

OPERATION & MAINTENANCE MANUAL

*Active Industrial Uniform Company Site
Lindenhurst, New York*

11 April 2002

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7017

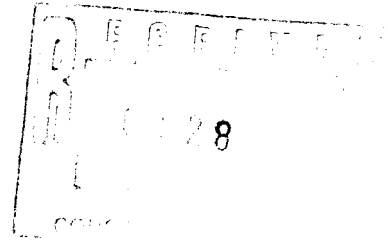
Prepared by:

PHOENIX ENVIRONMENTAL, INC.
57 Mall Drive
Commack, New York 11725

AND

ENVIRONMENTAL RESOURCES MANAGEMENT
520 Broad Hollow Road, Suite 210
Melville, New York 11747
72704.02.1760





OPERATION & MAINTENANCE MANUAL

*Active Industrial Uniform Company Site
Lindenhurst, New York*

11 April 2002

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7017

Prepared by:

PHOENIX ENVIRONMENTAL, INC.
57 Mall Drive
Commack, New York 11725

AND

ENVIRONMENTAL RESOURCES MANAGEMENT
520 Broad Hollow Road, Suite 210
Melville, New York 11747

OPERATION & MAINTENANCE MANUAL

*Active Industrial Uniform Company Site
Lindenhurst, New York*

11 April 2002

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7017

Prepared by:

PHOENIX ENVIRONMENTAL, INC.
57 Mall Drive
Commack, New York 11725

AND

ENVIRONMENTAL RESOURCES MANAGEMENT
520 Broad Hollow Road, Suite 210
Melville, New York 11747
72704.02.1760

TABLE OF CONTENTS

1.0	INTRODUCTION	1-1
1.1	PROJECT AND PURPOSE OF THE O&M MANUAL	1-1
2.0	SITE DESCRIPTION	2-1
2.1	HISTORY	2-1
2.2	HYDROGEOLOGY	2-2
2.3	OVERVIEW OF REMEDIAL SYSTEM	2-2
3.0	SITE REMEDIAL ACTION	3-1
3.1	GOALS OF REMEDIAL ACTION	3-1
3.2	DESCRIPTION OF SYSTEM OPERATION	3-3
3.2.1	GROUND WATER RECOVER SYSTEM	3-4
3.2.2	GROUND WATER TREATMENT SYSTEM	3-5
3.2.3	TREATED GROUND WATER DISCHARGE	3-5
3.2.4	ACID RECIRCULATION	3-6
3.2.5	SITE UTILITIES	3-6
3.2.6	SYSTEM START-UP AND SHUTDOWN PROCEDURES	3-7
3.2.7	SYSTEM CONTROLS AND ALARM CONDITIONS	3-10
4.0	MONITORING, TESTING AND RECORDS	4-1
4.1	MONITORING PLAN	4-2
4.1.1	ELEMENTS OF THE MONITORING PLAN	4-2
4.2	ENVIRONMENTAL MONITORING	4-5
4.2.1	GENERAL	4-5
4.2.2	SAMPLING PROGRAM	4-5
4.3	ON-SITE TREATMENT PLANT PERFORMANCE MONITORING	4-5
4.3.1	INFLUENT SAMPLING AND PROCEDURES	4-5
4.3.2	EFFLUENT SAMPLING AND PROCEDURES	4-6
4.3.3	AIR TESTING	4-6
4.4	ANALYTICAL PROGRAM	4-7
4.4.1	ANALYTICAL SCHEDULES AND METHODS	4-7
4.4.2	LABORATORY QC SAMPLES	4-7
4.4.3	REPORTING AND DELIVERABLES	4-7
4.4.4	SPECIAL ANALYTICAL PROTOCOLS	4-8
4.4.5	LABORATORY AUDIT	4-8
4.5	WATER LEVEL MEASUREMENTS	4-8

4.6	EVALUATION OF MONITORING RESULTS	4-8
4.7	RECORDS	4-9
5.0	MAINTENANCE	5-1
5.1	MAINTENANCE ACTIVITIES	5-2
5.1.1	FENCE	5-2
5.1.2	SIGNS	5-3
5.1.3	COVER	5-3
5.1.4	GROUNDWATER MONITORING SYSTEM	5-3
5.1.5	VEHICLE DRIVEWAY	5-4
5.1.6	MAINTENANCE REQUIREMENTS OF SPECIFIC COMPONENTS	5-5
5.1.7	MAINTENANCE SCHEDULE	5-8
5.2	INSPECTION AND MAINTENANCE CHECKLIST	5-8
5.3	PREVENTIVE MAINTENANCE SCHEDULE	5-9
5.4	CORRECTIVE MAINTENANCE	5-9
5.5	DISPOSAL OF USED MATERIALS AND WASTE	5-10
6.0	REPORTS	6-1
6.1	MONTHLY REPORTS	6-1
6.2	QUARTERLY REPORTS	6-1
6.3	YEARLY REPORTS	6-1
6.4	5 YEAR REVIEW	6-2
7.0	PERSONNEL	7-1
7.1	ORGANIZATION	7-1
7.1.1	CHAIN OF COMMAND	7-1
7.2	MANPOWER REQUIREMENTS	7-1
7.3	RESPONSIBILITIES AND DUTIES	7-2
7.4	QUALIFICATIONS	7-3
7.5	TRAINING (INCLUDING HEALTH AND SAFETY)	7-3
7.6	MATERIAL SAFETY DATA SHEETS	7-3
8.0	HEALTH AND SAFETY	8-1
9.0	RECORDS	9-1

10.0	EMERGENCY CONTINGENCY PLAN	10-1
10.1	EMERGENCY SPILL RESPONSE	10-1
10.2	FIRE/EXPLOSION	10-1
10.3	PERSONAL INJURY	10-1
10.4	TOXIC EXPOSURES	10-2
10.5	PUBLIC NOTIFICATION	10-2
10.6	EMERGENCY PHONE NUMBERS	10-2

LIST OF APPENDICES

<i>Appendix A</i>	<i>System Permits</i>
<i>Appendix B</i>	<i>Occupational Safety and Health Guideline for Hydrochloric Acid and BWE's Health and Safety Plan</i>
<i>Appendix C</i>	<i>Record Drawings and Valve Schedule</i>
<i>Appendix D</i>	<i>Manufacturer's Equipment Manuals</i>
<i>Appendix E</i>	<i>System Monitoring and Maintenance Log (Book 2)</i>

LIST OF TABLES

<i>Table 3.1</i>	<i>Design Concentrations for Influent Groundwater and Treated Effluent</i>	<i>Page 3-2</i>
<i>Table 4.1.1</i>	<i>Schedule of Sampling Activities for the Groundwater Treatment System</i>	<i>Page 4-3</i>

1.0 INTRODUCTION

1.1 PROJECT AND PURPOSE OF THE O&M MANUAL

This manual has been prepared to provide guidance to personnel responsible for operating and maintaining the groundwater recovery and treatment system at the Active Industrial Uniform Co. Site located on the south side of West Montauk Highway (State Route 27A) in Lindenhurst, New York. It is intended to serve as the primary reference source for procedures relating to the treatment system monitoring, sampling, record keeping, equipment maintenance, safety, emergency situations and general operations.

This manual should be considered supplementary to the specific and detailed operating, maintenance and repair procedures furnished with each major item of equipment by the equipment manufacturer. Hence, this manual, and the manufacturers' detailed technical literature relating to specific items of system equipment complement each other and provide the personnel with information necessary to understand the techniques, basic principles and procedures necessary to effectively operate and maintain this remedial treatment system.

This manual is not comprehensive nor does it provide information to deal with all possible situations. If any alarm lights or signals are activated or the system is not operating as designed, Blue Water Environmental, Inc. (Telephone No. (631) 249-1872) or the current System Operator should be contacted immediately.

2.0

SITE DESCRIPTION

The Active Industrial Uniform Company site is situated on a one-half acre parcel of land located on the south side of West Montauk Highway (State Route 27A) in the Village of Lindenhurst, Suffolk County, New York.

2.1

HISTORY

Remedial investigations have been conducted at this site since 1987. A Soil Vapor Extraction (SVE) system as an interim remedial measure (IRM) began operation in 1991. An IRM is an activity that begins immediately to remedy an obvious environmental problem before a full investigation is started to try and find all contamination at a site. The goal of the IRM was to remove soil contamination on-site. After the IRM, the New York State Department of Conservation (NYSDEC) approved a remedial investigation and feasibility study (RI/FS) in October 1993. Subsequently, it was determined from the RI/FS that soils on-site and the groundwater between the site and Little Neck Creek were contaminated. The RI/FS identified a shallow plume with concentrations of tetrachloroethene (PCE) as high as 20 ppm and heading southwest toward Little Neck Creek (approximately 800 feet away). Little Neck Creek discharges into the Great South Bay, approximately 4,200 feet south. The original design concept outlined in the Record of Decision (ROD) called for two groundwater recovery wells, one on-site, and one off-site 100 yards down gradient, each pumping at 60 gallons per minute (gpm). Results of the design investigation required a modification to the scope of work for remediation. Contamination of 10 parts per million (ppm) PCE was found in the groundwater three blocks away. Based on this information, the scope of work has been modified. It still consists of two ground water recovery wells, one well on-site and one well three blocks away, each pumping at 100 gpm. The DEC issued a Record of Decision (ROD) on

March 26, 1997, for the site, which calls for the following actions: 1) Expansion of the soil-vapor extraction (SVE) system; 2) Install an air-sparging system (blowing air through groundwater to remove contamination and treating the contaminants through the SVE system); 3) Install a groundwater pump and treat system. It has since been determined that the groundwater pump and treat system will adequately remediate the spill, therefore the SVE and air-sparging systems will not be installed.

2.2 *HYDROGEOLOGY*

Subsurface soils consist primarily of fine to coarse sand with varying amounts of gravel. There is a confining clay layer approximately 70 feet below land surface. The direction of ground water flow in the area is predominantly to the South. The depth-to-water on-site is approximately 8 to 10 feet below grade.

2.3 *OVERVIEW OF REMEDIAL SYSTEM*

The remedial system, constructed in the Fall of 2001, consists of two (2) groundwater recovery wells each equipped with a submersible pump. Recovery well 1 (RW-1) is located on the southwest portion of the site, recovery well 2 (RW-2) is located on Orchard Street. The recovered groundwater is pumped to the treatment system through underground piping located on-site and along Orchard Street, Shore Road, Lane Street, and Tompkins Ave. Inside the treatment building the groundwater recovery lines penetrate to aboveground PVC pipe. Each recovery line is equipped with a valve for flow control, and a flow meter. The groundwater recovery lines are then teed together prior to connection to two Branch Environmental air stripping towers. The process piping is designed so that the recovered groundwater can be pumped through the

air stripping tower individually, in parallel, or in series. Inside the air stripping towers Volatile Organic Carbons (VOCs) are removed from the recovered ground water by pulling ambient air through the system. The treated water is filtered and discharged via underground piping into a storm water catch basin located on Shore Road. The system's air discharge passes through a air/moisture separator and then passed through two 5,000 pound vapor phase granular activated carbon vessels, connected in series, and then discharged to the atmosphere through an emissions stack. A 3,000 gallon hydrochloric acid storage tank and acid circulation system is present at the site for cleaning the internal packing of the air stripping towers.

3.0

SITE REMEDIAL ACTION

This project requires the remediation of volatile organic compound (VOC) contaminated soil and groundwater located at Active Industrial Uniform Co. Site, Lindenhurst, New York. The project includes soil excavation and groundwater remediation. This manual addresses the operation and maintenance of the groundwater remediation system, which is scheduled to operate for approximately 10 years.

3.1

GOALS OF REMEDIAL ACTION

The goal of the operation of this system is to lower the concentrations of dissolved VOCs to levels that are below NYSDEC clean-up objectives. The progress toward meeting this goal will be monitored by collecting groundwater samples on a quarterly basis from eight on-site wells and three off-site monitoring wells. Samples will be analyzed for VOCs by EPA method 8260.

The anticipated influent groundwater concentrations that were used to design the system and the effluent requirements are summarized in Table 3.1

Table 3.1
Design Concentrations For Influent Groundwater and Treated Effluent
Active Industrial Uniform Site, Lindenhurst, New York
Site No. 1-52-125, NYSDEC Contract No. D004134

<u>Parameter</u>	<u>Influent Concentration</u>	<u>Effluent Concentration*</u>
Trichloroethane	5900 µg/l	10 µg/l
Tetrachloroethene	6800 µg/l	4 µg/l
1,2 Dichloroethene (Total)	2800 µg/l	10 µg/l
1,1,1 Trichloroethane	1200 µg/l	5 µg/l
Xylene	1100 µg/l	5 µg/l**
Vinyl Chloride	190 µg/l	10 µg/l
Iron	1.4 to 4.0 mg/l	4 mg/l
Manganese	2.83 to 10.1 mg/l	2 mg/l
Total Dissolved Solids	130 to 294 mg/l	Monitor
Total Suspended Solids	10 to 29 mg/l	20 mg/l
Aluminum	34 to 1810 ug/l	4000 ug/l
Arsenic	1.4 to 28.5 ug/l	140 ug/l
Cadmium (T)	0.3 to 9.5 ug/l	30 ug/l
Copper (T)	1.5 to 13.3 ug/l	38 ug/l
Nickel (T)	2.8 to 12.4 ug/l	65 ug/l
Silver (T)	0.6 to 2.2 ug/l	9 ug/l
Zinc (T)	15 to 163 ug/l	370 ug/l
Chloride (dissolved)	40 mg/l	NA
COD (dissolved)	mg/l	NA
Conductivity (dissolved) at 25 Deg C	0.28 to 5.1 ms/cm	NA
Turbidity	4 to 425 NTU	NA
PH	6.2	6 to 9
Alkalinity (dissolved)	39 to 80 mg/l	NA
Dissolved Oxygen	0.37 to 2.9 mg/l	NA

NYSDEC site specific Effluent limitations and monitoring Requirements
Effluent limits for xylene-o = 5 ug/l; Xylene-m&p = 10 ug/l.

Source: CDM Technical Specifications, Section 01010.

The remedial system, constructed in the Fall of 2001, consists of two (2) groundwater recovery wells each equipped with a submersible Grundfos pump. Recovery Well 1 (RW-1) is located on the southwest portion of the site and is recovering ground water at a rate of 80 gpm. Recovery well 2 (RW-2) is located 1600ft. to the south of the site on Orchard Street and is recovering ground water at a rate of 100 gpm. The system transfer pumps, acid recirculation system, system manifolds, and control panel are housed in the system remediation building. The building is a prefabricated metal building with electrical, natural gas, and water service. The recovered groundwater is pumped to the treatment system building via 3" diameter high-density polyethylene (HDPE) underground piping located on-site and along Orchard Street, Shore Road, Lane Street, and Tompkins Ave. Inside the treatment building the groundwater recovery lines penetrate to aboveground 3" schedule 80 PVC. Once inside the treatment building each recovery line is equipped with a valve for flow control, and a flow meter. The groundwater recovery lines are then teed together prior to connections to two Branch Environmental Air Stripping Towers. The process piping is designed so that the recovered groundwater can be pumped through the air stripping tower individually, in parallel, or in series. The air stripping towers remove VOCs from the groundwater by moving large quantities of air from the bottom of the tower to the top while the water is pumped to the top of the tower and allowed to cascade to the bottom. The treated water is then passed through a Harmsco 10 micron filter and discharged via 4" HDPE underground piping into a storm water catch basin located on Shore Road. The system's air discharge passes through a air/moisture separator and then passed through two 5,000 pound vapor phase granular activated carbon vessels, connected in series, and then discharged to the atmosphere through an emissions stack. The water collected in the air/moisture

separator is fed back into the system through a pump attached to the water collection tank.

Periodically the iron, manganese, and calcium carbonate, found naturally in the groundwater, will develop into a scale that could lead to clogging in the air stripping towers. The air stripper tower packing will require periodic cleaning by means of feeding hydrochloric acid through towers. A 3,000 gallon acid storage tank is present on site for storage of the hydrochloric acid. The hydrochloric acid is pumped into the system by an acid pump. The acid is then fed back into the storage tank. To reduce system down time, the process piping and valves were designed to allow for one tower to be cleaned while that other is still in operation. Information on safe handling of hydrochloric acid is included in Appendix B.

A more thorough understanding of the remedial system can be attained by reviewing the Process and Instrumentation Diagram (P&ID) for this project. A copy of this diagram can be found as part of the as-built drawings in Appendix C. The P&ID presents a schematic flow of the system. The groundwater recovery wells are equipped with submersible Grundfos pumps where the flow can be regulated by means of a control valve. The operation of the system is monitored and controlled in part by various gauges, switches and the System Control Panel which was custom built for this site by Blue Water Environmental, Inc. (Telephone No. (631) 249-1872).

3.2.1 GROUND WATER RECOVER SYSTEM

Each recovery well (RW-1 and RW-2) is equipped with a submersible Grundfos well pump and Coyote pump controller. The Coyote pump

controllers are independently installed to protect the pump motors against excessive backpressure and to prevent the pumps from running dry.

In order to adjust the flow from the well, the control valve should be used. The control valve is located on the western well of the building just as the recovery lines enter the building. Refer to the operation literature and the Grundfos pump curve for additional information.

3.2.2 ***GROUND WATER TREATMENT SYSTEM***

Two (2) Branch Environmental Stripper Towers, Model 48T25H have been installed to remove dissolved chlorinated compounds (VOCs) from the recovered ground water. A model PB-18 pressure blower, manufactured by Cameron Great Lakes, is rated to pull ambient air at 1350 cfm through the stripper towers and recovered ground water in order to remove the VOCs. The piping associated with the towers were designed so that the towers may be run in series or parallel, depending on contaminant levels, required flow rates, and cleaning activities. For a complete listing of all valves and what position they should be in to achieve the desired flow pattern, please refer to the *Valve Schedule*, included in Appendix C.

In order to provide a safe means of exhaust in accordance with the NYSDEC issued permit (see Appendix A), the effluent air from the stripper towers is sent through two (2) 5,000-pound granular activated carbon (GAC) vessels, connected in series, prior to discharge through the emissions stack.

3.2.3 ***TREATED GROUND WATER DISCHARGE***

The water collected at the bottom of the air stripping towers is pumped by two Goulds model 8SH1M5D3, 15hp end suction pumps (P-1 and P-2).

Depending on the mode of operation the suction pumps will connect to the next tower, the Harmsco 10-micron triple cartridge filter, or the acid storage tank. Prior to discharge to the storm sewer catch basin along Shore Rd. the treated water will pass through the Harmsco 10-micron triple cartridge filter.

3.2.4 ACID RECIRCULATION

Periodically the iron, manganese, and calcium carbonate found naturally in the groundwater will develop into a scale that could lead to clogging in the air stripping towers. The air stripper tower packing will require periodic cleaning by means of feeding hydrochloric acid through towers. A 3,000 gallon crosslinked polyethylene acid storage tank is present on site for this purpose. During cleaning events, the hydrochloric acid is pumped into the system by an acid pump. The acid is then fed back into the storage tank by the Goulds model 8SH1M5D3 end suction pump. To reduce system down time the process piping and valves were designed to allow for one tower to be cleaned while that other is still in operation.

3.2.5 SITE UTILITIES

Water

A potable water connection is made on the north end of the site directly from the water main located along Montauk Highway. A one-inch underground copper pipe makes the connection from the water meter at the northeast side of the site, around the east side of the treatment building, and enters the building along the south wall on the east side.

Electric

Electricity is supplied by the Long Island Power Authority (LIPA). The electric connection is made from the utility pole located on the north side of the site along Montauk Highway. The connection is an underground line that connects to the meter on the Northeast corner of the building. The electrical panels and transformers are located on the same wall in the interior of the building. LIPA supplies 120/208 volts, 3 phase, 4-wire.

Natural Gas

Natural Gas is supplied from a gas main located at the end of Tompkins Lane. The underground line is 2" HDPE, and connects to the gas meter outside the building at the southwest corner.

3.2.6 *SYSTEM START-UP AND SHUTDOWN PROCEDURES*

Recovery Wells

The two ground water well pumps will run continuously. The blower will start when any recovery well pump hand switch is turned to "Auto". The pumps start-up will be delayed by 1 minute to allow the blower to reach the design air flow rate. A current monitoring pump controller will prevent the pump from running dry. The flow will be monitored and totaled for each well. The low flow alarm will be generated when the totaled daily flow is outside the operator's deadband (hi/lo limits.) Low flow will not shut off the pump since the pump will be controlled locally by Coyote well pump controller.

Air Stripper Blower Operation

The air stripper blower starts when the blower (B-1) is in "auto" and RW-1, RW-2, or Transfer Pump 1(P-1) starts. B-1 stops 5 minutes (operator adjustable) after the last of RW-1 or RW-2 stops. The blower will not operate during acid recirculation (P-3 in Auto).

Transfer Pumps (P-1, P-2, P-3, P-4)

The following monitoring and control description is based on a variable speed transfer pump. The flow can also be controlled by a motorized valve on the discharge of the transfer pump (a motorized valve will require the addition of a high pressure shut down alarm.)

Transfer Pump No. 1 (P-1)

P-1 starts when the air stripper 1 sump level is at or above high level (operator adjustable). The pump speeds shall be varied to keep the air stripper sump at a constant level setpoint. (operator adjustable). P-1 will be limited to maximum flow rate (operator adjustable). P-1 shall stop when air stripper 1 sump level is at or below low level setpoint or an emergency stop alarm condition exists.

Transfer Pump No. 2 (P-2)

P-2 starts when the air stripper 2 sump level is at or above high level setpoint (operator settable). The pump speeds shall be varied to keep the air stripper sump at a constant level setpoint (operator adjustable). Transfer pump 2 (P-2) shall stop when air stripper 2 sump level is at or below low level setpoint or an alarm condition exists.

Acid Recirculation/Transfer Pump (P-3)

P-3 will operate from a "Hand-Off-Auto" hand switch on the control panel. When P-3 is in "Auto", the pump will stop for low level in the acid storage tank reaches and start when the tank is at or above high level.

Moisture Separator Pump (P-4)

P-4 will operate from a "hand-off-Auto" hand switch on the control panel. When P-4 is in "Auto", the pump will turn on for high level in the moisture separator and turn off at low level. AN alarm will be generated for Hi-Hi level in the moisture separator.

Building Sump Pump (P-5)

The building sump pump (P-5) is controlled locally by a level switch. The pump run status is monitored and level high alarms generated.

Chemical Transfer Pump/Acid Recirculation system

The acid recirculation system is a manned operation with only minimal controls (P-3 above). All valves must be modified manually. An alarm is generated if the acid storage tank reaches Level Alarm High-High (LAHH). The chemical transfer pump (P-6) is a manual operation. Do not fill tank if at high level.

Recovery Wells

Well Pump will stop if one of the following occurs:

1. Coyote pump controller detects a high backpressure or if well runs dry.
2. Air Stripper 1 or 2 sump Hi-Hi Level Alarm (LAHH). A float switch will also be used as backup to the calculated hi-hi level transducer output.
3. Building sump Level High-High Alarm (LAHH)
4. Blower low air flow (FSL)
5. Blower not in "auto"

The system will continue to run if the one of the Coyote pump controllers shut down a pump. An autodialer callout will occur, and that pump must be restarted manually.

On a hi-hi level in the building sump, or a low blower airflow the whole system will be shut down. The system must be reset manually after these conditions have been corrected.

Air Stripper Blower

Emergency stop: The blower will stop following shutdown of the recovery wells for other alarms.

Transfer Pumps (P-1, P-2, P-3, P-4)

Emergency stop. P-1 will stop for the following conditions:

1. Air stripper 2 sump Hi-Hi Level Alarm (LAHH)
2. Air stripper 1 or 2 differential air pressure alarm Hi (PAH)
3. Cartridge filter system Hi Pressure Alarm (PAH)
4. Air flow Switch Low (FSL)
5. Building sump Hi-Hi Level Alarm (LAHH)

Emergency Stop. P-2 will stop for the following conditions:

1. Acid storage tanks Hi-Hi Level Alarm (LAHH)
2. Cartridge filter system Hi Pressure Alarm (PAH)
3. Air flow Switch Low (FSL)
4. Building sump Hi-Hi Level Alarm (LAHH)

Emergency Stop. P-3 will stop for the following conditions:

1. Air stripper 1 sump Hi-Hi Level Alarm (LAHH)
2. Air Stripper 1 or 2 differential air Hi Pressure Alarm (PAH)
3. Building sump Hi-Hi Level Alarm (LAHH)
4. Secondary containment Hi-Hi Level Alarm (LAHH)

Emergency Stop: P-4 will stop if one of the following occurs:

1. Air stripper 1 or 2 sump Hi-Hi Level Alarm (LAHH)
2. Air Flow Switch Low (FSL)
3. Building sump Hi-Hi Level Alarm (LAHH)

Emergency Stop: P-5 will stop if one of the following occurs:

1. Air stripper 1 or 2 sump Hi-Hi Level Alarm (LAHH)
2. Air Flow Switch Low (FSL)
3. Building sump Hi-Hi Level Alarm (LA

The pumps will operate automatically after the emergency stop condition is corrected when in the "Auto" mode.

Auto-Dialer

A Sensaphone Express auto-dialer is present on-site and will notify BWE personnel of conditions that could develop that may interfere with the daily operation of the system. The conditions listed below will activate the call out function by the auto-dialer:

- Loss of power
- Low air flow in the stripper towers
- High pressure in RW-1 or RW-2
- High water level in ST-1 or ST-2
- High pressure in P-1 or P-2
- Low flow in RW-1 and RW-2

Currently the autodialer is set to call Mark Solomon((516) 315-3467) and Charlie Ferrito ((516) 523-6706) from BWE. The auto-dialer will need to be reprogrammed in the event a new operator is chosen for the site.

Treatment system operating records are the recorded results of observation, tests and measurements performed in the operating and maintenance of the remediation system. Data to be recorded and maintained should be the data necessary to control the system operation, to record operating conditions, or to provide data for determining system patterns and unusual trends.

The Groundwater System Checklist and Monitoring Report (included in Appendix E) shows those operational parameters which require monitoring. *The Groundwater System Checklist and Monitoring Report* should be filled out each week or during each site visit. Any apparent operating problems should be noted on the report. Significant problems or alarm conditions should be reported to the project manager immediately. A record of completed maintenance activities should be logged on the *Maintenance Schedule Checklist*. The completed forms serve as a reference of past system operations during troubleshooting. A copy of the completed forms should be filed in Appendix E of the on-site system maintenance manual. The manual should be kept in the system building. An additional copy should be sent to the Operation & Maintenance Division of the NYSDEC in the Albany office and the original should be sent to the Blue Water Environmental office or current System Operator.

4.1 MONITORING PLAN

4.1.1 ELEMENTS OF THE MONITORING PLAN

The operation of the remediation system includes ground water and air monitoring. This monitoring incorporates both permitted and non-permitted issues. The exact monitoring and sampling requirements may vary throughout the course of the project, but will include, at a minimum, the sampling of the system's air and water emissions on a monthly basis. The complete sampling schedule, including sampling frequency and analytical methods, is detailed in Table 4.1.1 *Schedule of Sampling Activities for the Groundwater Treatment System*. BWE will be utilizing the following laboratories for analyzing samples:

For Process & ground water:
Environmental Testing Laboratory
208 Rt. 109
Farmingdale, New York 11735

Process Air:
Microseeps
220 William Pitt Way
Pittsburgh, PA 15238

Discharge Air:
Air Toxics Ltd
180 Blue Ravine Road, Suite B,
Folsom, CA 95630

All checklists and logging forms will be included in a binder within the system building. Information logged will be provided to Blue Water Environmental on the day of service.

