASHER FOR 1/4" BOLT | |
| 18 | 1 | 1/4"-20 NUT | |
| 17 | 1 | 1/4"-20 UNC HEX BOLT 1 1/4" LG. | |
| | | | |
| | | | |
| | | | |
| 13 | 1 | LOCK WASHER FOR 5/16/BOLT | |
| 12 | 1 | FLAT WASHER FOR 5/16 BOLT | |
| 11 | 1 | 5/16-18 UNC NUT | |
| 10 | 1 | 5/16-18 UNC HEX. HD. BOLT .75 LG. | |
| 9 | 1 | HANGER 2" PIPE | |
| 8 | 1 | BREAKER, VACUUM 1/2" MPT | |
| 7 | 1 | BUSHING, PVC 1 1/4" X 1/2" | |
| 6 | 1 | BUSHING, PVC 2" X 1 1/4" | |
| 5 | 1 | TEE, PVC 2" FPT | |
| 4 | 2 | ELBOW, 90 DEGREE PVC 2" | |
| 3 | 1 | FERNCO 2" COUPLER | |
| 2 | TBD | PIPE 2" PVC | |
| 1 | 1 | ADAPTOR 2" MPT X 2" SOCKET PVC | |

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS

TOLERANCES
.XX+/-.01 FRACT +/-1/64
.XXX+/-.005 ANGLES+/-1/2
OTHER TOLERANCES AS SPECIFIED

EZ-STACKER (2 SERIES)

NEXT ASS'Y | USED ON

DRAWN BY: MEB | DATE: 10-6-98
CHECKED BY | DATE
APPROVED BY | DATE
MFG. APPROVAL
MATERIAL
FINISH

QED
ENVIRONMENTAL SYSTEMS INC.
6155 JACKSON ROAD, ANN ARBOR, MI.

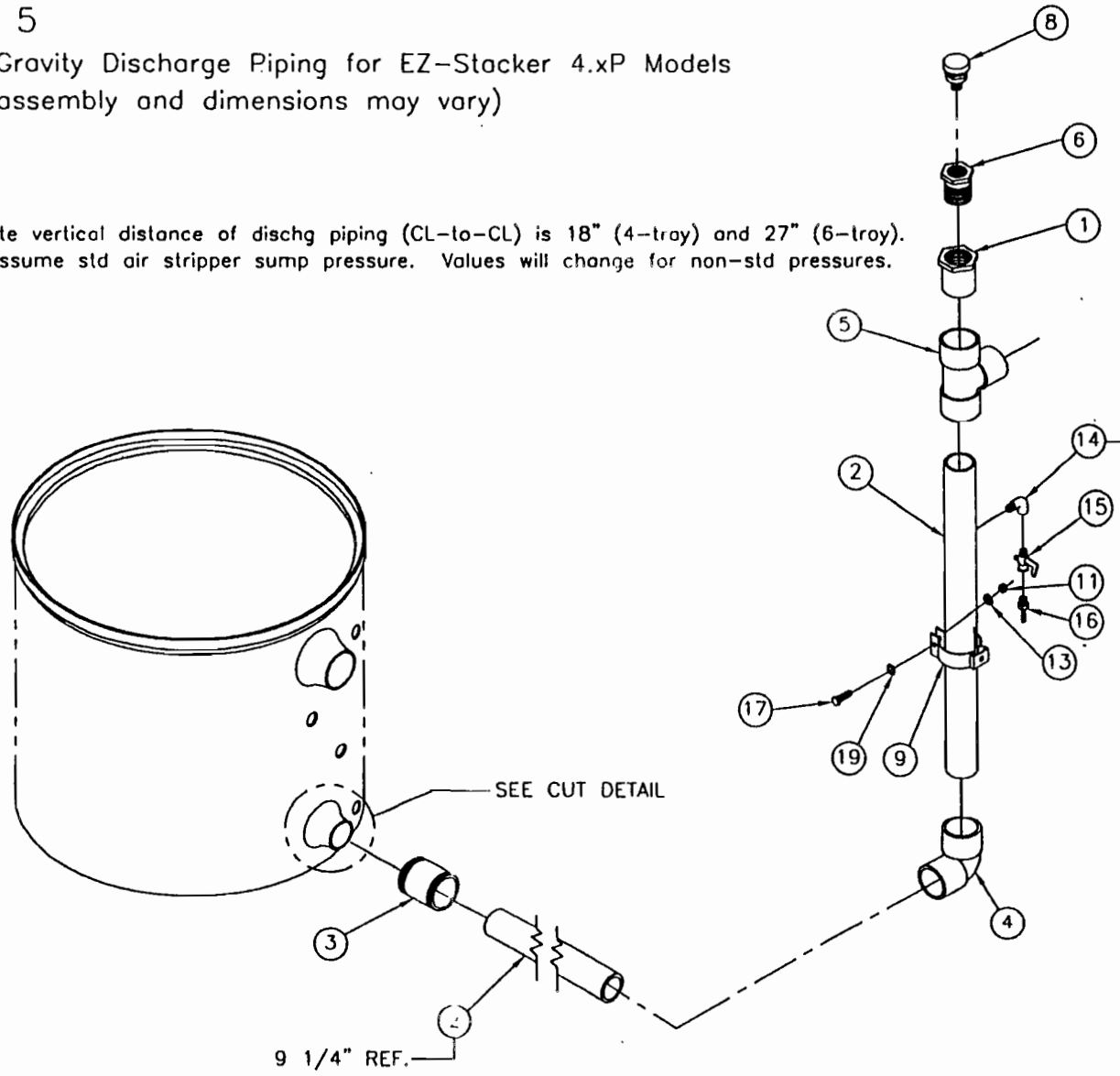
TITLE
GRAVITY DRAIN
ASSEMBLY/BOM/KIT

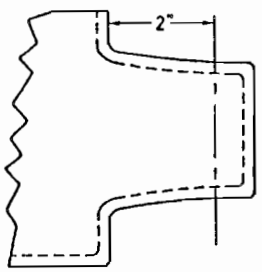
DRAWING NUMBER ezs2grov.dwg | REV
SCALE: N.S. | SHEET 1 OF 1

# Figure 5

Typical Gravity Discharge Piping for EZ-Stacker 4.xP Models
(Actual assembly and dimensions may vary)

Approximate vertical distance of dischg piping (CL-to-CL) is 18" (4-tray) and 27" (6-tray). Lengths assume std air stripper sump pressure. Values will change for non-std pressures.




CUT DETAIL
CUT AS SHOWN
FOR GRAVITY DRAIN MODELS ONLY

| ITEM | QTY | DESCRIPTION | PART # |
|---|---|---|---|
| 20 | | | |
| 19 | 1 | FLAT WASHER FOR 5/16" BOLT | |
| 18 | | | |
| 17 | 1 | 5/16-18 UNC HEX BOLT 1 1/2" LG. | |
| 16 | 1 | BARB 1/8"MPT X 3/16" BARB | |
| 15 | 1 | COCK, SHUTOFF 1/8"MPT X 1/8"FPT BRASS | |
| 14 | 1 | ELBOW, STREET 1/8" FPT BRASS | |
| 13 | 1 | LOCK WASHER FOR 5/16/BOLT | |
| 12 | | | |
| 11 | 1 | 5/16-18 UNC NUT | |
| 10 | | | |
| 9 | 1 | HANGER 3" PIPE | |
| 8 | 1 | BREAKER, VACUUM 1/2" MPT | |
| 7 | | | |
| 6 | 1 | BUSHING, PVC 1 1/2" X 1/2" | |
| 5 | 1 | TEE, PVC 3" SOCKET | |
| 4 | 1 | ELBOW, 90 DEGREE PVC 3" SCH 80 | |
| 3 | 1 | FERNCO 3" COUPLER | |
| 2 | TBD | PIPE 3" PVC SCH 80 | |
| 1 | 1 | BUSHING, PVC 3" SOC X THD. | |

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS
TOLERANCES .XX+/-.01 FRACT +/-1/64 .XXX+/-.005 ANGLES+/-1/2 OTHER TOLERANCES AS SPECIFIED
EZ-STACKER (4 SERIES)
NEXT ASSY | USED ON

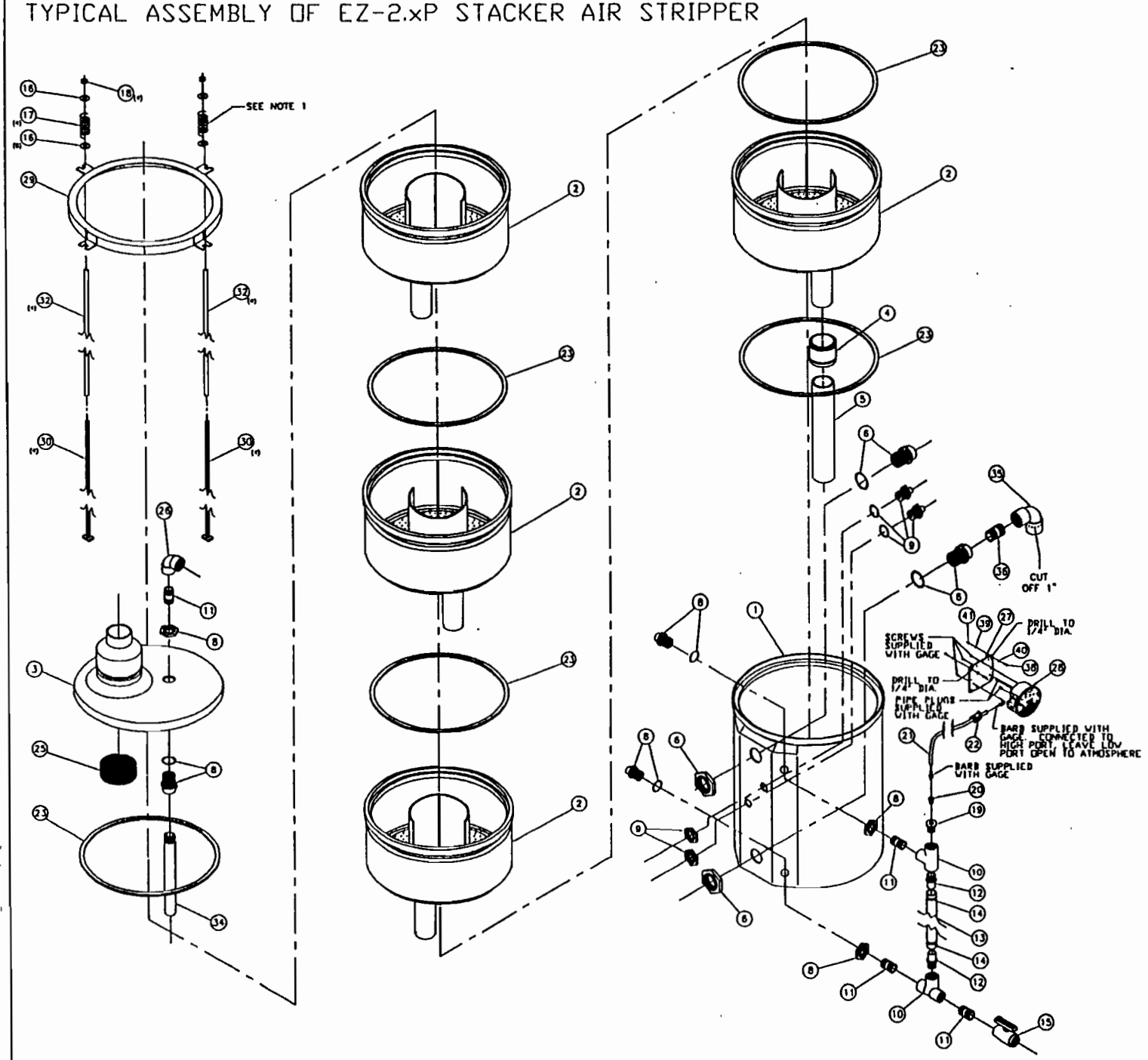
DRAWN BY: MEB | DATE: 7-23-98
CHECKED BY | DATE
APPROVED BY | DATE
MFG. APPROVAL
MATERIAL
FINISH

QED
ENVIRONMENTAL SYSTEMS INC.
6155 JACKSON ROAD, ANN ARBOR, MI.

TITLE
GRAVITY DRAIN
ASSEMBLY/BOM/KIT

DRAWER ezs4grav.dwg
SCALL S. | SHEET 1 OF 1

# TYPICAL ASSEMBLY OF EZ-2.xP STACKER AIR STRIPPER




1. COMPRESS SPRING TO 3.50 HEIGHT.

| ITEM | QTY | DESCRIPTION | PART # |
|---|---|---|---|
| 41 | 2 | NUT 1/4" | EXPENSED |
| 40 | 2 | WASHER, FLAT 1/4" | EXPENSED |
| 39 | 2 | WASHER, LOCK 1/4" | EXPENSED |
| 38 | 2 | BOLT, 1/4" HEX HD. | EXPENSED |
| 37 | | | |
| 36 | 1 | NIPPLE, CLOSE 2" PVC | 802074 |
| 35 | 1 | ELBOW 2" 90 DEGREE PVC THREADED | 802034 |
| 34 | 1 | PIPE 1" PVC 12.50 LG (THD. ONE END) | 802162 |
| 33 | | | |
| 32 | 4 | TUBING, NYLON 1/2" OD X 3/8" ID 69" LG | 35097 |
| 31 | | | |
| 30 | 4 | TIE ROD ASSEMBLY | 804042 |
| 29 | 1 | RING, TOP HOLD DOWN 27.63 OD | 804040 |
| 28 | 1 | MAGNEHELIC DIFFERENTIAL PRESSURE GAGE INCLUDES THE FOLLOWING: SCREWS, 6-32 RD. HD. (2) PIPE PLUG 1/8" (2) BARBS, 1/8" MPT X 3/16" BARB (2) | EZPGAUGE |
| 27 | 1 | BRACKET MOUNTING | 805179 |
| 26 | 1 | ELBOW 90 DEGREES PVC 1" MPT SCH 80 | 802037 |
| 25 | 1 | DEMISTER 3 PADS OF 37/87 3.80 HIGH X 7.50 DIA | 804052 |
| 24 | | | |
| 23 | 5 | GASKET, ROUND | 804038 |
| 22 | 1 | PINCH VALVE | 36559 |
| 21 | TBD | TUBING, CLEAR 5/16" O.D. X 3/16" I.D. | 802248 |
| 20 | 1 | REDUCER, BUSHING 1/4" X 1/8" BRASS | 34103 |
| 19 | 1 | REDUCER, BUSHING 1" X 1/4" BRASS | 803054 |
| 18 | 4 | NUT, 3/8-16 ZINC PLATED STEEL | 805180 |
| 17 | 4 | SPRING, NICKEL PLATED | 805214 |
| 16 | 8 | WASHER, FLAT 3/8 ZINC PLATED STEEL | 805181 |
| 15 | 1 | VAVLE, BALL PVC 1" FPT X 1" FPT | 802196 |
| 14 | 2 | CLAMPS, HOSE 13/16 X 1 1/2" | 805055 |
| 13 | .66 FT | TUBING, CLEAR PVC 1" I.D. 3/16" WALL | 802236 |
| 12 | 2 | BARB, NYLON 1" MPT X 1" BARB | 805020 |
| 11 | 4 | NIPPLE, CLOSE PVC 1" SCH 80 | 802103 |
| 10 | 2 | TEE, PVC 1" FPT SCH 80 | 802028 |
| 9 | 2 | BULKHEAD FITTING (RAVEN) 1/2" FPT | 802169 |
| 8 | 3 | BULKHEAD FITTING (RAVEN) 1 FPT | 802171 |
| 7 | | | |
| 6 | 2 | BULKHEAD FITTING 2" FPT (RAVEN) | 802174 |
| 5 | 1 | PIPE, PVC 3" 17.50 LG REF. | 802156 |
| 4 | 1 | FERNCO 3" COUPLER | 802166 |
| 3 | 1 | TRAY, TOP | 804029 |
| 2 | 4 | TRAYS, WITH SECONDARY PARTS | 804030 |
| 1 | 1 | SUMP | 804031 |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS

TOLERANCES
.XX +/-.01 FRACT +/-1/64
.XXX +/-.005 ANGLES +/-1/2
OTHER TOLERANCES AS SPECIFIED

2.4 EZ STACKER

NEXT ASS'Y | USED ON

DRAWN BY MEB | DATE 8/8/97
CHECKED BY | DATE
APPROVED BY | DATE
MFG. APPROVAL
MATERIAL
FINISH

Q.E.D.
ENVIRONMENTAL SYSTEMS INC.
6155 JACKSON ROAD, ANN ARBOR, MI.

TITLE
EZ-2.4 P
ASSEMBLY/BOM/KIT

DWG NUMBER ezs2osm.dw | REV
SCALE N.T.S. | SHEET 1 OF 1

# Bag Filter

DRC # 6154

**DIVERSIFIED REMEDIATION & CONTROLS**

21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660


INSTALLATION
OPERATION
MAINTENANCE
X100™
CONVERTIBLE FILTER HOUSING
OPERATOR
STUDY
GUIDE
READ AND UNDERSTAND
ENTIRE MANUAL BEFORE
OPERATING THIS VESSEL
FSI

**1. This manual has been prepared for the safe installation, operation, and maintenance of FSI pressure vessels.**

Warning labels have been reprinted in this manual. Warning labels are not a substitute for reading and understanding this manual. All labels must be replaced when legibility is lost or visibility is blocked. Labels have a part number in the lower left-hand corner for reordering.

**2. The location of the Installation, Operation and Maintenance Manual for the filter vessel.**

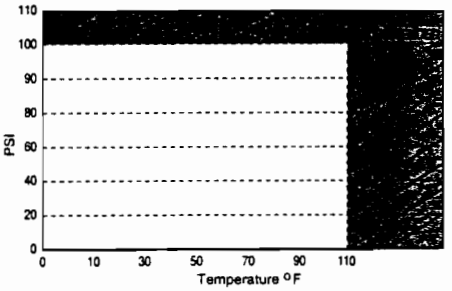
The end user is to place the Installation, Operation, and Maintenance Manual on each vessel upon final installation. The manual must be visible and accessible to the operator.

**3. Chemical Compatibility of the filter and the fluid being filtered.**

*PROTECTIVE CLOTHING*

Before operating this vessel, operator should wear protective gloves and face shield. Refer to Material Safety Data Sheet (MSDS), for specific instructions for handling the liquid, as supplied by the manufacturer of the material. (See Warnings)

**Temperature of operating range for the X100 Filter Vessel.**




## WARNINGS

**Before use, consult chemical compatibility guidelines.**
**This vessel is manufactured from talc filled polypropylene. The maximum operating pressure is rated at 100 PSI with water where the temperature does not exceed 110°F. The operating pressure may vary when using other substances and temperatures.**
**Although this housing material has a wide range of chemical resistance, there are several factors that affect or restrict the usage, i.e., temperature and concentration of solutions. Therefore the user should refer to published reference materials for chemical compatibility.**

**A partial list follows:**

- **Compass Corrosion Guide—Section B.**
- **Compass Chemical Resistance Guide for Elastomers.**
- **Dow Chemical Resistance Guide.**
- **DuPont Chemical Resistance and Fluid Compatibility.**

**Failure to comply with the chemical compatibility guidelines may result in extensive vessel structural integrity failure.**
**Such failure could result in severe injury to the user.**

**Hot and/or chemically active liquids can cause serious injury.**

**Wear protective face shield and clothing.**

**4. Mounting Location.**

Locate the filter away from direct sunlight and all heat sourcesthat could elevate its temperature beyond the maximum allowable. See lid for maximum temperature rating.

*MOUNTING*

Hard pipe the filter housing in place with 2 inch sch. 80 plastic piping. Secure the inlet and outlet pipe to provide filter support. If it is desirable to support the filter and its contents, polypropylene legs and floor mounting pads are a standard option.