TABLE 4.1.1
SCHEDULE OF SAMPLING ACTIVITIES FOR THE GROUNDWATER TREATMENT SYSTEM
ACTIVE INDUSTRIAL UNIFORM SITE
LINDENHURST, NEW YORK
SITE NO. 1-52-125
NYSDEC CONTRACT NO. D004134

Tasks	Start Up	Monthly	Quarterly	Semi-annually
<u>GROUND-WATER EXTRACTION TESTING</u>				
RW-1				
VOCs (EPA Method 8260)			X	
METALS (TAL)			X	
pH (field test)			X	
RW-2				
VOCs (EPA Method 8260)			X	
METALS (TAL)			X	
pH (field test)			X	
Combined Influent				
VOCs (EPA Method 8260)	X	X		
METALS (TAL)	X	X		
pH (field test)	X	X		
Midfluent				
VOCs (EPA Method 8120)	X		X	
Metals (TAL)	X			
pH (field test)	X			
Effluent				
VOCs (EPA Method 8260)	X	X		
METALS (TAL)			X	
pH (field test)				X
COD (Method 410.1/410.2/SM5220C)				X
Alkalinity (Method 310.1/SM2320B)				X
DO, Conductivity, Turbidity (field test)				X
Chlorine (field test)				X
TSS (Method 160.2/SM2540D)				X
TDS (Method 160.1/SM2540C)				X
<u>AIR TESTING</u>				
Influent				
Microseeps (EPA 601/602)	X	X		
Midfluent				
Microseeps (EPA 601/602)	X	X		
Effluent				
Air Toxics/STL (TO-14 analysis)	X	X		

TABLE 4.1.1
 SCHEDULE OF SAMPLING ACTIVITIES FOR THE GROUNDWATER TREATMENT SYSTEM
 ACTIVE INDUSTRIAL UNIFORM SITE
 LINDENHURST, NEW YORK
 SITE NO. 1-52-125
 NYSDEC CONTRACT NO. D004134

Tasks	Start Up	Monthly	Quarterly	Semi-annually
<u>GROUND-WATER MONITORING</u>				
Monitoring Wells*1 through 11				
VOCs (EPA Method 8260)			X	
DO, Conductivity (field test)			X	
pH (field test)			X	
Water levels			X	

Note

*Location of Monitoring Wells are shown on Site Plan attached to the as-built drawings in Appendix

4.2 ENVIRONMENTAL MONITORING

4.2.1 GENERAL

Groundwater monitoring wells will be sampled on a quarterly basis in order to track the progress of the site remedial activities. In addition, the system's effluent air and water will be sampled on a monthly basis to verify that the discharges do not exceed maximum emission concentrations, allowed by the system permits. Copies of the system discharge permits (equivalency) are included in Appendix A.

4.2.2 SAMPLING PROGRAM

All system sampling and groundwater monitoring well sampling will be performed in accordance with *the Schedule of Sampling Activities for the Groundwater Treatment System*, included on the preceding pages (see Table 4.1.1). Any changes to the sampling program will need to be approved NYSDEC.

4.3 ON-SITE TREATMENT PLANT PERFORMANCE MONITORING

In order to evaluate how effectively the recovery of groundwater is remediating the site and how effectively the system is treating that water prior to discharge, influent and effluent samples must be collected.

4.3.1 INFLUENT SAMPLING AND PROCEDURES

Influent groundwater sampling provides a baseline to evaluate the effectiveness of the system. By comparing the influent data to the effluent data we can determine the quantities of contaminant removed from the

subsurface as well as the efficiency of the system at removing the contaminants from the recovered water prior to discharge. The schedule of influent water sampling analytical methods and frequencies is included on the previous pages (see Table 4.1.1). All samples should be taken following the analytical method's requirements, the laboratory's specifications, and standard environmental sampling procedures to minimize the potentials for cross contamination or other erroneous data.

4.3.2 *EFFLUENT SAMPLING AND PROCEDURES*

Effluent groundwater sampling is required to document that the system is not exceeding the permitted maximum discharge limits. The schedule of effluent water sampling analytical methods and frequencies is included on the previous pages (see Table 4.1.1). All samples should be taken following the analytical method's requirements, the laboratory's specifications, and standard environmental sampling procedures to minimize the potentials for cross contamination or other erroneous data. In addition, the discharge connection to the sewer along Shore Road should be inspected monthly to insure that there are no blockages which could cause the sewer to overflow into the street.

4.3.3 *AIR TESTING*

Air will be sampled at the influent to the granulated carbon vessels, the midfluent between the two, and at the effluent before discharge through the stack. All samples should be taken following the analytical method's requirements and the laboratory's specifications. Air sampling will occur according to the schedule on the preceding pages (see Table 4.1.1).

4.4

ANALYTICAL PROGRAM

Proper system performance tracking can only be conducted with accurate data. A New York State certified laboratory must be selected to analyze the system and groundwater monitoring well samples to ensure accurate data. Personnel should be properly trained and familiar with all field sampling kits and meters required on-site.

4.4.1

ANALYTICAL SCHEDULES AND METHODS

A complete listing of the sampling schedule, including sampling locations, sampling methods, and frequencies is included in the summary table in section 4.1.1.

4.4.2

LABORATORY QC SAMPLES

Instructions from the laboratory regarding quality assurance/quality control (QA/QC) measures should be followed to preserve data integrity. This may include the collection and submission of trip blanks, field blanks, or equipment blanks.

4.4.3

REPORTING AND DELIVERABLES

All samples collected during a scheduled sampling event will be submitted to the laboratory for standard turnaround times. If additional sampling is required due to discharge exceedances, sample results may be expedited with the approval of the NYSDEC.

4.4.4

SPECIAL ANALYTICAL PROTOCOLS

All sampling should be conducted in a manner to minimize the possibility of cross contamination. Consult the laboratory regarding special sampling protocols, such as pre-filtration of samples, if you are not familiar with a particular sampling procedure.

4.4.5

LABORATORY AUDIT

The project laboratory should supply written documentation of their credentials, including New York State certification to Blue Water Environmental or current System Operator on an annual basis.

4.5

WATER LEVEL MEASUREMENTS

All groundwater monitoring wells will be gauged for depth to product and depth to water with an oil water interface probe during the quarterly groundwater sampling events. During the initial start-up of the system, additional well gauge data should be collected to confirm the capture zone of the groundwater extraction pumps.

4.6

EVALUATION OF MONITORING RESULTS

System monitoring and analytical data should be reviewed for content and accuracy as soon as possible after receipt. Any monitoring data, such as flow rates, that is inconsistent with previous data should be confirmed in the field. If the data is found to be accurate, the change in system performance should be reported to NYSDEC and a corrective action should be determined. If the analytical results of a discharge sample is found to be in exceedance of the system limits, NYSDEC should be

contacted immediately. An adjustment to the system must be made to bring the discharge into compliance, or the system must be shut down until such adjustment can be made. The discharge sample should be collected after the adjustment has been made to assure compliance.

4.7 -- **RECORDS**

During each site visit, a *Groundwater System Checklist and Monitoring Report* form should be completed. A record of completed maintenance activities should be logged on the *Maintenance Schedule Checklist*. The completed forms serve as a reference of past system operations during troubleshooting. Copies of the completed forms should be kept in the system maintenance manual inside the treatment shed. A copy should be kept in the binder, a copy should be sent to the Operation & Maintenance Division of the NYSDEC in the Albany office, and the original should be sent to the Blue Water Environmental office.

GENERAL REQUIREMENTS

Essential to the successful and economical operation of the remediation system is the regular and systematic maintenance of equipment, piping and system controls. Routine preventive maintenance of mechanical equipment, such as pumps and motors, will assure optimum equipment performance and reduce the frequency of equipment breakdown and interruptions to the treatment processes. Essential to good maintenance is the establishment of and adherence to a realistic maintenance program and schedule.

This chapter is intended to provide operating and maintenance personnel with the basic systems and procedures necessary to maintain the treatment system in good operating condition. It does not attempt to show step-by-step inspection, disassembly, adjustment, lubrication, or other maintenance details for specific items of equipment. The manufacturer's operation and maintenance manuals furnished with the equipment should be consulted for these details (Equipment manuals have been included in Appendix D. The systems and procedures outlined in this chapter, however, when properly implemented and routinely followed, will assure that the treatment system performs its design functions at maximum efficiency and with minimum interruptions or breakdown.

EQUIPMENT LOG

A logbook should be kept at the treatment building and should be filled out every time maintenance personnel visit the site. The log form should always indicate the date, name of maintenance personnel, operational status of the system, piece(s) of equipment worked on, description of action taken and the reason such action was required.

5.1 MAINTENANCE ACTIVITIES

Maintenance work on the treatment system may be either preventive maintenance or corrective maintenance. Preventive maintenance consists of those routine, recurring tasks performed periodically on equipment and appurtenances. This includes inspection, lubrication, adjustment, cleaning, minor repairs, etc. Corrective maintenance is synonymous with repair and is the restoration of a system or equipment item to a condition substantially equivalent to its original design capacity and efficiency through parts replacement, component reprocessing, over-haul, or rebuilding. In addition, sections on the maintenance of non-system site components, such as the perimeter fence and the driveway, are also included in this section. See Appendix E for the schedule of preventative maintenance.

5.1.1 FENCE

It is recommended that the perimeter fencing around the Site be inspected quarterly for tears or breaks. Due to the potential for vandalism, any breaks shall be repaired immediately. The locks on the gate are to be inspected and lubricated regularly, and replaced if necessary due to rusting or other damage.

5.1.2 SIGNS

The presence of appropriate signs to notify site personnel of safety concerns should be checked quarterly to insure adequate safety precautions. The scope of the project should also be reviewed quarterly to assure that no changes in site operations have been made that require changes to be made to the types or content of the signs present on site.

5.1.3 COVER

The groundcover of the entire site should be examined quarterly for any uneven surfaces or erosion activity. Repairs should be made as needed. Also, if any problems are found on regular site visits, they should be repaired as soon as possible. Water diversion may be considered to control on site erosion and settlement.

5.1.4 GROUNDWATER MONITORING SYSTEM

The ground water recovery wells and Site monitoring wells must be inspected on a regular basis and maintained as necessary to ensure integrity of the wells and prevent fouling of the well screens. Inspection of the ground water recovery wells and Site monitoring wells will consist of identifying problems associated with the following:

- Concrete surface seal
- Curb box or protective steel casing and lid
- Locks and locking caps
- Excessive well siltation

If fouling occurs, the operator must identify the cause and implement corrective measures. Any corrective proposed corrective measures must be approved by NYSDEC prior to implementation.

It is recommended that all wells are inspected quarterly, and the vegetation and soil around the wells maintained so that the wells remain visible and accessible.

The Site monitoring wells are installed with locking covers. The locks on the covers are to be inspected and lubricated quarterly, and any needed keys are to be kept on site in the system building. Gripper plugs on all wells should always form a tight seal with the well.

It is essential that the well vaults are maintained in a clean, dry condition to allow safe and efficient access to the equipment contained within the vaults. It is recommended that the vaults are inspected quarterly and after each storm event to ensure that each vault is free of standing water. If water is entering a vault, the operator is to check the frame and cover and vault penetrations. Measures are to be taken to prevent water from accumulating in the well vaults, and any leaks must be corrected as they are identified. The vaults must also be kept free of dirt. Any accumulated dirt is to be periodically removed with a shovel or brush and small dustpan. A brush and dustpan is to also be used as necessary to remove dirt from the vault equipment.

5.1.5 VEHICLE DRIVEWAY

The driveway leading from the street to the treatment building should be checked on a regular basis for the presence of potholes and other damage. Any uneven surface must be repaired when found to assure on site safety. During the winter months arrangements should be made to have a snow

plowing service contracted to clear the driveway and the sidewalk along Montauk Highway.

5.1.6 *MAINTENANCE REQUIREMENTS OF SPECIFIC COMPONENTS*

Maintenance requirements of the system components are detailed in the manufacture's equipment manuals found in Appendix D. The manufacturer's recommended maintenance and inspection schedules for the individual system components have been summarized in Appendix E. During each site visit, the Maintenance Log should be reviewed to determine what tasks must be completed to adhere to the manufacture's recommended maintenance schedules. To document tasks completed, as well as to provide an on-site record of system operations, the system monitoring record, maintenance schedule checklist and system monitoring report should be completed during each site visit.

Basic System Maintenance

The best sources of specific information on the performance of preventive maintenance tasks and recurring cleaning or lubrication procedures for the treatment system equipment are the manufacturer's operation and maintenance manuals and service bulletins provided for each piece of equipment. The individual responsible for supervising O&M personnel should assure that these technical documents are complete, current and are properly protected from damage or loss. Maintenance requirements for major equipment items are summarized in this section. This section should be used as a general guide only and should not be considered as a substitute for the more comprehensive information contained in the manufacturer's technical documents.

Ground Water Recovery Pumps (Grundfos)

The pumps and groundwater recovery system should be periodically checked for water quantity, pressure, drawdown, periods of cycling, and operation of controls.

The pumps should not be operated for any periods of time with the discharge valve closed. The Coyote pump controllers will shut down the pumps to prevent damage due to overheating.

If the pumps fail to operate, or if there is a loss of performance, refer to the Troubleshooting guide in the manufacturer's O&M literature.

The pump should be pulled annually (or more frequently as problems occur) to check for signs of iron fouling. If fouling occurs, notify Blue Water Environmental office or the current System Operator and schedule cleaning activities.

3" Globe Valve

Periodic inspection schedule should be established to determine how the fluid handled is affecting the efficiency of the valve assembly. Repair and adjustment should be made as needed, and in accordance with the manufacturer's literature.

Filter (Harmsco)

The filter element should be periodically inspected. Schedule for replacement of filter elements should be determined by operating experience and activation of the high-pressure switch.

Air Stripper Towers

The air stripper tower packing requires periodic cleaning by means of hydrochloric acid recirculation. Scaling is expected to occur due to the presence of iron, manganese or calcium carbonate in the ground water. A 3,000 gallon acid storage tank is piped into the system for this purpose. Due to the health and safety concerns associated with hydrochloric acid, supplemental information has been added to the original HASP (see Appendix B), to assure the safety of all personnel. This supplement to the HASP contains pertinent information involving the hydrochloric acid including safety concerns and chemical identification. The methodology and duration of recirculation will need to be developed on site during the first several cleanings. Frequency of cleaning should be determined in the field (as necessary). All rotating parts and accessories should be inspected. Frequency of inspection should be weekly at first in order to establish the schedule. Refer to the stripper tower manufacturer's O&M literature for instructions on cleaning the unit.

Granulated Activated Carbon Vessels

Periodically the granulated activated carbon will have to be removed and replaced. The timing and manpower requirements for this operation will be determined during the first activity of replacement. The spent carbon will be sampled and analyzed to determine the best disposal methods. An appendix document will be added after the first activity of replacement.

Treated Ground Water Discharge

The centrifugal discharge pump requires no lubrication. A periodic inspection schedule should be established to insure that the specified flow is provided. The catch basin requires periodic inspection for signs of iron fouling. If signs of iron fouling are considerable, contact the Blue Water

Environmental office or current System Operator. The Suffolk County Department of Public Works (SCDPW), New York State Department of Transportation (NYSDOT) and the Village of Lindenhurst may need to be contacted if street flooding occurs.

Hydrochloric Acid Disposal

The method of disposal will be determined after the first scheduled acid change-out. An appendix document will be added detailing the procedure at that time.

5.1.7 *MAINTENANCE SCHEDULE*

The manufacturer's operation and maintenance manuals of the major system components have been included in Appendix D. The maintenance tasks from each manual have been summarized on the Maintenance Schedule Checklist in Appendix E (System Monitoring and Maintenance Log, Book 2).

5.2 *INSPECTION AND MAINTENANCE CHECKLIST*

During each site visit, the Maintenance Log should be reviewed to determine what tasks must be completed to adhere to the manufacture's recommended maintenance schedules. Because different tasks require different frequencies, it is important to document the tasks that you completed during a site visit to avoid repetition of work. To document tasks completed, as well as to provide an on-site record of system operations, the system monitoring record, maintenance schedule checklist and system monitoring report should be completed during each site visit. See Appendix E.

PREVENTIVE MAINTENANCE SCHEDULE

The preventive maintenance program consists of a preventive maintenance task list as designated by the individual responsible for supervising O&M personnel for each item of system equipment and for each non-equipment system component, i.e., vault, piping components, etc., requiring periodic servicing and a preventive maintenance schedule for accomplishing these tasks. The development of the preventive maintenance program should be based on the manufacturer's O&M literature and on-going experience obtained in operating and maintaining the system. For the convenience of O&M personnel, a *Maintenance Schedule Checklist* has been prepared and is included in the system maintenance manual. This checklist is intended only as a guideline for starting a preventative maintenance program for the remedial system. It should be noted that the checklist should be updated and revised periodically based on actual experience gained in running the system.

CORRECTIVE MAINTENANCE

Corrective maintenance is defined, as the work required to accomplish major repairs and non-routine maintenance procedures. Planning and scheduling of maintenance work must make provisions to handle these non-recurring functions.

Although actual equipment breakdown may precede the planning of corrective maintenance, this resort to "breakdown" maintenance may cause disruptions in the treatment process and costly priority repair work. Accordingly, it is desirable to use anticipatory methods to plan corrective maintenance. These methods include periodic inspections of equipment, close review of equipment operating records, operator observations, and

notations in the logbooks and other analyses for the timely identification of impending problems.

5.5 *DISPOSAL OF USED MATERIALS AND WASTE*

Non-hazardous municipal waste such as paper and other litter blown onto the site will be disposed of through town facilities.

Used carbon material will be stored on site in a lined 15,000 lb roll-off container until sampled for hazardous substances. If the lab results determine that the carbon is non-hazardous, then the material will be regenerated at a local facility. If the used carbon material is determined hazardous, it will be disposed of at an appropriate facility to be determined by Blue Water Environmental Project Manager or current System Operator and approved by NYSDEC.

Once the acid used to clean the stripper tower packing is no longer usable, an appropriate facility will be contacted. The facility will be determined by the Blue Water Environmental Project Manager or current System Operator and approved by NYSDEC.

6.0 *REPORTS*

All reports should be sent to the NYSDEC's project manager, 625 Broadway, Albany, New York. 12233-7010.

6.1 *MONTHLY REPORTS*

Monthly system reports will include air and water discharge sampling results and an update of system processes. Any alarm conditions or repairs that existed throughout the month will also be included. Other information provided in monthly reports will include more specific details on the state of the groundwater recovery wells and air stripping towers such as pressures, water flow and total discharge rates.

6.2 *QUARTERLY REPORTS*

Quarterly monitoring reports will be due the month following groundwater sampling, and will provide all the lab sample results. The quarterly report will summarize the prior monthly reports throughout the quarter along with more detail of system performance.

6.3 *YEARLY REPORTS*

Yearly reports will be used to evaluate system performance and determine if any changes need to be made in system configuration and operation. Quarterly and monthly system reports will also be summarized in the yearly report.

5 YEAR REVIEW

The 5 year review will include a re-evaluation of projected cleanup duration along with the evaluation of system performance to determine if changes need to be made in system configuration and operation to meet such objectives.

7.0 PERSONNEL

All personnel entering the site should receive an orientation to site operations and any potential safety issues in the areas which they will be visiting/working. This orientation should include a review of the site's HASP and emergency procedures.

7.1 ORGANIZATION

The groundwater remediation system will be operated and maintained initially by Blue Water Environmental. When the contract for system operation and maintenance (O&M) is put out to bid the System Operator may change. If a new System Operator takes over the project, then all project contact information and emergency contingency plans will need to be updated.

7.1.1 CHAIN OF COMMAND

System O&M will be conducted by Blue Water Environmental's (or current System Operator's) environmental field technicians. The technicians are responsible for reporting system operating data as well as any unusual site information to the Blue Water Environmental (or current System Operator) project manager. The project manager will report directly to the NYSDEC.

7.2 MANPOWER REQUIREMENTS

Routine system monitoring can be conducted by one field technician. Some tasks, such as groundwater recovery well pump maintenance, quarterly well sampling, and acid washing of the stripper packing, may require additional manpower to complete the task safely. Based on the

schedule of sampling activities and preventative maintenance the project manager will determine what tasks warrant additional manpower. While conducting a task, if a field technician believes the task cannot be completed safely with the allotted personnel, the work should be stopped and the project manager contacted. The situation will be reviewed to determine if additional personnel should be on-site to complete the task.

7.3

RESPONSIBILITIES AND DUTIES

Blue Water Environmental or the current System Operator is responsible for keeping the system running at or near 100-percent of the time. The treatment system must operate at a minimum flow rate of 160 gpm. Downtime for maintenance will be limited to 24 hours per month without penalty. Downtime for alarms and non-routine maintenance will be limited to 48 hours per month without penalty. Downtime for utility outages and NYSDEC approved system upgrades will not be penalized. The system will be considered "operating" when the two extraction wells are operating greater than 80 gpm each. The total gallons pumped from each well shall be calculated monthly. All routine system O&M, unscheduled system and site maintenance, and system and groundwater sampling will be conducted by Blue Water Environmental's (or current System Operator's) environmental field technicians. The technicians are responsible for reporting system operating data as well as any unusual site information to the Blue Water Environmental (or current System Operator's) project manager. The project manager will make decisions regarding system and site maintenance that are covered under the general maintenance contract. Any additional tasks outside of the contract must be approved by NYSDEC.

7.4 *QUALIFICATIONS*

All personnel entering the site should receive an orientation to site operations and any potential safety issues in the areas which they will be visiting/working. This orientation should include a review of the site's HASP and emergency procedures. All personnel working where they may come in contact with contaminated soil, groundwater, or air, must have completed the OSHA Hazardous Waste Operations Training (OSHA 29 CFR 1910.120.)

7.5 *TRAINING (INCLUDING HEALTH AND SAFETY)*

All on site employees must have OSHA 40-hour HAZWOPER course and the appropriate knowledge of system operation.

7.6 *MATERIAL SAFETY DATA SHEETS*

Material Safety Data Sheets for materials that may be used on-site have been included in Appendix B.

Site operations related to the task described in this manual shall be conducted consistent with OSHA training and regulations. Some additional precautions are noted below:

During system operation, site dangers are expected to be relatively high. Personnel expecting to be working inside the shed for more than one hour should wear some form of hearing protection.

Some maintenance tasks may require work in areas of confined space. These working conditions need to be identified prior to beginning the task. Personnel performing these tasks must follow all OSHA regulations and guidelines for confined space entry. Such personnel must have certification of passing the 40-Hour health and safety training course.

Electrical maintenance and repairs should be performed only by qualified personnel. Specific safe practices for working with electrical equipment are as follows:

1. Do not ground yourself in water or on pipes or drains.
2. Positively "lock-out" appropriate circuit breakers and disconnect switches, and test circuit before working on electrical equipment.
3. Test power leads at the equipment with a voltmeter before contacting any normally energized component.
4. Keep all electrical controls accessible and well marked.
5. Never use metal ladders around electrical equipment.
6. Handle breaker wires as though they are "live" wires.
7. When there is a question about any electrical hazard, ask a knowledgeable person before you expose yourself to it.
8. Ground all electric tools and equipment.

Some additional safety concerns associated with the operation of the system have been summarized as a supplement (See Appendix B) to the original HASP. Please be aware that no safety plan can address all situations and circumstances that may occur on a site. Being aware of potential hazards is the best way to prevent accidents.

See Appendix B for the BWE's site specific Health and Safety Plan and supplemental safety information.

The Groundwater System Checklist and Monitoring Report (Appendix E) shows those operational parameters which require monitoring. The *Groundwater System Checklist and Monitoring Report* should preferably be filled out each week or during each site visit. Any apparent operating problems should be noted on the report. Significant problems or alarm conditions should be reported to the project manager immediately. A record of completed maintenance activities should be logged on the *Maintenance Schedule Checklist*. The completed forms serve as a reference of past system operations during troubleshooting. A copy of the completed forms should be filed in Appendix E of the on-site system maintenance manual. The manual is kept in the system building. An additional copy should be sent to the Operation & Maintenance Division of the NYSDEC in the Albany office and the original should be sent to the Blue Water Environmental office or current System Operator.

10.0 *EMERGENCY CONTINGENCY PLAN*

Blue Water Environmental has outlined their emergency contingency plan in the HASP included as Appendix B. When a new System Operator is selected to operate and maintain the system, the site HASP will need to be updated to include the contact phone numbers of the new System Operator.

10.1 *EMERGENCY SPILL RESPONSE*

In the event of a new environmental release, Blue Water Environmental or the current System Operator will coordinate clean-up activities. Please refer to the HASP for further details.

10.2 *FIRE/EXPLOSION*

In the event of a fire or explosion the work area should be evacuated and personnel should meet at the main gate of the site. The Lindenhurst Fire Department should be contacted by telephone at (631) 226-1212 or dial 911. Please refer to the site HASP (Appendix B) for additional information.

10.3 *PERSONAL INJURY*

In the event of personal injury to a site visitor or worker, the extent of the injury needs to be assessed. If trained personnel can apply first aid to remedy the injury, apply first aid, then notify the Blue Water Environmental (or current System Operator's) office. If the injury will require some medical attention, notify the Blue Water Environmental (or the current System Operator) office and proceed to the Brunswick Hospital Center. A map to the hospital is included in the HASP in

Appendix B. If the situation is more serious or life threatening, contact the Lindenhurst Fire Department and Rescue Unit by telephone at (631) 226-1212 or dial 911. Please refer to the site HASP (Appendix B) for additional information.

10.4 *TOXIC EXPOSURES*

In the event of an exposure of a site visitor or worker to toxic substances, the individual needs to be immediately removed from the toxic environment. The nature and extent of the exposure needs to be assessed. A review of the MSDS included in the site HASP should be conducted so that appropriate actions can be taken. If the exposure is minor, then notify the Blue Water Environmental (or current System Operator's) office. If the exposure will require some medical attention, notify the Blue Water Environmental (or current System Operator's) office and proceed to the Brunswick Hospital Center. A map to the hospital is included in the HASP in Appendix B. If the situation is more serious or life threatening, contact the Lindenhurst Fire Department and Rescue Unit by telephone at (631) 226-1212 or dial 911. Please refer to the site HASP (Appendix B) for additional information.

10.5 *PUBLIC NOTIFICATION*

All issues of public notification of site activities will be directed through the NYSDEC.

10.6 *EMERGENCY PHONE NUMBERS*

All emergency contact phone numbers are summarized in the site HASP (Appendix B, page 7-1).

Appendix A

System Permits

LOCATION	FACILITY	EMISSION POINT

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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



ADD
CHANGE
DELETE

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

PROCESS, EXHAUST OR VENTILATION SYSTEM
APPLICATION FOR PERMIT TO CONSTRUCT OR CERTIFICATE TO OPERATE

1. NAME OF OWNER / FIRM New York State Dept. of Conservation			2. NAME OF AUTHORIZED AGENT Mike Posillico Blue Water Environmental			3. TELEPHONE 631-752-2145			4. FACILITY NAME IF DIFFERENT FROM OWNER / FIRM Active Industrial Uniform Co. Site		
5. NUMBER AND STREET ADDRESS 50 Wolf Road			6. NUMBER AND STREET ADDRESS 1610 New Highway			7. FACILITY LOCATION (NUMBER AND STREET ADDRESS) Wellwood Avenue			8. CITY - TOWN - VILLAGE Lyndenhurst, NY		
9. CITY - TOWN - VILLAGE Albany			10. STATE NY			11. ZIP 12233			12. ZIP 11735		
13. OWNER CLASSIFICATION A. COMMERCIAL C. UTILITY F. MUNICIPAL I. RESIDENTIAL E. INDUSTRIAL D. FEDERAL G. EDUC. INST. J. OTHER			14. NAME OF P.E. OR ARCHITECT Dave Share			15. N.Y.S.P.E. OR ARCHITECT LICENSE NO. 075259			16. TELEPHONE (518) 286-2138		
17. NAME & TITLE OF OWNER'S REPRESENTATIVE Gerald W. Burke, PM			18. SIGNATURE OF OWNER'S REPRESENTATIVE OR AGENT WHEN APPLYING FOR A PERMIT TO CONSTRUCT (518) 457-9280			19. PERMIT TO CONSTRUCT A. NEW SOURCE B. MODIFICATION			20. CERTIFICATE TO OPERATE A. NEW SOURCE C. EXISTING SOURCE B. MODIFICATION		

19. EMISSION POINT NO.	20. GROUND ELEVATION (FT.)	21. HEIGHT ABOVE STRUCTURES (FT.)	22. STACK HEIGHT (FT.)	23. WIND SPEED (MPH)	24. EXH. TEMP. (°F)	25. EXH. VELOCITY (FT./SEC.)	26. EXH. FLOW RATE (ACFM)	27. EXH. VOLUME (CFM)	28. HRS / DAY	29. DATE / YR	30. OPERATIONS BY SEASON Spring Summer Fall
00001	10	10	25	8.0	90°F	0.35	1350		24	365	252, 92, 52, 5

DESCRIBE PROCESS OR UNIT	1.	
	2.	
	3.	
	4.	

EMISSION CONTROL EQUIPMENT ID.	CONTROL TYPE	MANUFACTURER'S NAME AND MODEL NUMBER	DISPOSAL METHOD	DATE INSTALLED MONTH / YEAR	USEFUL LIFE
01	17	Barney Sutcliffe Protect™ VS-6	9	10 / 00	10
02	17	Barney Sutcliffe Protect™ VS-6	9	10 / 00	10

CALCULATIONS

Constituent	GW Inf. Conc. (mg/L)	GW Eff. Conc. (mg/L)	Removed (mg/L)	GW Q (gpm)	Mass Loading (lb/hr)	Carb Removal (%)	ER (lb/hr)
Trichloroethene	5.900	0.010	5.890	200	0.59	99%	0.006
Tetrachloroethene	6.800	0.004	6.796	200	0.68	99%	0.007
1,2-Dichloroethene (total)	2.800	0.010	2.790	200	0.28	99%	0.003
1,1,1-Trichloroethane	1.200	0.005	1.195	200	0.12	99%	0.001
Xylenes	1.100	0.005	1.095	200	0.11	99%	0.001
Vinyl Chloride	0.190	0.010	0.180	200	0.02	20%	0.014

Groundwater Water Quality For Design and Effluent Limits

<u>Parameter</u>	<u>Influent Concentration</u>	<u>Effluent Concentration*</u>
Trichloroethane	5900 µg/l	10 µg/l
Tetrachloroethene	6800 µg/l	4 µg/l
1,2 Dichloroethene (Total)	2800 µg/l	10 µg/l
1,1,1 Trichloroethane	1200 µg/l	5 µg/l
Xylene	1100 µg/l	5 µg/l**
Vinyl Chloride	190 µg/l	10 µg/l
Iron	1.4 to 4.0 mg/l	4 mg/l
Manganese	2.83 to 10.1 mg/l	2 mg/l
Total Dissolved Solids	130 to 294 mg/l	Monitor
Total Suspended Solids	10 to 29 mg/l	20 mg/l
Aluminum	34 to 1810 ug/l	4000 ug/l
Arsenic	1.4 to 28.5 ug/l	140 ug/l
Cadmium (T)	0.3 to 9.5 ug/l	30 ug/l
Copper (T)	1.5 to 13.3 ug/l	38 ug/l
Nickel (T)	2.8 to 12.4 ug/l	65 ug/l
Silver (T)	0.6 to 2.2 ug/l	9 ug/l
Zinc (T)	15 to 163 ug/l	370 ug/l
Chloride (dissolved)	40 mg/l	NA
COD (dissolved)	mg/l	NA
Conductivity (dissolved) at 25 Deg C	0.28 to 5.1 ms/cm	NA
Turbidity	4 to 425 NTU	NA
pH	6.2	6 to 9
Alkalinity (dissolved)	39 to 80 mg/l	NA
Dissolved Oxygen	0.37 to 2.9 mg/l	NA

* NYSDEC site specific Effluent limitations and monitoring Requirements

** effluent limits for xylene-o = 5 ug/l; Xylenc-m&p = 10 ug/l.

INCORPORATED
VILLAGE OF LINDENHURST, NEW YORK

THIS CARD MUST BE KEPT POSTED
IN A CONSPICUOUS PLACE ON THE
PREMISES FOR WHICH IT IS ISSUED.

All Reference to This Permit
Must be by Number

PERMIT NO. 22099 Date Issued 6/11/01

Issued to NY S DEC

Address 67 W. MONTAUK HWY
LINDENHURST NY

Location

Thomas Haden
en

INC. VILLAGE OF LINDENHURST
BUILDING PERMIT

NO. 22099

TM #103-22-1-9.1

Permission is hereby granted for the erection - alteration of the building described below, in accordance with the application

Date of Issue...JUNE 11, 2001...Expires...JUNE 10, 2002..

Location.....67 WEST MONTAUK HIGHWAY

File Map....Sec.... Block....Lot No....

Type..

ALTERATION CONSISTING OF 26' X 32' METAL STORAGE BUILDING (PUMPS, TANKS ETC.) FOR NEIGHBORHOOD GROUNDWATER REMEDIATION (TONERS - 2 - OUTSIDE OF BUILDING TO BE 34')

Owner: NYSDEC

Contractor....

THIS PERMIT NOT VALID UNLESS IN ACCORDANCE WITH ALL ORDINANCES OF THE INC. VILLAGE OF LINDENHURST.

Cost Stated...\$45,000.00
Fee Paid....\$495.00

THIS PERMIT WILL EXPIRE ONE YEAR FROM DATE OF ISSUE IF WORK IS NOT STARTED. PERMIT MUST BE RENEWED IF WORK IS NOT COMPLETED AND INSPECTED WITHIN TWO YEARS.

Thomas Maher
.....
Building Inspector *gm*

.....This permit must be shown when requested.

NOTE: The holder of this permit is requested to familiarize himself with the ordinance under which said permit is granted. Any violation of the provisions of said ordinance shall render the offender liable for the penalties provided therefore, and in addition thereto may result in the immediate revocation of the permit.

NYS DEC
67 W. Montauk Hwy.
Blue Water - 752-2145

T.M. #. 22-1-9.1
PERMIT NO. 22099

NOTICE OF FINAL INSPECTION

When construction has been completed mail or bring this card for final inspection and furnish the following when needed. Underwriters Certificate, Final Plumbing Card, Final Survey and Board of Health approval

IT SHALL BE UNLAWFUL TO OCCUPY ANY DWELLING OR PART THEREOF UNTIL FINAL INSPECTION HAS BEEN MADE AND A CERTIFICATE OF OCCUPANCY ISSUED.

26' x 32' Metal Storage
Building

Building Inspector
Inc. Village of Lindenhurst

Phone: 957-7510

Fax: 957-4605

DATE OF INSPECTION

NYS DEC
67 W. Montauk Hwy.
Blue Water - 752-2145

TM. 22-1-9.1
PERMIT NO. 22099

NOTICE OF SECOND INSPECTION

Builder must mail this card when the framing of the construction is completed for inspection, before being permitted to proceed with sheetrock, plaster, etc.

FAILURE TO DO SO WOULD BE IN VIOLATION OF THE BUILDING ORDINANCE.

26' x 32' Metal Storage
Building

Building Inspector
Inc. Village of Lindenhurst

Phone: 957-7510

Date of Inspection Requested

Date of Inspection

Appendix B
Occupational Safety and Health
Guideline for Hydrochloric Acid and
BWE's Health and Safety Plan

Health and Safety Plan Ammendment
Additional Health and Safety Issues Associated with System Operation
Active Industrial Uniform Site, Lindenhurst, NY

The health and safety plan developed by Bluewater in August 2000 is still in effect for this site. All emergency phone numbers and evacuation routes are contained within the Bluewater Plan. This is meant to be a suppliment to the Bluewater Plan, and contains additional issues to be considered once the system has been started up.

Issue of Concern	Corrective Action
Moving Parts, Gears and Belts	Never operate equipment without machine guards securely in place.
	Always wear proper PPE (hard hat, steel toe boots, eye protection).
	Lock Out and Tag Prior to Servicing.
	All on site employees should be aware of equipment function and familiar with the manuals.
High Pressure Tanks and Pipes	Drain/Release all pressurized equipment prior to servicing.
	Lock Out and Tag Prior to Servicing.
	Always wear proper PPE (hard hat, safety glases).
Vapor Accumulation in Building	Maintain proper ventilation within closed areas.
	Monitor ambient air space each work day.
	Have an evacuation route planned in case of high vapor concentrations.
Caustic Materials (Acid Tank)	Maintain clearly visible labels on appropriate items.
	Always wear proper PPE (eye and skin protection).
	Do not allow materials to come in direct contact with skin.
	Know the location and function of the safety shower and eyewash in case of emergency
Electrical Hazards	Assure proper grounding of all electrical equipment.
	Keep water a safe distace away from all electrical equipment
	Always wear proper PPE (rubber sole boots).
Fire Hazards	Maintain a recently serviced accessible fire extinguisher.
	Check cutoff switches where overheating is possible.
Slips, Trips and Falls	Be aware of the hazards around you.
	Any unsafe surfaces or areas should be documented and corrected.
Vehicle Traffic	Wear proper PPE (safety vest, hard hat, steel toe boots)

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR HYDROCHLORIC ACID

INTRODUCTION

This guideline summarizes pertinent information about hydrochloric acid for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine whether new information is available.

SUBSTANCE IDENTIFICATION

* Formula : HCl

* Synonyms : Anhydrous hydrochloric acid, hydrochloride, muriatic acid, spirits of salt, hydrochloric acid, chlorohydric acid, emulsion bowl cleaner

* Identifiers :

1. CAS No.: 7647-01-0
2. RTECS No.: MW4025000
3. DOT UN: 1050 15
4. DOT label: Poison gas, corrosive

* Appearance and odor

Hydrochloric acid is a colorless to slightly, yellow gas with an irritating, pungent odor. The air odor threshold concentration for hydrochloric acid has been reported as 0.77 part per million (ppm) parts of air.

CHEMICAL AND PHYSICAL PROPERTIES

* Physical data

1. Molecular weight: 36.46
2. Boiling point (at 760 mm Hg): -85.05 degrees C (-121.09 degrees F)
3. Specific gravity: 1.187 at -84.9 degrees C (-120.82 degrees F)
4. Vapor density: 1.268
5. Melting point: -114.2 degrees C (-173.6 degrees F)
6. Vapor pressure at 20 degrees C (68 degrees F): Greater than 1 mm Hg
7. Solubility: Soluble in water, alcohol, benzene, and ether.
8. Evaporation rate: Data not available.

* **Reactivity**

1. Conditions contributing to instability: None reported.
2. Incompatibilities: Contact between hydrochloric acid and hydroxides, amines, alkalis, or metals, such as copper, brass, zinc, potassium, and sodium should be avoided.

3. Hazardous decomposition products: Toxic gases and vapors such as chlorine may be released in a fire involving hydrochloric acid.
4. Special precautions: None reported.

*** Flammability**

Hydrochloric acid is a nonflammable gas.

The National Fire Protection Association has assigned a flammability rating of 0 (minimal fire hazard) to hydrochloric acid.

1. Flash point: Not applicable.
2. Autoignition temperature: Not applicable.
3. Flammable limits in air: Not applicable.
4. Extinguishant: For small fires use dry chemical or carbon dioxide. Use water spray, fog, or regular foam to fight large fires involving hydrochloric acid.

Fires involving hydrochloric acid should be fought upwind from the maximum distance possible. Keep unnecessary people away; isolate the hazard area and deny entry. Isolate the leak or spill area for at least 150 feet in all directions, until gas has dispersed. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Containers of hydrochloric acid may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool fire exposed containers from the sides with water until well after the fire is out. Do not get water inside the containers. Stay away from the ends of containers. Firefighters should wear a full set of chemical protective clothing and self-contained breathing apparatus when fighting fires involving hydrochloric acid.

EXPOSURE LIMITS

*** OSHA PEL**

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit(s) (PEL[s]) for hydrochloric acid is 5 ppm (7 milligrams per cubic meter (mg/m³)) as a ceiling limit. A worker's exposure to hydrochloric acid shall at no time exceed this ceiling level [29 CFR 1910.1000, Table Z-1].

*** NIOSH REL**

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for hydrochloric acid of 5 ppm (7 mg/m³) as a ceiling .

*** ACGIH TLV**

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned hydrochloric acid a ceiling limit value of 5 ppm (7.5 mg/m³), which should not be exceeded during any part of the working exposure.

*** Rationale for Limits**

The NIOSH limit is based on the risk of eye, mucous membrane, and skin irritation.
The ACGIH limit is based on the risk of acute irritation.

HEALTH HAZARD INFORMATION

* Routes of Exposure

Exposure to hydrochloric acid can occur through inhalation, ingestion, and eye or skin contact.

* Summary of toxicology

1. Effects on Animals: Hydrochloric acid is a severe irritant of the eyes and respiratory system. The 30-minute LC(50)s in rats and mice and 4,701 ppm and 2,644, respectively. Animals exposed to high concentrations of hydrochloric acid gas developed necrosis of the tracheal and bronchial epithelium; pulmonary edema, atelectasis, and emphysema; and damage to the pulmonary blood vessels and liver. Chronic exposure to 10 ppm for 6 hours/day for life did not cause neoplastic lesions or serious irritant effects in the nasal epithelium of rats. In experimental animals, exposure to a concentration of 1,350 ppm hydrochloric acid gas caused clouding of the cornea after 1.5 hours and exposure to 3,000 ppm for 6 hours caused slight erosion of the corneal epithelium. Exposure to 100 ppm for 6 hours daily for 50 days caused only slight irritation of the eyes, but no permanent injury. Hydrochloric acid is mildly toxic by ingestion; the oral LD(50) in rabbits is 900 mg/kg. Hydrochloric acid is injurious to the rabbit eye only at concentrations having an acidity below pH 3. Contact of the eye with 0.25N to 1N acid for 20 seconds resulted in some scarring of rabbit corneas; in rare instances, opacities of the lens have been produced by splashes of the acid. Hydrochloric acid has produced mutagenic effects in bacterial and insect test systems.

2. Effects on Humans: Hydrochloric acid is irritating and corrosive to the eyes, skin, and mucous membranes. Exposure to high concentrations can cause laryngitis, bronchitis, and pulmonary edema. Brief exposures (up to a few minutes) to concentrations in the range of 1,300 to 2,000 ppm are lethal to humans. In workers, exposure to 50 to 100 ppm for 1 hour was barely tolerable; short exposure to 35 ppm caused irritation of the throat, and 10 ppm was considered the maximal concentration allowable for prolonged exposure. In one study, workers chronically exposed to hydrochloric acid did not exhibit the pulmonary function changes observed in nine subjects exposed to similar concentrations, which suggests that workers become acclimatized to hydrochloric acid. Dental discoloration and erosion of exposed incisors may occur on prolonged exposure to low concentrations. Hydrochloric acid causes burns of the skin and mucous membranes; the severity of the burns depends on the concentration of the solution. Burns may progress to ulcerations and lead to keloid and retractile scarring. Frequent contact of the skin with aqueous solution may cause dermatitis. Contact of the eyes with aqueous solutions may produce reduced vision or blindness. Ingestion of hydrochloric acid causes severe burns of the mouth, esophagus, and stomach, with consequent pain, nausea, and vomiting.

* Signs and symptoms of exposure

1. Acute exposure: Acute exposure to hydrochloric acid vapor or aerosol produces inflammation and may cause ulceration of the nose, throat, and larynx; laryngeal spasm or pulmonary edema may occur on rare occasions. Eye and skin burns occur at high concentrations. Burns of the skin and mucous membranes result from contact with the solution. Frostbite may occur from contact with the cryogenic liquid. Both the gas and solutions of hydrochloric acid may cause eye irritation, severe burns, and permanent damage with loss of sight. Ingestion causes corrosion of

the mucous membranes, esophagus, and stomach; dysphagia; nausea; vomiting; intense thirst; and diarrhea. Circulatory collapse and death may follow.

2. Chronic exposure: Chronic exposure by skin contact with aqueous solutions may result in dermatitis and photosensitization. Dental discoloration and erosion of exposed incisors may occur on prolonged exposure to low concentrations of hydrochloric acid.

EMERGENCY MEDICAL PROCEDURES

* Emergency medical procedures:

Rescue: Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the Material Safety Data Sheet required by OSHA's Hazard Communication Standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures, the location and proper use of emergency equipment, and methods of protecting themselves during rescue operations.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve hydrochloric acid and lead to worker exposures to this substance:

- * The manufacture and transportation of hydrochloric acid
- * Use as a catalyst or chlorinating agent in chemical synthesis; during metal treatment and fabricating operations in electroplating, acid dipping, stripping, electropolishing, etching, welding, and flamecutting of metal primed with paint or cleaned with chlorinated hydrocarbons; as a gaseous flux in babbitting
- * Use in industrial chemical cleaning operations
- * Use in activation of petroleum wells; in waste treatment operations for neutralization of alkaline waste streams
- * Use in removing scale from boilers and heat-exchange equipment, as a laboratory reagent, an alcohol denaturant

Methods that are effective in controlling worker exposures to hydrochloric acid, depending on the feasibility of implementation, are as follows:

- * Process enclosure
- * Local exhaust ventilation
- * General dilution ventilation
- * Personal protective equipment

Workers responding to a release or potential release of a hazardous substance must be protected as required by paragraph (q) of OSHA's Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120].

MEDICAL SURVEILLANCE

OSHA is currently developing requirements for medical surveillance. When these requirements are promulgated, readers should refer to them for additional information and to determine whether employers whose employees are exposed to hydrochloric acid are required to implement medical surveillance procedures.

*** Medical Screening**

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical surveillance program is intended to supplement, not replace, such measures. To detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

*** Preplacement medical evaluation**

Before a worker is placed in a job with a potential for exposure to hydrochloric acid, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, and respiratory system. Medical surveillance for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society.

A preplacement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to hydrochloric acid at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the eyes, skin, and respiratory system.

*** Periodic medical evaluations**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to hydrochloric acid exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of hydrochloric acid on the eyes, skin, and respiratory system. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

*** Termination medical evaluations**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

*** Biological monitoring**

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for hydrochloric acid.

WORKPLACE MONITORING AND MEASUREMENT

Determination of a worker's exposure to airborne hydrochloric acid is made using a treated silica gel tube. Samples are collected at a maximum flow rate of 0.5 liter/minute (ceiling) until a minimum collection volume of 2.5 liters is reached. Analysis is conducted by ion chromatography. This method is partially validated and is described in the OSHA Computerized Information System and in NIOSH Method No. 7903 (inorganic acids).

PERSONAL HYGIENE PROCEDURES

If hydrochloric acid contacts the skin, workers should flush the affected areas immediately with plenty of water, followed by washing with soap and water.

Clothing contaminated with hydrochloric acid should be removed immediately, and provisions should be made for the safe removal of the chemical from the clothing. Persons laundering the clothes should be informed of the hazardous properties of hydrochloric acid, particularly its potential for causing irritation.

A worker who handles hydrochloric acid should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, using toilet facilities, applying cosmetics, or taking medication.

Workers should not eat, drink, use tobacco products, apply cosmetics, or take medication in areas where hydrochloric acid or a solution containing hydrochloric acid is handled, processed, or stored.

STORAGE

Hydrochloric acid should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's Hazard Communication Standard [29 CFR 1910.1200]. Containers of hydrochloric acid should be protected from physical damage and should be stored separately from hydroxides, amines, alkalis, or metals, such as copper, brass, zinc, potassium, and sodium.

SPILLS AND LEAKS

In the event of a spill or leak involving hydrochloric acid, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

1. Notify safety personnel.
2. Remove all sources of heat and ignition.
3. Ventilate the area of the spill or leak.

4. Stop leak if this can be done without risk. If the source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
5. All spills on land involving liquid hydrochloric acid or hydrochloric acid should be contained, if possible, to prevent entry into bodies of water or sewer systems. Vapors can be dispersed with water fog or spray. Do not put water directly on leak or spill area.
6. Neutralize spills with crushed limestone, soda ash, lime, or sodium bicarbonate. After neutralizing, take up with sand or other noncombustible absorbent material and place into closed containers for later disposal.
7. For large liquid spills, build dikes far ahead of the spill to contain the hydrochloric acid for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

*** Emergency planning requirements**

Employers owning or operating a facility at which there are 500 pounds or more of hydrogen chloride (gas only) must comply with EPA's emergency planning requirements [40 CFR Part 355.30].

*** Reportable quantity requirements for hazardous releases**

A hazardous substance release is defined by EPA as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of contaminated containers) of hazardous substances. In the event of a release that is above the reportable quantity for that chemical, employers are required to notify the proper Federal, State, and local authorities [40 CFR 355.40].

The reportable quantity of hydrochloric acid is 5,000 pounds. If an amount equal to or greater than this quantity is released within a 24-hour period in a manner that will expose persons outside the facility, employers are required to do the following: - Notify the National Response Center immediately at (800) 424-8802 or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].

- Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].

- Notify the community emergency coordinator to the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

*** Community right-to-know requirements**

Employers who own or operate facilities in SIC codes 20 to 39 that employ 10 or more workers and that manufacture 25,000 pounds or more of hydrochloric acid per calendar year or otherwise use 10,000 pounds or more of hydrochloric acid per calendar year are required by EPA [40 CFR Part 372.30] to submit a Toxic Chemical Release Inventory form (Form R) to EPA reporting the amount of hydrochloric acid emitted or released from their facility annually.

*** Hazardous waste management requirements**

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Under the Resource Conservation and Recovery Act (RCRA), EPA has specifically listed many chemical wastes as hazardous. Although hydrochloric acid is not specifically listed as a hazardous waste under RCRA, EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (703) 412-9810 (in the Washington, D.C. area) or toll-free at (800) 424-9346 (outside Washington, D.C.). In addition, relevant State and local authorities should be contacted for information on any requirements they may have for the waste removal and disposal of this substance.

RESPIRATORY PROTECTION

*** Conditions for respirator use**

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of hydrochloric acid exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should only use respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

*** Respiratory protection program**

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's Respiratory Protection Standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the latest edition of the NIOSH Respirator Decision Logic and the NIOSH Guide to Industrial Respiratory Protection.

PERSONAL PROTECTIVE EQUIPMENT

Workers should use appropriate personal protective clothing and equipment that must be carefully selected, used, and maintained to be effective in preventing skin contact with hydrochloric acid. The selection of the appropriate personal protective equipment (PPE) (e.g., gloves, sleeves, encapsulating suits) should be based on the extent of the worker's potential

exposure to hydrochloric acid. The resistance of various materials to permeation by hydrochloric acid is shown below:

Material Breakthrough time (hr) :

Butyl Rubber >8

Teflon >8

Saranex >8

Barricade >8

Responder >8

Polyvinyl Chloride >4

Polyethylene <1(*)

(*) Not recommended, degradation may occur

To evaluate the use of these PPE materials with hydrochloric acid, users should consult the best available performance data and manufacturers' recommendations. Significant differences have been demonstrated in the chemical resistance of generically similar PPE materials (e.g., butyl) produced by different manufacturers. In addition, the chemical resistance of a mixture may be significantly different from that of any of its neat components.

Any chemical-resistant clothing that is used should be periodically evaluated to determine its effectiveness in preventing dermal contact. Safety showers and eye wash stations should be located close to operations that involve hydrochloric acid.

Splash-proof chemical safety goggles or face shields (20 to 30 cm long, minimum) should be worn during any operation in which a solvent, caustic, or other toxic substance may be splashed into the eyes.

In addition to the possible need for wearing protective outer apparel (e.g., aprons, encapsulating suits), workers should wear work uniforms, coveralls, or similar full-body coverings that are laundered each day. Employers should provide lockers or other closed areas to store work and street clothing separately. Employers should collect work clothing at the end of each work shift and provide for its laundering. Laundry personnel should be informed about the potential hazards of handling contaminated clothing and instructed about measures to minimize their health risk.

Protective clothing should be kept free of oil and grease and should be inspected and maintained regularly to preserve its effectiveness.

Protective clothing may interfere with the body's heat dissipation, especially during hot weather or during work in hot or poorly ventilated work environments.