The legs can be shortened by saw cutting. Note: The plastic legs are used in conjunction with hard piping to provide rigid filter support. For filters requiring solid floor mounting, stainless steel or carbon steel support legs are a standard option.

The height of the support legs can be adjusted by moving the belly bands of the leg assembly up or down the filter housing.

Maximum floor to filter outlet is13 1/4 inches.

Use commercially available 3/8 inch diameter floor anchors.

**5. Piping.**

The piping material used should be the same as the base material of the vessel.

The piping temperature and pressure rating should be equal to or greater than that of the vessel.

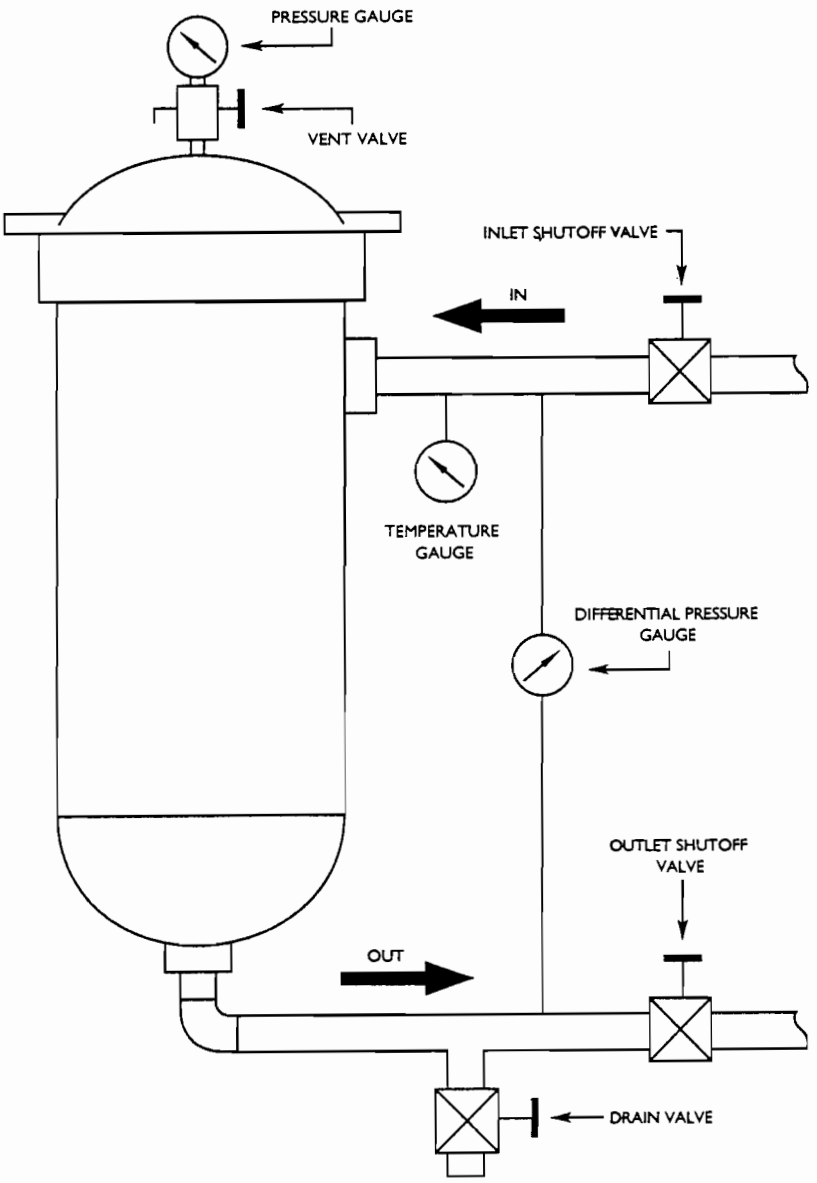
*RELIEF VALVE*

It is the responsibility of the end user to protect the system components, such as the FSI filter, from being over-pressurized.

This can be achieved by installing a system relief valve.

*PRESSURE GAUGE, TEMPERATUE GAUGE, AND VENT VALVE*

FSI does not supply the vessel pressure gauge, temperature gauge, or the vent valve. It is the responsibility of the end user to obtain, install, and maintain the proper components. Refer to Figure 1 (See Warnings)

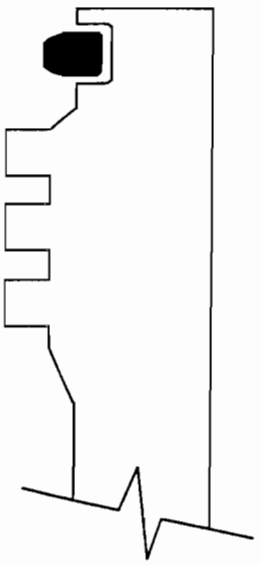



(Figure 1)

**6. Gasket.**

*GASKET INSTALLATION*

Clean the gasket groove.
Slip the gasket over the filter and into the groove.
Make sure the gasket is not twisted and the bevelled edges are facing out.
Apply a small amount of non-contaminating lubricant to the outside of the gasket.
Use only FSI replacement gaskets.
Refer to Figure 2
(See Warnings)



(Figure 2)

**WARNINGS**

**Vent Valve exhaust can be dangerous — direct exhaust to a safe place.**

**Do not open vessel under pressure; escaping fluid under pressure can cause serious injury.**

**Gasket can fail, causing serious injury. Gasket material must be chemically and temperature compatible with fluid being filtered.**

**7. Opening and Closing the Filter.**

*OPENING*

To Isolate the filter:

1. Turn off and lock out pump.
2. Turn off inlet shutoff valve.
3. Turn off outlet shutoff valve.
4. Drain filter (vent valve may have to be cracked open).
5. Filter should have no internal pressure.
6. Check pressure gauge for zero PSI.
7. Remove lid manually by turning counterclockwise.
   A gentle tap against the handle may be necessary, if the lid was over tightened.

Refer to Figure 1

Remove filter bag or cartridge with caution. Insert new filter bag, or cartridge.
Note: The recommended differential pressure across a filter element before changing is: 10-15 PSI for bag filters, 10-15 PSI for cartridges.

*CLOSING*

1. Lubricate the gasket with a small amount of sanitary O-ring lubricant.
2. Turn the lid clockwise until it bottoms out.
   STOP, additional force will not enhance the seal; it will cause the threads to stick.
3. Before opening the inlet valve, close the drain valve and vent bind.

**8. Converting from a bag filter to a cartridge filter.**

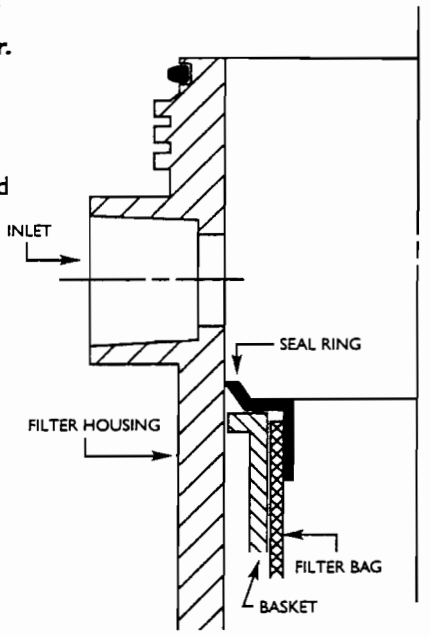
1. Remove the basket.
2. Clean the inside of the filter housing.
   Do not scratch the molded interior surface.
3. Lubricate the cartridge conversion plate with a small amount of sanitary O-ring lubricant.
4. Slide the plate into the housing with the boss facing down.
   Push the plate firmly against the support ribs.

Refer to Figure 4

**9. Converting from a cartridge filter to a bag filter.**

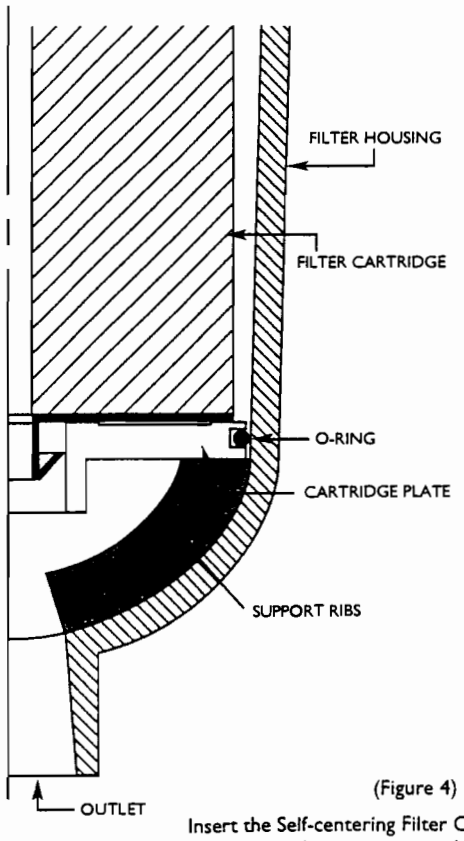
1. Clean the inside of the filter housing.
   Do not scratch the molded interior surface.
2. Pull out the cartridge conversion plate.
3. Drop the basket in.

Refer to Figure 3




(Figure 3)

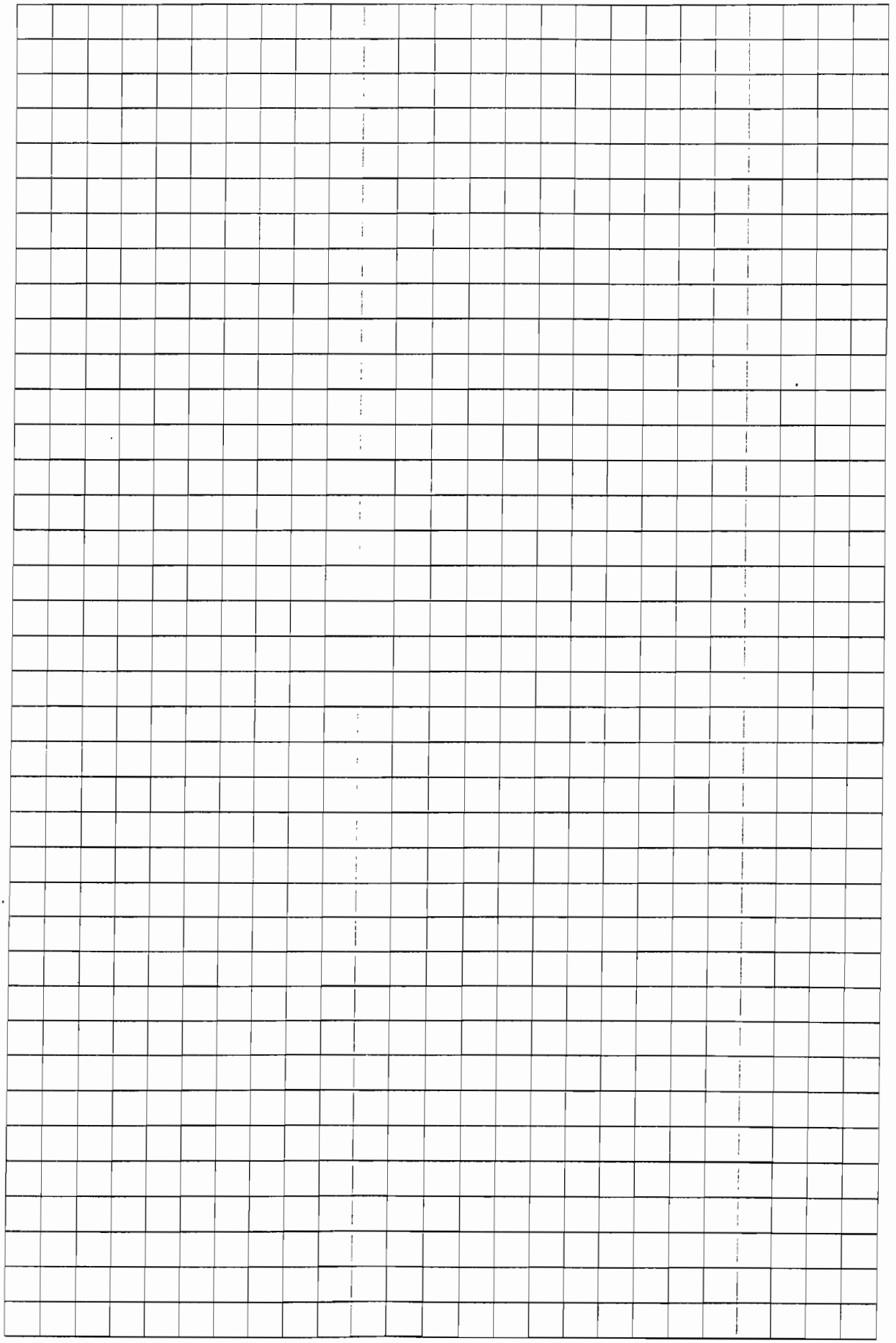
Insert Filter Bag into the basket.
Make sure the bag seal ring bottoms out against the basket shoulder.
The ring seals against the filter wall.




(Figure 4)

Insert the Self-centering Filter Cartridge.
Stop when it bottoms out on the cartridge plate.

X100 FILTER VESSEL



## → OPTIONS & REPLACEMENT PARTS

| Part No. | Description |
|---|---|
| 36028 | Replacement Lid - No Gasket |
| 36002 | X100 Plastic Basket |
| 36005 | Cartridge Plate |
| 36017 | (2) Plastic Leg and Foot Assembly |
| 281276A | Carbon Steel Tripod Legs |
| 281276B | 304 Stainless Steel Tripod Legs |
| EGT30096B | Lid Gasket (BUNA) |
| EGT30096VI | Lid Gasket (VITON) |
| EGR253B | Plate Gasket (BUNA) |
| EGR253VI | Plate Gasket (VITON) |

Patents Pending

## X SERIES FILTERS MANUFACTURER'S SUGGESTED RETAIL PRICES

### Housings - X100

| Part No. | Model No. | Description | Price |
|---|---|---|---|
| 416014B | X100B | X100 Bag Vessel - Buna Gasket | |
| 416014C | X100C | X100 Cartridge Vessel - Buna Gasket | |

Housings include - Lid, Basket or Cartridge Plate and Gaskets (Leg-Foot assemblies not included)

### Filter Bags - X01

| Part No. | Price | Part No. | Price |
|---|---|---|---|
| BPONG1X01 | | BPMO100X01 | |
| BPONG5X01 | | BPMO150X01 | |
| BPONG10X01 | | BPMO200X01 | |
| BPONG25X01 | | BPMO300X01 | |
| BPONG50X01 | | BPMO600X01 | |
| BPONG100X01 | | BPMO800X01 | |

Case Quantity - 50 Bags

### Cartridges - X20

| Part No. | Price |
|---|---|
| CMMF [1-5] X20 | |
| CMMF [10-25] X20 | |
| CMMF [50-75-100] X20 | |

Case Quantity - 6 Cartridges

## WARNINGS

**The X100 vessel is only designed to use lathe cut gaskets made of self-energizing material such as BUNA-N or VITON. FSI Does Not Recommend the use of gaskets or O-rings that are made of non-self energizing (i.e. non-elastomeric) material such as rope type gaskets, teflon, or graphite-impregnated materials.**

**The X100 is talc filled polypropylene. Please refer to chemical resistance guides for filter housing compatibility with specific chemicals at various temperatures. Only use this housing with chemical vs. temperature ratings of "+" or "excellent". FSI will not assume responsibility for the use of this housing with chemicals and/or at temperatures and pressures that are not compatible with or within the safe operating range of this filter housing. Please refer to nameplate data on this housing which gives maximum operating temperature and pressure limits, and which assumes the operation of this housing is with chemically compatible fluids. Consult the FSI Engineering Department (1-800-348-3205) for pressure limits at different operating and/or ambient temperatures.**

**WARNING**

BEFORE USE
REMOVE RED CAP
PLUG
REPLACE WITH
COMPATIBLE
PLUG VALVE OR
GAUGE

**WARNING**

WITH WATER
SERVICE
MAX PRESSURE
100 PSI
MAX TEMPERATURE
110°F

**WARNING**

**BEFORE USE, CONSULT CHEMICAL COMPATIBILITY GUIDELINES.**

This vessel is manufactured from talc filled polypropylene. The maximum operating pressure is rated at 100 PSI with water where the temperature does not exceed 110°F. The operating pressure may vary using other substances and temperatures.
Although this housing material has a wide range of chemical resistance, there are several factors that affect or restrict usage, i.e., temperature and concentration of solutions. Therefore, the user should refer to published reference materials for chemical compatibility.

A partial list follows:

Compass Corrosion Guide-Section B.
Compass Chemical Resistance Guide for Elastomers
Dow Chemical Resistance Guide.
DuPont Chemical Resistance and Fluid Compatibility.

Failure to comply with the chemical compatibility guidelines may result in extensive vessel structural integrity failure.

**SUCH FAILURE COULD RESULT IN SEVERE INJURY TO THE USER.**

MANUFACTURED IN THE USA
PRINTED IN USA

FSI ® 100 Anchor Road
P.O. Box 735
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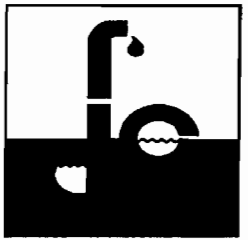
(219) 879-3307
(219) 879-0632 FAX
Filter Specialists, Inc. 800-348-3205

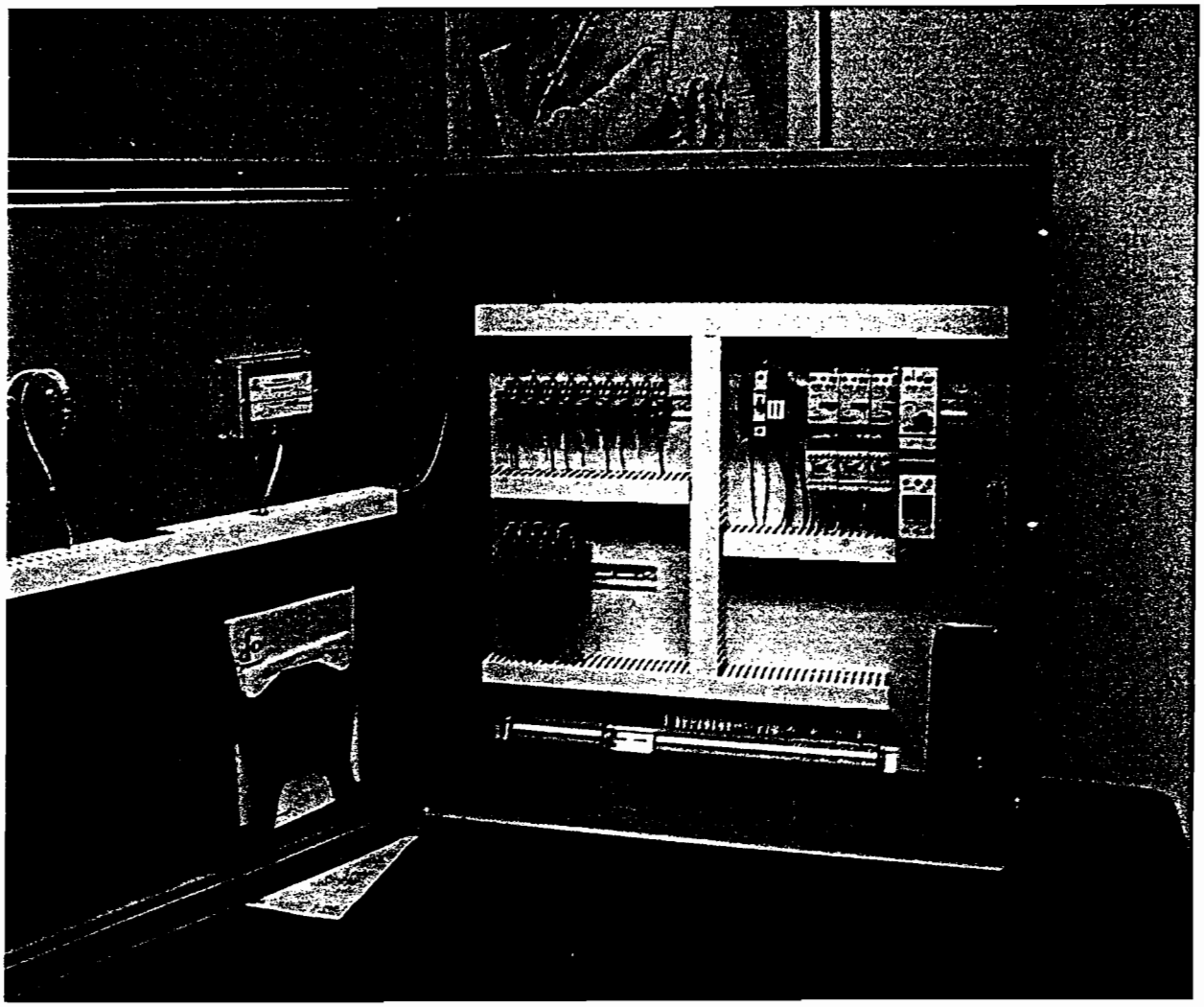
# Control Panel

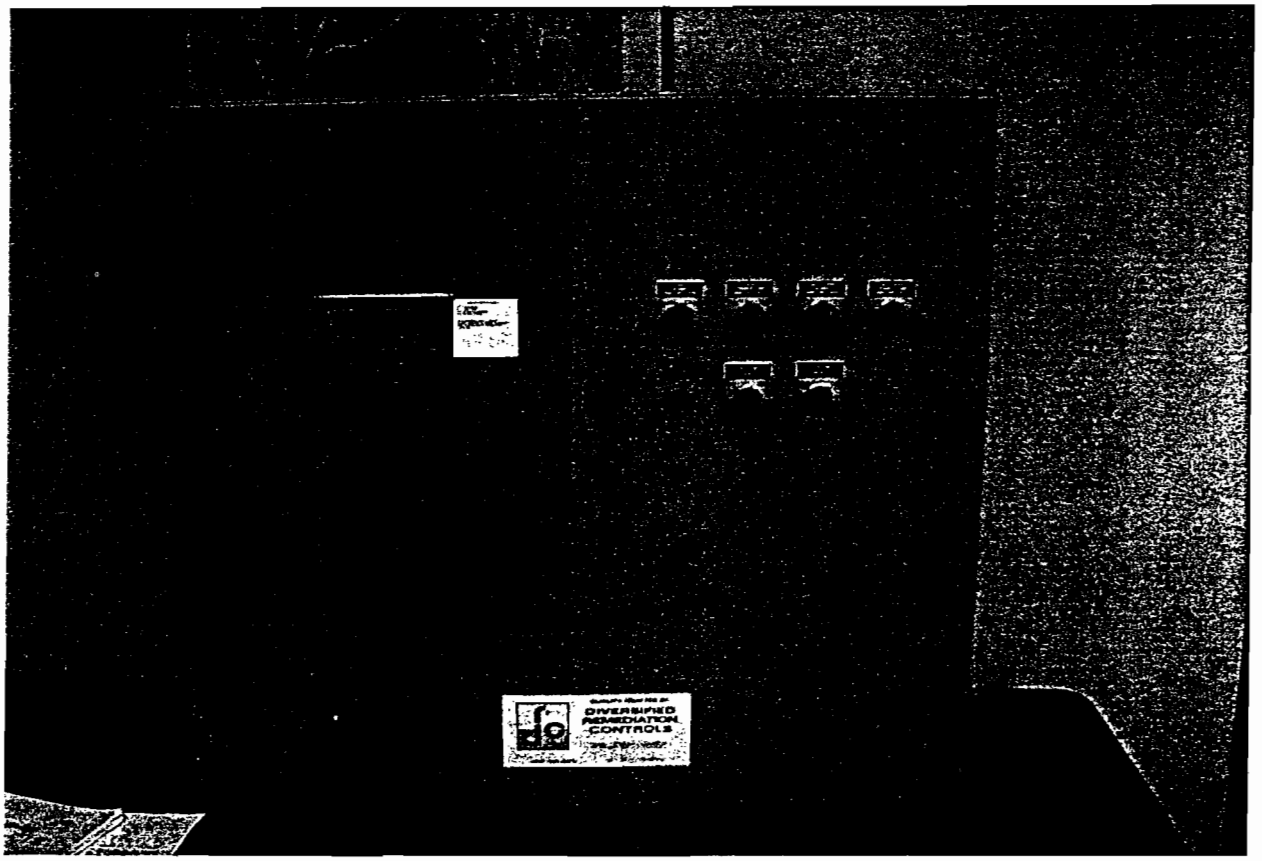
DRC # 6154



**DIVERSIFIED REMEDIATION & CONTROLS**

21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660

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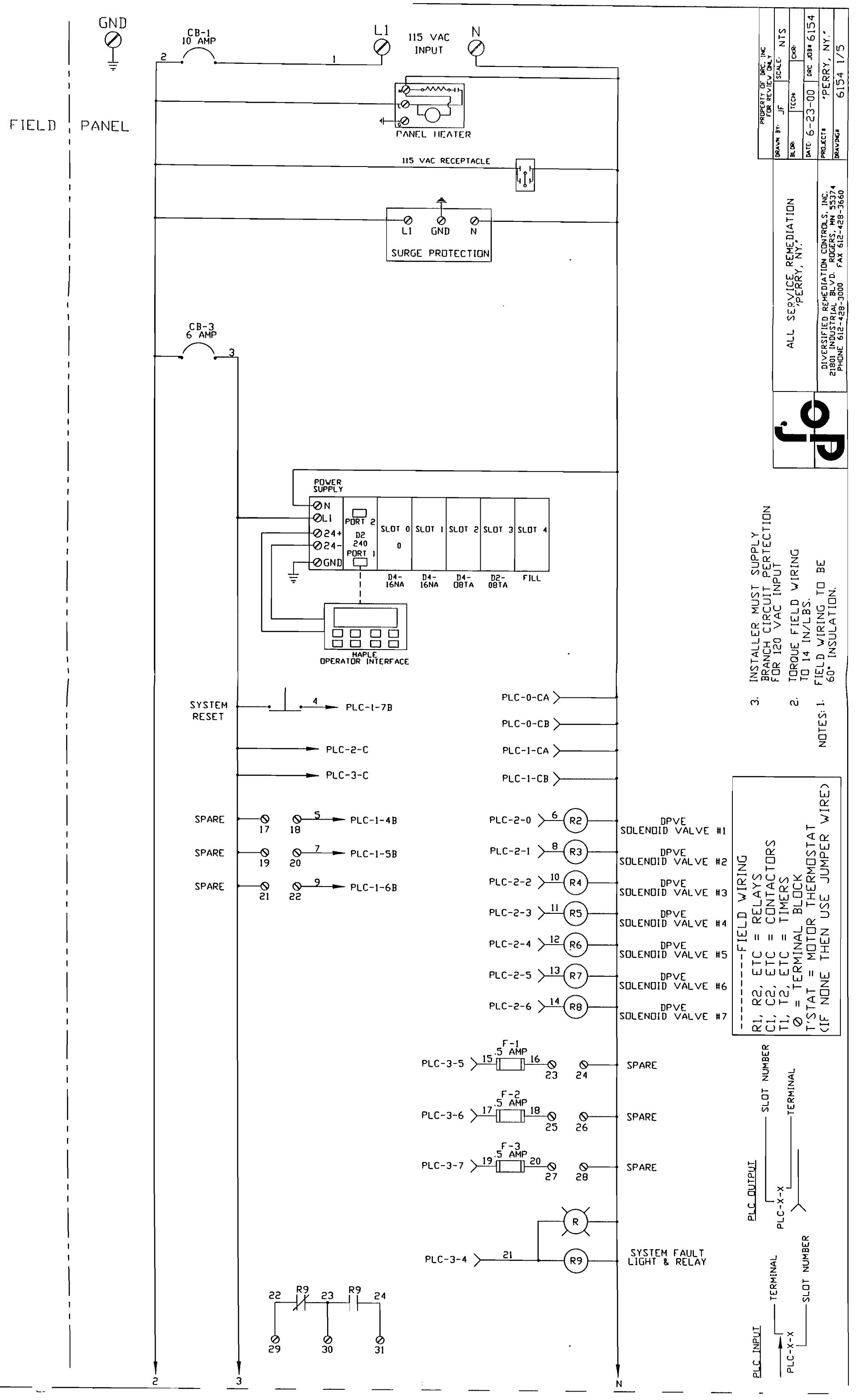
RESEARCH
CONTROLS

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FOR REVIEW ONLY

| | | | |
|---|---|---|---|
| DRAWN BY: JF | SCALE: NTS | | |
| BLDR: | TECH: | CKR: | |
| DATE: 6-23-00 | DRC JOB#: 6154 | | |
| PROJECT#: "PERRY, NY." | | | |
| DRAWING#: 6154 1/5 | | | |

ALL SERVICE REMEDIATION
"PERRY, NY."

DIVERSIFIED REMEDIATION CONTROLS, INC.
21801 INDUSTRIAL BLVD. ROGERS, MN 55374
PHONE 612-428-3000 FAX 612-428-3660

FIELD | PANEL

3

N

PLC-2-7

O
H A

DPVE BLOWER

25 → T'STAT (32/33) → 26 → C1 OL → 27 → G, C1

28 → PLC-0-4B

C1 AUX → 29 → PLC-1-0A

PLC-3-3 → 30 → R1 → VACUUM REDUCING SOLENOID VALVE RELAY

PLC-3-0

O
H A

DPVE TRANSFER PUMP

31 → T'STAT (34/35) → 32 → C2 OL → 33 → G, C2

34 → PLC-0-5B

C2 AUX → 35 → PLC-1-1A

PLC-3-1

O
H A

AIR STRIPPER BLOWER

36 → T'STAT (36/37) → 37 → C3 OL → 38 → G, C3

39 → PLC-0-6B

C3 AUX → 40 → PLC-1-2A

PLC-3-2

O
H A

AIR STRIPPER TRANSFER PUMP

41 → T'STAT (38/39) → 42 → C4 OL → 43 → G, C4

44 → PLC-0-7B

C4 AUX → 45 → PLC-1-3A

3

R1 → PLC-1-4A → 46 → 1, 2 → DPVE VACUUM REDUCING SOLENOID VALVE

R2 → PLC-1-5A → 47 → 3, 4 → DPVE SOLENOID VALVE #1

R3 → PLC-1-6A → 48 → 5, 6 → DPVE SOLENOID VALVE #2

R4 → PLC-1-7A → 49 → 7, 8 → DPVE SOLENOID VALVE #3

R5 → PLC-1-0B → 50 → 9, 10 → DPVE SOLENOID VALVE #4

R6 → PLC-1-1B → 51 → 11, 12 → DPVE SOLENOID VALVE #5

R7 → PLC-1-2B → 52 → 13, 14 → DPVE SOLENOID VALVE #6

R8 → PLC-1-3B → 53 → 15, 16 → DPVE SOLENOID VALVE #7

3

N

NOTES:
1. FIELD WIRING TO BE 60° INSULATION.
2. TORQUE FIELD WIRING TO 14 IN/LBS.
3. INSTALLER MUST SUPPLY BRANCH CIRCUIT PERTECTION FOR 120 VAC INPUT

---------FIELD WIRING
R1, R2, ETC = RELAYS
C1, C2, ETC = CONTACTORS
T1, T2, ETC = TIMERS
Ø = TERMINAL BLOCK
T'STAT = MOTOR THERMOSTAT
(IF NONE THEN USE JUMPER WIRE)

PLC OUTPUT: PLC-X-X — SLOT NUMBER, TERMINAL

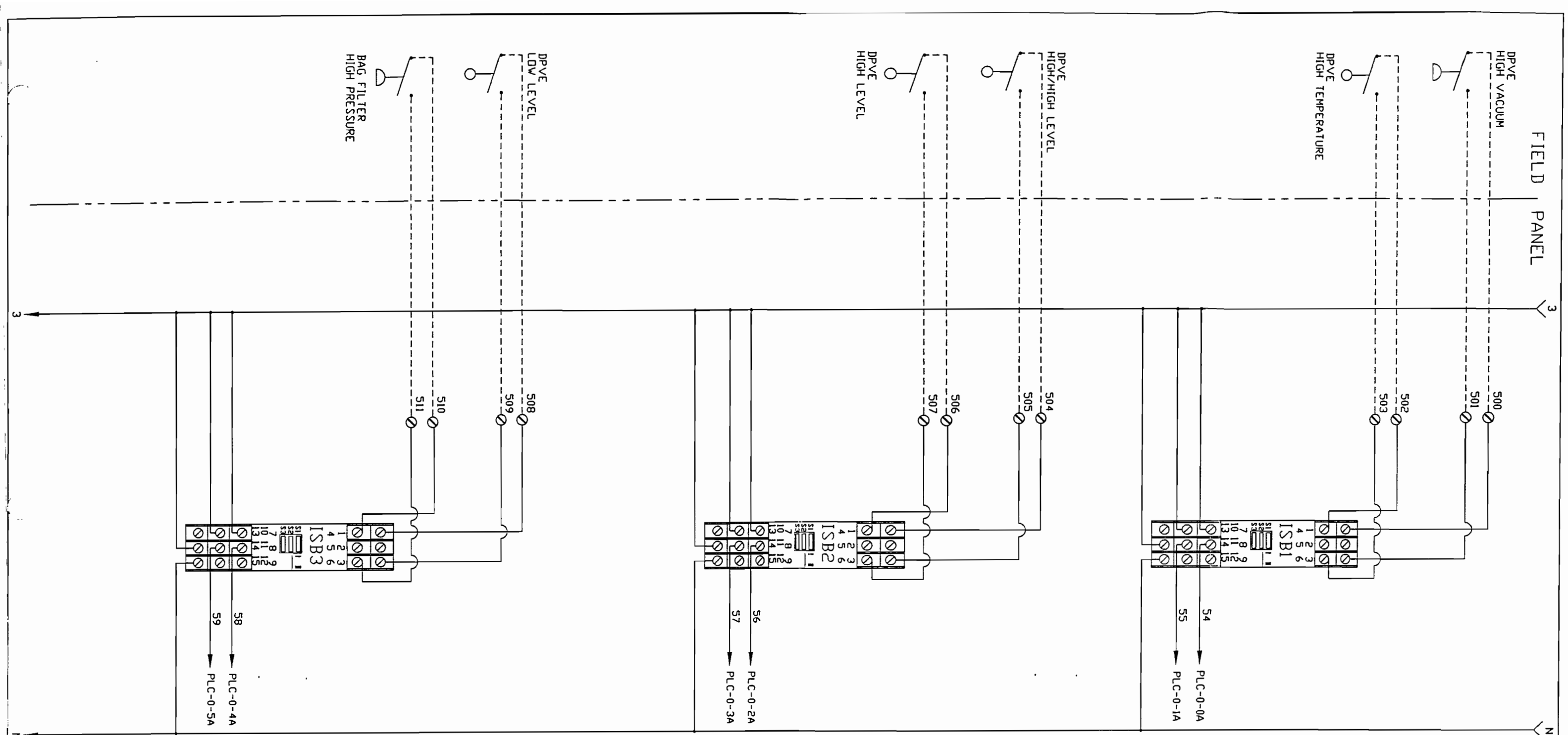
PLC INPUT: PLC-X-X — TERMINAL, SLOT NUMBER

PROPERTY OF DRC, INC
FOR REVIEW ONLY

DRAWN BY: JF | SCALE: NTS | DRC JOB# 6154
BLDR: | TECH: | CKR:
DATE: 6-23-00 | PROJECT# "PERRY, NY."
DRAWING# 6154 2/5

ALL SERVICE REMEDIATION
"PERRY, NY."

DIVERSIFIED REMEDIATION CONTROLS, INC.
21801 INDUSTRIAL BLVD. ROGERS, MN 55374
PHONE 612-423-3000 FAX 612-428-3660




SLOT NUMBER

---------FIELD WIRING
R1, R2, ETC = RELAYS
C1, C2, ETC = CONTACTORS
T1, T2, ETC = TIMERS
⌀ = TERMINAL BLOCK
T'STAT = MOTOR THERMOSTAT
(IF NONE THEN USE JUMPER WIRE)

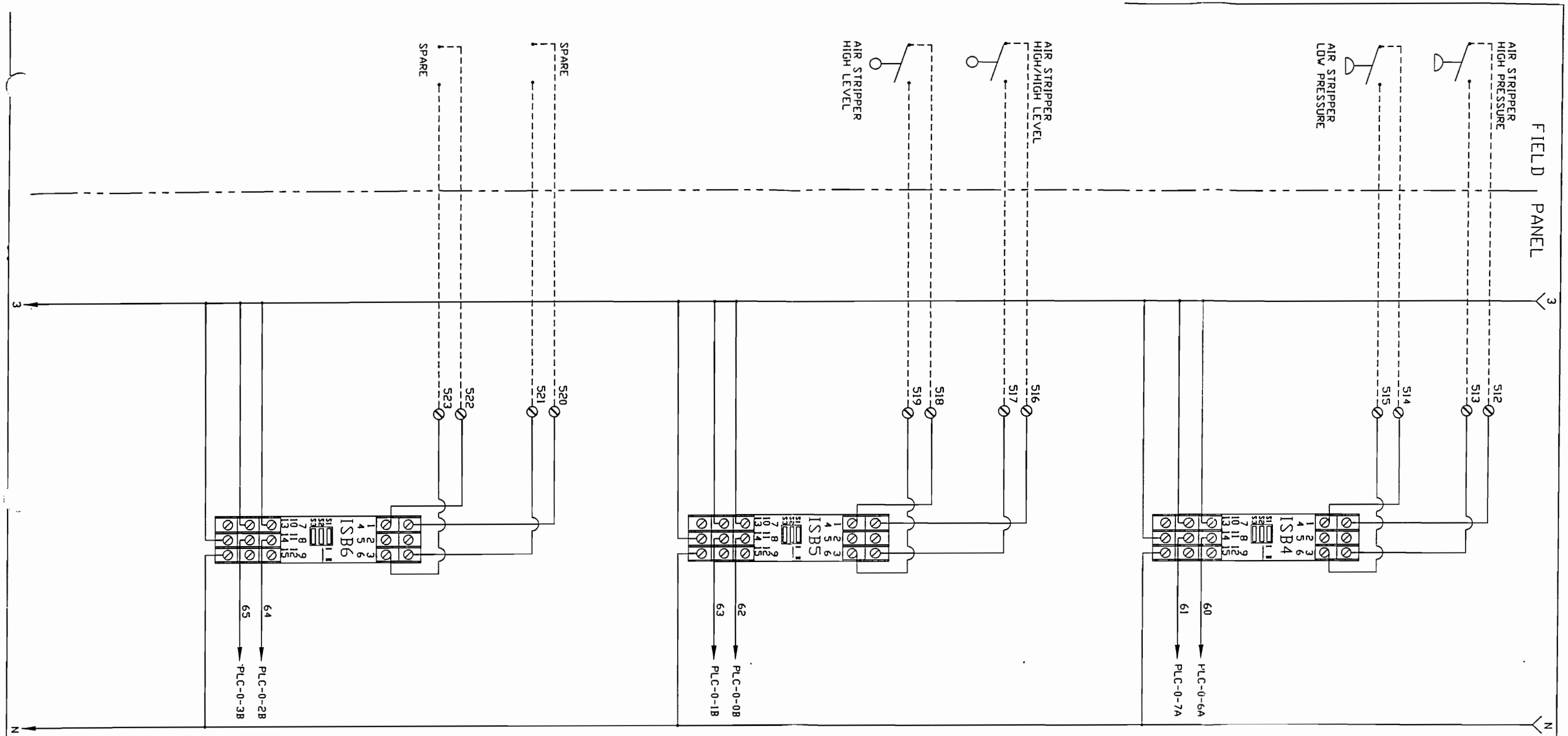
NOTES:
1. FIELD WIRING TO BE 60° INSULATION.
2. TORQUE FIELD WIRING TO 14 IN/LBS.
3. INSTALLER MUST SUPPLY BRANCH CIRCUIT PERTECTION FOR 120 VAC INPUT

ALL SERVICE REMEDIATION
'PERRY, NY.'