**SITE SPECIFIC HEALTH AND
SAFETY PLAN FOR
REMEDIATION OF VOLATILE
ORGANIC CONTAMINATED
SOIL AND GROUND WATER**

*Active Industrial Uniform Site
Implementation of Remedial Activities*

*Site No. 1-52-125
Lindenhurst, Long Island
Suffolk County, New York*

August 2000

Revision 1

TABLE OF CONTENTS

1.0	INTRODUCTION	1 - 1
1.1	IMPLEMENTATION	1 - 1
1.2	SITE LOCATION	1 - 2
1.3	SITE BACKGROUND	1 - 2
2.0	PERSONNEL RESPONSIBILITIES	2 - 1
2.1	BWE'S PROJECT MANAGER	2 - 1
2.2	BWE'S RESIDENT PROJECT REPRESENTATIVE	2 - 1
2.3	BWE'S HEALTH AND SAFETY COORDINATOR	2 - 1
2.4	BWE'S HEALTH AND SAFETY TECHNICIAN	2 - 2
3.0	MEDICAL MONITORING AND PERSONNEL TRAINING REQUIREMENTS	3 - 1
3.1	MEDICAL MONITORING	3 - 1
3.2	PERSONNEL TRAINING	3 - 2
4.0	WORK ZONE MONITORING AND PERSONAL PROTECTIVE EQUIPMENT	4 - 1
4.1	WORK ZONE MONITORING	4 - 1
4.1.1	Action Levels During Sediment Remediation	4 - 3
4.1.2	Action Level Response Measures	4 - 4
4.2	PERSONNEL SAMPLING	4 - 4
4.2.1	Sampling and Analytical Methodologies	4 - 6
4.3	PERSONAL PROTECTIVE EQUIPMENT	4 - 6
4.3.1	Level D Protection	4 - 7
4.3.2	Level C Protection	4 - 7
4.3.3	Level B Protection	4 - 8
4.4	LOGS, REPORTS AND RECORDKEEPING	4 - 8
5.0	DECONTAMINATION	5 - 1
5.1	GENERAL PERSONNEL DECONTAMINATION	5 - 1
5.2	PERSONNEL DECONTAMINATION PROCEDURES	5 - 1
5.2.1	Personal Protection Decontamination Procedure	5 - 1
5.3	EQUIPMENT DECONTAMINATION	5 - 2

5.4	MANAGEMENT OF GENERATED WASTES	5 - 2
6.0	SITE ACCESS AND SITE CONTROL	6 - 1
7.0	EMERGENCY RESPONSE	7 - 1
7.1	NOTIFICATION OF SITE EMERGENCIES	7 - 1
7.2	RESPONSIBILITIES	7 - 2
7.3	ACCIDENTS AND INJURIES	7 - 2
7.4	SITE COMMUNICATIONS	7 - 4
8.0	SPECIAL PRECAUTIONS AND PROCEDURES	8 - 1
8.1	SEGREGATION OF WORK ACTIVITIES	8 - 1
8.1.1	Exclusion Zone	8 - 1
8.1.2	Contamination Reduction Zone	8 - 1
8.1.3	Support Zone	8 - 2
8.2	EXCAVATION ACTIVITIES	8 - 2
8.3	HEAVY MACHINERY/EQUIPMENT	8 - 2
8.4	TEMPERATURE-RELATED HAZARDS	8 - 2
8.4.1	Heat Stress	8 - 2
8.4.2	Cold Stress	8 - 4
8.5	TRAFFIC	8 - 5
8.6	UNDERGROUND/OVERHEAD UTILITIES	8 - 5
8.7	ADDITIONAL SAFETY PRACTICES	8 - 6
9.0	NOISE MONITORING PROGRAM	9 - 1
9.1	MONITORING OBJECTIVES	9 - 2
9.2	PERSONAL/AREA MONITORING	9 - 2
9.3	PERIMETER MONITORING	9 - 3

LIST OF FIGURES

- 1 Hospital Location Map***
- 2 Work Zone Location Map***

LIST OF TABLES

- 1 Ground-Water Contaminants***
- 2 Physical Safety Concerns***
- 3 Emergency Contacts***
- 4 Reference of Common Symptoms***

LIST OF EXHIBITS

- Exhibit 1: Health and Safety Plan Review Record***
- Exhibit 2: BWE Occupational Safety and Health Certification***
- Exhibit 3: Field Medical Data Sheet***

LIST OF APPENDICES

- Appendix A: Community Protection Plan***
- Appendix B: Spill Prevention Plan***
- Appendix C: Confined Space Entry Program***
- Appendix D: Occupational Safety & Health Guideline for Hydrochloric Acid
(Amended 2/02)**

INTRODUCTION

This Health and Safety Plan (HASP) is designed to reduce and control the risk of exposure to workers from chemical substances and physical or other hazards which may be present in the sediment, water and/or air associated with Site remediation activities. This Plan is supplemented by the Blue Water Environmental's (BWE's) Standard Operating Procedures provided as a separate document. The procedures described herein were developed in accordance with the following provisions:

- The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations (CFR), Parts 1910 and 1926 (29 CFR 1910 and 1926)
- American National Standards Institute (ANSI) Standard Z88.2-1980,
- National Institute for Occupational Safety and Health (NIOSH),
- American Conference of Governmental Industrial Hygienists (ACGIH) Exposure Guidelines,
- New York State Labor Law Section 876 (Right-to-Know Law),
- Environmental Protection Agency (EPA) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH, OSHA, and EPA)
- In addition, 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER), 1910.1017 - Vinyl Chloride, 1910.1027 - Cadmium, and 1910.95 - Hearing Conservation.

The health and safety guidelines within this HASP may be modified if new information changes the characterization of the site. The specific activities to be performed during the Project are described in the Contract Documents.

IMPLEMENTATION

The BWE will perform air ground water monitoring during activities where the potential exposure to chemical hazards exists and will enforce this Site Specific HASP regarding chemical exposures. These air monitoring activities are described in Section 4.1 of this HASP.

The BWE is required to use this HASP for site remediation activities. The BWE shall be responsible for implementation of all physical safety measures for its employees as required under applicable regulations including OSHA.

1.2 *SITE LOCATION*

The Active Industrial Uniform Company site is located on a one-half acre parcel of land located on the south side of West Montauk Highway (State Route 27A) in the village of Lindenhurst, Suffolk County, New York.

1.3 *SITE BACKGROUND*

Past releases from former operations at the site have created contamination in dry wells and the ground water. Chemical hazards which may be encountered during remediation activities, and the maximum concentrations of these constituents, measured in the ground water are provided in Table 1. It is assumed that concentrations in the soil are at or above the concentrations found in ground water. A summary of the OSHA Permissible Exposure Limits (PELs) associated with these constituents is also presented in Table 1.

Table 2 lists potential physical hazards that may be encountered at the site during construction and remediation activities.

Waste management practices at the Active Industrial Uniform site have been modified and various remedial activities undertaken to eliminate or reduce the potential for future ground water releases off the site property.

TABLE 1
SOIL AND GROUNDWATER
CHEMICAL OF CONCERN

Constituent	OSHA PEL
Trichloroethane	10 ppm
1,1,1 Trichloroethane	100 ppm
Xylene	100 ppm
Vinyl Chloride	1 ppm average
Manganese	5 mg/m ³
Aluminum	15 mg/m ³
Arsenic	10 ug/ m ³
Cadmium	5 ug/ m ³
Copper	1 mg/m ³
Nickel	1 mg/m ³
Silver	0.01 mg/m ³
Zinc	15 mg/m ³
Total Dust	15 mg/m ³
Respirable Dust	5 mg/m ³
PM ₁₀	0.15 mg/m ³ (NYSDEC TAGM #4031)

Notes:

ppm Parts per million by volume.
mg/m³ Milligrams per cubic meter.
µg/m³ Micrograms per cubic meter.

TABLE 2 .
PHYSICAL SAFETY CONCERNS

Hazard	Description	Location	Procedures Used to Monitor/Reduce Hazard
Heavy equipment	Excavation and sludge moving equipment, off-site transport vehicles	Used throughout site	Personnel maintain eye contact with operators; hard hats and safety glasses worn during equipment operation. Use of hand signals for communication.
Existing underground utilities	Storm sewer, possibly electrical, telephone, gas	Throughout site	Locate and verify that utilities have been abandoned prior to site operations. Locate and flag prior to subsequent excavation activities.
Overhead utility power lines	Above ground	Throughout site	Maintain at least 10 feet of total clearance for lines 69 KV or less during work activities.
Noise	During site activities	Throughout site	Noise monitoring/hearing protectors with proper noise reduction rating.
Temperature extremes	Hot weather activities/cold weather activities	Throughout site	Protection as designated by health and safety coordinator and as designated in this HASP.
Insects	Bees, wasps, spiders, deer ticks	Throughout site	Identify if worker is allergic to insects; have bee sting kit available.
Animal bites/rabies	Bear, deer, rats, raccoons, dogs, cats, rabbits	Throughout site	Do not approach any animal. Dispose of food and debris, maintain good housekeeping.
Plants	Poison ivy, poison sumac, poison oak	Specific areas of site	Identify and do not touch.
Weather	Lightning, heavy rain or snow	Throughout site	With lightning, move all workers indoors; beware of slippery conditions
Reptiles	Snakes and snapping turtles	Throughout site	Do not agitate Keep fingers away
Excavation areas	Sampling, pipe and installation, excavating	Throughout site	Maintain adequate barriers; at least two workers present during work. Support or slope trench excavations.

2.0

PERSONNEL RESPONSIBILITIES

The following responsibilities and authorities have been or will be assigned to designated personnel for the site remediation activities.

2.1

BWE'S PROJECT MANAGER

Person duly appointed by BWE to act in a supervisory capacity over all BWE employees and activities. The Project Manager is responsible for ensuring that health and safety responsibilities are carried out in conjunction with this HASP.

2.2

BWE'S RESIDENT PROJECT REPRESENTATIVE

Person duly appointed by BWE, under the supervision of BWE's Project Manager, to conduct oversight remediation/construction and related field activities. The Resident Project Representative (RPR) is not responsible for carrying out BWE health and safety responsibilities on the site unless designated in writing by BWE's Project Manager.

2.3

BWE'S HEALTH AND SAFETY COORDINATOR

Person duly appointed by BWE, under the supervision of BWE's Health and Safety Director, to implement this HASP on behalf of the BWE, and SubBWEs to check that appropriate health and safety measures are implemented throughout site remediation activities as specified in this HASP and in the Contract Documents. The Health and Safety Coordinator (HSC) will assume:

- responsibility for the field implementation, evaluation, and any necessary field modification of this HASP as described in Section 1.1;
- responsibility to monitor the health and safety of all site personnel, including BWE and SubBWEs, as specified in this HASP;
- responsibility for calibration and maintenance of monitoring instruments to check their proper operation and reliability;
- responsibility to conduct a daily "tailgate" safety briefing meeting;
- authority to suspend any remediation activity at the site due to any ineffectiveness of this HASP; authority to suspend BWE's work activities if HSC observes any non-conformance to this HASP or OSHA regulations by the BWE; and

- authority to maintain compliance with all applicable federal, state, and local regulations.

The HSC will have the following minimum training and experience:

- two years of experience in the investigation and/or remediation of hazardous waste sites or related field experience;
- formal training in health and safety, including 40 hour hazardous waste operations training course, 8-hour refresher course within the last year, and OSHA 8-hour Supervisor Training;
- experience and training in the implementation of personnel protection and air monitoring programs;
- “hands-on” experience with the operation and maintenance of real time air monitoring equipment and air sampling equipment; and
- certified in cardiopulmonary resuscitation (CPR) and first aid.

BWE site personnel will receive an appropriate level of training necessary to perform applicable site duties. This training will be verified and documented by the HSC.

2.4

BWE'S HEALTH AND SAFETY TECHNICIAN

The BWE shall retain the services of a Health and Safety Technician (HST), who must be present at the site at all times while work is being conducted in the exclusion zone or contamination reduction zone. The HST may be the BWE's site superintendent. The HST must have, at a minimum:

- two years of experience in the remediation of hazardous waste sites or related field experience;
- formal training in health and safety, including 40 hour hazardous waste operations training course, 8-hour refresher course within the last year, and OSHA 8-hour Supervisor Training; and
- experience and training in the implementation of personnel protection programs.

In addition, the HST must be:

- certified in CPR and first aid.

MEDICAL MONITORING

OSHA has established requirements for a medical surveillance program designed to monitor and reduce health risks for employees who may potentially be exposed to hazardous materials. This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations. Each employee must undergo testing and training, including field training activities and a determination of his/her ability to wear personal protective equipment, such as chemical resistant clothing and respirators. The medical examinations must be administered on an annual basis and as warranted for the hazardous chemicals listed in Table 1 of this HASP. These examinations shall be provided by employers without cost or loss of pay to the employee.

Due to potential exposure to hazardous materials, site personnel involved with the remediation activities in the exclusion or contamination reduction zones (refer to Section 8.0) must participate in a medical monitoring program meeting specifications of 29 CFR Part 1910.120, HAZWOPER. The examining physician is required to provide a written report to the employer of any medical condition which would place employees at increased risk of wearing a respirator or other personal protective equipment (PPE). A physician will specify respiratory protection clearance, or the user's ability to wear a respirator of any type for a work shift. Each employer (BWE) engaged in site work shall assume the responsibility of maintaining a medical surveillance program as well as maintaining site personnel medical training, and fit test records on-site as regulated by 29 CFR 1910.20, Access to Medical and Exposure Records.

A medical examination program is required for those employees who are required to wear or may wear respiratory protection as specified by 29 CFR 1910.134, Respiratory Protection and 29 CFR 1910.120, HAZWOPER. This program must determine an individual's ability to wear respiratory protection while performing designated duties. Elements of 29 CFR 1910.134, Respiratory Protection, must be complied with, and may be subject to verification by the HSC. This verification may include review of the BWE's required written respiratory protection program regarding the selection, care, employee training requirements, use and maintenance of respirators.

PERSONNEL TRAINING

Site personnel which may be involved in the exclusion and reduction zones, must have participated in a health and safety training program that complies with OSHA 29 CFR 1910.120, HAZWOPER, prior to mobilization at the site. This program must instruct employees on the intent of the standard health and safety principles and procedures, proper operation of monitoring instruments, use of personal protective equipment, decontamination, and site specific emergency response plans.

The BWE will inform its employees of the specific chemical hazards of the contaminants to be remediated at the Site. Chemical specific training shall be provided as required under 29 CFR 1910.1200, Hazard Communication.

In addition, site employees may be required to undergo site-specific training, as deemed appropriate by the HSC, prior to the start-up of any given task. This training will be performed and documented by the HSC. The site-specific training will address potential hazards and associated risks, site operating procedures, and emergency response and site control methods to be employed. A copy of this HASP will be made available to site personnel for review.

Any additional specialized training will be provided by the HSC as dictated by the nature of site activities. Specialized training will be provided for activities such as the handling of unidentified substances. Employees involved in these types of activities will be given instruction by the HSC regarding the potential hazards involved with site activities and the appropriate health and safety procedures to be followed. Training materials and methods will be reviewed by the BWE's Environmental Health and Safety Director, or designee.

Exhibits 1 through 3 located at the end of this HASP, will be completed prior to the BWE mobilizing equipment at the site.

WORK ZONE MONITORING AND PERSONAL PROTECTIVE EQUIPMENT

During remedial activities at the site, such as excavation, potential exposures may occur from releases of particulates or VOCs that:

- 1) may contain the chemicals of concern identified in Table 1, and/or
- 2) give rise to excess airborne concentrations of respirable particulates.

Although the chemicals of concern do not represent direct inhalation hazards, they may be inhaled with respirable dust, ingested, or absorbed through the skin. Consequently, the potential risk of exposure to these contaminants is through inhalation, ingestion of, or skin contact with dust which is generated during site remediation activities.

The measures which will be implemented to protect on-site personnel, and to minimize potential exposures generated by remediation activities are outlined in this section of the HASP.

The remainder of this section identifies monitoring requirements, criteria and decision logic for upgrading or downgrading the necessary levels of personal protection, and describes the different levels of personal protection to be worn by on-site personnel during construction and remediation activities.

In the event that work zone monitoring requires the use of personal protective equipment above Level C, the work will not continue until discussions are held between the BWE and Engineer.

4.1

WORK ZONE MONITORING

The potential of exposure to workers from the chemicals of concern at the site is primarily through inhalation, ingestion, or absorption during site remediation activities. Through safe work practices and the use of personal protective clothing described (Section 4.4), exposure through ingestion and absorption can be minimized. The potential exposure of on-site personnel to VOCs, respirable particulates and metals through inhalation will be assessed through a stringent work zone monitoring program.

The work zone monitoring program will be implemented during activities where site media containing chemicals of concern above remedial goals may be generated. Once confirmatory samples show that the remedial goals for the limits of remediation have been achieved in a work area monitoring will be terminated.

Implementation of the work zone monitoring program will be the responsibility of the BWE. Site monitoring will be conducted by the HST, or a qualified person designated by, and under the direct supervision of, the HSC. The work zone monitoring program may consist of both real-time air monitoring in the work zone, and the collection of samples worn by personnel in the work zone (Section 4.3).

Real-time air monitoring using direct reading equipment will be performed in the work area for:

- total dust during excavation, drilling and soil moving activities and; and
- organic vapors throughout the implementation of the work plan activities.

In addition real-time air monitoring using direct reading equipment will be performed at the site boundary in the direction of the prevailing wind for total dust during excavation, drilling and soil moving activities. Monitoring of VOCs, will be representative of the worker's breathing zone using a photo ionization detection instrument.

Real-time air monitoring results will be used as action level criteria for 1) implementing additional engineering controls, precautions, or procedures, and 2) upgrading or downgrading the levels of personal protective equipment, if necessary.

Personal air sampling will be performed during discrete tasks, by collecting samples from selected personnel in the work zone, in accordance with OSHA regulations. Samples will be analyzed for respirable dust and the chemicals identified in Table 1 by an independent laboratory, to verify that the action level established for real-time monitoring adequately protect workers to the OSHA PELs (Identified in Table 1). The results of sampling will be used as necessary to modify the real-time air monitoring action levels.

Site work zone monitoring activities will be recorded in a dedicated Site Safety logbook. Information recorded in the logbook will include the following:

- Map or sketch of the area of monitoring for each day's activities;
- Wind direction and other pertinent meteorological data;
- Personal protective equipment information;
- Date, time, and concentrations of real-time monitoring results;
- Exceedances of any action levels, including any corrective actions and level of protection upgrades that were implemented;
- Workers chosen to wear sampling equipment, collection media, date sampling was performed, and the task involved;
- Results of samples, including any modifications to the monitoring program that may be made as a result of the sampling results; and
- Instrument calibration results.

4.1.1

Action Levels for Site Media

The following action levels will apply to site activities for real time monitoring:

Total Dust in the Work Area	15 mg/m ³
PM ₁₀ Dust at the Property Boundary	0.15 mg/ m ³
Volatile Organic Compounds	5 ppm

If a reading equal to or greater than action level is obtained, work will stop, personnel will leave the area and the area will be re-evaluated and VOC levels will be reduced by using engineering controls.

If the VOC concentration levels remain at 5 ppm or greater, the HST will use Dragger tubes to identify the specific VOC in Table 1. The following chemical specific action levels will apply to site activities for the Dragger tube monitoring results:

Trichloroethane	10 ppm
1,1,1 Trichloroethane	100 ppm
Xylene	100 ppm
Vinyl Chloride	1 ppm

If Dragger tube monitoring indicates concentrations below the chemical specific action levels, then work may continue. Subsequent Dragger tube monitoring will be conducted every 15 minutes while the real time VOC level remains at or above 5 ppm.

If the VOC concentrations can not be reduced to a concentration below the chemical specific action level by the use of engineering controls, the work area will be upgraded to Level C for the VOCs listed in Table 1 as well as vinyl chloride concentrations up to 10 ppm (see section 4.3). Affected workers in this area will use Tyvek clothing, respiratory protection, and organic vapor cartridges. The work area will be upgraded to Level B for concentrations of vinyl chloride greater than 10 ppm (see section 4.3). Affected workers in this area will use Tyvek clothing and supplied air respiratory protection. The HST will continue to monitor the work area for VOCs and dust and if levels are below the action limits, the HST work area may be downgraded to Level D (see section 4.3) work.

4.1.2

Action Level Response Measures

The BWE will be responsible for implementing effective particulate control measures during work activities, as necessary to comply with the requirements of the HASP. If the results of the real-time air monitoring in the work zone exceed the action levels described in the previous subsections, remediation activities will temporarily cease, and appropriate corrective actions shall be immediately implemented.

Corrective actions will be implemented and upgrade the level of personal protective equipment. If, after the appropriate corrective actions have been implemented, air monitoring of the work zone reveals concentrations in excess of the action levels, remediation activities will again temporarily cease. Non-essential personnel will be directed to leave the exclusion zone, and personnel remaining in the exclusion zone must don the appropriate level of personal protective equipment as described in Section 4.4. Personnel shall then continue work, and the HSC, or designee, will continue air monitoring. Corrective actions and upgrades in personal protection will remain in effect until subsequent air monitoring results indicate that airborne concentrations of are below the action level for a lower level of personal protection.

Personnel sampling will be performed by the BWE during discrete work tasks to verify that the action levels, which are measured by real-time particulate monitoring, are appropriate to afford protection to on-site workers during work activities. Samples will be collected by fitting appropriate workers selected by the HSC with air sampling pumps, which draw air at a prescribed flow rate. The pump will draw air across the sample media, which will then be removed and sent to a laboratory for analysis. Sampling equipment will be provided by the BWE.

The total exposure to a contaminant over a given period of time can be calculated for each worker, as follows:

(pump flow rate in liters/minute) (minutes sampled) = total sampled liters of air

Then:

$$\frac{(\text{total mg of contaminant})}{(\text{sampled liters of air}) (1 \text{ m}^3/1,000 \text{ liters})} = \frac{\text{actual contaminant exposure}}{\text{in mg/m}^3}$$

After completion of the BWE's mobilization activities, samples may be collected by the HSC from the workers, on a daily basis during the first week of activities where site activities may generate dust in excess of 15 mg/m³ total dust in the work area, 5 mg/m³ respirable dust in the work area, or 0.15 mg/m³ PM₁₀ at the property boundary. During this week period, the air sample results for total dust will be compared to the real time monitoring data collected pursuant to Section 4.2.

Pending the results of sampling performed during the first week of remediation activities, the HSC may either:

- modify the respirable particulate action levels for all remaining sediment work; or
- collect additional samples, to determine whether the action levels for remaining work may be modified.

Sampling will continue until it is established by the HSC that the results of the sampling program are consistent with the real-time particulate monitoring, and that workers are not experiencing unexpected exposures exceeding the OSHA PELs.

As necessary, the HSC may collect samples more frequently in order to take into account any variances in the nature of the work conducted, weather conditions, soil concentration, or actions to be taken in the event particulate levels are higher than anticipated.

The results of sampling will be used as necessary to modify the real-time air monitoring action levels.

4.2.1 *Sampling and Analytical Methodologies*

Sampling methodologies (i.e., pump flow rates, calibration, sampling media and subsequent analysis) will be performed in accordance with NIOSH or OSHA methodologies, and the written instructions of the equipment manufacturer. The samples will be collected over a time frame that will not exceed NIOSH or OSHA guidelines, and will not restrict the flow of air through the filter cartridge. For example, if sample collection is calculated to be for eight hours based upon the assumed filter loading, and the worker will be in the work zone for 10 hours, then two five-hour samples will be collected at a higher sampling rate for appropriate loading or the sampling rate for one 10 hour sample may be reduced.

Each sample pump will be equipped with a 10 millimeter (mm) cyclone, to check that only respirable particulates enter the pump. Sampling media will be 37 mm PVC pre-weighed filters. The initial pump flow rate will be 1.7 liters per minute. The initial sample volume will be 800 liters. Both flow rate and sample volume may be adjusted based upon dust loading rates to the filter.

Samples will be submitted to an American Industrial Hygiene Association (AIHA) accredited laboratory for 24 hour verbal turnaround time, and analyzed for respirable particulates using NIOSH Method 0600, and for cadmium using NIOSH Method 7300. All analyses will be conducted using the lowest achievable detection limit for that NIOSH Method.

4.3 *PERSONAL PROTECTIVE EQUIPMENT*

Types of PPE to be used during excavation and remediation activities are discussed in this section. The levels of PPE specified in this section are based upon OSHA guidelines

presented in 29 CFR 1910.120 and conform to the requirements of 29 CFR 1910 Subpart I. PPE used must be approved by NIOSH and ANSI.

Level D protection will be used at a minimum for site activities within the work zones. Modified Level D will be used for personnel that will be in direct contact with soil. The BWE will have Level C protective equipment available on-site at all times if it becomes necessary, based on site conditions, to upgrade, downgrade or modify levels of protection, such as an increase in VOCs above the action levels associated with section 4.1.1 and where engineering controls could not reduce the VOC levels. The HSC will immediately inform EPA's on-site representative of any decisions made to upgrade or downgrade levels of personal protection.

4.3.1 *Level D Protection*

Equipment listed in this Section will be the minimum to be worn for all Level D work:

- Long sleeve coveralls or work uniform where work functions do not include liquid splashes or immersion.
- Outer neoprene, butyl rubber or equivalent gloves with inner latex gloves. Outer leather or cotton gloves may be necessary when handling sharp objects.
- Steel-toe, steel-shank work boots with chemical-resistant rubber overboots, or steel-toe, steel-shank chemical-resistant boots.
- Safety glasses (ANSI Z-87) with side shields (contact lenses prohibited).
- Hard hat.

Optional Equipment as Required by the HSC

- Hearing protection with an appropriate noise reduction rating (NRR).

Level D Protection Modified

- Disposable outer chemical coveralls (Tyvek or comparable).
- Inner Nitrile gloves. Sleeves and gloves are to be taped together.

4.3.2

Level C Protection

Equipment listed in this section will be the minimum to be worn for all Level C work:

- Full-face air purifying respirator (APR) equipped with combination High Efficiency Particulate Air (HEPA) and organic vapor cartridges which provide a service life of at least 1 hour for concentrations of vinyl chloride up to 10 ppm.
- Personnel utilizing respiratory protection must be medically cleared in accordance with OSHA to wear a respirator and be "fit-tested" with the respirator model and size to be used in the field. Personnel using respiratory protection must be clean shaven. Mustaches are permitted if they are above the lip line. Contact lenses are prohibited. Workers who require corrective lenses for vision will obtain spectacle kits for full face respirators. Half-mask air purifying respirators will not be used unless specifically approved by the HSC, who will also record this allowance in the safety and health log book.
- Chemical-resistant clothing such as Tyvek®, poly-coated Tyvek® or Saranex®. Suits will be one piece hooded with booties and elastic wrist bands.
- Outer chemical-resistant nitrile or neoprene gloves and inner latex gloves. Note: Outer gloves (leather or cotton) may be required when handling sharp objects. Sleeves and outer gloves are to be taped together.
- Steel-toe, steel-shank work boots with disposable chemical-resistant rubber overboots, or steel-toe, steel-shank chemical-resistant boots.
- Hard hat.

Optional Equipment as Required by the HSC

- Hearing protection with appropriate NRR.

4.3.3

Level B Protection

Equipment listed in this Section will be the minimum to be worn for Level B work:

- Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved),
- Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit;
- Disposable (chemical-resistant overalls) coveralls,
- Gloves, outer, chemical-resistant,

- Gloves, inner, chemical-resistant,
- Boots, outer, chemical-resistant steel toe and shank,
- Boot-covers, outer, chemical-resistant (disposable), and

4.4

LOGS, REPORTS, AND RECORDKEEPING

Logs, reports and records related to this project will be maintained in the custody of the HSC. Following project completion, it will be transferred to BWE's offices.

Step 1 - Segregated Equipment Drop: Deposit contaminated equipment (tools, sampling devices, monitoring instruments, etc.) onto plastic drop cloths or tarps.

Step 2 - Over boot and Outer Glove Wash: Overboots and outer gloves shall be scrubbed with a dilute decontamination (Alconox®) solution.

Step 3 - Over boot and Outer Glove Rinse: Decontamination solution shall be rinsed off overboots and outer gloves using generous amounts of water.

Step 4 - Tape Removal: Remove tape from around boots and gloves and place into container with plastic liner for disposal.

Step 5 - Removal of Overboots and Outer Gloves: Remove overboots and place them in a container with a plastic liner. Next, remove outer gloves and place in container.

Step 6 - Removal of Disposable Coveralls: With care, remove chemical resistant disposable coveralls and place into a container with plastic liner for disposal. The exterior of the suit must not come into contact with any inner layers of clothing.

Step 7 - Inner Glove Wash and Rinse (if contaminated): Inner gloves shall be washed with a dilute decontamination (Alconox®) solution and then rinsed with potable water.

Step 8 - Remove Respirator: Remove respirator. Attempt to keep face/inner glove contact to a minimum.

Step 9 - Inner Glove Removal: Remove inner gloves and place in plastic-lined container for disposal.

Step 10 - Field Wash: Wash hands and face thoroughly.

5.3

EQUIPMENT DECONTAMINATION

CRZs for equipment decontamination shall be established at the site, in locations approved by the BWE. These stations will be used to completely decontaminate machinery and equipment used by the BWE. The stations must include shovels, brushes, power washers, a steam jenny, detergent solutions if necessary, and provisions to collect decontamination wash and rinse waters. Equipment and heavy machinery exiting the site or entering areas of the site which have been remediated or do not require remediation must be completely decontaminated. Visible materials will be removed from excavating equipment. A high pressure, low volume spray wash will then be used to remove any residual materials on the machinery.

Decontamination washwaters, solids, and discarded health and safety equipment will be contained, properly labeled, and disposed of consistent with applicable state and federal regulations.

SITE ACCESS AND SITE CONTROL

Portions of the site are surrounded by a chain-link fence. The gates of the site entrance will be locked at all times during non-working hours. Authorized visitors, including employees of the BWE and regulatory agencies must sign in and out at the main gate prior to entering or leaving the site.