DIVERSIFIED REMEDIATION CONTROLS, INC.
21801 INDUSTRIAL BLVD. ROGERS, MN 55374
PHONE 612-428-3000 FAX 612-428-3660



| | | | |
|---|---|---|---|
| DRAWN BY: JF | | SCALE: NTS | |
| BLDR: | TECH: | CKR: | |
| DATE: 6-23-00 | | DRC JOB#: 6154 | |
| PROJECT#: 'PERRY, NY.' | | | |
| DRAWING#: 6154 3/5 | | | |




SLOT NUMBER

---------FIELD WIRING
R1, R2, ETC = RELAYS
C1, C2, ETC = CONTACTORS
T1, T2, ETC = TIMERS
Ø = TERMINAL BLOCK
T'STAT = MOTOR THERMOSTAT
(IF NONE THEN USE JUMPER WIRE)

NOTES:
1. FIELD WIRING TO BE 60° INSULATION.
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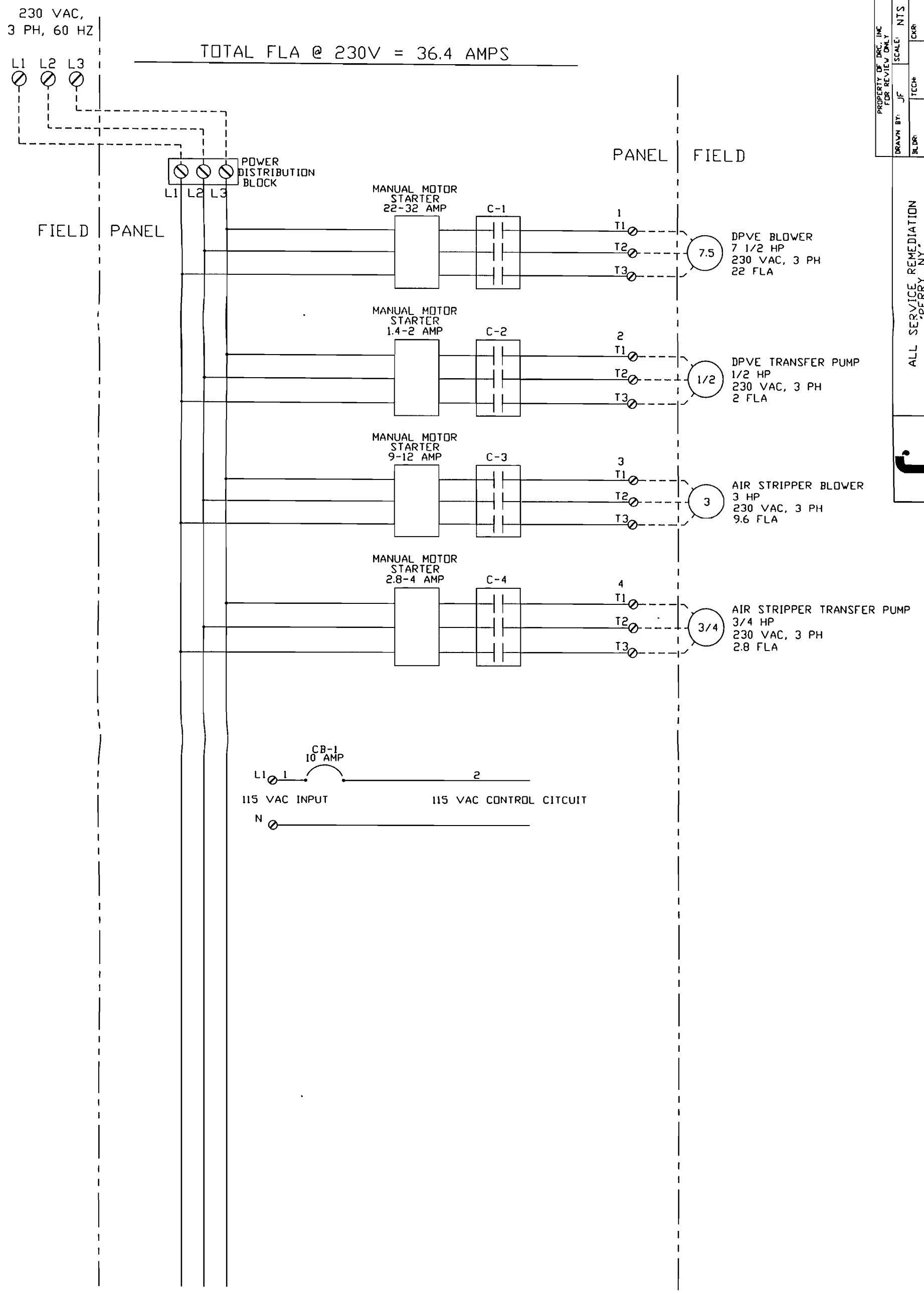
ALL SERVICE REMEDIATION
'PERRY, NY.'

DIVERSIFIED REMEDIATION CONTROLS, INC.
21801 INDUSTRIAL BLVD. ROGERS, MN 55374
PHONE 612-428-3000 FAX 612-428-3660



| | | | |
|---|---|---|---|
| DRAWN BY: JF | | SCALE: NTS | |
| BLDR: | TECH: | CKR: | |
| DATE: 6-23-00 | | DRC JOB#: 6154 | |
| PROJECT#: 'PERRY, NY.' | | | |
| DRAWING#: 6154 4/5 | | | |




PROPERTY OF DRC, INC
FOR REVIEW ONLY

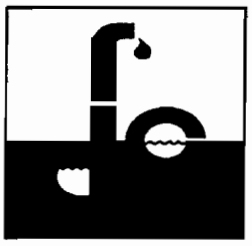
DRAWN BY: JF | SCALE: NTS
BLDR: | TECH: | CKR:
DATE: 6-23-00 | DRC JOB# 6154
PROJECT# "PERRY, NY."
DRAWING# 6154 5/5

ALL SERVICE REMEDIATION
"PERRY, NY."