When work is being conducted outside of fenced areas, the BWE will take precautions to limit access to these areas. Personnel entering an active Work Area must sign in at the register in the BWE's office. Each person be briefed regarding on-site conditions by the BWE's HST. Persons entering the work area during intrusive activities in which hazardous materials may be encountered must be trained in accordance with OSHA 1910.120. No other person(s) will be permitted to enter areas where such intrusive field activities are being conducted.

Sign-in procedures will be implemented by the BWE to check that only authorized personnel participate in the remediation activities. The HSC will be responsible for coordinating this effort. The BWE will be responsible to maintain sign-in/sign-out sheets at each CRZ. Red "Danger" barrier tape will be used to surround areas where work involving heavy equipment and/or potentially hazardous materials work is being performed. Open excavations will be surrounded by temporary barrier fencing (e.g., snow fencing) as well as red "Danger" barrier tape at the conclusion of each work day.

EMERGENCY RESPONSE**NOTIFICATION OF SITE EMERGENCIES**

The HSC will serve as the site emergency coordinator and will coordinate emergency response activities. Prior to the implementation of work activities, the BWE will designate an assembly area for use by BWE employees. Safe evacuation routes will be designated.

In the event of an emergency, site personnel must signal distress with three blasts from an air horn. Site activities, including work in the work area, will stop immediately. Employees are required to report back to the assigned areas to account for site employees and initiate emergency procedures. Employees in the work area will exit and follow the decontamination procedures, unless alternate instructions are given by the HSC.

Appropriate authorities will be immediately notified of the nature and extent of the emergency by the HSC. Emergency procedures, under direction from the HSC, will be initiated. Table 3 will be posted in the security office trailer and the BWE's trailer.

In the event of fire, site personnel must be evacuated to a safe distance away from the fire by the HSC. The Project Manager and local fire department will be notified immediately by the HSC. The HSC will monitor potential contaminant migration.

If an evacuation of the Site is required, individuals not responding to medical, fire, or other emergencies may leave the site through the designated evacuation routes to the designated assembly area(s). Supervisory personnel must account for those employees they are responsible for. Unaccounted for employees must be reported to the HSC immediately. The BWE will provide to the HSC a daily list of names of BWE employees and SubBWEs who are working at the Site. This list will be used to account for personnel on site.

Table 3 provides emergency telephone numbers and Figure 1 presents the route to Brunswick Hospital Center. These will be posted on site.

RESPONSIBILITIES

The HSC will be responsible for initiating responses to emergencies, and will:

- notify appropriate authorities (police, fire) and/or health care facilities of the activities and hazards of the site prior to the initiation of work;
- ensure that a map which details the most direct route to the nearest hospital is posted within the support zone;
- ensure that the safety equipment required to be provided by the BWE is available at the site; and
- have working knowledge of safety equipment available at the site.

Prior to the initiation of work at the site, a letter which identifies the activities to be performed at the site and the associated hazards will be prepared and forwarded to appropriate representatives of the Brunswick Hospital Center and the local police and fire departments.

A follow-up visit or telephone call will be made to the Brunswick Hospital Center. If there is no response, BWE will check that the hospital clearly understands the nature of any emergency services to be provided.

ACCIDENTS AND INJURIES

A worker recognizing a potential safety hazard should correct the hazard if possible and/or bring the hazard to the attention of the HSC or their supervisor.

In the event of a safety or health emergency at the site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed, and to protect others from hazards. The HSC will be immediately notified and will respond according to the seriousness of the injury.

The injured employee's supervisor is responsible for completing a Record of Injury and Illness Form (OSHA 101 or equivalent). Field Medical Data Sheets (Exhibit 3) should accompany the injured to the attending physician.

First Aid

If an emergency involves personnel injuries, the local fire rescue squad and/or Emergency Medical Service (EMS) will be contacted immediately by the HSC or designee. If designated, individuals trained in first aid and/or CPR, who are currently certified, may perform first aid treatment until EMS arrives. The HSC designee should be prepared to provide the following information:

- Exact location of the emergency;
- Phone number they are calling from;
- Type of injury(ies);
- How many persons have been injured; and
- What assistance or first aid is being given to the injured person(s).

Do NOT hang up unless told to do so. In most cases, the emergency dispatcher will require the caller to stay on the phone.

When emergency response authorities arrive, site personnel will immediately inform them of the details of the situation and what type of chemicals or hazards may be encountered on the site. If available and applicable, Material Safety Data Sheets (MSDS) should be given to the responders.

Individuals performing or expecting to perform first aid shall receive blood-borne pathogens training, as required by OSHA 29 CFR 1910.1030. Areas contaminated with blood shall be appropriately disinfected with approved agents. First aid kits maintained on site shall be approved by a licensed physician:

The following basic procedures should be followed for assisting an injured person.

- Remain calm and quickly evaluate the emergency.
- Contact Emergency Services (refer to Table 3)
- Do not move the injured person unless necessary or instructed to do so by the HSC or incident commander.

- If possible, move any physical and chemical hazards away from the area of the injured person.
- Take care of the most serious injuries first; bleeding must be stopped, breathing must be restored, etc.
- Cover injured person to keep warm.

The HSC will observe and document recognized symptoms of injury or illness. Table 7-2 can be utilized for reference of common symptoms specific to the chemicals of concern at the site.

A portable eye wash station shall be provided by the BWE and available on site in the event quick drenching for the eyes is required. The portable eyewash station must provide at least fifteen minutes of potable water or water which contains additives for use in eyewash stations.

Following an emergency incident, the BWE's Project Manager will critique the response and follow up on any deficiencies noted in the critique.

7.4

SITE COMMUNICATIONS

Telephones will be used as the primary off-site communication network. At least two (2) portable radios will be provided by the BWE on-site to check communication with employees working in the work area(s). Site communication systems will be set up by the HSC. When radio communication is ineffective, hand signals will be utilized as follows.

- | | |
|------------------------|------------------------------|
| • Hand grips throat | - Can't breathe! |
| • Grip partner's wrist | - Evacuate area immediately! |
| • Hands on top of head | - Need Assistance. |
| • Thumbs up | - O.K., No problem. |
| • Thumbs down | - No, Negative. |

**TABLE 3
EMERGENCY CONTACTS**

EMERGENCIES: 911

POLICE: New York State Police Department	Emergency:	911
	Other:	(631) 756-3300

SUFFOLK COUNTY SHERIFF: (631) 852-8000

FIRE DEPARTMENT AND RESCUE UNIT (LINDENHURST) (631) 226-1212

BRUNSWICK HOSPITAL GENERAL INFORMATION (631) 789-7000

PROJECT MANAGER:	
Michael Posillico – Office	(516) 752-2145
Michael Posillico – Mobile	(516) 523-0470

PROJECT MANAGER:	
Tom Spatafora - Office	(516) 752-2145
Tom Spatafora – Mobile	(516) 523-0565

SAFETY OFFICER:	
Rich Santamaria	(631) 249-1872

NYSDEC REMEDIAL PROJECT MANAGER:	
Gerard Burke - Office	(518) 457-9285
Gerard Burke - Site Trailer	TBA

NATIONAL RESPONSE CENTER: (800) 424-8802

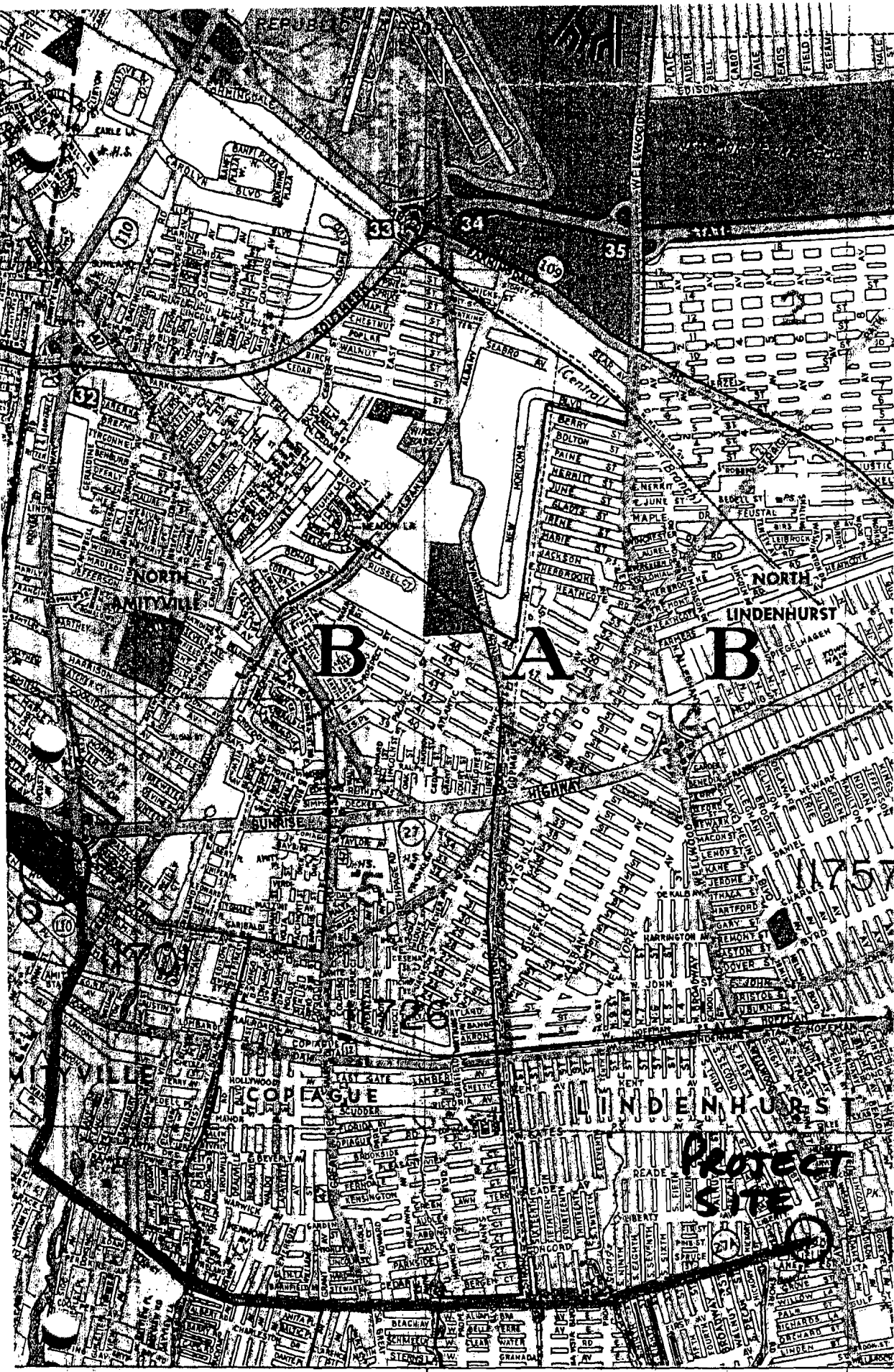
CHEMTREC (800) 262-8200

POISON CONTROL CENTER: (516) 542-2323

HOSPITAL	Brunswick Hospital Center
	366 Broadway, Amityville, NY 11701

EMERGENCY ROUTE TO THE HOSPITAL (see Figure 1):

From the Site, take Montauk Highway west approximately 3 miles, then take Rte 110 (Broadway) north for a little over 1 mile. Hospital is on the left.



2

3

FOR ADJOINING AREA SEE MAP NO. 5

TABLE 4
REFERENCE OF COMMON SYMPTOMS

Type of Injury or Exposure	Symptom
Chemical Exposure, Ingestion Inhalation or	<p>Symptoms of chemical exposure, ingestion or inhalation may include one or more of the following:</p> <p>Weakness, lassitude, insomnia; facial pallor; pale eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist, ankles; encephalopathy; nephropathy; irritation of eyes; hypertension.</p> <p>NIOSH Pocket Guide to Chemical Hazards, June 1990</p>
Heat Stroke	Signs and symptoms of heat stroke are hot, red skin; very small pupils; and very high body temperature - sometimes as high as 105 degrees. If the victim was sweating from heavy work or exercise, his or her skin may be wet; otherwise, it will feel dry.
Heat Exhaustion	The usual signs and symptoms of heat exhaustion are cool, pale, and moist skin, heavy sweating; dilated pupils, headache, nausea; dizziness; and vomiting. Body temperature will be nearly normal.
Hypothermia	Signs and symptoms of hypothermia are: shivering; a decreased and sometimes irregular heart rate; a weak pulse; cool skin; decreased blood pressure; decreasing core temperature and slow, irregular breathing.
Frostbite	Signs and symptoms of frostbite are: a sensation of cold followed by numbness; tingling, stinging and aching may be felt initially. The skin may appear white, reddish-purple and finally black; blisters may also be present.

8.0 SPECIAL PRECAUTIONS AND PROCEDURES

8.1 SEGREGATION OF WORK ACTIVITIES

In areas where remediation will occur, both physical and chemical hazards shall be minimized by the establishment and maintenance of work zones. Depending on the area of the site being remediated, these zones may be relocated by the BWE to locations approved by the BWE. The HSC will be responsible for ensuring that the following work zones are established by the BWE.

8.1.1 Exclusion Zone

An exclusion zone (EZ) cell will be established at each work area when remediation activities are initiated. The EZ will be delineated by the BWE subject to the approval of the HSC, and will include the limits of the operating area. The perimeter (the Hotline), of the EZ will be established using red "Danger" barricade tape. Persons within the EZ will wear the required level of personal protection. A work area will remain an exclusion zone until site performance standards for the work area have been achieved.

8.1.2 Contamination Reduction Zone

The CRZ is the transition area between the EZ and the clean support zone (SZ). Preliminary equipment and personnel decontamination will take place in the CRZ. A CRZ will be established at each exclusion zone, and two primary CRZs will be established for the decontamination of equipment and personnel leaving the site.

Figure 8-1 presents a typical layout of an EZ and adjoining CRZ. Before any equipment travels from the EZ to the support zone, it must be decontaminated in accordance with the BWE's approved Decontamination Plan. The Decontamination Plan is specified in the Specifications and the procedures are explained in Section 5.0 of this HASP.

Primary CRZs will be established at locations approved by the HSC. Personnel and equipment that have contacted contaminated material must be decontaminated prior to leaving the site.

8.1.3

Support Zone

The SZ is considered to be the area on site where there is no potential exposure to chemical contaminants. PPE is not required in the SZ but should be available for use in emergencies. Clean equipment and materials should be stored and maintained within the SZ. PPE must be donned in the SZ prior to entering the CRZ. The SZ covers work areas on the site which are not designated as EZs or CRZs.

8.2

EXCAVATION ACTIVITIES

Excavation activities shall be performed in accordance with OSHA regulations 1926.651 and 1926.652. The HSC or designee will perform daily inspections of the excavation. The inspection will be documented in the safety logbook.

8.3

HEAVY MACHINERY/EQUIPMENT

Site personnel must remain aware of site activities that involve the use of heavy equipment and machinery. Since respiratory protection and eyewear reduces peripheral vision of the wearer, it is essential that personnel at the site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

If cranes are to be used at the site, the BWE must provide BWE a copy of the operators license and annual crane inspection. The BWE will be responsible for performing and documenting daily before/after use inspections.

8.4

TEMPERATURE-RELATED HAZARDS

Due to the anticipated duration of the project, work activities in both hot and cold weather may be encountered. Heat stress and cold stress may pose a threat to the health and safety of site personnel. Work/rest regimens will be implemented as necessary so that personnel do not suffer adverse effects from temperature-related hazards

Heat stress is the combination of environmental and physical factors that constitute the total heat load imposed on the body. Heat strain is the series of physiological responses to heat stress. When the strain is excessive for the exposed individual, a feeling of discomfort or distress may result, and finally, a heat disorder may ensue. The severity of strain will depend not only on the magnitude of the prevailing stress, but also on the age, physical fitness, degree of acclimatization, and dehydration of the worker.

A good rule of thumb to prevent dehydration from heat stress is that fluid intake should equal fluid loss from the body, which can be accomplished through frequent small intakes of water prior to entering the EZ.

Heat disorder is a general term used to describe one or more of the following heat-related disabilities or illnesses:

- *Heat cramps* - painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Cramps usually occur after heavy sweating, and often begin at the end of a work shift.
- *Heat exhaustion* - profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache. The skin is cool and sometimes pale and clammy with sweat. Body temperature is normal or subnormal. Nausea, vomiting and unconsciousness may occur.
- *Heat stroke* - sweating is diminished or absent. The skin is hot, dry, and flushed. Increased body temperature, if uncontrolled, may lead to delirium, convulsions, coma, and even death. Medical care is urgently needed.

As many of the following control measures as are appropriate to site conditions should be utilized to aid in preventing and controlling heat disorder:

- Provide for adequate liquids to replace lost body fluids and replace water and salt lost from sweating. Encourage personnel to drink more than the amount required to satisfy thirst.
- Replace fluids with cool water.
- Establish a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.
- Take breaks in a cool rest area if possible.

- Do not assign other tasks to personnel during rest periods.
- Inform personnel of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

8.4.2

Cold Stress

Exposure to cold weather, wet conditions and extreme wind-chill factors may result in excessive loss of body heat (hypothermia) and/or frost bite. In general, when actual or equivalent temperatures fall below 32°F, work regimens need to be modified to protect workers from cold stress. To guard against cold exposure and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be readily available, rest periods should be adjusted as needed, and the physical conditions of on-site personnel should be closely monitored. Personnel working at the site must be made aware of the signs and symptoms of frost bite and hypothermia such as shivering, reduced blood pressure, reduced coordination, drowsiness, impaired judgment, fatigue, pupils dilated but reactive to light, and numbing of the fingers and toes.

To best prepare for working outdoors in cold weather, the following measures should be taken:

- Wear insulated cold weather clothing (i.e., long underwear, coats, gloves, hats, hard hat liners, thermal vests, etc.);
- Wear clothing in layers and with loose fit to create dead air spaces. Avoid tight-fitting garments;
- Outer garments should be "windproof" made of close weave, film-like materials;
- Cover all exposed skin. Wind chill will rapidly promote tissue freezing (frostbite);
- Protect the extremities. At the first sign of a prickling sensation or numbness, move to a location where hands and feet can be warmed;
- Keep clothing or exposed skin dry. Change garments if they become wet. This is especially true of socks and gloves;
- Keep out of the wind. Work behind wind breaks and provide them if necessary; and
- Avoid handling cold objects.

Cold Stress can be described as one or more of the following conditions.

- *Trenchfoot* - Caused by continuous exposure to wet or dampness without freezing. Feet swell, tingle, itch, and become painful and may be followed by blisters, superficial skin death and open sores.
- *Frostbite* - Early signs include a prickling sensation and/or numbness. Superficial frostbite will result in reddening of the skin and numbness possibly with water blisters. Deep freezing of tissue will result in poor to non-existent blood circulation, an initial whitening of the skin, followed by cyanosis and eventually gangrene.
- *Hypothermia* - Hypothermia is caused by prolonged cold exposure and heat loss. This condition can rapidly be accelerated by wet skin, use of sedatives or alcohol, and inadequate clothing. Early symptoms are shivering and chills followed by slurred speech, loss of manual dexterity, confusion and drowsiness, death may occur.

The following measures should be implemented to prevent or treat cold stress injuries:

- *Trenchfoot* - Dry feet and keep dry with dry socks and shoes. See a physician for further treatment.
- *Frostbite* - In mild cases, warm the skin gradually. Do not rub with snow or expose the skin to high temperatures. Warm water (<100°F) may be suitable. In extreme cases, seek professional medical attention.
- *Hypothermia* - Move victim to warm, dry location. Remove wet garments and put on dry, warm clothing. Give the victim warm fluids or food. Do not give alcoholic beverages. Help the victim walk or move around to build up body heat.

8.5

TRAFFIC

Approved work area protection such as traffic cones, "People Working" signs, arrow boards, barricades, lights, traffic vests, and barricade tape where applicable, should be appropriately located along the road to divert motorists safely around the site activities. "Truck Entering" warning signs will be posted.

When excavation activities are conducted near an active roadway, the HSC may direct the BWE to temporarily halt work until vehicular traffic passes. See Site Control plan for details on traffic control.

UNDERGROUND/OVERHEAD UTILITIES

BWE will identify areas where underground utilities may be encountered. Site personnel shall undertake extreme caution when work activities are required to take place near existing buried utilities.

Buried and overhead utilities such as electrical conductors, water, or gas distribution mains may also be present at the site. The BWE must check that equipment and machinery is kept clear of overhead utilities throughout remediation activities. Underground utilities will be identified in place prior to excavating with mechanical equipment. Where underground utilities are suspected, only hand digging will be performed.

ADDITIONAL SAFETY PRACTICES

The following are important safety precautions which will be enforced during the project:

Personal Hygiene

- Eating, drinking, chewing gum or tobacco, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any work area. Smoking is discouraged on the site.
- Hands and face must be thoroughly washed upon leaving the CRZ and before eating, drinking, or any other activity.
- Whenever decontamination procedures are in effect, the entire body should be thoroughly washed off-site as soon as possible after the protective garment is removed.

Fire Prevention and Protection

If flammables are to be used at the site, they will be stored only in approved safety cans or inside a flammable storage cabinet located away from sources of ignition. Workers are to be instructed to keep flammable material away from ignition sources. If hot work is required at the site such as torch cutting and welding, a Hot Work permit will be issued and a fire watch will remain in effect for a period of 30 minutes following the completion of the work. Site fire extinguishers will be type ABC and placed in areas throughout the site 100 feet from where the potential of a fire exists.

Fire protection will be provided by the local fire department. In the event of a fire, the Project Manager or senior site representative will notify the first responders by calling the Islip Fire Department at 911 (See Table 3)

Walking and Working Surfaces

The HST will periodically perform a site walk to ensure that walkways, aisles, and associated work areas are free from slippery or wet surfaces. It will also be the responsibility of the HST to inform workers of conditions which may exist where there is a likelihood that conditions could change that may cause a hazardous walking surface.

Site Housekeeping

Workers associated with the site are responsible for keeping their work area clear and free of debris. It will be the responsibility of each supervisor to ensure that their tools, materials, and miscellaneous trash has been placed in its appropriate container or storage location prior to the end of each work shift.

Mechanical Equipment Inspection

Prior to the mobilization of heavy equipment to the site, an initial inspection will be performed and documented by an assigned person who is considered a competent person on the operation and maintenance of the particular machine. The inspection will also include obtaining copies of State or local regulatory required inspections.

Cranes will also be inspected each day before and after use. These inspections will be documented and maintained in the site's safety inspection files.

Sanitation

Restroom facilities will be made available at the work site which may include portable toilets and wash facilities. A portable whole body shower will be used in the event decontamination of workers is needed. The rinse water will be collected and analyzed for compliance with appropriate disposal criteria.

Workers' will be allowed access to bottled water for drinking purposes. Refuge and associated waste will be collected in an approved DOT container and a subcontractor will be used for transportation and disposal.

Work Activities in the Exclusion Zone

- Contact with potentially contaminated surfaces shall be avoided whenever possible. Personnel, wherever possible, should not 1) walk through puddles, mud, or other discolored surfaces; 2) kneel on ground; 3) lean, sit or place equipment on drums, containers, vehicles or the ground.
- Medicine and alcohol can increase the effect of exposure to certain compounds. Illegal drugs and alcoholic beverages will not be brought on site or consumed by personnel on site who are involved in the project. Prescribed medication may be consumed by an employee providing the HSC has been made aware of the prescription requirements and has verified that exposure to on-site contaminants will not influence the medication's effect.
- Personnel and equipment in the work areas shall be minimized, consistent with effective site operations.
- Work areas for various remediation activities will be established.
- Procedures for leaving the work areas must be planned and implemented prior to initiating remediation and remediation activities. Work areas and decontamination procedures must be established on the basis of prevailing site conditions.
- Respirators will be issued for the exclusive use of one worker only, and will be cleaned after each use. If a respirator is used by more than one user, disinfection is mandated after each use. (A chlorine solution of 25 parts per million (ppm) to 50 ppm or commercially available disinfectant pads are recommended.) Respirators will not be hung by their straps during their drying. Respirators will be stored in clean plastic bags without filter cartridges.
- Exterior gloves and boots shall be taped to the disposable, chemical-protective suits as necessary.
- Potentially dangerous equipment left unattended shall be identified by a red "DANGER, DO NOT OPERATE" tag.
- Ear protection may be required for all site personnel working around heavy equipment. This requirement will be based on monitoring ambient noise levels and at the discretion of the HSC.
- Cartridges for air-purifying respirators in use will be changed daily at a minimum. Used cartridges must be disposed of as contaminated waste.

Site by Rick Long
Blue Water Environmental
Active Industrial Uniform

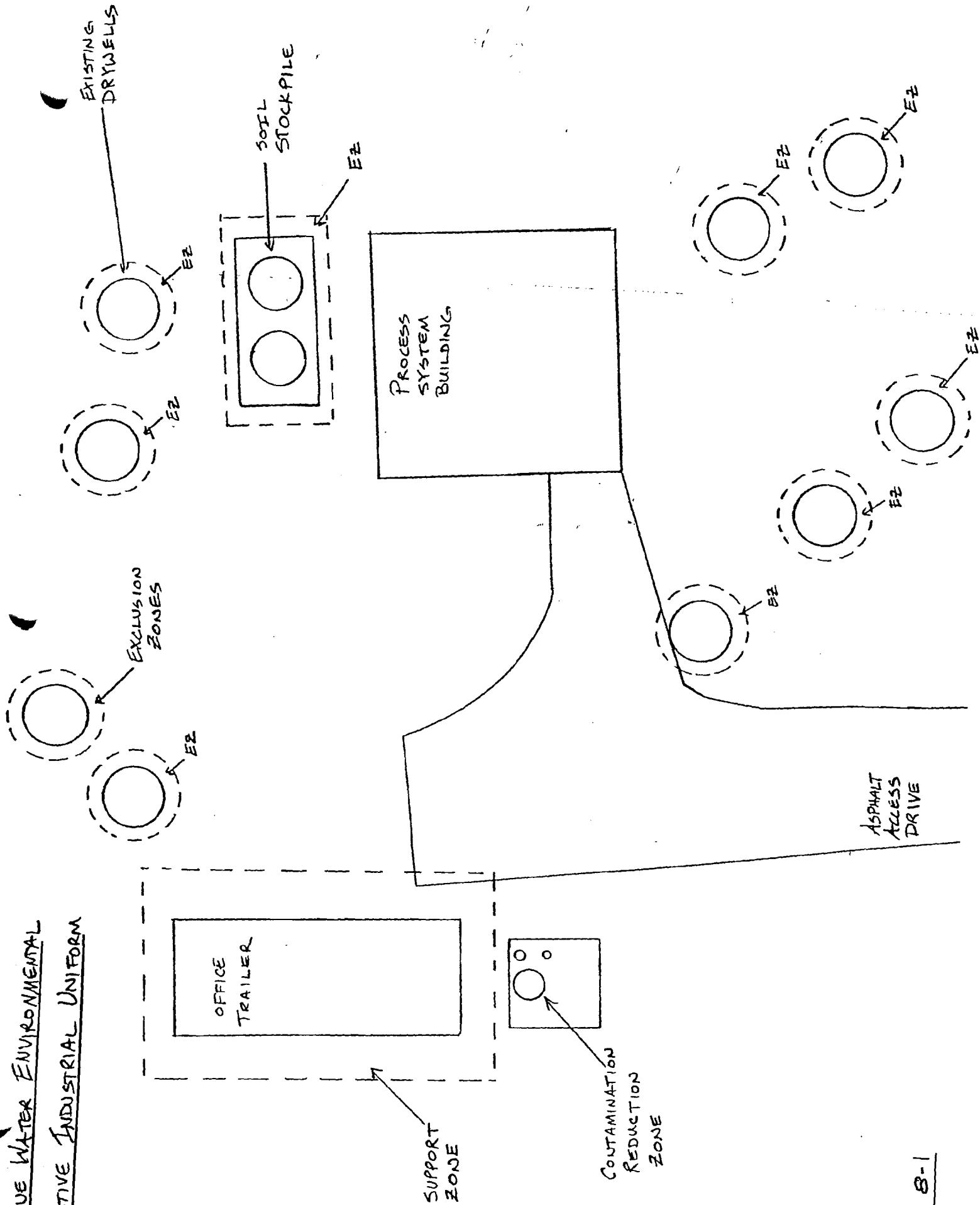
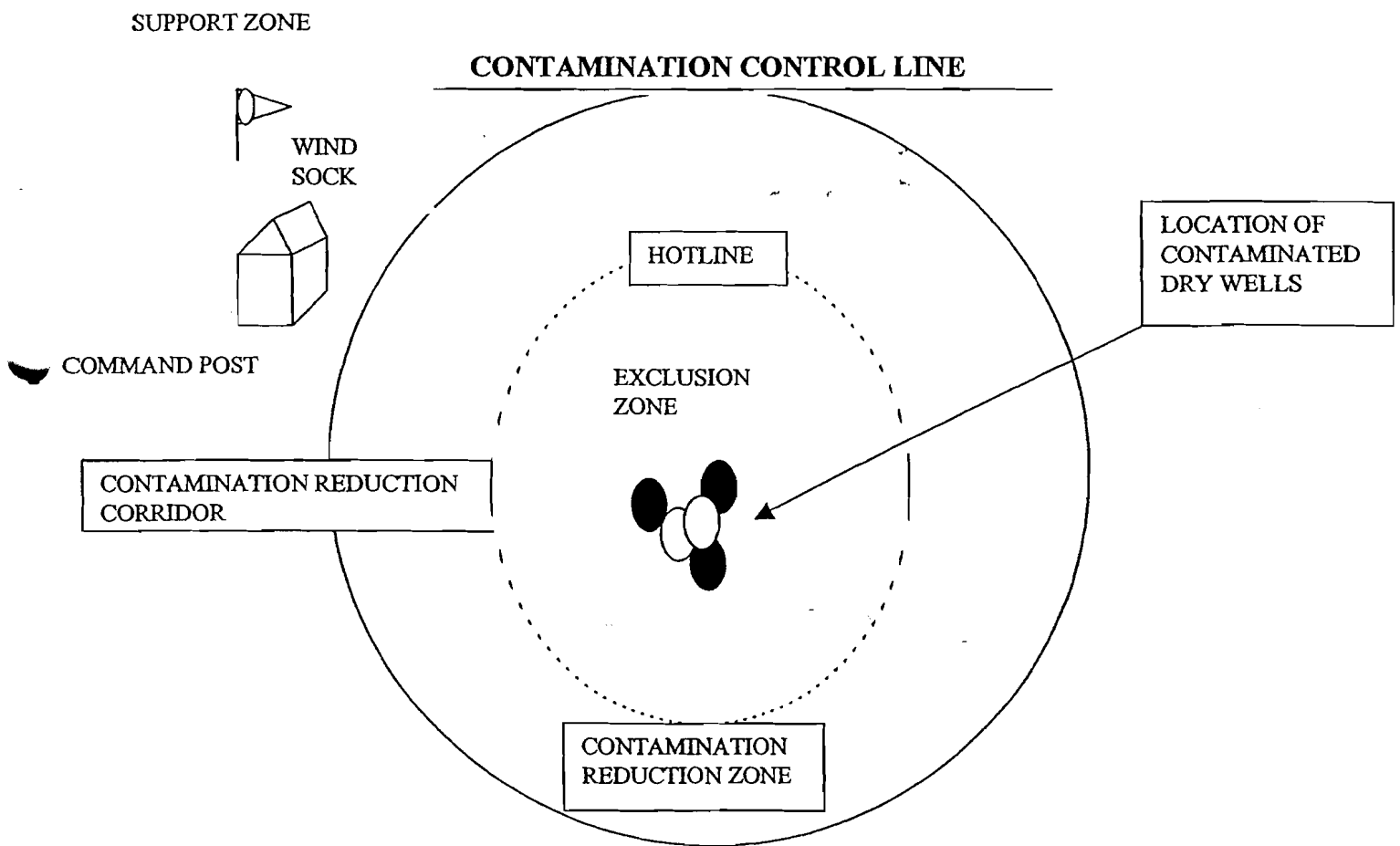


FIGURE 8-1

Figure 2

SITE WORK ZONES



NOISE MONITORING PROGRAM

This section describes the Noise Monitoring Program that will be implemented by the BWE during remediation activities at the site. The purpose of the Noise Monitoring Program is to determine whether remedial activities generate noise levels that exceed OSHA action levels.

Implementation of the Noise Monitoring Program will be the responsibility of the BWE, and will be conducted under the direct supervision of the HSC. The Noise Monitoring Program may consist of real-time monitoring and personal dosimetry if determined to be appropriate.

Monitoring will be performed along the site perimeter, at three separate locations, termed "perimeter noise stations". The stations will be located at 100 feet inside the site perimeter or 100 feet from the work zone whichever is further from the work zone. If necessary, the locations may be changed during the work.

The real-time monitoring will be conducted at the established perimeter noise monitoring stations using a Quest Model 215 Sound Level Meter or similar device. Each station will be marked with high visibility flagging.

Noise monitoring at the perimeter stations will be conducted during activities where there is potential for action levels to be exceeded. Once monitoring has demonstrated that there is no potential for action levels to be exceeded, monitoring may be terminated.

Perimeter Noise Monitoring Program activities will be recorded in the dedicated Site Safety logbook by the HSC. Information recorded in the logbook will include the following:

- Map or sketch of the area of monitoring for each day's activities, and the location of each perimeter noise monitoring station. If station locations are changed during a work day, another sketch will be prepared to document the changes;
- Wind direction and other pertinent meteorological data;
- Date, time, and noise level of all real-time monitoring results;
- Exceedances of any action levels, including any corrective actions that were implemented; and

- Instrument calibration results.

9.1

NOISE MONITORING OBJECTIVES

The following are stop work action levels based upon noise monitoring:

- personnel exposure levels of 85 decibels (dBA) over an 8 hour time weighted average

9.2

PERSONAL/AREA NOISE MONITORING

The HST will perform noise measurements consistent with criteria as established in the OSHA 29 CFR 1910.95 regulation. A walk-around survey will be performed during representative noise generation operations. Measurements will include potential exposures for workers conducting remediation operations as well as measurements in additional adjacent areas that may also be affected. These measurements will be utilized to delineate boundaries of sound levels that may require implementation of a hearing conservation program or engineering/administrative controls.

During performance of the walk-around survey, data pertaining to employee job function will also be collected. This data may include as appropriate: distance from employee to the primary noise sources; need for employee to be present or in close proximity to the noise field; employee exposure time pattern and existence of any known employee auditory problems (e.g., ear infections, ringing in the ears, or trouble with hearing after the work shift).

Information on machine or process data will also be collected including: type and condition of machines; machine operation and source and characteristics of the noise. Data regarding size and shape of the area in which noise is generated; layout of equipment, work stations and break areas; surface materials; potential for acoustical treatment; noise from other sources (spill-over noise) and the presence of barriers or enclosures will also be noted.

Following data collection, recommendations of potential engineering and/or administrative controls, requirements for hearing protector attenuation and OSHA

requirements for a hearing conservation program, if applicable will be made and implemented as appropriate.

9.3

PERIMETER NOISE MONITORING

Continuous real-time air monitoring will be conducted at the perimeter of the site. Monitoring will be performed at fixed locations where the terrain is relatively flat, there are no obstructions such as buildings or trees, and the location is representative and proximate to the work zones. Noise monitoring results will be used as action level criteria for implementing additional engineering controls or procedures in the work areas.

Perimeter noise monitoring will be performed using a Quest Model 215 Sound Level Meter or similar device selected by the HSC. Monitoring instruments will meet the established requirements set forth by OSHA, Mine Safety and Health Administration (MSHA), NIOSH, and state agencies where applicable.

In the event that perimeter monitoring exceeds the action level, then all remediation activities will be stopped by the HSC and the corrective actions as may be appropriate will be implemented. Background noise monitoring will be used to evaluate the contribution of background noise on the exceedance of action levels.

—

—

—

EXHIBITS

EXHIBIT 1

HEALTH AND SAFETY PLAN REVIEW RECORD

*Active Industrial Uniform Site
Lindenhurst, Long Island
Suffolk County, New York*

I have read the Site Specific Health and Safety Plan for this project and have been briefed on the nature, level, and degree of exposure likely as a result of participation in this project. I agree to conform to all the requirements of the Site Specific Health and Safety Plan.

Employee Signature

Date

Name

Supervisor Signature

Date

Name

EXHIBIT 2

BWE OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

Project: Active Industrial Uniform Site
Active Industrial Uniform Site
Lindenhurst, Long Island
Suffolk County, New York

BWE: _____

1. BWE certifies that the following personnel to be employed during the remediation activities have met the following requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120) and other applicable OSHA standards.

<u>BWE Personnel</u>	<u>Training</u>	<u>Respirator Type & Make</u>	<u>Medical Exam</u>	<u>Date & Clearance for Resp/HW</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. BWE certifies that it has received a copy of the Site Specific Health and Safety Plan and checks that its employees are informed and will comply with the requirements of the Site Specific Health and Safety Plan.
3. BWE further certifies that it has read, understands, and will comply with all provisions of its contractual agreement with BWE, specifically, the rights assigned to both parties with respect to the implementation of the Site Specific Health and Safety Plan.

Signed: _____ Date: _____

EXHIBIT 3
FIELD MEDICAL DATA SHEET

Name: _____ Phone: _____

Address: _____

Date of Birth: _____ Height: _____ Weight: _____

Allergies: _____

Particular Sensitivities: _____

Do you wear contact lenses?: _____ **NOTE: Contact lenses are not permitted on-site.**

Do you wear corrective lenses?: _____

List exposures to hazardous chemicals, if any and resultant illness or symptoms:

List medications you presently use: _____

List any other medical restrictions: _____

Special medical, fire or incident response training: _____

Name, address and phone number of personal physician: _____

Nearest Relative: _____ Phone: _____

Social Security Number: _____

Driver License Number: _____

Driver License State: _____

Driver License Class or Designation: _____

Driver License Restrictions: _____

Employee Signature

Date

APPENDIX A
Community Protection Plan

A1.0

Community Protection Plan

Real-time air monitoring for particulate levels at the perimeter of the EZ is necessary to determine that the health and safety of onsite workers and the community is protected. Volatile compounds are identified as contaminants of concern through extensive water sampling, therefore, monitoring for their presence will be required. The following monitoring activities will be conducted at the site for worker and community protection.

A1.1

Frequency of Monitoring

Particulate dust (nuisance dust) will be monitored at the downwind perimeter of the EZ during the first day of excavation activities. If total particulate levels exceed 5 mg/m³ above background, the responsible excavation activities must be halted, monitoring continued and appropriate corrective action taken. If particulate levels exceed 5 mg/m³, continuous monitoring will be established. All readings will be available for NYSDEC and New York State Department of Health (NYSDOH) personnel to review.

A1.2

Emission Response Plan

If the organic vapor level decreases below 100 µg/m³ greater than the upwind particulate level, dredging/processing activities can resume. The conditions will be discussed with the Engineer and appropriate dust suppression techniques will be employed if deemed necessary. If the organic vapor levels are greater than 100 µg/m³ over background but less than 150 µg/m³ over background at the perimeter of the EZ, excavation activities can resume provided:

- the particulate level 200 ft. downwind of the EZ or half the distance to the nearest residential or commercial structure, whichever is less, is below 100 µg/m³ over background; and
- potential dust generating equipment is scrutinized to determine if additional suppression methods are appropriate.

If the organic vapor level is above 150 µg/m³ at the perimeter of the EZ, work activities must be shutdown. When work shutdown occurs, downwind air monitoring, as directed by the HSC, will be implemented to check that vapor emission does not impact the

nearest residential or commercial structure at levels exceeding those specified in the Major Particulate Emission section below.

Major Particulate Emission

If any organic levels greater than $100 \mu\text{g}/\text{m}^3$ over background are identified 200 ft. downwind from the Survey Site or half the distance to the nearest residential or commercial property, whichever is less, work activities must be halted.

If particulate levels persist greater than $100 \mu\text{g}/\text{m}^3$ above background 200 ft. downwind, or half the distance to the nearest residential or commercial property from the EZ, airborne particulates must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (10 foot zone).

If either of the following criteria is exceeded in the 20 foot zone, then the Major Particulate Emission Response Plan shall be automatically implemented:

- Particulate levels approaching $100 \mu\text{g}/\text{m}^3$ above background for a period of more than 30 minutes.
- Particulate levels greater than $200 \mu\text{g}/\text{m}^3$ above background for any time period.

A1.3

Major Particulate Emission Response Plan

Upon activation, the following activities will be undertaken:

- The local police authorities will immediately be contacted by the HSC and advised of the situation.
- Frequent air monitoring will be conducted at 30 minute intervals within the 20 foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the HSC.
- Emergency contacts will go into effect as appropriate.

APPENDIX B
Spill Prevention Plan

SPILL PREVENTION PLAN

BWE is aware that the potential for spills during this project exists. By recognizing the areas with greatest potential risk and developing ready and clear contingency plans, materials, manpower and equipment needed to respond, the impact of a potential spill can be greatly reduced.

POTENTIAL SOURCES OF SPILLS AND RESPONSE INFORMATION

- Leaking trucks and heavy equipment
- Motor on dredge
- Leaking pipes from dredge to process area.
- Fueling dredge
- Run on from off site areas
- Truck rollovers.

POLLUTION PREVENTION

- Protective boom placed in outfall area.
- Biodegradable oils used in dredge
- Silt fences and positive containment of on site storm water and differentiating off site run off (asphalt tip-up curb)
- Secondary containment (process areas)
- Vehicle and equipment inspection as per New York State Department of Transportation standards.

EMERGENCY CONTACTS

Michael J. Posillico, Project Manager, will be point of first contact to administrate required response. He can be reached by calling:

Office..... (516) 752-2145
Mobile..... (516) 523-0470
Home..... (516) 385-9083

Second respondent, **Thomas R. Spatafora**, General Field Supervisor:

Office..... (516) 752-2145
Mobile..... (516) 523-0565
Home.....(516) 385-5088

ADDITIONAL CONTACTS:

MPC ENVIRONMENTAL SERVICES

(516) 369-4900

Contact: Mr. Jim Davies

Additional notifications may also be made to:

NYSDEC.....(800) 457-7362

USEPA NATIONAL RESPONSE CENTER.....(800) 424-8802

POLICE..... 911

Reporting of any spill will include the following information in accordance with 49 CFR:

- 1) Name and telephone number of person reporting the incident and the time of Coast Guard or NYSDEC notification.
- 2) Name and telephone number of the supervisor on duty and additional respondents called.
- 3) Estimated quantity of material released.
- 4) Extent of contamination.
- 5) Description of incident.

RESPONSE EQUIPMENT (ON-SITE)

- New Holland 665 Skid Steer
- 20 Cubic Yard Sealed Roll-Off Container
- 400 Linear Feet of Floating Containment Boom
- Skid of 6 mil Polyethylene Plastic Sheeting
- Bulk Water Gelling Polymer
- Bulk Oil Absorbent (Speedy Dry)
- Wood Plugs.
- USDOT Emergency Guidebooks.
- Shovels and Brooms.
- Absorbent Towels
- Cellular telephones, Digital Radio Communication
- Spill Control Procedures and Emergency Contact Telephone Numbers.

PERSONNEL PROTECTIVE EQUIPMENT AND SAFETY EQUIPMENT

- Tyvek Coveralls
- Surgical Gloves
- Rubber Protective Gloves
- Rubber Work Boots
- Half and Full Face Masks
- Protective Head Gear
- Emergency Escape Packs
- Protective Eyewear
- Wash Down Area
- Eyewash Station
- First Aid Station
- Fire Extinguishers
- Air Horn

The following represent the activities to be conducted in the event of a spill after notification of regulatory authorities when it is safe to do so:

- Containment of the spill by using absorbent pillows, booms and dikes shall be performed immediately. Priority for containment shall be first to prevent the spill from entering dry wells, drains or surface water.
- Once the spill has been contained, free liquids shall be collected utilizing adsorbent materials or pumps to transfer the material to a secure containment vessel.
- After cleanup of free liquids, all visually contaminated materials, including soil, shall be transferred to appropriate containers. End point sampling shall be performed to insure removal of all contaminated materials.

All responses will be critiqued and followed up by the HSC.

APPENDIX C
Confined Space Entry Program

CONFINED SPACE ENTRY

Confined space means a space that:

- is large enough and so configured that an employee can bodily enter and perform assigned work; and
- has limited or restricted means of entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry; and
- is not designed for continuous employee occupancy.

A permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

- contains or has a potential to contain a hazardous atmosphere;
- contains a material that has the potential for engulfing an entrant;
- has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- contains any other recognized serious safety or health hazard.

Also as defined under 1926.21(6)(ii), a “confined or enclosed space” means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels. Confined spaces will be treated as permit confined spaces until monitoring and evaluation has indicated that it is appropriate to downgrade as designated by the HSC.

For purposes of this plan, confined space and permit required confined space is used interchangeably. Entry into permit confined spaces pose potential health and safety risks due to: a flammable or explosive atmosphere; lack of oxygen to support life; toxic materials; or general safety hazards. The elements of a confined space entry plan have been developed based on the Confined Space Standards at 29 CFR § 1910.146 and guidance provided in EPA's Standard Operating Safety Guides.

General Provisions

- The HSC will be responsible to identify on-site permit required and non-permit required confined spaces.
- If any activities by subBWEs require a confined space entry, it will be the responsibility of that subBWE to appoint a responsible person who will coordinate and monitor the permit confined space entry.
- The HSC will be designated as the entry supervisor and has the responsibility to issue the Confined Space Entry Permit (CSEP), to evaluate and monitor work performed within a confined space for possible hazards, and to determine the safety procedures, personal protective equipment and rescue equipment required.
- When possible, confined spaces should be identified with a posted sign which reads: "Caution - Confined Space - Do Not Enter Unless Authorized".
- Only personnel trained and knowledgeable of the requirements of these Confined Space Entry procedures will be authorized to enter a confined space or be a confined space attendant.
- A CSEP (Exhibit 4) must be issued prior to the performance of any work within a confined space. The CSEP will become part of the permanent and official record of the Site.
- Natural ventilation shall be provided for the confined space prior to initial entry and for the duration of the CSEP. Positive/forced mechanical ventilation may be required to dissipate accumulated gases.
- If flammable liquids may be contained within the confined space, explosion proof equipment will be used. All equipment shall be positively grounded. Technically competent personnel trained in testing methods using an explosive gas detector will test the atmosphere within the confined space. If combustible gases are present, entry will not be allowed until the source has been isolated and the space flushed or purged so that the test indicates less than twenty five percent of the lower explosive limit (LEL).
- The contents of any confined space will, where necessary, be removed prior to entry. All sources of ignition will also be removed prior to entry.
- Hand tools used in confined spaces shall be in good repair, explosion proof and spark proof, and selected according to intended use. Where possible, pneumatic power tools will be used.
- Hand-held lights and other illumination utilized in permit required confined spaces shall be equipped with guards to prevent contact with the bulb and will be explosion-proof.
- Compressed gas cylinders, except cylinders used for self-contained breathing apparatus, shall not be taken into confined spaces. Gas hoses shall be removed from

the 'space and the supply turned off at the cylinder valve when personnel exit from the confined space.

- If a permit required confined space requires respiratory equipment or where rescue may be difficult, safety belts, body harnesses, and lifelines will be used. The outside attendant will be provided with the same equipment as those working within the confined space.
- A ladder is required in all confined spaces deeper than the employee's shoulders. The ladder will be secured and not removed until all employees have exited the space.
- Technically competent personnel (entry supervisor) will use approved oxygen testing equipment to test the atmosphere within the permit required confined space to determine whether the air is respirable and contains sufficient oxygen to support normal consciousness. If the air is found to be oxygen deficient (less than 19.5 percent by volume), positive ventilation techniques, including fans and blowers, will be used to increase the oxygen content.
- Only Mine Safety and Health Administration (MSHA)/National Institute of Occupational Safety and Health (NIOSH)-approved self contained breathing apparatus or airline respirators equipped with a five-minute emergency air supply (egress bottle) will be used in untested confined spaces or in any confined space with conditions determined immediately dangerous to life and health.
- When toxic or chemical materials that could result in injury by contact or inhalation by persons entering the confined space are detected or suspected, several actions will be taken by on-Site personnel. First, any piping that conveys hazardous materials to the confined space will be isolated. Second, the space will be emptied of the hazardous substance until safe limits are reached. Third, adequate ventilation equipment, as well as all other appropriate protective equipment for protection of the eyes, face, and arms will be provided if the work to be done in the confined space includes welding, burning, or heating, which may generate toxic fumes and gases. Finally, all employees entering a confined space that has contained corrosive materials will wear eye and other appropriate protective equipment to prevent possible contact with any remaining corrosive material.
- Where air-moving equipment is used to provide ventilation, chemicals will be removed from the vicinity to prevent introduction into the confined space.
- Vehicles will not be left running near confined space work or near air-moving equipment being used for confined space ventilation.
- Smoking, chewing or eating in confined spaces will be prohibited at all times.
- Deviation from these confined space entry procedures requires the prior permission of the Site Safety Officer.

Procedure for Permit Required Confined Space Entry

A hazard evaluation will be conducted before any work in a confined space is started, to identify existing or potential work area hazards that have the potential to cause injuries, illness or property damage. Examples of work area hazard control items include unguarded openings, high or low temperatures, poor illumination, sharp edges, steam, compressed gases and liquids, flammable or combustible materials, and mechanical or electrical exposures. When dealing with hazards that cannot be eliminated or controlled, adequate PPE will be used. The atmosphere of permit required confined space entry will be monitored for oxygen content, flammability, and toxic gases as indicated in Exhibit 4.

Prior to entry into a confined space, consideration will be given to how life support systems would function in the event of a power failure. For example, in the event of electrical failure, lights, warning systems, and other electrically powered devices would be inoperative. Site personnel will have an emergency plan of action that provides alternate illumination and a means of manual escape from the confined space. No life support systems which are dependent on electrical power will be utilized. The HSC will have communicated alternate sources of light to all employees engaged in work in confined spaces.

Each employee entering a permit required confined space will wear a safety belt equipped with a life-line for evacuation purposes in case of an emergency. If the entry is through a top opening, the safety belt will be of the harness type that will suspend a person in an upright position. Emergency equipment such as life-lines, safety harnesses, fire extinguishers, breathing equipment and other devices appropriate to the situation will be ready and immediately available. All personnel engaged in the activity will be trained in the use of the life support system, rescue system, and emergency equipment. In keeping with the buddy system, at least one person, trained in first aid and respiration, will be immediately available outside the confined space to provide assistance if needed, utilizing a planned and immediately available communications means.

The HSC will complete the Confined Space Entry Checklist (Exhibit 5) prior to a confined space entry.

Confined Space Attendant

While personnel are inside the confined space, a confined space attendant will monitor the activities and provide external assistance to those in the space. The attendant will

have no other duties which may take his/her attention away from the work or require him/her to leave the vicinity of the confined space at any time while personnel are in the space. The confined space attendant will maintain at least voice contact with all personnel in the confined space. Visual contact is preferred, if possible. The attendant will have the means available to contact rescue personnel in the event of an emergency. The attendant has the authority to command entrants to leave the confined space.

CONFINED SPACE ENTRY CHECKLIST

Task Completed	Health and Safety Coordinator Task
	Evaluate the job to be done and identify the potential hazards before the confined space entry job is scheduled. Check all planned entry procedures are consistent with the requirements of 29 CFR 1910 and 1926.
	Check that all process piping, mechanical and electrical equipment, etc., have been disconnected, purged, blanked-off or locked and tagged as necessary.
	If possible, check removal of any standing fluids that may produce toxic or air displacing gases, vapors, or dust.
	Initiate a Confined Space Entry Permit (CSEP).
	Check that any hot work (welding, burning, open flames, or spark producing operation) that is to be performed in the confined space is indicated on the CSEP.
	Check that the space is ventilated before starting work in the confined space and for the duration of the time that the work is to be performed in the space.
	Check that the personnel who enter the confined space and the confined space attendant are familiar with the contents and requirements of the confined space entry procedure.
	<p>Check remote atmospheric testing of the confined space prior to employee entry and before validation/revalidation of a CSEP to check the following:</p> <ul style="list-style-type: none"> • oxygen content between 19.5% and 23.0% • no concentration of combustible gases in the space. Sampling will be done throughout the confined space and specifically at the lowest point in the space. • the absence of other atmospheric contaminants, if the space has contained toxic, corrosive, or irritant material. • if remote testing is not possible, Level B personal protective equipment is required.
	Designate whether hot or cold work will be allowed
	Check that a copy of the CSEP is posted at the work site
	Cancel the permit upon completion of the task.

Appendix D:
Occupational Safety And Health Guideline For Hydrochloric Acid
(amended to HASP 2/02)

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR HYDROCHLORIC ACID

INTRODUCTION

This guideline summarizes pertinent information about hydrochloric acid for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine whether new information is available.

SUBSTANCE IDENTIFICATION

* Formula : HCl

* Synonyms : Anhydrous hydrochloric acid, hydrochloride, muriatic acid, spirits of salt, hydrochloric acid, chlorohydric acid, emulsion bowl cleaner

* Identifiers :

1. CAS No.: 7647-01-0
2. RTECS No.: MW4025000
3. DOT UN: 1050 15
4. DOT label: Poison gas, corrosive

* Appearance and odor

Hydrochloric acid is a colorless to slightly, yellow gas with an irritating, pungent odor. The air odor threshold concentration for hydrochloric acid has been reported as 0.77 part per million (ppm) parts of air.

CHEMICAL AND PHYSICAL PROPERTIES

* Physical data

1. Molecular weight: 36.46
2. Boiling point (at 760 mm Hg): -85.05 degrees C (-121.09 degrees F)
3. Specific gravity: 1.187 at -84.9 degrees C (-120.82 degrees F)
4. Vapor density: 1.268
5. Melting point: -114.2 degrees C (-173.6 degrees F)
6. Vapor pressure at 20 degrees C (68 degrees F): Greater than 1 mm Hg
7. Solubility: Soluble in water, alcohol, benzene, and ether.
8. Evaporation rate: Data not available.

* Reactivity

1. Conditions contributing to instability: None reported.
2. Incompatibilities: Contact between hydrochloric acid and hydroxides, amines, alkalis, or metals, such as copper, brass, zinc, potassium, and sodium should be avoided.

3. Hazardous decomposition products: Toxic gases and vapors such as chlorine may be released in a fire involving hydrochloric acid.
4. Special precautions: None reported.

*** Flammability**

Hydrochloric acid is a nonflammable gas.

The National Fire Protection Association has assigned a flammability rating of 0 (minimal fire hazard) to hydrochloric acid.

1. Flash point: Not applicable.
2. Autoignition temperature: Not applicable.
3. Flammable limits in air: Not applicable.
4. Extinguishant: For small fires use dry chemical or carbon dioxide. Use water spray, fog, or regular foam to fight large fires involving hydrochloric acid.