DIVERSIFIED REMEDIATION CONTROLS, INC.
21801 INDUSTRIAL BLVD. ROGERS, MN 55374
PHONE 612-428-3000 FAX 612-428-3660

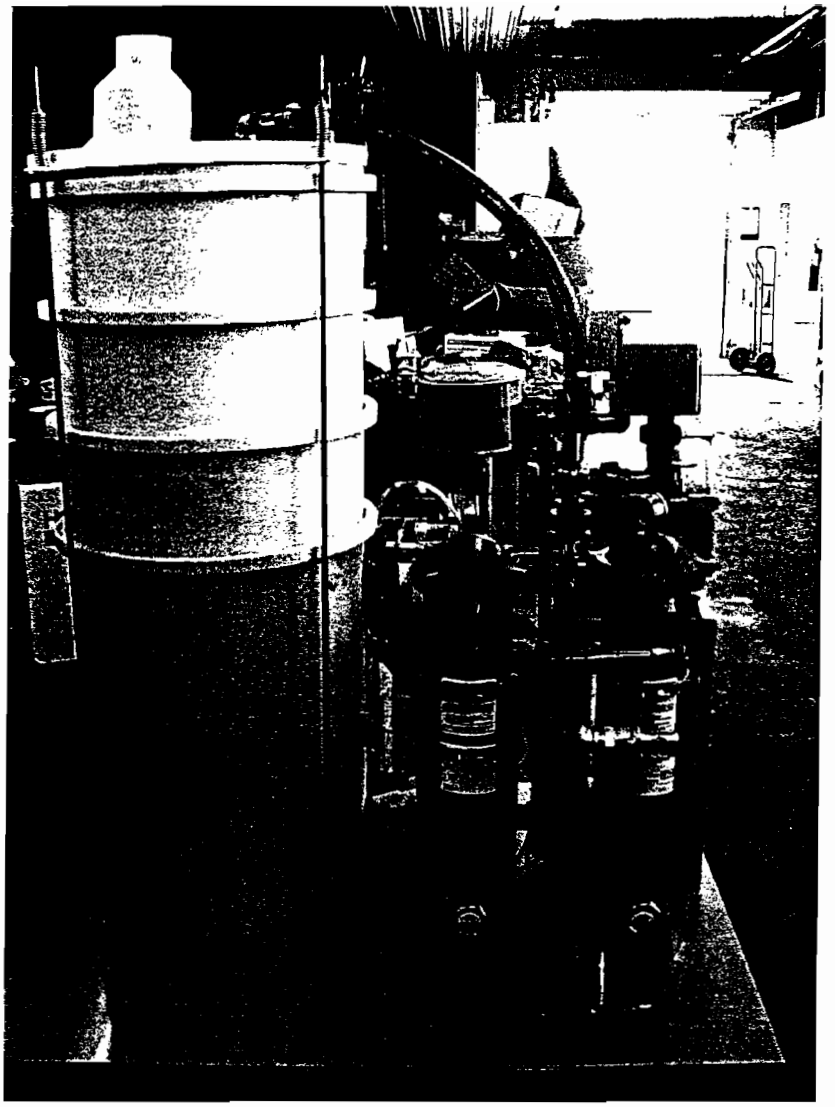
# System Pictures

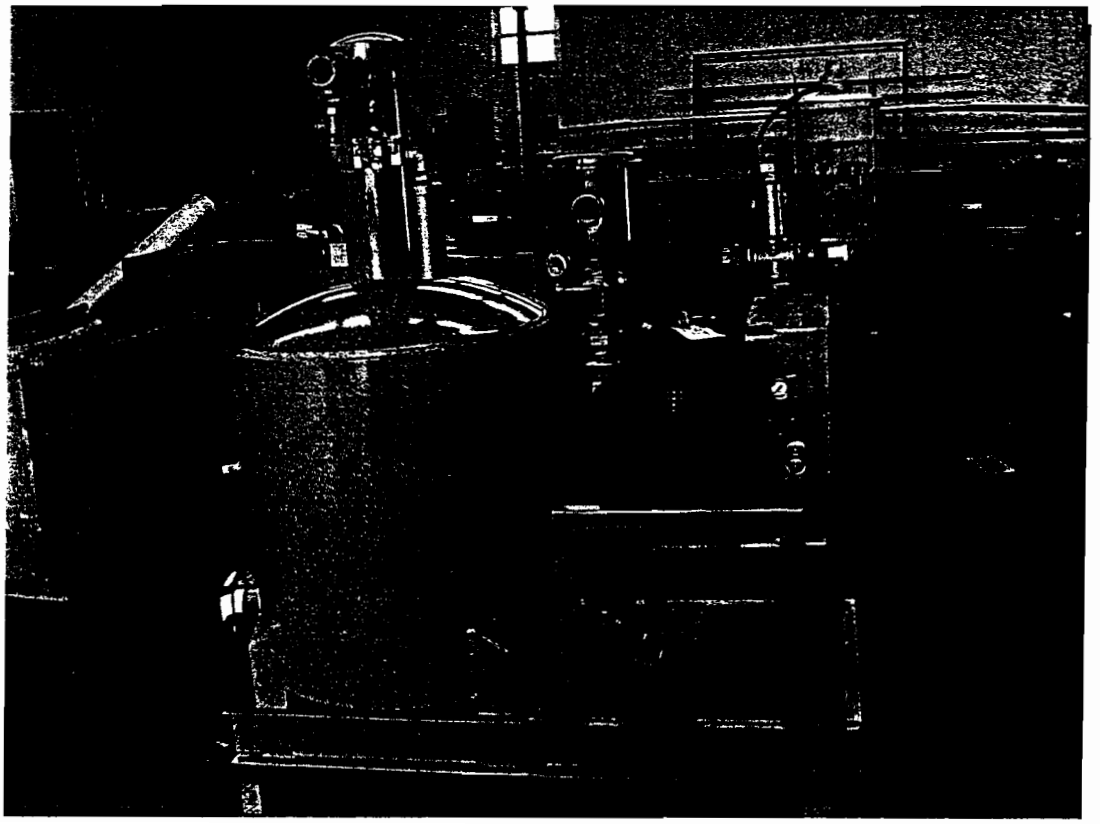
DRC # 6154

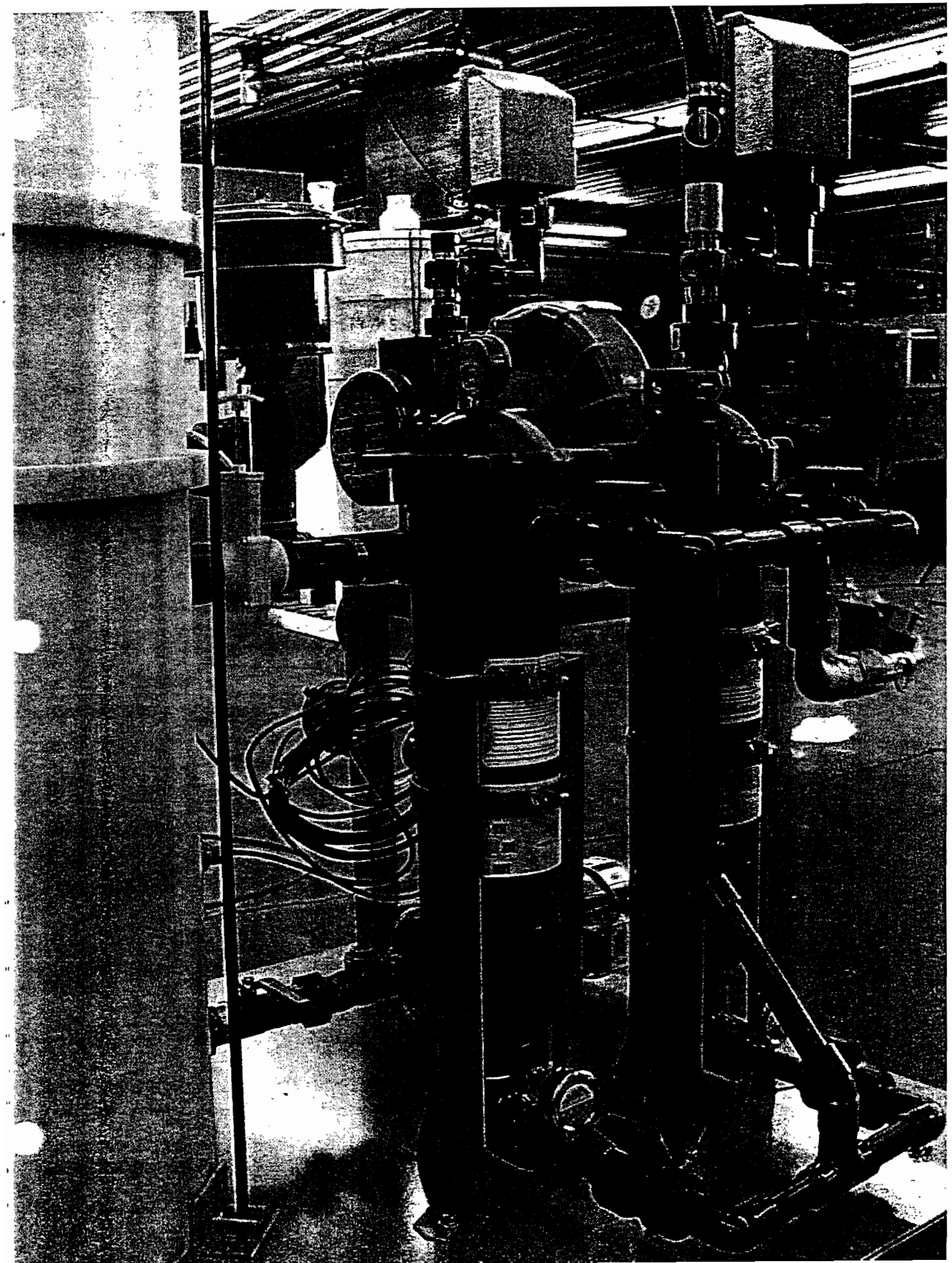


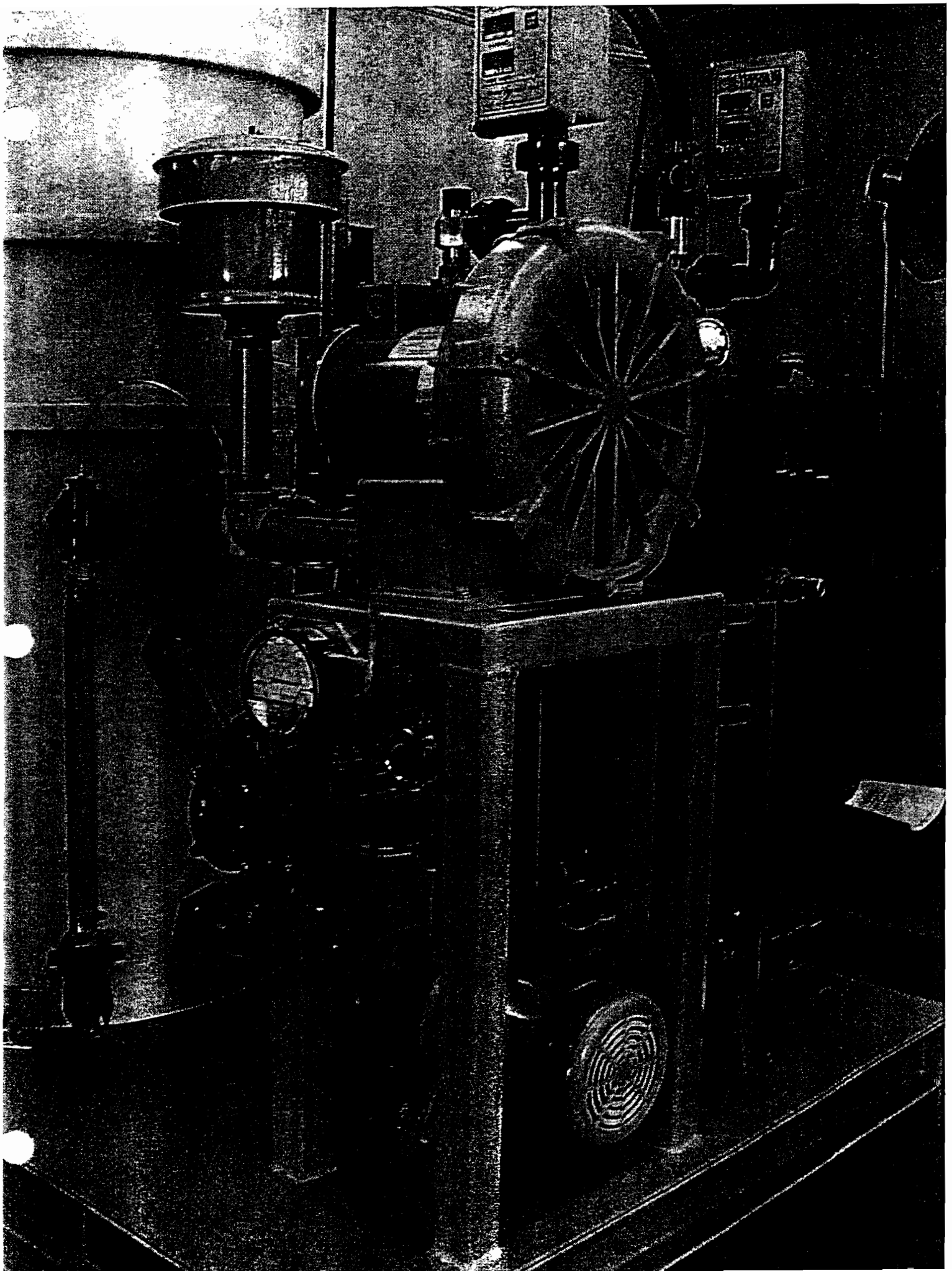
**DIVERSIFIED REMEDIATION & CONTROLS**

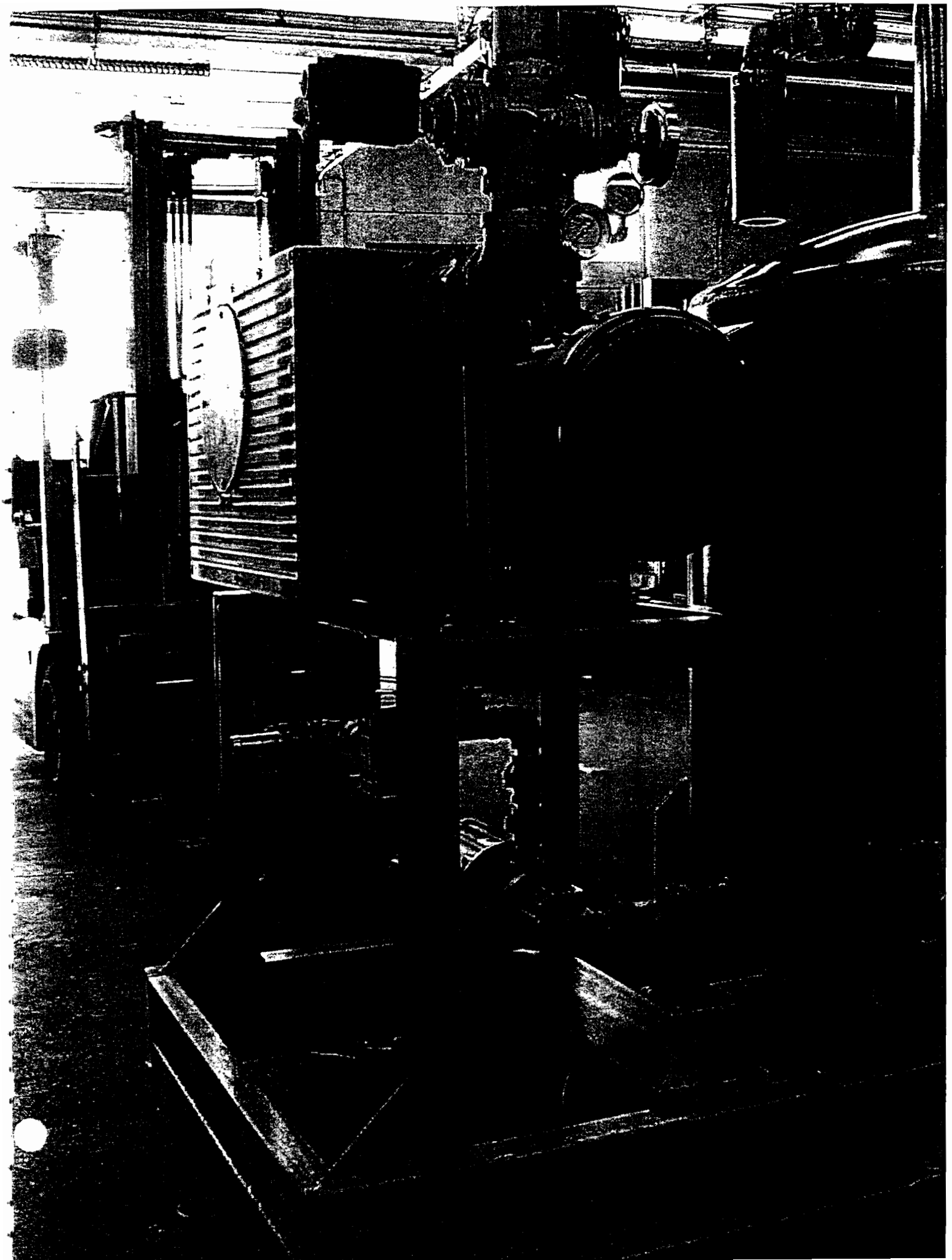
21801 Industrial Blvd. Rogers, MN 55374 Phone (763) 428-3000 Fax (763) 428-3660

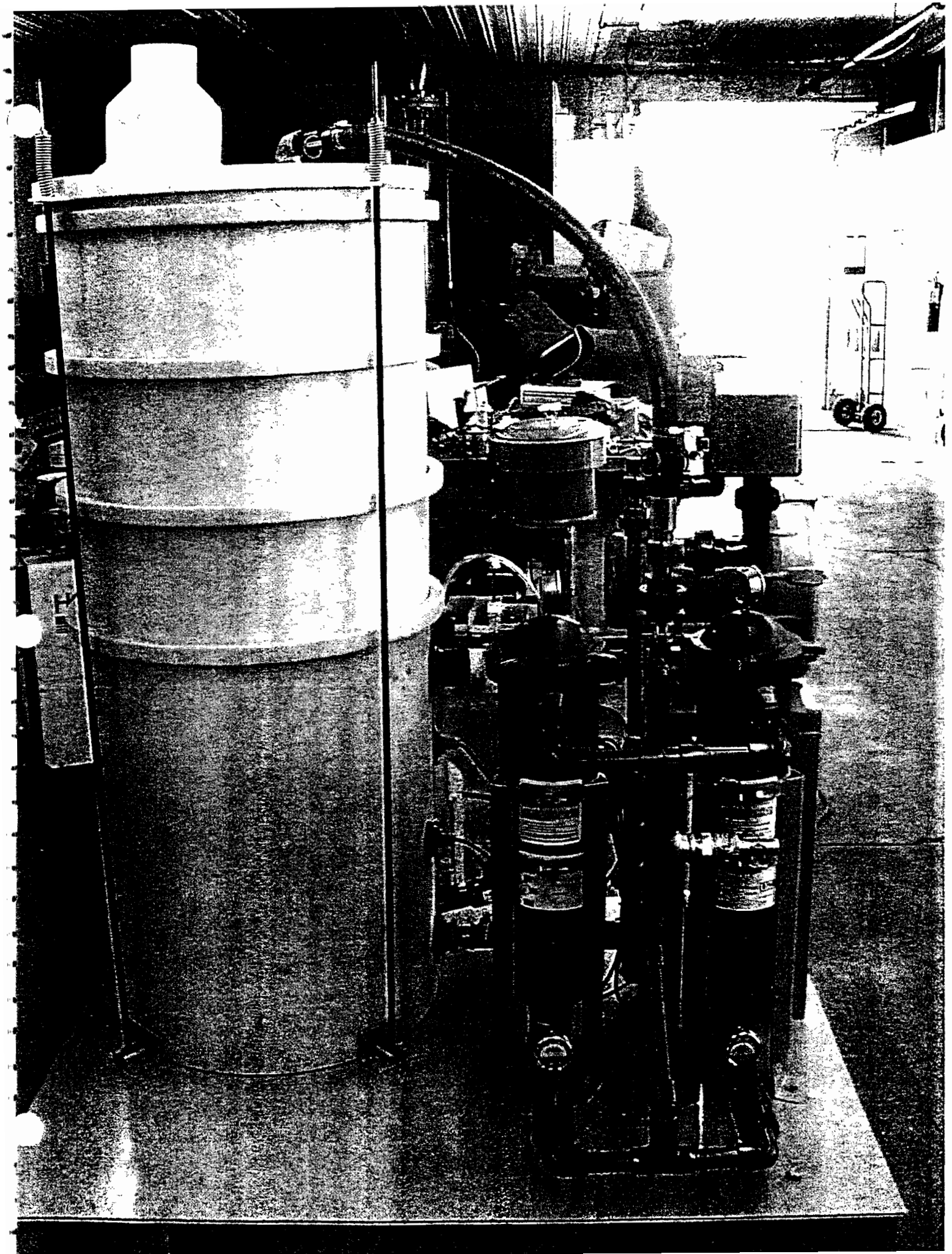












# APPENDIX B

## REPORT OF REMEDIAL ACTIVITIES – FORMER EMPTY DRUM STORAGE AREA

# REPORT OF REMEDIAL ACTIVITIES
# FORMER EMPTY DRUM STORAGE AREA

CHAMPION PRODUCTS, INC.
PERRY, NEW YORK

DEC SITE NO: V00018-9
DELTA PROJECT NO. S098-009-5

Delta
Environmental
Consultants, Inc.

4068 Mt. Royal Boulevard
Suite 225-Gamma
Allison Park, Pennsylvania 15101-2951
USA
412/487-7700
FAX: 412/487-9785

March 7, 2001

New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

Attention: Martin Doster

Subject: **Report of Remedial Activities**
**Former Empty Drum Storage Area**
Champion Products, Inc.
Perry, New York
DEC Site No: V00018-9
Delta Project No. S098-009

Dear Martin:

The purpose of this report is to provide you with the results of the remedial activities that occurred in the referenced area in November 2000. The activities were conducted in accordance with the recommendations provided in Section 2.8 of the Final Remediation Workplan (Workplan).

As discussed in the Workplan, the proposed activities for the former empty drum storage area consisted of soil excavation and confirmatory soil sampling. Based on the tasks performed and the results obtained from the remedial activities, Champion Products, Inc. requests that "no further action" be required for the soil or ground water in the former empty drum storage area.

Please contact me if you have any questions or comments regarding the items contained in this document.

Sincerely,

**DELTA ENVIRONMENTAL CONSULTANTS, INC.**

Stephen A. Zbur, P.G.
Project Manager

cc: Andrew English, NYSDEC
G. Anders Carlson, NYSDOH
Matt Forcucci, NYSDOH
George Johnson, Sara-Lee Corporation
Sally Gallivan, Champion
Sam Gullo, Family Furniture
Maureen Crough, Sidley & Austin
Paul Sylvestri, Harter Secrest & Emery LLP
Bob Elliot, P.E., Lu Engineers, P.C.
Harold C. Parker, Esq.

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**REPORT OF REMEDIAL ACTIVITIES**
**FORMER EMPTY DRUM STORAGE AREA**

**CHAMPION PRODUCTS INC.**
**PERRY, NEW YORK**
**DEC SITE NO: V00018-9**
**DELTA PROJECT NO. S098-009**

## 1.0 INTRODUCTION

Effective March 9, 2000, the New York Department of Environmental Conservation (Department) and Champion Products, Inc. entered into a Remedial Voluntary Cleanup Agreement (Agreement) for the above-referenced facility. In accordance with the Agreement, Champion is implementing the Final Remediation Workplan (Workplan) for the facility.

Part of the remedial strategy presented in the Workplan (see Section 2.8) included the excavation and off-site disposal of approximately 250 cubic yards of soil, from the former empty drum storage area (EDSA), that contained tetrachloroethene (PCE) in excess of the Department's Technical Assistance Guidance Manual (TAGM, Appendix A, Table 1) soil objective of 1,400 micrograms per kilogram (ug/kg). The remaining remedial activities, currently being performed, in accordance with the Agreement, include the operation and maintenance of a dual-phase vapor extraction system in the screen wash areas.

This document details the scope of work and results of the EDSA remediation activities performed during November 2000.

## 2.0 SOIL DELINEATION

As discussed in the Workplan, six soil samples were initially obtained from the EDSA in 1998 at depths ranging from 8–14 feet below ground surface (bgs). Each of the soil samples was analyzed for volatile organic compounds (VOCs) by EPA Method 8260. Tetrachloroethene was reported in soil sample SB-20 (obtained at a depth of 8 feet bgs) at a concentration (2,600 ug/kg) that exceeded the TAGM soil objective of 1,400 ug/kg.

Additional soil sampling was performed on June 10, 1999 to determine the extent and magnitude of PCE in excess of the TAGM soil objective. This sampling included advancing six additional Geoprobe borings (GP-101 through GP-106) to a depth of 15 feet bgs. Three soil samples were obtained from each boring and analyzed for VOCs. The soil samples were obtained at two-foot intervals from depths of 2-4 feet, 8-10 feet and 13-15 feet bgs. Figure 1 presents the 1998 and 1999 sample locations within the EDSA.

Chemistry data from the 18 soil samples obtained in June 1999 reported all VOC concentrations less than the TAGM soil objective. Analytical results from four areas within and adjacent to the EDSA (MW-103, MW-202, SB-21 and SB-22) indicate that ground water in this area does not contain levels of PCE, or any other targeted VOC, above the ground water quality standard.

Historical soil analytical results and ground water analytical results are presented in Tables 1 and 2, respectively.

## 3.0 SOIL EXCAVATION

On November 9, 2000 approximately 400 cubic yards of soil were excavated from within the areas shown on Figure 2. The excavation was advanced to a depth of 14 feet bgs. Prior to initiating excavation activities, the concrete pad, shown in Figure 1, and associated awning were removed in order to facilitate excavation of additional soil from beneath the former pad area. The soil between ground surface and a depth of 6 feet was removed and reused as backfill (based on previous soil delineation data).

Soil removed from below 6 feet to 14 feet was stockpiled covered with plastic. This material was transported to CWM Chemical Services facility (CWM) in Model City, New York on November 29, 2000 and disposed of as a non-hazardous media. The disposal manifests are included as Appendix A. Based on the information provided on the manifests, 185.74 tons (or approximately 245 cubic yards) of soil were transported to CWM.

Confirmatory sampling was performed to evaluate soil quality at the base and sidewalls of the excavation. Eleven soil samples were obtained from the excavation (seven from the sidewall and four from the bottom) and submitted to Upstate Laboratories, Inc. for analysis of VOCs by EPA Method 8260. Figure 2 shows the approximate location of each confirmatory sample collected. Field screening was performed during the remedial activities using an organic vapor monitor (OVM). The OVM readings are presented in Table 3.

The analytical results indicated that ten of the eleven samples did not contain PCE concentrations greater than the TAGM soil objective. Tetrachloroethene was detected at a concentration of 1,900 ug/kg at sidewall sample SW-1, located approximately 4 feet from the building and at a depth of 12 feet bgs. This concentration exceeds the TAGM soil objective of 1,400 ug/kg. Trichloroethene was also detected in SW-1 at a concentration of 230 ug/kg. This value is below the TAGM soil objective of 700 ug/kg. Additional excavation was not performed east of SW-1 or deeper than 14 feet due to the presence of the building. The analytical results are summarized in Table 4 and a copy of the laboratory analytical report is included in Appendix B.

## 4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the activities performed for this investigation, Delta concludes the following:

- Approximately 186 tons of soil containing VOCs were removed from the site and transferred to CWM's facility in Model City, NY for disposal.
- Eleven soil samples were obtained from the sidewalls and base of the excavation.
- One targeted analyte (PCE) was detected along the east sidewall (SW-1) in excess of the TAGM guidance value at a depth of 12 feet bgs. Additional vertical and lateral excavation was not performed due to the presence of the building.
- The analytical results obtained from ground water samples at monitoring wells MW-103 and MW-202 and soil borings SB-21 and SB-22 did not reveal the presence of targeted analytes above ground water quality standards.
- Soil from the ground surface to 12 feet bgs does not exceed the TAGM soil objective for PCE or any other targeted VOCs. The absence of VOCs from this zone and the presence of the adjacent building eliminate the direct contact exposure pathway.
- Total VOCs in the EDSA are below the recommended total VOC soil cleanup objective of 10,000 ug/kg, as discussed in Section 8.6 of the Workplan.

Based on the conclusions provided above, we recommend that no further action be required for the soil or ground water in the former empty drum storage area. Continued quarterly ground water monitoring will be performed at monitoring wells MW-103 and MW-202 as part of the ongoing activities associated with the dual phase vapor extraction system.

Please contact us if you have any questions or comments regarding the items contained in this document.

Sincerely,

**DELTA ENVIRONMENTAL CONSULTANTS, INC.**

Heather Watson
Staff Scientist

3/7/01
Date

Stephen A. Zbur, P.G.
Project Manager

3/7/01
Date

**TABLES**

TABLE 1
HISTORICAL SOIL ANALYTICAL RESULTS
FORMER EMPTY DRUM STORAGE AREA
CHAMPION PRODUCTS INC.
PERRY, NEW YORK
DELTA PROJECT NO. S098-009

PERIOD: From 06/22/1998 thru 06/10/1999 - Inclusive
SAMPLE TYPE: Soil

| SITE | DATE | DEPTH | Tetrachloro ethylene (ug/kg) | Toluene (ug/kg) | Trichloro ethylene (ug/kg) | Bromomethane (ug/kg) | Chloromethane (ug/kg) | cis-1,3-Dichloropropene (ug/kg) |
|---|---|---|---|---|---|---|---|---|
| Soil Quality | | | 1400 | 1500 | 700 | | | |
| GP-101 | 06/10/1999 | 2.00 | <3 | <3 | 8 | <3 | <3 | <3 |
| GP-101 | 06/10/1999 | 8.00 | <3 | <3 | 5 | <3 | <3 | <3 |
| GP-101 | 06/10/1999 | 13.00 | <3 | <3 | 9 | <3 | <3 | <3 |
| GP-102 | 06/10/1999 | 2.00 | <3 | <3 | <3 | 39 | 18 | <3 |
| GP-102 | 06/10/1999 | 8.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-102 | 06/10/1999 | 13.00 | 4 | <3 | <3 | <3 | <3 | <3 |
| GP-103 | 06/10/1999 | 2.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-103 | 06/10/1999 | 8.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-103 | 06/10/1999 | 13.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-104 | 06/10/1999 | 2.00 | 200 | <3 | 52 | <3 | <3 | <3 |
| GP-104 | 06/10/1999 | 8.00 | 400 | <4 | 37 | <4 | <4 | <4 |
| GP-104 | 06/10/1999 | 13.00 | 1100 | <3 | <3 | <3 | <3 | <3 |
| GP-105 | 06/10/1999 | 2.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-105 | 06/10/1999 | 8.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-105 | 06/10/1999 | 13.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-106 | 06/10/1999 | 2.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-106 | 06/10/1999 | 8.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| GP-106 | 06/10/1999 | 13.00 | <3 | 3 | 16 | <3 | <3 | 5 |
| MW-103 | 06/22/1998 | 14.00 | <3 | <3 | <3 | <3 | <3 | <3 |

Soil Quality = NYDEC TAGM Soil Cleanup Objectives for Protection of Ground Water Quality

---=Not analyzed

TABLE 1
HISTORICAL SOIL ANALYTICAL RESULTS
FORMER EMPTY DRUM STORAGE AREA
CHAMPION PRODUCTS INC.
PERRY, NEW YORK
DELTA PROJECT NO. S098-009

PERIOD: From 06/22/1998 thru 06/10/1999 - Inclusive
SAMPLE TYPE: Soil

| SITE | DATE | DEPTH | Tetrachloro ethylene (ug/kg) | Toluene (ug/kg) | Trichloro ethylene (ug/kg) | Bromomethane (ug/kg) | Chloromethane (ug/kg) | cis-1,3-Dichloropropene (ug/kg) |
|---|---|---|---|---|---|---|---|---|
| Soil Quality | | | 1400 | 1500 | 700 | | | |
| MW-202 | 08/18/1998 | 10.00 | 24 | <3 | <3 | <3 | <3 | <3 |
| SB-19 | 08/18/1998 | 8.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| SB-20 | 08/18/1998 | 8.00 | [2600] | <36 | 210 | <36 | <36 | <36 |
| SB-21 | 08/18/1998 | 8.00 | <3 | <3 | <3 | <3 | <3 | <3 |
| SB-22 | 11/03/1998 | 10.00 | <1 | <1 | <1 | <1 | <1 | <1 |

Soil Quality = NYDEC TAGM Soil Cleanup Objectives for Protection of Ground Water Quality

[]=Greater than Action Level ---=Not analyzed

TABLE 2
GROUND WATER ANALYTICAL RESULTS
FORMER EMPTY DRUM STORAGE AREA
CHAMPION PRODUCTS INC.
PERRY, NEW YORK
DELTA PROJECT NO. S098-009

PERIOD: From 06/25/1998 thru 11/02/2000 - Inclusive
SAMPLE TYPE: Water

| SITE | DATE | Carbon disulfide (ug/l) | Methylene chloride (ug/l) | Tetrachloro ethylene (ug/l) | Toluene (ug/l) |
|---|---|---|---|---|---|
| WQS | | 50 | 5 | 5 | 5 |
| GP-104 | 06/10/1999 | <3 | <3 | <3 | <3 |
| MW-103 | 06/25/1998 | <3 | <3 | <3 | <3 |
| MW-103 | 07/17/1998 | <3 | <3 | <3 | <3 |
| MW-103 | 08/18/1998 | <3 | [16] | <3 | [12] |
| MW-103 | 11/03/1998 | <1 | <1 | <1 | <1 |
| MW-103 | 07/06/2000 | <3 | <3 | 3 | <3 |
| MW-103 | 11/02/2000 | --- | <0.50 | 3 | <0.50 |
| MW-202 | 08/21/1998 | <3 | <3 | <3 | <3 |
| MW-202 | 11/05/1998 | 44 | <1 | <1 | <1 |
| MW-202 | 07/06/2000 | <3 | <3 | <3 | <3 |
| MW-202 | 11/02/2000 | --- | <0.50 | <0.50 | <0.50 |
| SB-21 | 08/18/1998 | <3 | <3 | <3 | <3 |
| SB-22 | 11/03/1998 | <1 | <1 | <1 | <1 |

WQS= Water Quality Standards (6NYCRR, Table 1, cf. section 703.5)

[]=Greater than Action Level ---=Not analyzed

**TABLE 3**

**FIELD OVM READINGS**
**FORMER EMPTY DRUM STORAGE AREA**
**NOVEMBER 9, 2000**

| Sample Location | Depth of Sample (feet bgs) | OVM Readings (ppm) |
|---|---|---|
| CS-1 | 14 | 0.0 |
| CS-2 | 14 | 1.5 |
| CS-3 | 14 | 0.0 |
| CS-4 | 14 | 0.0 |
| SW-1 | 12 | 1.3 |
| SW-2 | 12 | 1.8 |
| SW-3 | 12 | 0.5 |
| SW-4 | 12 | 1.8 |
| SW-5 | 12 | 2.1 |
| SW-6 | 12 | 0.6 |
| SW-7 | 12 | 0.3 |

TABLE 4
CONFIRMATORY SOIL ANALYTICAL RESULTS
FORMER EMPTY DRUM STORAGE AREA
CHAMPION PRODUCTS INC.
PERRY, NEW YORK
DELTA PROJECT NO. S098-009

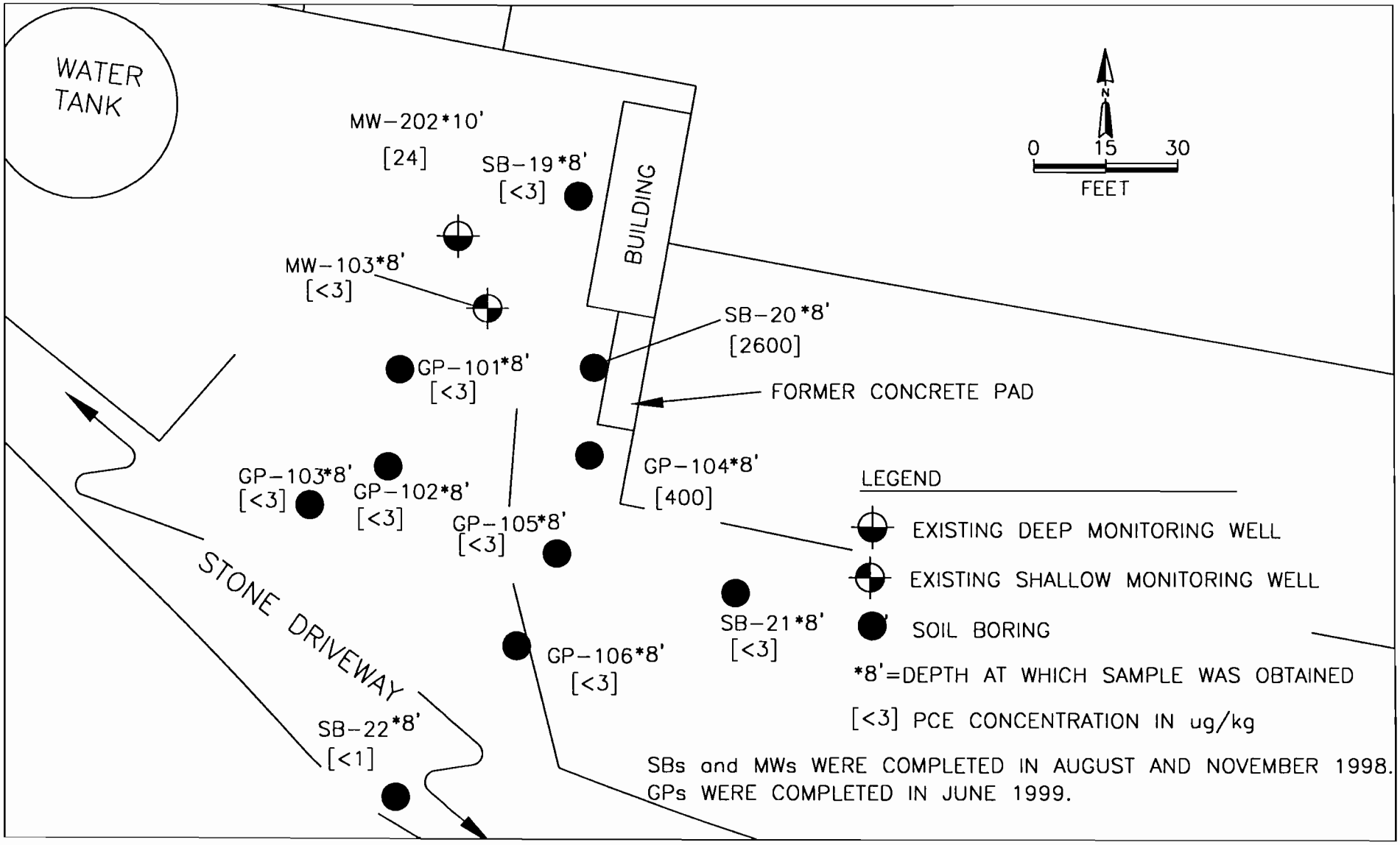
PERIOD: From 11/09/2000 thru 11/09/2000 - Inclusive
SAMPLE TYPE: Soil

| SITE | DATE | DEPTH | Tetrachloro ethylene (ug/kg) | Trichloro ethylene (ug/kg) |
|---|---|---|---|---|
| Soil Quality | | | 1400 | 700 |
| CS-1 | 11/09/2000 | 14.00 | 37 | <3 |
| CS-2 | 11/09/2000 | 14.00 | 37 | <3 |
| CS-3 | 11/09/2000 | 14.00 | 4 | <3 |
| CS-4 | 11/09/2000 | 14.00 | <3 | <3 |
| SW-1 | 11/09/2000 | 12.00 | [1900] | 230 |
| SW-2 | 11/09/2000 | 12.00 | 150 | <3 |
| SW-3 | 11/09/2000 | 12.00 | 210 | <17 |
| SW-4 | 11/09/2000 | 12.00 | 8 | <4.0 |
| SW-5 | 11/09/2000 | 12.00 | <3 | <3 |
| SW-6 | 11/09/2000 | 12.00 | <3 | <3 |
| SW-7 | 11/09/2000 | 12.00 | 400 | <17 |

Soil Quality = NYDEC TAGM Soil Cleanup Objectives for Protection of Ground Water Quality

[]=Greater than Action Level ---=Not analyzed

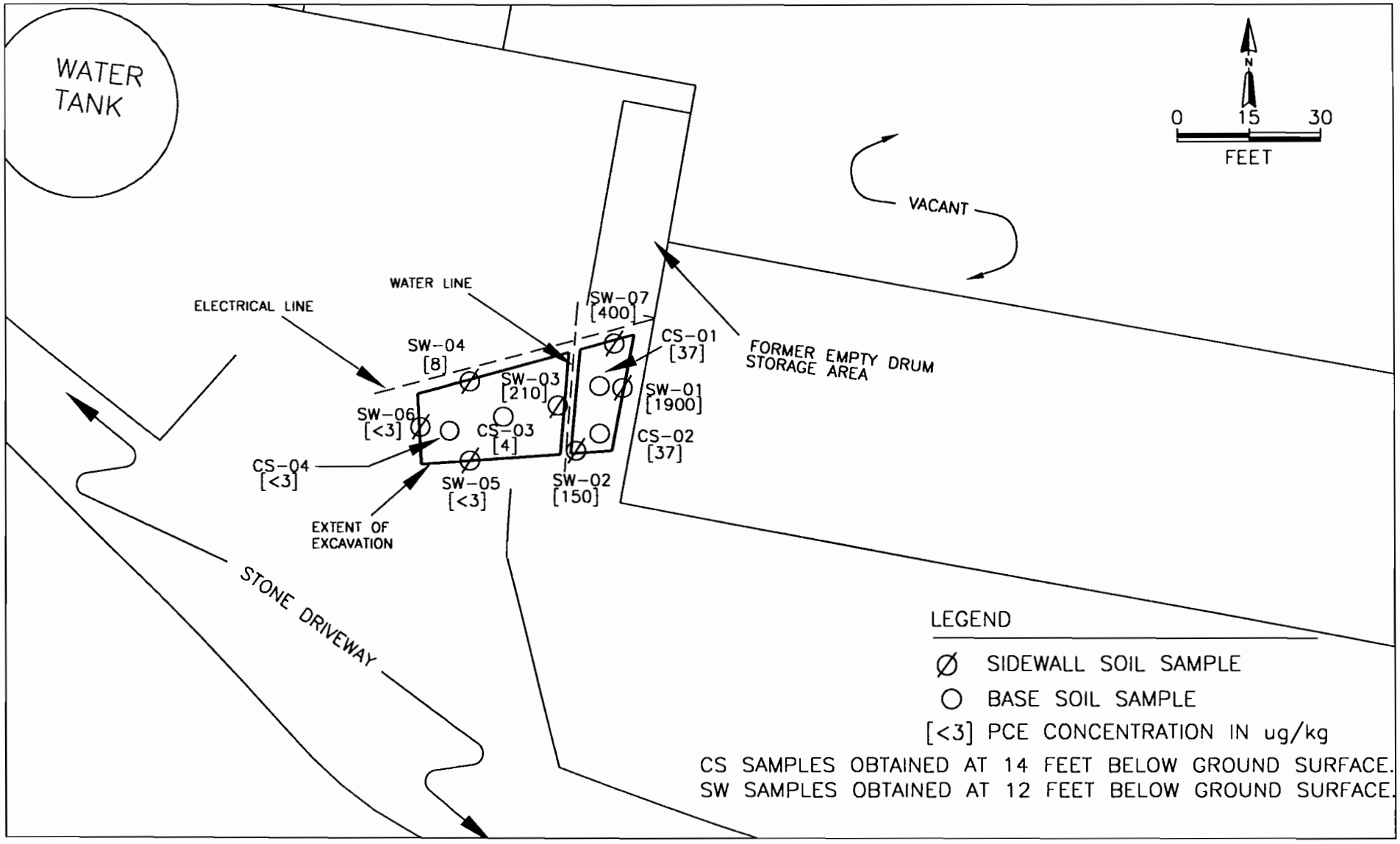
**FIGURES**




Delta Environmental Consultants, Inc.

TITLE:
SOIL CONCENTRATIONS-PCE
FORMER EMPTY DRUM STORAGE AREA
CHAMPION PRODUCTS COMPANY
PERRY, NEW YORK

| DWN: HLW | DES.: | PROJECT NO.: S098-009 |
|---|---|---|
| CHKD: | APPD: | FIGURE NO.: 1 |
| DATE: 8/9/99 | REV.: | |




Delta Environmental Consultants, Inc.

TITLE:
SOIL EXCAVATION AREA/ CONFIRMATORY SAMPLES
FORMER EMPTY DRUM STORAGE AREA
CHAMPION PRODUCTS COMPANY
PERRY, NEW YORK

| DWN: HLW | DES.: | PROJECT NO.: S098-009 |
|---|---|---|
| CHKD: | APPD: | FIGURE NO.: 2 |
| DATE: 8/9/99 | REV.: | |

**APPENDIX A**

**DISPOSAL MANIFESTS**

# NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: N.Y.D.0.5.1.8.1.7.5.7.5 | Manifest Document No.: 100054 | 2. Page 1 of 1

3. Generator's Name and Mailing Address
CHAMPION PRODUCTS INC
200 MAIN ST N
PERRY NY 14530-1225

4. Generator's Phone ( 716) 237-6111

5. Transporter 1 Company Name: Price Trucking | 6. US EPA ID Number: NYD046765574 | A. Transporter's Phone: 800 825-6001

7. Transporter 2 Company Name | 8. US EPA ID Number | B. Transporter's Phone

9. Designated Facility Name and Site Address
CWM CHEMICAL SERVICES, L.L.C.
1550 BALMER RD.
MODEL CITY NY 14107

10. US EPA ID Number: NYD049836679 | C. Facility's Phone: (716)754-823

| 11. Waste Shipping Name and Description | 12. Containers No. | 12. Containers Type | 13. Total Quantity | 14. Unit Wt/Vol |
|---|---|---|---|---|
| a. NON REGULATED MATERIAL | 1 | DT | Est 30 | TONS |
| b. | | | | |
| c. | | | | |
| d. | | | | |

D. Additional Descriptions for Materials Listed Above
a. CR6830

E. Handling Codes for Wastes Listed Above
L

15. Special Handling Instructions and Additional Information
CHEMTREC Emergency Response Number (800)424-9300 WMI Contract

8153701O

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: Joseph A. Galarneau | Signature: Joseph A. Galarneau | Month 11 Day 29 Year 00

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Patrick Pichon | Signature: Patrick Pichon | Month 11 Day 29 Year 00

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

19. Discrepancy Indication Space
actual Rec'd 55980 P

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: EILEEN CARTER | Signature: Eileen Carter | Month 11 Day 30 Year 00

GENERATOR

TRANSPORTER

FACILITY

ORIGINAL - RETURN TO GENERATOR

CWMI

# NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. N.Y.D.0.5.1.8.1.7.5.7.5 | Manifest Document No. 170003 | 2. Page 1 of 1

3. Generator's Name and Mailing Address
CHAMPION PRODUCTS INC
200 MAIN ST N
PERRY NY 14530-1225
4. Generator's Phone ( 716) 237-6111

5. Transporter 1 Company Name: Buffalo Fuel Corp | 6. US EPA ID Number: N.Y.R.0.0.0.0.4.5.7.2.4 | A. Transporter's Phone: 800-677-8003

7. Transporter 2 Company Name | 8. US EPA ID Number | 8. Transporter's Phone

9. Designated Facility Name and Site Address
CWM CHEMICAL SERVICES, L.L.C.
1550 BALMER RD.
MODEL CITY NY 14107
10. US EPA ID Number: N Y D 0 4 9 8 3 6 6 7 9
C. Facility's Phone: (716)754-823

| 11. Waste Shipping Name and Description | 12. Containers No. | 12. Containers Type | 13. Total Quantity | 14. Unit Wt/Vol |
|---|---|---|---|---|
| a. NON REGULATED MATERIAL | 1 | DT | EST 30 | TON |
| b. | | | | |
| c. | | | | |
| d. | | | | |

D. Additional Descriptions for Materials Listed Above
a. CR6830

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
CHEMTREC Emergency Response Number (800)424-9300 WMI Contract

81537005

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: Joseph A. Galarneau | Signature: Joseph A. Galarneau | Month 11 Day 29 Year 00

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Norm Perkins | Signature | Month . Day . Year .

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month 11 Day 29 Year 00

19. Discrepancy Indication Space
Actual Rec'd 61880#

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: Eileen Carter | Signature: Eileen Carter | Month 11 Day 30 Year 00

GENERATOR

TRANSPORTER

FACILITY

ORIGINAL - RETURN TO GENERATOR

CWMI

# NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. N.Y.D.0.5.1.8.1.7.5.7.5 | Manifest Document No. 00004 | 2. Page 1 of 1

3. Generator's Name and Mailing Address
CHAMPION PRODUCTS INC
200 MAIN ST N
PERRY NY 14530-1225

4. Generator's Phone ( 716 ) 237-6111

5. Transporter 1 Company Name BUFFALO Fuel CORP | 6. US EPA ID Number NYR000045724 | A. Transporter's Phone 800 671 8002

7. Transporter 2 Company Name | 8. US EPA ID Number | B. Transporter's Phone

9. Designated Facility Name and Site Address
CWM CHEMICAL SERVICES, L.L.C.
1550 BALMER RD.
MODEL CITY NY 14107

10. US EPA ID Number N.Y.D.0.4.9.8.3.6.6.7.9

C. Facility's Phone (716)754-8231

| 11. Waste Shipping Name and Description | 12. Containers No. | Type | 13. Total Quantity | 14. Unit Wt/Vol |
|---|---|---|---|---|
| a. NON REGULATED MATERIAL | 1 | DT | EST 30 | TONS |
| b. | | | | |
| c. | | | | |
| d. | | | | |

D. Additional Descriptions for Materials Listed Above
a. CR6830

E. Handling Codes for Wastes Listed Above
L

15. Special Handling Instructions and Additional Information
CHEMTREC Emergency Response Number (800)424-9300 WMI Contract

8153704

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.
Printed/Typed Name: Joseph A. Galarneau | Signature: Joseph A Galarneau | Month 11 Day 29 Year 00

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: MARK FAITSKO | Signature: Mark Faitsko | Month 11 Day 29 Year 00

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name | Signature | Month . Day . Year .

19. Discrepancy Indication Space
actual Rec 72860 P

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: ELLEEN CARTER | Signature: Eileen Carter | Month 11 Day 30 Year 00

GENERATOR
TRANSPORTER
FACILITY

ORIGINAL - RETURN TO GENERATOR

CWMI

# NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: N.Y.D.0.5.1.8.1.7.5.7.5
Manifest Document No.: 00001
2. Page 1 of 1

3. Generator's Name and Mailing Address
CHAMPION PRODUCTS INC
200 MAIN ST N
PERRY NY 14530-1225
4. Generator's Phone ( 716 ) 237-6111

5. Transporter 1 Company Name: PRICE TRUCKING
6. US EPA ID Number: NYD046765574
A. Transporter's Phone: 716 822 1414

7. Transporter 2 Company Name:
8. US EPA ID Number:
8. Transporter's Phone:

9. Designated Facility Name and Site Address
CWM CHEMICAL SERVICES, L.L.C.
1550 BALMER RD.
MODEL CITY NY 14107
10. US EPA ID Number: N.Y.D.0.4.9.8.3.6.6.7.9
C. Facility's Phone: (716)754-823

| 11. Waste Shipping Name and Description | 12. Containers No. | 12. Containers Type | 13. Total Quantity | 14. Unit Wt/Vol |
|---|---|---|---|---|
| a. NON REGULATED MATERIAL | 1 | DT ~~Sort~~ | 22 | T ~~Ton~~ |
| b. | | | | |
| c. | | | | |
| d. | | | | |

D. Additional Descriptions for Materials Listed Above
a. CR6830

E. Handling Codes for Wastes Listed Above
L

15. Special Handling Instructions and Additional Information
CHEMTREC Emergency Response Number (800)424-9300 WMI Contract
8153700 3

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.
Printed/Typed Name: Joseph A. Galarneau
Signature: Joseph A. Galarneau
Month 11 Day 29 Year 00

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: RALPH M. CROSS
Signature: Ralph M. Cross
Month 11 Day 29 Year 00

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month . Day . Year .