Fires involving hydrochloric acid should be fought upwind from the maximum distance possible. Keep unnecessary people away; isolate the hazard area and deny entry. Isolate the leak or spill area for at least 150 feet in all directions, until gas has dispersed. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Containers of hydrochloric acid may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool fire exposed containers from the sides with water until well after the fire is out. Do not get water inside the containers. Stay away from the ends of containers. Firefighters should wear a full set of chemical protective clothing and self-contained breathing apparatus when fighting fires involving hydrochloric acid.

EXPOSURE LIMITS

*** OSHA PEL**

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit(s) (PEL[s]) for hydrochloric acid is 5 ppm (7 milligrams per cubic meter (mg/m³)) as a ceiling limit. A worker's exposure to hydrochloric acid shall at no time exceed this ceiling level [29 CFR 1910.1000, Table Z-1].

*** NIOSH REL**

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for hydrochloric acid of 5 ppm (7 mg/m³)) as a ceiling .

*** ACGIH TLV**

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned hydrochloric acid a ceiling limit value of 5 ppm (7.5 mg/m³), which should not be exceeded during any part of the working exposure.

*** Rationale for Limits**

The NIOSH limit is based on the risk of eye, mucous membrane, and skin irritation.

The ACGIH limit is based on the risk of acute irritation.

HEALTH HAZARD INFORMATION

* Routes of Exposure

Exposure to hydrochloric acid can occur through inhalation, ingestion, and eye or skin contact.

* Summary of toxicology

1. Effects on Animals: Hydrochloric acid is a severe irritant of the eyes and respiratory system. The 30-minute LC(50)s in rats and mice and 4,701 ppm and 2,644, respectively. Animals exposed to high concentrations of hydrochloric acid gas developed necrosis of the tracheal and bronchial epithelium; pulmonary edema, atelectasis, and emphysema; and damage to the pulmonary blood vessels and liver. Chronic exposure to 10 ppm for 6 hours/day for life did not cause neoplastic lesions or serious irritant effects in the nasal epithelium of rats. In experimental animals, exposure to a concentration of 1,350 ppm hydrochloric acid gas caused clouding of the cornea after 1.5 hours and exposure to 3,000 ppm for 6 hours caused slight erosion of the corneal epithelium. Exposure to 100 ppm for 6 hours daily for 50 days caused only slight irritation of the eyes, but no permanent injury. Hydrochloric acid is mildly toxic by ingestion; the oral LD(50) in rabbits is 900 mg/kg. Hydrochloric acid is injurious to the rabbit eye only at concentrations having an acidity below pH 3. Contact of the eye with 0.25N to 1N acid for 20 seconds resulted in some scarring of rabbit corneas; in rare instances, opacities of the lens have been produced by splashes of the acid. Hydrochloric acid has produced mutagenic effects in bacterial and insect test systems.

2. Effects on Humans: Hydrochloric acid is irritating and corrosive to the eyes, skin, and mucous membranes. Exposure to high concentrations can cause laryngitis, bronchitis, and pulmonary edema. Brief exposures (up to a few minutes) to concentrations in the range of 1,300 to 2,000 ppm are lethal to humans. In workers, exposure to 50 to 100 ppm for 1 hour was barely tolerable; short exposure to 35 ppm caused irritation of the throat, and 10 ppm was considered the maximal concentration allowable for prolonged exposure. In one study, workers chronically exposed to hydrochloric acid did not exhibit the pulmonary function changes observed in nine subjects exposed to similar concentrations, which suggests that workers become acclimatized to hydrochloric acid. Dental discoloration and erosion of exposed incisors may occur on prolonged exposure to low concentrations. Hydrochloric acid causes burns of the skin and mucous membranes; the severity of the burns depends on the concentration of the solution. Burns may progress to ulcerations and lead to keloid and retractile scarring. Frequent contact of the skin with aqueous solution may cause dermatitis. Contact of the eyes with aqueous solutions may produce reduced vision or blindness. Ingestion of hydrochloric acid causes severe burns of the mouth, esophagus, and stomach, with consequent pain, nausea, and vomiting.

* Signs and symptoms of exposure

1. Acute exposure: Acute exposure to hydrochloric acid vapor or aerosol produces inflammation and may cause ulceration of the nose, throat, and larynx; laryngeal spasm or pulmonary edema may occur on rare occasions. Eye and skin burns occur at high concentrations. Burns of the skin and mucous membranes result from contact with the solution. Frostbite may occur from contact with the cryogenic liquid. Both the gas and solutions of hydrochloric acid may cause eye irritation, severe burns, and permanent damage with loss of sight. Ingestion causes corrosion of

the mucous membranes, esophagus, and stomach; dysphagia; nausea; vomiting; intense thirst; and diarrhea. Circulatory collapse and death may follow.

2. Chronic exposure: Chronic exposure by skin contact with aqueous solutions may result in dermatitis and photosensitization. Dental discoloration and erosion of exposed incisors may occur on prolonged exposure to low concentrations of hydrochloric acid.

EMERGENCY MEDICAL PROCEDURES

* Emergency medical procedures:

Rescue: Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the Material Safety Data Sheet required by OSHA's Hazard Communication Standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures, the location and proper use of emergency equipment, and methods of protecting themselves during rescue operations.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve hydrochloric acid and lead to worker exposures to this substance:

- * The manufacture and transportation of hydrochloric acid
- * Use as a catalyst or chlorinating agent in chemical synthesis; during metal treatment and fabricating operations in electroplating, acid dipping, stripping, electropolishing, etching, welding, and flamecutting of metal primed with paint or cleaned with chlorinated hydrocarbons; as a gaseous flux in babbiting
- * Use in industrial chemical cleaning operations
- * Use in activation of petroleum wells; in waste treatment operations for neutralization of alkaline waste streams
- * Use in removing scale from boilers and heat-exchange equipment, as a laboratory reagent, an alcohol denaturant

Methods that are effective in controlling worker exposures to hydrochloric acid, depending on the feasibility of implementation, are as follows:

- * Process enclosure
- * Local exhaust ventilation
- * General dilution ventilation
- * Personal protective equipment

Workers responding to a release or potential release of a hazardous substance must be protected as required by paragraph (q) of OSHA's Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120].

MEDICAL SURVEILLANCE

OSHA is currently developing requirements for medical surveillance. When these requirements are promulgated, readers should refer to them for additional information and to determine whether employers whose employees are exposed to hydrochloric acid are required to implement medical surveillance procedures.

*** Medical Screening**

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical surveillance program is intended to supplement, not replace, such measures. To detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

*** Preplacement medical evaluation**

Before a worker is placed in a job with a potential for exposure to hydrochloric acid, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, and respiratory system. Medical surveillance for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society.

A preplacement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to hydrochloric acid at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the eyes, skin, and respiratory system.

*** Periodic medical evaluations**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to hydrochloric acid exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of hydrochloric acid on the eyes, skin, and respiratory system. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

*** Termination medical evaluations**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

*** Biological monitoring**

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for hydrochloric acid.

WORKPLACE MONITORING AND MEASUREMENT

Determination of a worker's exposure to airborne hydrochloric acid is made using a treated silica gel tube. Samples are collected at a maximum flow rate of 0.5 liter/minute (ceiling) until a minimum collection volume of 2.5 liters is reached. Analysis is conducted by ion chromatography. This method is partially validated and is described in the OSHA Computerized Information System and in NIOSH Method No. 7903 (inorganic acids).

PERSONAL HYGIENE PROCEDURES

If hydrochloric acid contacts the skin, workers should flush the affected areas immediately with plenty of water, followed by washing with soap and water.

Clothing contaminated with hydrochloric acid should be removed immediately, and provisions should be made for the safe removal of the chemical from the clothing. Persons laundering the clothes should be informed of the hazardous properties of hydrochloric acid, particularly its potential for causing irritation.

A worker who handles hydrochloric acid should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, using toilet facilities, applying cosmetics, or taking medication.

Workers should not eat, drink, use tobacco products, apply cosmetics, or take medication in areas where hydrochloric acid or a solution containing hydrochloric acid is handled, processed, or stored.

STORAGE

Hydrochloric acid should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's Hazard Communication Standard [29 CFR 1910.1200]. Containers of hydrochloric acid should be protected from physical damage and should be stored separately from hydroxides, amines, alkalis, or metals, such as copper, brass, zinc, potassium, and sodium.

SPILLS AND LEAKS

In the event of a spill or leak involving hydrochloric acid, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

1. Notify safety personnel.
2. Remove all sources of heat and ignition.
3. Ventilate the area of the spill or leak.

4. Stop leak if this can be done without risk. If the source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
5. All spills on land involving liquid hydrochloric acid or hydrochloric acid should be contained, if possible, to prevent entry into bodies of water or sewer systems. Vapors can be dispersed with water fog or spray. Do not put water directly on leak or spill area.
6. Neutralize spills with crushed limestone, soda ash, lime, or sodium bicarbonate. After neutralizing, take up with sand or other noncombustible absorbent material and place into closed containers for later disposal.
7. For large liquid spills, build dikes far ahead of the spill to contain the hydrochloric acid for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

*** Emergency planning requirements**

Employers owning or operating a facility at which there are 500 pounds or more of hydrogen chloride (gas only) must comply with EPA's emergency planning requirements [40 CFR Part 355.30].

*** Reportable quantity requirements for hazardous releases**

A hazardous substance release is defined by EPA as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of contaminated containers) of hazardous substances. In the event of a release that is above the reportable quantity for that chemical, employers are required to notify the proper Federal, State, and local authorities [40 CFR 355.40].

The reportable quantity of hydrochloric acid is 5,000 pounds. If an amount equal to or greater than this quantity is released within a 24- hour period in a manner that will expose persons outside the facility, employers are required to do the following: - Notify the National Response Center immediately at (800) 424-8802 or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].

- Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].

- Notify the community emergency coordinator to the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

*** Community right-to-know requirements**

Employers who own or operate facilities in SIC codes 20 to 39 that employ 10 or more workers and that manufacture 25,000 pounds or more of hydrochloric acid per calendar year or otherwise use 10,000 pounds or more of hydrochloric acid per calendar year are required by EPA [40 CFR Part 372.30] to submit a Toxic Chemical Release Inventory form (Form R) to EPA reporting the amount of hydrochloric acid emitted or released from their facility annually.

- **Hazardous waste management requirements**

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Under the Resource Conservation and Recovery Act (RCRA), EPA has specifically listed many chemical wastes as hazardous. Although hydrochloric acid is not specifically listed as a hazardous waste under RCRA, EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (703) 412-9810 (in the Washington, D.C. area) or toll-free at (800) 424-9346 (outside Washington, D.C.). In addition, relevant State and local authorities should be contacted for information on any requirements they may have for the waste removal and disposal of this substance.

RESPIRATORY PROTECTION

- * **Conditions for respirator use**

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of hydrochloric acid exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should only use respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

- * **Respiratory protection program**

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's Respiratory Protection Standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the latest edition of the NIOSH Respirator Decision Logic and the NIOSH Guide to Industrial Respiratory Protection.

PERSONAL PROTECTIVE EQUIPMENT

Workers should use appropriate personal protective clothing and equipment that must be carefully selected, used, and maintained to be effective in preventing skin contact with hydrochloric acid. The selection of the appropriate personal protective equipment (PPE) (e.g., gloves, sleeves, encapsulating suits) should be based on the extent of the worker's potential

exposure to hydrochloric acid. The resistance of various materials to permeation by hydrochloric acid is shown below:

Material Breakthrough time (hr) :

Butyl Rubber >8

Teflon >8

Saranex >8

Barricade >8

Responder >8

Polyvinyl Chloride >4

Polyethylene <1(*)

(*) Not recommended, degradation may occur

To evaluate the use of these PPE materials with hydrochloric acid, users should consult the best available performance data and manufacturers' recommendations. Significant differences have been demonstrated in the chemical resistance of generically similar PPE materials (e.g., butyl) produced by different manufacturers. In addition, the chemical resistance of a mixture may be significantly different from that of any of its neat components.

Any chemical-resistant clothing that is used should be periodically evaluated to determine its effectiveness in preventing dermal contact. Safety showers and eye wash stations should be located close to operations that involve hydrochloric acid.

Splash-proof chemical safety goggles or face shields (20 to 30 cm long, minimum) should be worn during any operation in which a solvent, caustic, or other toxic substance may be splashed into the eyes.

In addition to the possible need for wearing protective outer apparel (e.g., aprons, encapsulating suits), workers should wear work uniforms, coveralls, or similar full-body coverings that are laundered each day. Employers should provide lockers or other closed areas to store work and street clothing separately. Employers should collect work clothing at the end of each work shift and provide for its laundering. Laundry personnel should be informed about the potential hazards of handling contaminated clothing and instructed about measures to minimize their health risk.

Protective clothing should be kept free of oil and grease and should be inspected and maintained regularly to preserve its effectiveness.

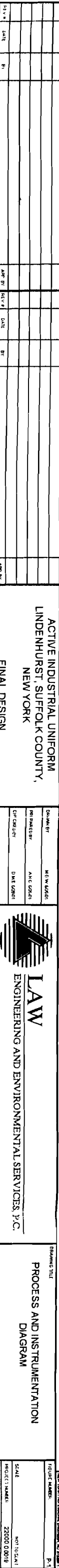
Protective clothing may interfere with the body's heat dissipation, especially during hot weather or during work in hot or poorly ventilated work environments.

Health and Safety Plan Ammendment
Additional Health and Safety Issues Associated with System Operation
Active Industrial Uniform Site, Lindenhurst, NY

The health and safety plan developed by Bluewater in August 2000 is still in effect for this site. All emergency phone numbers and evacuation routes are contained within the Bluewater Plan. This is meant to be a suppliment to the Bluewater Plan, and contains additional issues to be considered once the system has been started up.

Issue of Concern	Corrective Action
Moving Parts, Gears and Belts	Never operate equipment without machine guards securely in place. Always wear proper PPE (hard hat, steel toe boots, eye protection). Lock Out and Tag Prior to Servicing. All on site employees should be aware of equipment function and familiar with the manuals.
High Pressure Tanks and Pipes	Drain/Release all pressurized equipment prior to servicing. Lock Out and Tag Prior to Servicing. Always wear proper PPE (hard hat, safety glases).
Vapor Accumulation in Building	Maintain proper ventilation within closed areas. Monitor ambient air space each work day. Have an evacuation route planned in case of high vapor concentrations.
Caustic Materials (Acid Tank)	Maintain clearly visible labels on appropriate items. Always wear proper PPE (eye and skin protection). Do not allow materials to come in direct contact with skin. Know the location and function of the safety shower and eyewash in case of emergency
Electrical Hazards	Assure proper grounding of all electrical equipment. Keep water a safe distace away from all electrical equipment Always wear proper PPE (rubber sole boots).
Fire Hazards	Maintain a recently serviced accessible fire extinguisher. Check cutoff switches where overheating is possible.
Slips, Trips and Falls	Be aware of the hazards around you. Any unsafe surfaces or areas should be documented and corrected.
Vehicle Traffic	Wear proper PPE (safety vest, hard hat, steel toe boots)

Appendix C
Record Drawings and Valve Schedule



DRAWING TITLE <h1>PROCESS AND INSTRUMENTATION DIAGRAM</h1>	PROJECT NUMBER 220006 0.00018	SHEET NO. 1 OF 1 PROJECT NAME 220006 0.00018	SHEET NO. 1 OF 1 PROJECT NAME 220006 0.00018
		SHEET NO. 1 OF 1 PROJECT NAME 220006 0.00018	SHEET NO. 1 OF 1 PROJECT NAME 220006 0.00018

Cartridge Filter Bypass																
No.	Size	Material	End Connections	Matrix	Location	Series	ST-1 only	ST-2 only	Series Regen	ST-1 Regen w/ ST-2 in operation	ST-2 Regen w/ ST-1 in operation	ST-1 Regen only	ST-2 Regen only	Series/ST-2 only	ST-1 only	Acid Tank Filling
BV-1	3"	PVC	Solvent Weld	Water	RW-1 extraction pipe (in well vault)	O	O	O	O	O	O	O	O	NA	NA	NA
BV-2	3"	PVC	Solvent Weld	Water	RW-2 extraction pipe (in well vault)	O	O	O	O	O	O	O	O	NA	NA	NA
BV-3	3"	PVC	Solvent Weld	Water	RW-1 extraction pipe header (in building)	O	O	O	CL	O	O	NA	NA	NA	NA	NA
BV-4	3"	PVC	Solvent Weld	Water	RW-2 extraction pipe header (in building)	O	O	O	CL	O	O	NA	NA	NA	NA	NA
BV-5	3"	PVC	Solvent Weld	Water	Extra connection for spare Recovery Well	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	NA
BV-6	1.5"	PVC	Solvent Weld	Water	P-5 discharge pipe	O	O	O	O	O	O	O	O	NA	NA	NA
BV-7	1.5"	PVC	Solvent Weld	Water	Before 4" reducer from P-5, at PVC cross	O	O	O	CL	O	O	O	O	NA	NA	NA
BV-8	1.5"	PVC	Solvent Weld	Water	Before 4" reducer from P-4, at PVC cross	O	O	O	NA	O	O	NA	NA	NA	NA	NA
BV-9	4"	PVC	Solvent Weld	Water	ST-1 bypass line to ST-2	CL	CL	O	CL	O	CL	NA	CL	NA	NA	NA
BV-10	4"	PVC	Solvent Weld	Water	In-line from RW-1/RW-2 to ST-1/ST-2	O	O	CL	CL	CL	O	CL	NA	NA	NA	NA
BV-11	4"	PVC	Solvent Weld	Water	Acid line, at T-4	CL	CL	NA	O	O	CL	O	CL	NA	NA	NA
BV-12	4"	PVC	Solvent Weld	Water	Suction pipe to P-1 from ST-1, inside building	O	O	NA	O	O	O	O	NA	NA	O	NA
BV-13	4"	PVC	Solvent Weld	Water	ST-2 bypass line to storm sewer connection	CL	O	NA	CL	CL	O	CL	NA	NA	CL	NA
BV-14	4"	PVC	Solvent Weld	Water	After T-5, flow to ST-2 from P-1	O	CL	NA	O	O	CL	CL	CL	NA	CL	NA
BV-15	4"	PVC	Solvent Weld	Water	Before T-7, flow to ST-2 from P-1	O	NA	CL	O	CL	O	CL	CL	NA	NA	NA
BV-16	4"	PVC	Solvent Weld	Water	At T-8, on acid line connecting to ST-2	CL	NA	CL	CL	CL	O	CL	O	NA	NA	NA
BV-17	4"	PVC	Solvent Weld	Water	Suction pipe to P-2 from ST-2, inside building	O	NA	O	O	O	O	NA	O	NA	NA	NA
BV-18	4"	PVC	Solvent Weld	Water	P-2 discharge pipe, before T-10	O	NA	O	O	O	O	CL	O	NA	NA	CL
BV-19	4"	PVC	Solvent Weld	Water	Between T-8 and T-10, on acid tank inlet pipe	CL	NA	CL	O	CL	O	CL	O	NA	NA	NA
BV-20	4"	PVC	Solvent Weld	Water	Between T-10 and T-11, flow to the cartridge filter system	O	CL	O	CL	O	CL	NA	CL	NA	O	NA
BV-21	4"	PVC	Solvent Weld	Water	Between T-11 and T-12	CL	O	CL	NA	CL	O	NA	NA	O	CL	NA
BV-22	4"	PVC	Solvent Weld	Water	Between T-12 and T-13	CL	CL	CL	NA	CL	CL	NA	NA	O	O	NA
BV-23	4"	PVC	Solvent Weld	Water	Disposal pipe from acid tank	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	CL
BV-24	4"	PVC	Solvent Weld	Water	Discharge pipe from acid tank	CL	CL	CL	O	O	O	O	O	NA	NA	CL
BV-25	4"	PVC	Solvent Weld	Water	After T-15, suction pipe to P-3	CL	CL	CL	O	O	O	O	O	NA	NA	CL
BV-26	4"	PVC	Solvent Weld	Water	P-3 discharge pipe	CL	CL	CL	O	O	O	O	O	NA	NA	NA
BV-27	2"	PVC	Solvent Weld	Water	Acid drum pump connection port	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	O
BV-28	2"	Bronze	Soldered	Pot. Water	Portable water line	O	O	O	O	O	O	O	O	NA	NA	O
BV-29	1"	PVC	Solvent Weld	Water	Drain port on Cartridge filter system	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	NA
BV-30	1.5"	PVC	Solvent Weld	Water	Suction pipe to P-4/discharge from knock-out tank	O	O	O	NA	O	O	NA	NA	NA	NA	NA
BV-31	4"	PVC	Solvent Weld	Water	At T-6, flow to acid tank from P-1	CL	NA	NA	CL	O	CL	O	CL	NA	NA	NA
BV-32	4"	PVC	Solvent Weld	Water	Discharge from cartridge filter system to storm sewer	O	O	O	CL	O	O	CL	CL	NA	NA	NA
BV-33	1"	Bronze	Hose Bib	Water	Drain port on ST-2	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	NA
BV-34	1"	Bronze	Hose Bib	Water	Drain port on ST-1	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	NA
BV-35	8"	PVC	Solvent Weld	Air	ST-1 bypass air pipe, between T-17 and T-18	CL	CL	O	CL	O	CL	CL	O	NA	NA	NA
BV-36	8"	PVC	Solvent Weld	Air	ST-1 air discharge pipe, before T-18	O	O	CL	CL	CL	O	CL	NA	NA	NA	NA
BV-37	0.25"	PVC	Solvent Weld	Air	High pressure alarm indicator, ST-2	O	NA	O	CL	O	CL	NA	CL	NA	NA	NA
BV-38	0.25"	PVC	Solvent Weld	Air	High pressure alarm indicator, ST-2	O	NA	O	CL	O	CL	NA	CL	NA	NA	NA
BV-39	0.25"	PVC	Solvent Weld	Air	High pressure alarm indicator, ST-1	O	O	NA	CL	CL	O	CL	NA	NA	NA	NA
BV-40	0.25"	PVC	Solvent Weld	Air	High pressure alarm indicator, ST-1	O	O	NA	CL	CL	O	CL	NA	NA	NA	NA
BV-41	2"	Bronze	Soldered	Pot. Water	Portable water line connection to Acid tank	CL	CL	CL	CL	CL	CL	CL	CL	NA	NA	O
GLV-1	3"	PVC	Flanged	Water	RW-1 extraction pipe header (in building)	O	O	O	O	O	O	O	O	NA	NA	NA
GLV-2	3"	PVC	Flanged	Water	RW-2 extraction pipe header (in building)	O	O	O	O	O	O	O	O	NA	NA	NA
GLV-3	4"	PVC	Flanged	Water	P-1 discharge pipe	O	O	NA	O	O	O	O	O	NA	NA	NA
GLV-4	4"	PVC	Flanged	Water	P-2 discharge pipe	O	NA	O	O	O	O	NA	O	CL	CL	NA
GLV-5	4"	PVC	Flanged	Water	Cartridge filter inlet	O	O	O	CL	O	O	NA	NA	CL	CL	NA
GLV-6	4"	PVC	Flanged	Water	Cartridge filter discharge	O	O	O	NA	O	O	NA	CL	NA	NA	NA
BFV-1	8"	PVC	Flanged	Air	ST-2 air inlet	O	CL	O	CL	O	CL	CL	CL	NA	NA	NA
BFV-2	8"	PVC	Flanged	Air	ST-1 air inlet	O	CL	CL	CL	CL	CL	CL	CL	NA	NA	NA
BFV-3	8"	PVC	Flanged	Air	Blower discharge	O	O	O	O	O	O	O	O	NA	NA	NA
BFV-4	8"	PVC	Flanged	Air	ST-2 air bypass, "ST-1 only" operation	CL	O	CL	CL	O	CL	O	NA	NA	NA	NA
CV-1	3"	PVC	Solvent Weld	Water	RW-1 extraction pipe header (in building)											
CV-2	3"	PVC	Solvent Weld	Water	RW-2 extraction pipe header (in building)											
CV-3	4"	PVC	Solvent Weld	Water	P-1 discharge pipe											
CV-4	4"	PVC	Solvent Weld	Water	P-2 discharge pipe											
CV-5	4"	PVC	Solvent Weld	Water	ST-1 bypass line to ST-2											
CV-6	1.5"	PVC	Solvent Weld	Water	From P-4 to PVC cross											
CV-7	4"	PVC	Solvent Weld	Water	P-3 discharge pipe											
CV-8	1.5"	PVC	Solvent Weld	Water	P-5 discharge pipe											
CV-9	1.5"	PVC	Solvent Weld	Water	P-5 discharge pipe											

Abbreviations Table:

BV	Ball valve	BFV	Butterfly Valve	GLV	Globe valve	CV	Check valve	ST	Stripper tower	P	Transfer pump	RW	Recovery well	PVC	Poly-vinyl chloride
----	------------	-----	-----------------	-----	-------------	----	-------------	----	----------------	---	---------------	----	---------------	-----	---------------------

Appendix D
Manufacturer's Equipment Manuals

1. Recovery Well Pumps
 - Extraction Well Pump
 - RW-2 Extraction Pump Substitution
 - Stainless Steel Submersible Pump
2. Air Stripper Towers and GAC Filters
 - Air Stripper Tower Submittal
 - Air Stripper Tower Addendum
 - Air Stripper Guy Wire Components
 - Vapor Phase GAC Off Gas Treatment System
 - Harmsco Industrial Filter
 - Piping Appurtenance – Harmsco Cartridge Filter
3. Air Stripper Blower
 - Pressure Blowers – Cincinnati Fan
 - Tower Air Stripping System Blower Skid
4. Transfer Pumps
 - Building Sump Pump
 - Centrifugal Pump Re-Submittal
 - Zoeller Pump Company
 - Goulds Centrifugal Pump Model NPE/NPE-F
 - Texel Magnetic Drive Pump
 - US Motors
5. Control Equipment
 - Process Instrumentation and controls
 - Auto Dialer Control Manual
 - Magneoflow Electromagnetic Flow Meter
 - Anderson Series H3 Pressure Switch
 - Mercoird Series 1000 Pressure Switch
 - Anderson Flotech Vane Operated Flow Switch
6. Miscellaneous
 - Heating and Ventilation system calculations and components
 - Backdraft Dampers
 - Gas Unit Heater
 - Dayton Belt Drive Axial Roof Ventilator
 - Rolling Steel Door
 - Rolling Service Door
 - Extraction Well Seals
 - Sink Faucets
 - Safety Shower
 - Acid Recirculation Tank Installation and Re-Submittal