19. Discrepancy Indication Space
actual read 22.0T

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: EILEEN CARTER
Signature: Eileen Carter
Month 11 Day 30 Year 00

GENERATOR
TRANSPORTER
FACILITY

ORIGINAL - RETURN TO GENERATOR

CWMI

# NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. N.Y.D.0.5.1.8.1.7.5.7.5 | Manifest Document No. 000 02 | 2. Page 1 of 1

3. Generator's Name and Mailing Address
CHAMPION PRODUCTS INC
200 MAIN ST N
PERRY NY 14530-1225
4. Generator's Phone ( 716 ) 237-6111

5. Transporter 1 Company Name: Buffalo Fuel Corp | 6. US EPA ID Number: N.Y.R.0.0.0.4.5.7.2.4 | A. Transporter's Phone: 800-677-3002

7. Transporter 2 Company Name | 8. US EPA ID Number | B. Transporter's Phone

9. Designated Facility Name and Site Address
CWM CHEMICAL SERVICES, L.L.C.
1550 BALMER RD.
MODEL CITY NY 14107
10. US EPA ID Number: N.Y.D.0.4.9.8.3.6.6.7.9
C. Facility's Phone: (716)754-8231

| 11. Waste Shipping Name and Description | 12. Containers No. | 12. Containers Type | 13. Total Quantity | 14. Unit Wt/Vol |
|---|---|---|---|---|
| a. NON REGULATED MATERIAL | 1 | DT ~~Ramp~~ PA | est. 30 | TON |
| b. | | | | |
| c. | | | | |
| d. | | | | |

D. Additional Descriptions for Materials Listed Above
a. CR6830

E. Handling Codes for Wastes Listed Above
L

15. Special Handling Instructions and Additional Information
CHEMTREC Emergency Response Number (800)424-9300 WMI Contract

81537001

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.
Printed/Typed Name: Joseph A. Galarneau | Signature: Joseph A. Galarneau | Month 11 Day 29 Year 00

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Kevin M. Henry | Signature: Kevin M. Henry | Month 11 Day 29 Year 00

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name | Signature | Month . Day . Year .

19. Discrepancy Indication Space
actual load 69460 P

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Eileen Carton | Signature: Eileen Carton | Month 11 Day 30 Year 00

GENERATOR
TRANSPORTER
FACILITY

ORIGINAL - RETURN TO GENERATOR

CWMI

# NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. N.Y.D.0.5.1.8.1.7.5.7.5 | Manifest Document No. 20006 | 2. Page 1 of 1

3. Generator's Name and Mailing Address
CHAMPION PRODUCTS INC
200 MAIN ST N
PERRY NY 14530-1225

4. Generator's Phone ( 716) 237-6111

5. Transporter 1 Company Name: Price Trucking | 6. US EPA ID Number: N4D.0.4.6.7.6.5.5.7.4 | A. Transporter's Phone: 1-800-825-6001

7. Transporter 2 Company Name | 8. US EPA ID Number | 8. Transporter's Phone

9. Designated Facility Name and Site Address
CWM CHEMICAL SERVICES, L.L.C.
1550 BALMER RD.
MODEL CITY NY 14107

10. US EPA ID Number: N.Y.D.0.4.9.8.3.6.6.7.9

C. Facility's Phone (716)754-823

| 11. Waste Shipping Name and Description | 12. Containers No. | 12. Containers Type | 13. Total Quantity | 14. Unit Wt/Vol |
|---|---|---|---|---|
| a. NON REGULATED MATERIAL | 1 | DT | EST 20 | TON |
| b. | | | | |
| c. | | | | |
| d. | | | | |

D. Additional Descriptions for Materials Listed Above
a. CR6830

E. Handling Codes for Wastes Listed Above
L

15. Special Handling Instructions and Additional Information
CHEMTREC Emergency Response Number (800)424-9300 WMI Contract

8537123

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: Joseph A. Galarneau | Signature: Joseph A. Galarneau | Month 11 | Day 29 | Year 00

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: JOE BRAINARD | Signature | Month 11 | Day 29 | Year 00

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

19. Discrepancy Indication Space
actual read 35080P

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: EILEEN CARTER | Signature: Eileen Carter | Month 12 | Day 01 | Year 00

GENERATOR — TRANSPORTER — FACILITY

ORIGINAL - RETURN TO GENERATOR

## APPENDIX B

## LABORATORY ANALYTICAL REPORTS – NOVEMBER 2000

**Upstate Laboratories inc.**

Shipping: 6034 Corporate Dr. • E. Syracuse, NY 13057-1017 • (315) 437-0255 • Fax (315) 437-1209
Mailing: Box 289 • Syracuse, NY 13206
Albany (518) 459-3134
Binghamton (607) 724-0478
Buffalo (716) 649-2533
Rochester (716) 436-9070
New Jersey (201) 703-1324

November 30, 2000

Mr. Steve Zbur
Unit Manager
Delta Environmental Consultants
4068 Mt. Royal Blvd.
Suite 225 - Gamma
Allison Park, PA 15101

Re: Analysis Report #31800014 - 5098-009

Dear Mr. Zbur:

Please find enclosed the results for your samples which were received on November 10, 2000.

We have included the Chain of Custody Record as part of your report. You may need to reference this form for a more detailed explanation of your sample. Samples will be disposed of approximately one month from final report date.

Should you have any questions, please feel free to give us a call.

Thank you for your patronage.

Sincerely,

UPSTATE LABORATORIES, INC.

Anthony J. Scala
Director

AJS/jd

Enclosures: report, invoice

cc/encs: N. Scala, ULI
file

Disclaimer: The test results and procedures utilized, and laboratory interpretations of data obtained by ULI as contained in this report are believed by ULI to be accurate and reliable for sample(s) tested. In accepting this report, the customer agrees that the full extent of any and all liability for actual and consequential damages of ULI for the services performed shall be equal to the fee charged to the customer for the services as liquidated damages.

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS 5098-009
Sampled by: Client CS-1,14' 0815H 11/09/00 G

APPROVAL:
QC:
Lab I.D.: 10170

ULI I.D.: 31800014 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 91% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3181 |
| Bromomethane | <3ug/kg dw | | VM3181 |
| Vinyl Chloride | <2ug/kg dw | | VM3181 |
| Chloroethane | <3ug/kg dw | | VM3181 |
| Methylene Chloride | 140ug/kg dw | 44 | VM3181 |
| Acetone | <11ug/kg dw | | VM3181 |
| Carbon Disulfide | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3181 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| Chloroform | <3ug/kg dw | | VM3181 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3181 |
| 2-Butanone | <11ug/kg dw | | VM3181 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3181 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3181 |
| Bromodichloromethane | <3ug/kg dw | | VM3181 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3181 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Trichloroethene | <3ug/kg dw | | VM3181 |
| Dibromochloromethane | <3ug/kg dw | | VM3181 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3181 |
| Benzene | <3ug/kg dw | | VM3181 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Bromoform | <3ug/kg dw | | VM3181 |
| 4-Methyl-2-pentanone | <11ug/kg dw | | VM3181 |
| 2-Hexanone | <11ug/kg dw | | VM3181 |
| Tetrachloroethene | 37ug/kg dw | | VM3181 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3181 |
| Toluene | <3ug/kg dw | | VM3181 |
| Chlorobenzene | <3ug/kg dw | | VM3181 |
| Ethylbenzene | <3ug/kg dw | | VM3181 |
| Styrene | <3ug/kg dw | | VM3181 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3181 |
| o-Xylene | <3ug/kg dw | | VM3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS
Sampled by: Client

APPROVAL:
QC:
Lab I.D.: 10170

5098-009
CS-2,14' 0820H 11/09/00 G

ULI I.D.: 31800015
Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 93% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3184 |
| Bromomethane | <3ug/kg dw | | VM3184 |
| Vinyl Chloride | <2ug/kg dw | | VM3184 |
| Chloroethane | <3ug/kg dw | | VM3184 |
| Methylene Chloride | 37ug/kg dw | 44 | VM3184 |
| Acetone | 26ug/kg dw | 44 | VM3184 |
| Carbon Disulfide | <3ug/kg dw | | VM3184 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3184 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3184 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3184 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3184 |
| Chloroform | <3ug/kg dw | | VM3184 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3184 |
| 2-Butanone | <11ug/kg dw | | VM3184 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3184 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3184 |
| Bromodichloromethane | <3ug/kg dw | | VM3184 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3184 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3184 |
| Trichloroethene | <3ug/kg dw | | VM3184 |
| Dibromochloromethane | <3ug/kg dw | | VM3184 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3184 |
| Benzene | <3ug/kg dw | | VM3184 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3184 |
| Bromoform | <3ug/kg dw | | VM3184 |
| 4-Methyl-2-pentanone | <11ug/kg dw | | VM3184 |
| 2-Hexanone | <11ug/kg dw | | VM3184 |
| Tetrachloroethene | 37ug/kg dw | | VM3184 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3184 |
| Toluene | <3ug/kg dw | | VM3184 |
| Chlorobenzene | <3ug/kg dw | | VM3184 |
| Ethylbenzene | <3ug/kg dw | | VM3184 |
| Styrene | <3ug/kg dw | | VM3184 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3184 |
| o-Xylene | <3ug/kg dw | | VM3184 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS
Sampled by: Client

APPROVAL: QC: Lab I.D.: 10170

5098-009
SW-1,12' 0925H 11/09/00 G

ULI I.D.: 31800016 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 85% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <35ug/kg dw | 05 | VM3184 |
| Bromomethane | <35ug/kg dw | 05 | VM3184 |
| Vinyl Chloride | <24ug/kg dw | 05 | VM3184 |
| Chloroethane | <35ug/kg dw | 05 | VM3184 |
| Methylene Chloride | 130ug/kg dw | 44 | VM3184 |
| Acetone | <120ug/kg dw | 05 | VM3184 |
| Carbon Disulfide | <35ug/kg dw | 05 | VM3184 |
| 1,1-Dichloroethene | <35ug/kg dw | 05 | VM3184 |
| 1,1-Dichloroethane | <35ug/kg dw | 05 | VM3184 |
| trans-1,2-Dichloroethene | <35ug/kg dw | 05 | VM3184 |
| cis-1,2-Dichloroethene | <35ug/kg dw | 05 | VM3184 |
| Chloroform | <35ug/kg dw | 05 | VM3184 |
| 1,2-Dichloroethane | <35ug/kg dw | 05 | VM3184 |
| 2-Butanone | <120ug/kg dw | 05 | VM3184 |
| 1,1,1-Trichloroethane | <35ug/kg dw | 05 | VM3184 |
| Carbon Tetrachloride | <35ug/kg dw | 05 | VM3184 |
| Bromodichloromethane | <35ug/kg dw | 05 | VM3184 |
| 1,2-Dichloropropane | <35ug/kg dw | 05 | VM3184 |
| cis-1,3-Dichloropropene | <35ug/kg dw | 05 | VM3184 |
| Trichloroethene | 230ug/kg dw | | VM3184 |
| Dibromochloromethane | <35ug/kg dw | 05 | VM3184 |
| 1,1,2-Trichloroethane | <35ug/kg dw | 05 | VM3184 |
| Benzene | <35ug/kg dw | 05 | VM3184 |
| trans-1,3-Dichloropropene | <35ug/kg dw | 05 | VM3184 |
| Bromoform | <35ug/kg dw | 05 | VM3184 |
| 4-Methyl-2-pentanone | <120ug/kg dw | 05 | VM3184 |
| 2-Hexanone | <120ug/kg dw | 05 | VM3184 |
| Tetrachloroethene | 1900ug/kg dw | | VM3184 |
| 1,1,2,2-Tetrachloroethane | <35ug/kg dw | 05 | VM3184 |
| Toluene | <35ug/kg dw | 05 | VM3184 |
| Chlorobenzene | <35ug/kg dw | 05 | VM3184 |
| Ethylbenzene | <35ug/kg dw | 05 | VM3184 |
| Styrene | <35ug/kg dw | 05 | VM3184 |
| m-Xylene and p-Xylene | <35ug/kg dw | 05 | VM3184 |
| o-Xylene | <35ug/kg dw | 05 | VM3184 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc. APPROVAL:
Analysis Results QC:
Report Number: 31800014 Lab I.D.: 10170
Client I.D.: DELTA ENV. CONSULTANTS 5098-009
Sampled by: Client SW-2,12' 0945H 11/09/00 G

ULI I.D.: 31800017 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 86% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3181 |
| Bromomethane | <3ug/kg dw | | VM3181 |
| Vinyl Chloride | <2ug/kg dw | | VM3181 |
| Chloroethane | <3ug/kg dw | | VM3181 |
| Methylene Chloride | 52ug/kg dw | 44 | VM3181 |
| Acetone | <12ug/kg dw | | VM3181 |
| Carbon Disulfide | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3181 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| Chloroform | <3ug/kg dw | | VM3181 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3181 |
| 2-Butanone | <12ug/kg dw | | VM3181 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3181 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3181 |
| Bromodichloromethane | <3ug/kg dw | | VM3181 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3181 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Trichloroethene | <3ug/kg dw | | VM3181 |
| Dibromochloromethane | <3ug/kg dw | | VM3181 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3181 |
| Benzene | <3ug/kg dw | | VM3181 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Bromoform | <3ug/kg dw | | VM3181 |
| 4-Methyl-2-pentanone | <12ug/kg dw | | VM3181 |
| 2-Hexanone | <12ug/kg dw | | VM3181 |
| Tetrachloroethene | 150ug/kg dw | | VM3181 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3181 |
| Toluene | <3ug/kg dw | | VM3181 |
| Chlorobenzene | <3ug/kg dw | | VM3181 |
| Ethylbenzene | <3ug/kg dw | | VM3181 |
| Styrene | <3ug/kg dw | | VM3181 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3181 |
| o-Xylene | <3ug/kg dw | | VM3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS 5098-009
Sampled by: Client SW-3,12' 1040H 11/09/00 G

APPROVAL:
QC:
Lab I.D.: 10170

ULI I.D.: 31800018 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 89% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <17ug/kg dw | 05 | VM3190 |
| Bromomethane | <17ug/kg dw | 05 | VM3190 |
| Vinyl Chloride | <11ug/kg dw | 05 | VM3190 |
| Chloroethane | <17ug/kg dw | 05 | VM3190 |
| Methylene Chloride | 70ug/kg dw | 44 | VM3190 |
| Acetone | <56ug/kg dw | 05 | VM3190 |
| Carbon Disulfide | <17ug/kg dw | 05 | VM3190 |
| 1,1-Dichloroethene | <17ug/kg dw | 05 | VM3190 |
| 1,1-Dichloroethane | <17ug/kg dw | 05 | VM3190 |
| trans-1,2-Dichloroethene | <17ug/kg dw | 05 | VM3190 |
| cis-1,2-Dichloroethene | <17ug/kg dw | 05 | VM3190 |
| Chloroform | <17ug/kg dw | 05 | VM3190 |
| 1,2-Dichloroethane | <17ug/kg dw | 05 | VM3190 |
| 2-Butanone | <56ug/kg dw | 05 | VM3190 |
| 1,1,1-Trichloroethane | <17ug/kg dw | 05 | VM3190 |
| Carbon Tetrachloride | <17ug/kg dw | 05 | VM3190 |
| Bromodichloromethane | <17ug/kg dw | 05 | VM3190 |
| 1,2-Dichloropropane | <17ug/kg dw | 05 | VM3190 |
| cis-1,3-Dichloropropene | <17ug/kg dw | 05 | VM3190 |
| Trichloroethene | <17ug/kg dw | 05 | VM3190 |
| Dibromochloromethane | <17ug/kg dw | 05 | VM3190 |
| 1,1,2-Trichloroethane | <17ug/kg dw | 05 | VM3190 |
| Benzene | <17ug/kg dw | 05 | VM3190 |
| trans-1,3-Dichloropropene | <17ug/kg dw | 05 | VM3190 |
| Bromoform | <17ug/kg dw | 05 | VM3190 |
| 4-Methyl-2-pentanone | <56ug/kg dw | 05 | VM3190 |
| 2-Hexanone | <56ug/kg dw | 05 | VM3190 |
| Tetrachloroethene | 210ug/kg dw | | VM3190 |
| 1,1,2,2-Tetrachloroethane | <17ug/kg dw | 05 | VM3190 |
| Toluene | <17ug/kg dw | 05 | VM3190 |
| Chlorobenzene | <17ug/kg dw | 05 | VM3190 |
| Ethylbenzene | <17ug/kg dw | 05 | VM3190 |
| Styrene | <17ug/kg dw | 05 | VM3190 |
| m-Xylene and p-Xylene | <17ug/kg dw | 05 | VM3190 |
| o-Xylene | <17ug/kg dw | 05 | VM3190 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS 5098-009
Sampled by: Client CS-3,14' 1040H 11/09/00 G

APPROVAL:
QC:
Lab I.D.: 10170

ULI I.D.: 31800019 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 92% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3181 |
| Bromomethane | <3ug/kg dw | | VM3181 |
| Vinyl Chloride | <2ug/kg dw | | VM3181 |
| Chloroethane | <3ug/kg dw | | VM3181 |
| Methylene Chloride | 160ug/kg dw | 44 | VM3181 |
| Acetone | <11ug/kg dw | | VM3181 |
| Carbon Disulfide | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3181 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| Chloroform | <3ug/kg dw | | VM3181 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3181 |
| 2-Butanone | <11ug/kg dw | | VM3181 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3181 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3181 |
| Bromodichloromethane | <3ug/kg dw | | VM3181 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3181 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Trichloroethene | <3ug/kg dw | | VM3181 |
| Dibromochloromethane | <3ug/kg dw | | VM3181 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3181 |
| Benzene | <3ug/kg dw | | VM3181 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Bromoform | <3ug/kg dw | | VM3181 |
| 4-Methyl-2-pentanone | <11ug/kg dw | | VM3181 |
| 2-Hexanone | <11ug/kg dw | | VM3181 |
| Tetrachloroethene | 4ug/kg dw | | VM3181 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3181 |
| Toluene | <3ug/kg dw | | VM3181 |
| Chlorobenzene | <3ug/kg dw | | VM3181 |
| Ethylbenzene | <3ug/kg dw | | VM3181 |
| Styrene | <3ug/kg dw | | VM3181 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3181 |
| o-Xylene | <3ug/kg dw | | VM3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS
Sampled by: Client

APPROVAL:
QC:
Lab I.D.: 10170

5098-009
CS-4,14' 1125H 11/09/00 G

ULI I.D.: 31800020
Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 92% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3181 |
| Bromomethane | <3ug/kg dw | | VM3181 |
| Vinyl Chloride | <2ug/kg dw | | VM3181 |
| Chloroethane | <3ug/kg dw | | VM3181 |
| Methylene Chloride | 250ug/kg dw | 44 | VM3181 |
| Acetone | <11ug/kg dw | | VM3181 |
| Carbon Disulfide | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3181 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| Chloroform | <3ug/kg dw | | VM3181 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3181 |
| 2-Butanone | <11ug/kg dw | | VM3181 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3181 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3181 |
| Bromodichloromethane | <3ug/kg dw | | VM3181 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3181 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Trichloroethene | <3ug/kg dw | | VM3181 |
| Dibromochloromethane | <3ug/kg dw | | VM3181 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3181 |
| Benzene | <3ug/kg dw | | VM3181 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Bromoform | <3ug/kg dw | | VM3181 |
| 4-Methyl-2-pentanone | <11ug/kg dw | | VM3181 |
| 2-Hexanone | <11ug/kg dw | | VM3181 |
| Tetrachloroethene | <3ug/kg dw | | VM3181 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3181 |
| Toluene | <3ug/kg dw | | VM3181 |
| Chlorobenzene | <3ug/kg dw | | VM3181 |
| Ethylbenzene | <3ug/kg dw | | VM3181 |
| Styrene | <3ug/kg dw | | VM3181 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3181 |
| o-Xylene | <3ug/kg dw | | VM3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS
Sampled by: Client

APPROVAL: _____
QC: _____
Lab I.D.: 10170

5098-009
SW-4,12' 1130H 11/09/00 G

ULI I.D.: 31800021
Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 81% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <4ug/kg dw | | MB3181 |
| Bromomethane | <4ug/kg dw | | MB3181 |
| Vinyl Chloride | <2ug/kg dw | | MB3181 |
| Chloroethane | <4ug/kg dw | | MB3181 |
| Methylene Chloride | 110ug/kg dw | 44 | MB3181 |
| Acetone | <12ug/kg dw | | MB3181 |
| Carbon Disulfide | <4ug/kg dw | | MB3181 |
| 1,1-Dichloroethene | <4ug/kg dw | | MB3181 |
| 1,1-Dichloroethane | <4ug/kg dw | | MB3181 |
| trans-1,2-Dichloroethene | <4ug/kg dw | | MB3181 |
| cis-1,2-Dichloroethene | <4ug/kg dw | | MB3181 |
| Chloroform | <4ug/kg dw | | MB3181 |
| 1,2-Dichloroethane | <4ug/kg dw | | MB3181 |
| 2-Butanone | <12ug/kg dw | | MB3181 |
| 1,1,1-Trichloroethane | <4ug/kg dw | | MB3181 |
| Carbon Tetrachloride | <4ug/kg dw | | MB3181 |
| Bromodichloromethane | <4ug/kg dw | | MB3181 |
| 1,2-Dichloropropane | <4ug/kg dw | | MB3181 |
| cis-1,3-Dichloropropene | <4ug/kg dw | | MB3181 |
| Trichloroethene | <4ug/kg dw | | MB3181 |
| Dibromochloromethane | <4ug/kg dw | | MB3181 |
| 1,1,2-Trichloroethane | <4ug/kg dw | | MB3181 |
| Benzene | <4ug/kg dw | | MB3181 |
| trans-1,3-Dichloropropene | <4ug/kg dw | | MB3181 |
| Bromoform | <4ug/kg dw | | MB3181 |
| 4-Methyl-2-pentanone | <12ug/kg dw | | MB3181 |
| 2-Hexanone | <12ug/kg dw | | MB3181 |
| Tetrachloroethene | 8ug/kg dw | | MB3181 |
| 1,1,2,2-Tetrachloroethane | <4ug/kg dw | | MB3181 |
| Toluene | <4ug/kg dw | | MB3181 |
| Chlorobenzene | <4ug/kg dw | | MB3181 |
| Ethylbenzene | <4ug/kg dw | | MB3181 |
| Styrene | <4ug/kg dw | | MB3181 |
| m-Xylene and p-Xylene | <4ug/kg dw | | MB3181 |
| o-Xylene | <4ug/kg dw | | MB3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS
Sampled by: Client

APPROVAL:
QC:
Lab I.D.: 10170

5098-009
SW-5,12' 1133H 11/09/00 G

ULI I.D.: 31800022
Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 90% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3181 |
| Bromomethane | <3ug/kg dw | | VM3181 |
| Vinyl Chloride | <2ug/kg dw | | VM3181 |
| Chloroethane | <3ug/kg dw | | VM3181 |
| Methylene Chloride | 51ug/kg dw | 44 | VM3181 |
| Acetone | <11ug/kg dw | | VM3181 |
| Carbon Disulfide | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3181 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| Chloroform | <3ug/kg dw | | VM3181 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3181 |
| 2-Butanone | <11ug/kg dw | | VM3181 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3181 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3181 |
| Bromodichloromethane | <3ug/kg dw | | VM3181 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3181 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Trichloroethene | <3ug/kg dw | | VM3181 |
| Dibromochloromethane | <3ug/kg dw | | VM3181 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3181 |
| Benzene | <3ug/kg dw | | VM3181 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Bromoform | <3ug/kg dw | | VM3181 |
| 4-Methyl-2-pentanone | <11ug/kg dw | | VM3181 |
| 2-Hexanone | <11ug/kg dw | | VM3181 |
| Tetrachloroethene | <3ug/kg dw | | VM3181 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3181 |
| Toluene | <3ug/kg dw | | VM3181 |
| Chlorobenzene | <3ug/kg dw | | VM3181 |
| Ethylbenzene | <3ug/kg dw | | VM3181 |
| Styrene | <3ug/kg dw | | VM3181 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3181 |
| o-Xylene | <3ug/kg dw | | VM3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS
Sampled by: Client

APPROVAL:
QC:
Lab I.D.: 10170

5098-009
SW-6,12' 1140H 11/09/00 G

ULI I.D.: 31800023 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 91% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <3ug/kg dw | | VM3181 |
| Bromomethane | <3ug/kg dw | | VM3181 |
| Vinyl Chloride | <2ug/kg dw | | VM3181 |
| Chloroethane | <3ug/kg dw | | VM3181 |
| Methylene Chloride | 180ug/kg dw | 44 | VM3181 |
| Acetone | <11ug/kg dw | | VM3181 |
| Carbon Disulfide | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethene | <3ug/kg dw | | VM3181 |
| 1,1-Dichloroethane | <3ug/kg dw | | VM3181 |
| trans-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| cis-1,2-Dichloroethene | <3ug/kg dw | | VM3181 |
| Chloroform | <3ug/kg dw | | VM3181 |
| 1,2-Dichloroethane | <3ug/kg dw | | VM3181 |
| 2-Butanone | <11ug/kg dw | | VM3181 |
| 1,1,1-Trichloroethane | <3ug/kg dw | | VM3181 |
| Carbon Tetrachloride | <3ug/kg dw | | VM3181 |
| Bromodichloromethane | <3ug/kg dw | | VM3181 |
| 1,2-Dichloropropane | <3ug/kg dw | | VM3181 |
| cis-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Trichloroethene | <3ug/kg dw | | VM3181 |
| Dibromochloromethane | <3ug/kg dw | | VM3181 |
| 1,1,2-Trichloroethane | <3ug/kg dw | | VM3181 |
| Benzene | <3ug/kg dw | | VM3181 |
| trans-1,3-Dichloropropene | <3ug/kg dw | | VM3181 |
| Bromoform | <3ug/kg dw | | VM3181 |
| 4-Methyl-2-pentanone | <11ug/kg dw | | VM3181 |
| 2-Hexanone | <11ug/kg dw | | VM3181 |
| Tetrachloroethene | <3ug/kg dw | | VM3181 |
| 1,1,2,2-Tetrachloroethane | <3ug/kg dw | | VM3181 |
| Toluene | <3ug/kg dw | | VM3181 |
| Chlorobenzene | <3ug/kg dw | | VM3181 |
| Ethylbenzene | <3ug/kg dw | | VM3181 |
| Styrene | <3ug/kg dw | | VM3181 |
| m-Xylene and p-Xylene | <3ug/kg dw | | VM3181 |
| o-Xylene | <3ug/kg dw | | VM3181 |

dw = Dry weight

DATE: 11/30/00

Upstate Laboratories, Inc.
Analysis Results
Report Number: 31800014
Client I.D.: DELTA ENV. CONSULTANTS 5098-009
Sampled by: Client SW-7,12' 1145H 11/09/00 G

APPROVAL:
QC:
Lab I.D.: 10170

ULI I.D.: 31800024 Matrix: Soil

| PARAMETERS | RESULTS | KEY | FILE# |
|---|---|---|---|
| Percent Solids | 90% | | WD2596 |
| **TCL Volatiles by EPA Method 8260** | | | |
| Chloromethane | <17ug/kg dw | 05 | VM3184 |
| Bromomethane | <17ug/kg dw | 05 | VM3184 |
| Vinyl Chloride | <11ug/kg dw | 05 | VM3184 |
| Chloroethane | <17ug/kg dw | 05 | VM3184 |
| Methylene Chloride | 72ug/kg dw | 44 | VM3184 |
| Acetone | <56ug/kg dw | 05 | VM3184 |
| Carbon Disulfide | <17ug/kg dw | 05 | VM3184 |
| 1,1-Dichloroethene | <17ug/kg dw | 05 | VM3184 |
| 1,1-Dichloroethane | <17ug/kg dw | 05 | VM3184 |
| trans-1,2-Dichloroethene | <17ug/kg dw | 05 | VM3184 |
| cis-1,2-Dichloroethene | <17ug/kg dw | 05 | VM3184 |
| Chloroform | <17ug/kg dw | 05 | VM3184 |
| 1,2-Dichloroethane | <17ug/kg dw | 05 | VM3184 |
| 2-Butanone | <56ug/kg dw | 05 | VM3184 |
| 1,1,1-Trichloroethane | <17ug/kg dw | 05 | VM3184 |
| Carbon Tetrachloride | <17ug/kg dw | 05 | VM3184 |
| Bromodichloromethane | <17ug/kg dw | 05 | VM3184 |
| 1,2-Dichloropropane | <17ug/kg dw | 05 | VM3184 |
| cis-1,3-Dichloropropene | <17ug/kg dw | 05 | VM3184 |
| Trichloroethene | <17ug/kg dw | 05 | VM3184 |
| Dibromochloromethane | <17ug/kg dw | 05 | VM3184 |
| 1,1,2-Trichloroethane | <17ug/kg dw | 05 | VM3184 |
| Benzene | <17ug/kg dw | 05 | VM3184 |
| trans-1,3-Dichloropropene | <17ug/kg dw | 05 | VM3184 |
| Bromoform | <17ug/kg dw | 05 | VM3184 |
| 4-Methyl-2-pentanone | <56ug/kg dw | 05 | VM3184 |
| 2-Hexanone | <56ug/kg dw | 05 | VM3184 |
| Tetrachloroethene | 400ug/kg dw | | VM3184 |
| 1,1,2,2-Tetrachloroethane | <17ug/kg dw | 05 | VM3184 |
| Toluene | <17ug/kg dw | 05 | VM3184 |
| Chlorobenzene | <17ug/kg dw | 05 | VM3184 |
| Ethylbenzene | <17ug/kg dw | 05 | VM3184 |
| Styrene | <17ug/kg dw | 05 | VM3184 |
| m-Xylene and p-Xylene | <17ug/kg dw | 05 | VM3184 |
| o-Xylene | <17ug/kg dw | 05 | VM3184 |

dw = Dry weight

KEY PAGE

1 MATRIX INTERFERENCE PRECLUDES LOWER DETECTION LIMITS
2 MATRIX INTERFERENCE
3 PRESENT IN BLANK
4 ANALYSIS NOT PERFORMED BECAUSE OF INSUFFICIENT SAMPLE
5 THE PRESENCE OF OTHER TARGET ANALYTE(S) PRECLUDES LOWER DETECTION LIMITS
6 BLANK CORRECTED
7 HEAD SPACE PRESENT IN SAMPLE
8 QUANTITATION LIMIT IS GREATER THAN THE CALCULATED REGULATORY LEVEL. THE QUANTITATION LIMIT THEREFORE BECOMES THE REGULATORY LEVEL.
9 THE OIL WAS TREATED AS A SOLID AND LEACHED WITH EXTRACTION FLUID
10 ADL(AVERAGE DETECTION LIMITS)
11 PQL(PRACTICAL QUANTITATION LIMITS)
12 SAMPLE ANALYZED OVER HOLDING TIME
13 DISSOLVED VALUE MAY BE HIGHER THAN TOTAL DUE TO CONTAMINATION FROM THE FILTERING PROCEDURE
14 SAMPLED BY ULI
15 DISSOLVED VALUE MAY BE HIGHER THAN TOTAL; HOWEVER, THE VALUES ARE WITHIN EXPERIMENTAL ERROR
16 AN INHIBITORY FACTOR WAS OBSERVED IN THIS ANALYSIS
17 PARAMETER NOT ANALYZED WITHIN 15 MINUTES OF SAMPLING
18 THE SERIAL DILUTION OF THIS SAMPLE SUGGESTS A POSSIBLE PHYSICAL AND/OR CHEMICAL INTERFERENT IN THIS DETERMINATION. THE DATA MAY BE BIASED EITHER HIGH OR LOW.
19 CALCULATION BASED ON DRY WEIGHT
20 INDICATES AN ESTIMATED VALUE, DETECTED BUT BELOW THE PRACTICAL QUANTITATION LIMITS
21 UG/KG AS REC.D / UG/KG DRY WT
22 MG/KG AS REC.D / MG/KG DRY WT
23 INSUFFICIENT SAMPLE PRECLUDES LOWER DETECTION LIMITS
24 SAMPLE DILUTED/BLANK CORRECTED
25 ND(NON-DETECTED)
26 MATRIX INTERFERENCE PRECLUDES LOWER DETECTION LIMITS/BLANK CORRECTED
27 SPIKE RECOVERY ABNORMALLY HIGH/LOW DUE TO MATRIX INTERFERENCE
28 POST-DIGESTION SPIKE FOR FURNACE AA ANALYSIS IS OUTSIDE OF THE CONTROL LIMITS (85-115%); HOWEVER, THE SAMPLE CONCENTRATION IS BELOW THE PQL
29 ANALYZED BY METHOD OF STANDARD ADDITIONS
30 METHOD PERFORMANCE STUDY HAS NOT BEEN COMPLETED/ND(NON-DETECTED)
31 FIELD MEASURED PARAMETER TAKEN BY CLIENT
32 TARGET ANALYTE IS BIODEGRADED AND/OR ENVIRONMENTALLY WEATHERED
33 NON-POTABLE WATER SOURCE
34 VOLATILE ASP CODES
---
(B)POSSIBLE/PROBABLE BLANK CONTAMINATION (D)ALL COMPOUNDS IDENTIFIED AT A SECONDARY DILUTION FACTOR (J)DETECTED BELOW THE CRQL
35 THE HYDROCARBONS DETECTED IN THE SAMPLE DID NOT CROSS-MATCH WITH COMMON PETROLEUM DISTILLATES
36 MATRIX INTERFERENCE CAUSING SPIKES TO RESULT IN LESS THAN 50.0% RECOVERY
37 MILLIGRAMS PER LITER (MG/L) / POUNDS (LBS) PER DAY
38 MILLIGRAMS PER LITER (MG/L) OF RESIDUAL CHLORINE (CL2) / POUNDS (LBS) PER DAY OF CL2
39 MICROGRAMS PER LITER (UG/L) / POUNDS (LBS) PER DAY
40 MILLIGRAMS PER LITER (MG/L) LINEAR ALKYL SULFONATE (LAS) / POUNDS (LBS) PER DAY LAS
41 RESULTS ARE REPORTED ON AN AS REC.D BASIS
42 THE SAMPLE WAS ANALYZED ON A TOTAL BASIS; THE TEST RESULT CAN BE COMPARED TO THE TCLP REGULATORY CRITERIA BY DIVIDING THE TEST RESULT BY 20, CREATING A THEORETICAL TCLP VALUE
43 METAL BY CONCENTRATION PROCEDURE
44 POSSIBLE CONTAMINATION FROM FIELD/LABORATORY

**Upstate Laboratories, Inc.**
6034 Corporate Drive • E. Syracuse, NY 13057-1017
(315) 437 0255 Fax 437 1209

# Chain Of Custody Record

11/24

| Client: Delta | Client Project # / Project Name: SO98-009 | | |
|---|---|---|---|
| Client Contact: Steve Zbur | Phone # 412467-7703 | Site Location (city/state): Champion | |

| Sample Location: | Date | Time | Matrix | Grab or Comp. | ULI Internal Use Only | No. of Containers | VOCs 8260 1) | 2) | 3) | 4) | 5) | 6) | 7) | 8) | 9) | 10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS-1, 14' | 11/9/00 | 815 | Soil | G | 3180014 | 1 | ✓ | X | | | | | | | | |
| CS-2, 14' | 11/9/00 | 820 | Soil | G | 15 | 1 | ✓ | X | | | | | | | | |
| SW-1 12' | 11/9/00 | 9:25 | Soil | G | 16 | 1 | ✓ | X | | | | | | | | |
| SW-2 12' | 11/9/00 | 9:45 | Soil | G | 17 | 1 | ✓ | X | | | | | | | | |
| SW-3, 12 | 11/9/00 | 10:40 | Soil | G | 18 | 1 | ✓ | X | | | | | | | | |
| CS-3, 14 | 11/9/00 | 10:40 | Soil | G | 19 | 1 | ✓ | X | | | | | | | | |
| CS-4, ~~12~~ 14' | 11/9/00 | 11:25 | Soil | G | 20 | 1 | ✓ | X | | | | | | | | |
| SW-4, ~~13~~ 12' | 11/9/00 | 11:30 | Soil | G | 21 | 1 | ✓ | X | | | | | | | | |
| SW-5, ~~14~~ 12' | 11/9/00 | 11:33 | Soil | G | 22 | 1 | ✓ | X | | | | | | | | |
| SW-6 12' | 11/9/00 | 11:40 | Soil | G | 23 | 1 | ✓ | X | | | | | | | | |

| parameter and method / sample bottle: | type | size | pres. |
|---|---|---|---|
| 1) VOCs 8260 | Glass | | N |
| 2) % Solids (BS) | | | |
| 3) | | | |
| 4) | | | |
| 5) | | | |
| 6) | | | |
| 7) | | | |
| 8) | | | |
| 9) | | | |
| 10) | | | |

Note: The numbered columns above cross-reference with the numbered columns in the upper right-hand corner.

Special Turnaround Time_____ (Lab Notification required)

Remarks

Sampled by: (Please Print) Steve Zbur

Company: Delta

ULI Internal Use Only
Delivery (check one):
☐ ULI Sampled
☐ Pickup ☐ Dropoff
☐ CC _____

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) |
|---|---|---|---|
| S. Zbur | 11/9/00 | 11:56 | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) |
| | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) |
| | | | |
| Relinquished by: (Signature) | Date | Time | Rec'd for Lab by: (Signature) |
| | 11/10/00 | 11:30 | B. Denuele |

6034 Corporate Drive • E. Syracuse, NY 13057-1017
(315) 437 0255 Fax 437 1209

# Chain Of Custody Record

11124

| Client: | Client Project # / Project Name | | | | | No. of Con-tainers | VOCs 8260 | | | | | | | | | Special Turnaround Time_____ (Lab Notification required) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Delta | 5098-009 | | | | | | | | | | | | | | | |
| Client Contact: Zbur | Phone # 412 489-7703 | Site Location (city/state) Champion | | | | | | | | | | | | | | |
| Sample Location: | Date | Time | Matrix | Grab or Comp. | ULI Internal Use Only | | 1) | 2) | 3) | 4) | 5) | 6) | 7) | 8) | 9) | 10) | Remarks |
| SW-7, 12' | 11/9/00 | 11:45 | Soil | G | 3180024(1) | | ✓ | (X) | | | | | | | | | |

| parameter and method | sample bottle: | type | size | pres. |
|---|---|---|---|---|
| 1) VOCs 8260 | | Glass | | N |
| 2) 0/G Solids VOC | | | | |
| 3) | | | | |
| 4) | | | | |
| 5) | | | | |
| 6) | | | | |
| 7) | | | | |
| 8) | | | | |
| 9) | | | | |
| 10) | | | | |

Note: The numbered columns above cross-reference with the numbered columns in the upper right-hand corner.

Sampled by: (Please Print) Steve Zbur
Company: Delta

ULI Internal Use Only
Delivery (check one):
☐ ULI Sampled
☐ Pickup ☐ Dropoff
☐ CC _____

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) |
|---|---|---|---|
| S. Zbur | 11/9/00 | 11:59 | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) |
| | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) |
| | | | |
| Relinquished by: (Signature) | Date | Time | Rec'd for Lab by: (Signature) |
| | 11/10/00 | 11:30 | B. Senecal |

Syracuse Rochester Buffalo Albany Binghamton Fair Lawn (NJ)