11319-01-B
EXTRACTION WELL PUMPS RE-SUBMITTAL

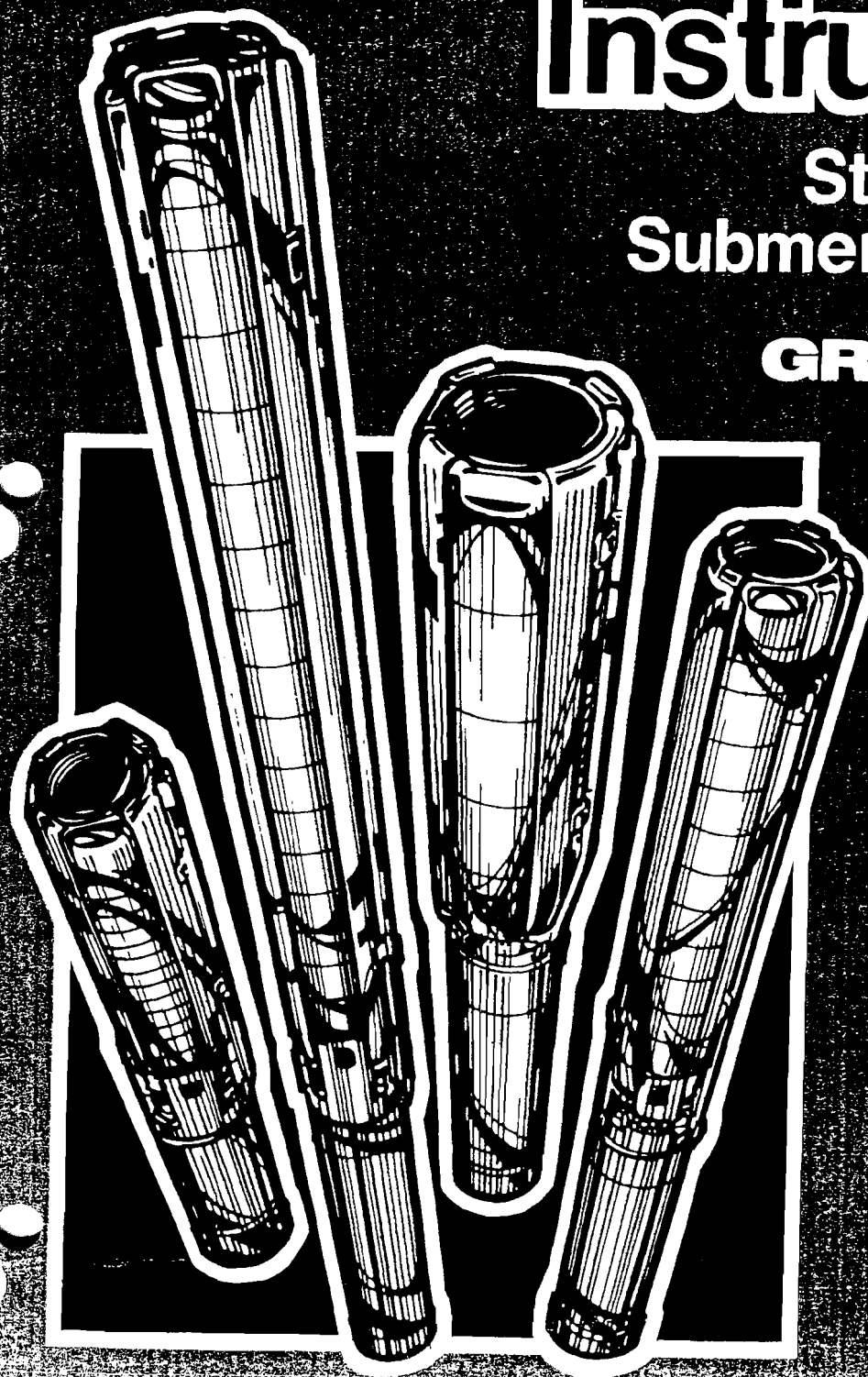
Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

TEFLON FITTED
BY
PUMPS OF OKLAHOMA
OKLAHOMA CITY
(405) 235-2695 • FAX (405) 235-9897

Installation and Operating Instructions

**Stainless Steel
Submersible Pumps**

GRUNDFOS 



1. Shipment
Inspection
■ Page 1

2. Pre-Installation
Checklist
■ Page 1

3. Wire Cable
Type
■ Page 2

4. Splicing the
Motor Cable
■ Page 2

5. Installation
■ Page 3

6. Electrical
■ Page 4

7. Start-up
■ Page 6

8. Trouble-
shooting
■ Page 7

9. Technical
Data
■ Page 10

Please leave these instructions

Installation and Operating Instructions

TABLE OF CONTENTS

SECTION 1	
Shipment Inspection	Page 1
SECTION 2	
Pre-Installation Checklist	Page 1
SECTION 3	
Wire Cable Type	Page 2
SECTION 4	
Splicing the Motor Cable	Page 2
SECTION 5	
Installation	Page 3
SECTION 6	
Electrical	Page 4
Engine Driven Generators	4
Control Box / Panel Wiring	4
High Voltage Surge Arresters	5
Control Box / Panel Grounding	5
Wiring Checks and Installation	5
SECTION 7	
Start-Up	Page 6
Three-Phase Motors	6
Developing the Well	6
Operation	7
SECTION 8	
Troubleshooting	Page 7
Preliminary Tests	7
Troubleshooting Chart	8
SECTION 9	
Technical Data	Page 10

Installation and Operation Instructions

GRUNDFOS STAINLESS STEEL SUBMERSIBLE PUMPS

Your Grundfos Submersible Pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

SECTION 1.

Shipment Inspection

Examine the components carefully to make sure no damage has occurred to the pump-end, motor, cable or control box during shipment.

This Grundfos Submersible Pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage. During unpacking and prior to installation, **make sure that the pump is not dropped or mishandled.**

The motor is equipped with an electrical cable. **Under no circumstance should the cable be used to support the weight of the pump.**

You will find a loose data plate wired to the pump. It should be securely mounted at the well or attached to the control box.

SECTION 2.

Pre-Installation Checklist

Before beginning installation, the following checks should be made. They are all critical for the proper installation of this submersible pump.

☒ **A. CONDITION OF THE WELL**

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. The stainless steel construction of the Grundfos submersible make it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy water.

If this pump is used to replace an oil-filled submersible or oil-lubricated line-shaft turbine in an existing well, **the well must be blown or bailed clear of oil.**

Determine the maximum depth of the well, and the draw-down level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

☒ **B. CONDITION OF THE WATER**

Submersible pumps are designed for pumping clear and cold water that is free of air and gases. Decreased pump performance and life expectancy can occur if the water is not cold and clear or contains air and gases.

Maximum water temperature should not exceed 102°F. Special consideration must be given to the pump and motor if it is to be used to pump water above 102°F.

The Grundfos stainless steel submersible is highly resistant to the normal corrosive environment found in some water wells. If water well tests determine the water has an excessive or unusual corrosive quality, or exceeds 102°F, contact your Grundfos representative for information concerning specially designed pumps for these applications.

☒ **C. INSTALLATION DEPTH**

A check should be made to ensure that the installation depth of the pump will always be at least three feet below the maximum draw-down level of the well. For flow rates exceeding 100 gpm, the NPSH may have to be considered. Refer to NPSH curves in the technical brochure.

The bottom of the motor should never be installed lower than the top of the well screen or within five feet of the well bottom.

If the pump is to be installed in a lake, pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in Table A.

☒ **D. ELECTRICAL SUPPLY**

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual

SECTION 3.

Wire Cable Type

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor may be solid or stranded. The cable may consist of individually insulated conductors twisted together, insulated conductors molded side by side in one flat cable or insulated conductors with a round overall jacket.

The conductor insulation should be type RW, RUW, TW, TWU or equivalent and must be suitable for use with submersible pumps. An equivalent Canadian Standards Association certified wire may also be used. See Table D for recommended sizes of cable lengths.

SECTION 4.

Splicing the Motor Cable

A good cable splice is critical to proper operation of the submersible pump and must be done with extreme care.

If the splice is carefully made, it will work as well as any other portion of the cable, and will be completely watertight.

Grundfos recommends using a heat shrink splice kit. The splice should be made in accordance with the kit manufacture's instructions. Typically a heat shrink splice can be made as follows:

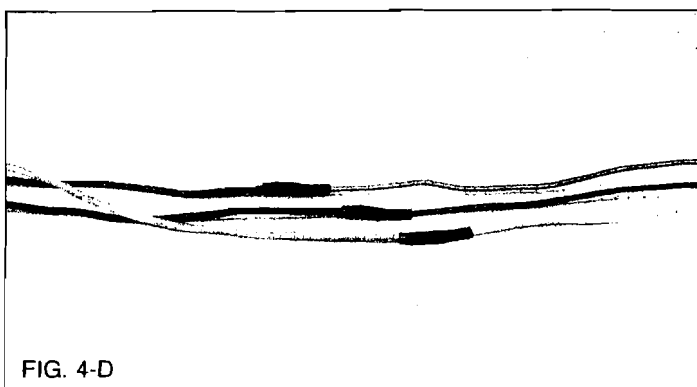
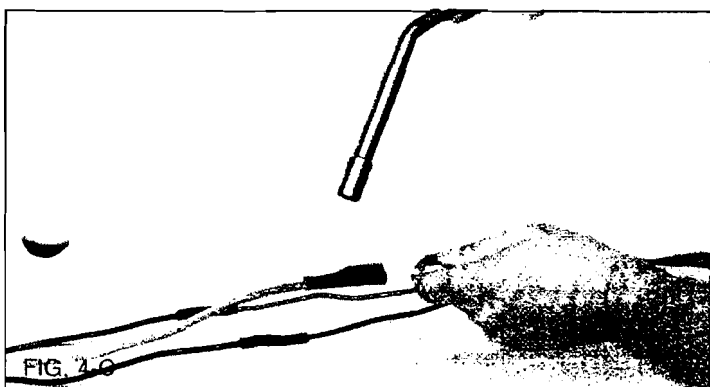
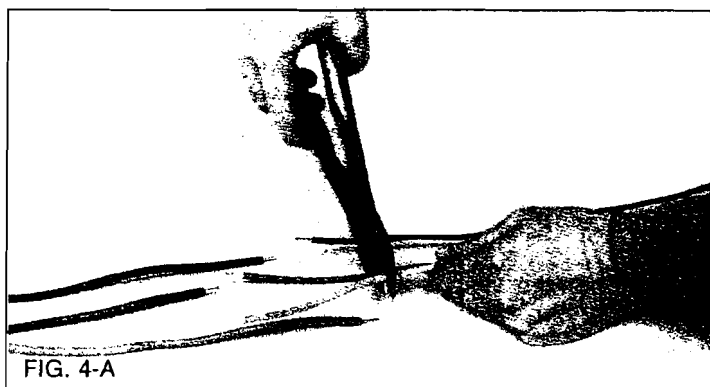
1. Examine the motor cable and the drop cable carefully for damage.
2. Cut the motor leads off in a staggered manner. Cut the end of the drop cable so that the ends match up with the motor leads (See Figure 4-A). On single-phase motors, be sure to match the colors.
3. Strip back and trim off ½ inch of insulation from each lead, making sure to scrape the wire bare to obtain a good

connection. Be careful not to damage the copper conductor when stripping off the insulation.

4. Slide the heat shrink tubing on to each lead. Insert a properly sized "Sta-kon" type connector on each lead, making sure that lead colors are matched. Using a "Sta-kon" crimping pliers, indent the lugs (Figure 4-B). Be sure to squeeze hard on the pliers, particularly when using large cable.

5. Center the heat shrink tubing over the connector. Using a propane torch, lighter, or electric heat gun, uniformly heat the tubing starting first in the center working toward the ends (Figure 4-C).

6. Continue to apply the heat to the tubing using care not to let the flame directly contact the tubing. When the tubing shrinks and the sealant flows from the ends of the tubing, the splice is complete (Figure 4-D).



SECTION 5.

Installation

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

A back-up wrench should be used when the riser pipe is attached to the pump. The pump should be gripped only by the flats on the top of the discharge chamber. **The body of the pump, cable guard or motor should not be gripped under any circumstance.**

If Steel Riser Pipe is Used:

We recommend that steel riser pipes always be used with the larger submersibles. An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.** When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump-end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above and below the splice.

If Plastic or Flexible Riser Pipe is Used:

It is recommended that plastic type riser pipe be used **only** with the smaller domestic submersibles. The pipe manufacturer or representative should be contacted to insure the pipe type and physical characteristics are suitable for this use. Use the correct joint compound recommended by the pipe manufacturer. In addition to making sure that joints are securely fastened, the use of a torque arrester is recommended when using plastic pipe.

Do not connect the first plastic or flexible riser section directly to the pump. Always attach a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping and possible cable

damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above each joint.

IMPORTANT- Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe. Leave 3 to 4 inches of slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. As a general rule, you can estimate that plastic pipe will stretch to approximately 2% of its length. For example, if you installed 200 feet of plastic riser pipe, the pump may actually be down 204 feet. If the depth setting is critical, check with the manufacturer of the pipe to determine how to compensate for pipe stretch.

When plastic riser pipe is used, it is recommended that a safety cable be attached to the pump to lower and raise it. The discharge piece of a Grundfos 4 inch submersible is designed to accommodate this cable (Figure 5-A).

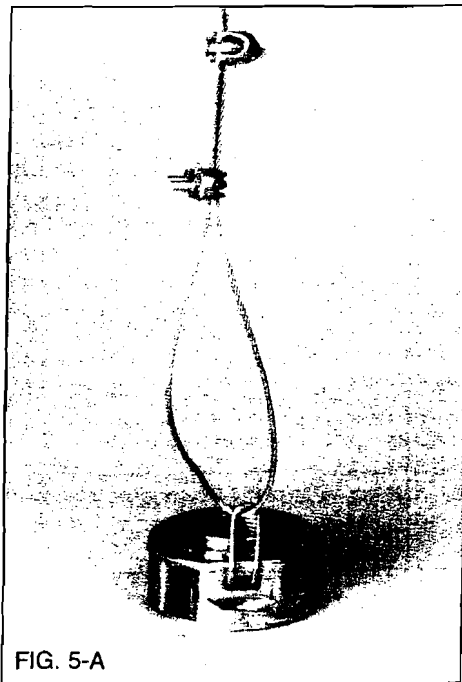


FIG. 5-A

Check valves:

A check valve should always be installed at the surface of the well. In addition, for installations deeper than 200 feet, check valves should be installed at no more than 200 foot intervals.

Protect the well from contamination:

To protect against surface water entering the well and contaminating the water source, the well should be finished off above grade, and a locally approved well seal or pitless adapter unit utilized.

SECTION 6.

Electrical

WARNING: To reduce the risk of electric shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in Table E.

If voltage variations are larger than $\pm 10\%$, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current. If direct on-line starting is not acceptable and reduced starting current is required, an auto-transformer or resistant starters should be used for 5 to 30 HP motors (depending on cable length). For motors over 30 HP, use auto-transformer starters.

Engine-Driven Generators

If the submersible pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contacted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

If power is going to be supplied through transformers, Table C outlines the minimum KVA rating and capacity required for satisfactory pump operation.

Control Box/Panel Wiring

1. Single-Phase Motors:

Single-phase motors must be connected as indicated in the motor control box. A typical single-phase wiring diagram using a Grundfos control box is shown (Figure 6-A).

2. Three-Phase Motors:

Three-phase motors must be used with the proper size and type of motor starter to ensure the motor is protected against damage from low voltage, phase failure, current unbalance and overload current. A properly sized starter with ambient-compensated extra quick-trip overloads must be used to give the best possible motor winding protection. **Each of the three motor legs must be protected with overloads.** The thermal overloads must trip in less than 10 seconds at locked rotor (starting) current. For starter and overload protection guide, see Table H. A three-phase motor wiring diagram is illustrated below (See Figure 6-B).

Pumps should NEVER be started to check rotation unless the pump is totally submerged. Severe damage may be caused to the pump and motor if they are run dry.

Single-Phase Wiring Diagram
for GRUNDFOS Control Boxes

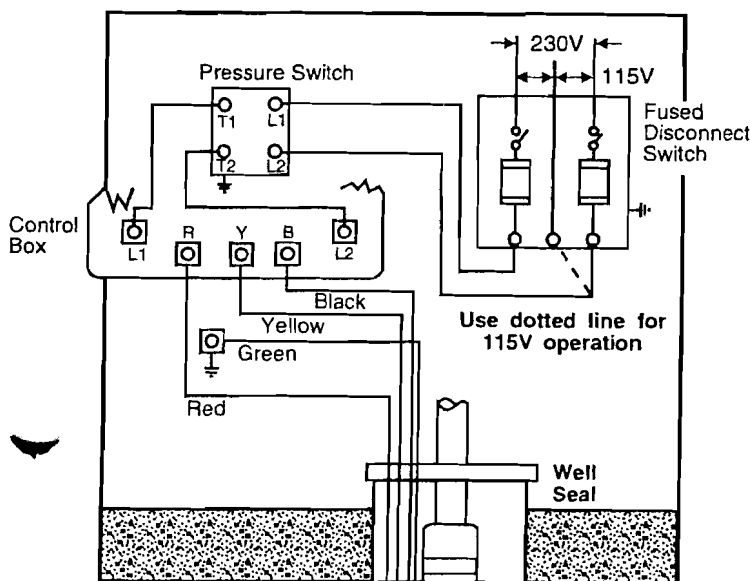


Figure 6-A

Three-Phase Wiring Diagram
for GRUNDFOS and FRANKLIN Motors

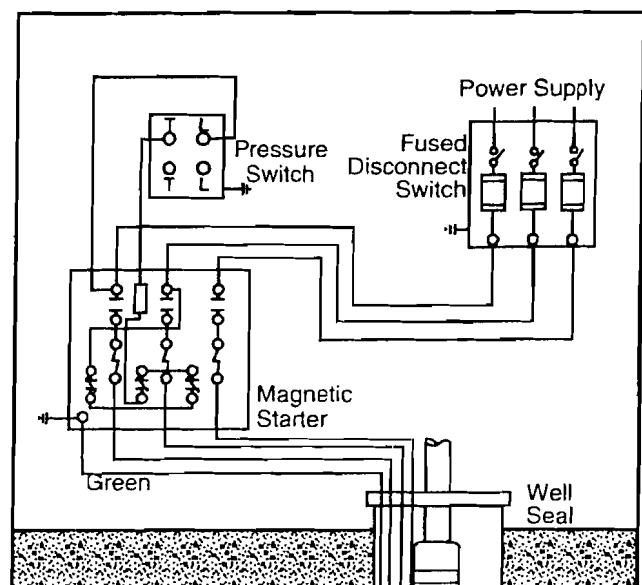


Figure 6-B

High Voltage Surge Arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges. Lightning voltage surges in power lines are caused when lightning strikes somewhere in the area. Switching surges are caused by the opening and closing of switches on the main high-voltage distribution power lines.

The correct voltage-rated surge arrester should be installed on the supply (line) side of the control box (Figure 6-C and 6-D). The arrester must be grounded in accordance with the National Electrical Code and local codes and regulations.

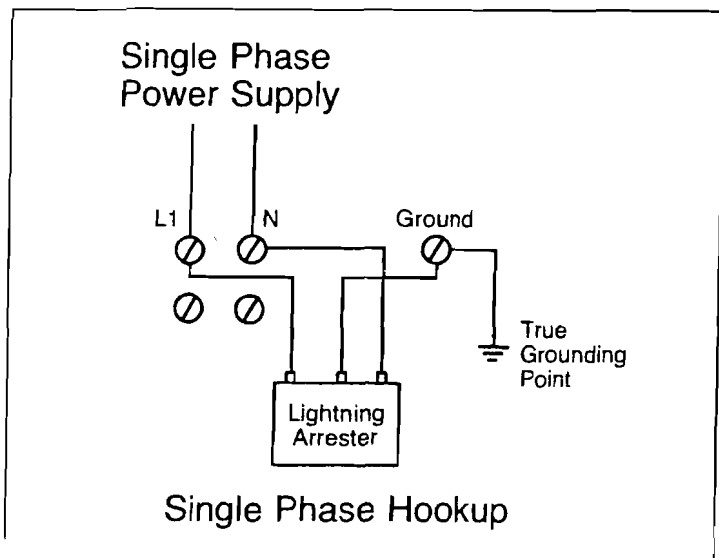


Figure 6-C

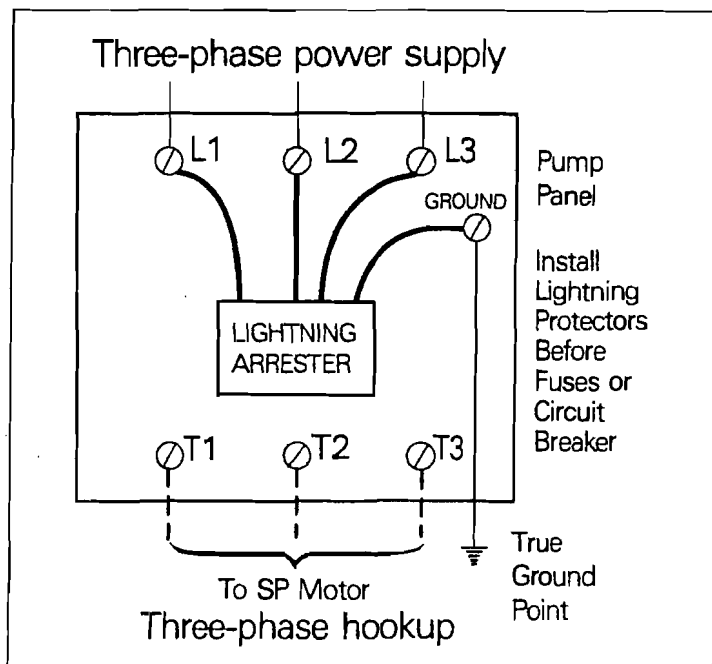


Figure 6-D

The warranty on all three-phase submersible motors is VOID if:

1. The motor is operated with single-phase power through a phase converter.
2. Three-leg ambient compensated extra quick-trip overload protectors are not used.
3. Three-phase current unbalance is not checked and recorded. (See START-UP Section 7 for Instructions.)
4. High voltage surge arresters are not installed.

Control Box/Panel Grounding

The control box or panel shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations. The ground wire should be a bare copper conductor at least the same size as the drop cable wire size. The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be: a grounding rod driven into the water strata, steel well casing submerged into the water lower than the pump setting level, and steel discharge pipes without insulating couplings. If plastic discharge pipe and well casing are used or if a grounding wire is required by local codes, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel. Do not ground to a gas supply line. Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.

Wiring Checks and Installation

Before making the final surface wiring connection of the drop cable to the control box or panel, it is a good practice to check the insulation resistance to ensure that the cable and splice are good. Measurements for a new installation must be at least 2,000,000 ohm. Do not start the pump if the measurement is less than this.

If it is higher than 2,000,000 ohm, the drop cable should then be run through the well seal by means of a conduit connector in such a way as to eliminate any possibility of foreign matter entering the well casing. Conduit should always be used from the pump to the control box or panel to protect the drop cable (See Figure 6-E). Finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box or panel and high voltage surge arrester have been grounded.

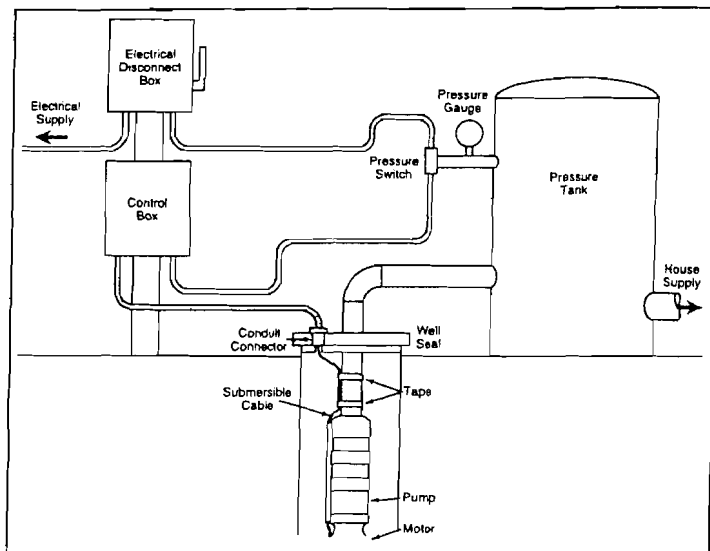


Figure 6-E

SECTION 7.

Start-Up

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

- A. Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.
- B. Adjust the gate valve one-third of the way open.
- C. On three-phase units, check direction of rotation and current unbalance according to the instructions below.

For single-phase units proceed directly to "Developing the Well".

- D. Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Three-Phase Motors

1. Check the direction of rotation

Three-phase motors can run in either direction depending on how they are connected to the power supply. When the three cable leads are first connected to the power supply, there is a 50% chance that the motor will run in the proper direction. **To make sure the motor is running in the proper direction, carefully follow the procedures below:**

- A. Start the pump and check the water quantity and pressure developed.
- B. Stop the pump and interchange any two leads.
- C. Start the pump and again check the water quantity and pressure.
- D. Compare the results observed. The wire connection which gave the highest pressure and largest water quantity is the correct connection.

2. Check for current unbalance

Current unbalance causes the motor to have reduced starting torque, overload tripping, excessive vibration and poor performance which can result in early motor failure. It is very important that current unbalance be checked in all three-phase systems. **Current unbalance between the legs should not exceed 5% under normal operating conditions.**

The supply power service should be verified to see if it is a two or three transformer system. If two transformers are present, the system is an "open" delta or wye. If three transformers are present, the system is true three-phase.

Make sure the transformer ratings in kilovolt amps (KVA) is sufficient for the motor load. See Table C.

The percentage of current unbalance can be calculated by using the following formulas and procedures:

$$\text{Average current} = \frac{\text{Total of current values measured on each leg}}{3}$$

$$\% \text{ Current unbalance} = \frac{\text{Greatest amp difference from the average}}{\text{average current}} \times 100$$

To determine the percentage of current unbalance:

- A. Measure and record current readings in amps for each leg (hookup 1). Disconnect power.

- B. Shift or roll the motor leads from left to right so the drop cable lead that was on terminal 1 is now on 2, lead on 2 is now on 3, and lead on 3 is now on 1 (hookup 2). Rolling the motor leads in this manner will not reverse the motor rotation. Start the pump, measure and record current reading on each leg. Disconnect power.
- C. Again shift drop cable leads from left to right so the lead on terminal 1 goes to 2, 2 to 3 and 3 to 1 (hookup 3). Start pump, measure and record current reading on each leg. Disconnect power.
- D. Add the values for each hookup.
- E. Divide the total by 3 to obtain the average.
- F. Compare each single leg reading from the average to obtain the greatest amp difference from the average.
- G. Divide this difference by the average to obtain the percentage of unbalance.

Use the wiring hookup which provides the lowest percentage of unbalance. (See Table F for a specific example of correcting for three-phase power unbalance.)

Developing the Well

After proper rotation and current unbalance have been checked, start the pump and let it operate until the water runs clear of sand, silt and other impurities.

Slowly open the valve in small increments as the water clears until the desired flow rate is reached. Do not operate the pump beyond its maximum flow rating. **The pump should not be stopped until the water runs clear.**

If the water is clean and clear when the pump is first started, the valve should still be **slowly opened until the desired flow rate is reached**. As the valve is being opened, the drawdown should be checked to ensure the pump is always submerged. **The dynamic water level should always be more than 3 feet above the inlet strainer of the pump.**

Disconnect the temporary piping arrangements and complete the final piping connections.

Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

Operation

1. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling and operation of controls.

2. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 8.

SECTION 8.

Troubleshooting

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following chart covers most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above-ground checks

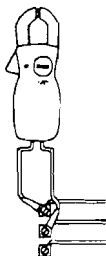
before pulling the pump from the well.

Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well. WARNING: Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.

Preliminary Tests

SUPPLY VOLTAGE



How to Measure

By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box or starter.

On single-phase units, measure between line and neutral.

On three-phase units measure between the legs (phases.)

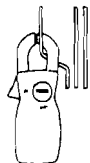
What it Means

When the motor is under load, the voltage should be within $\pm 10\%$ of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

CURRENT MEASUREMENT



How to Measure

By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box or starter. See Electrical Data, Table E, for motor amp draw information.

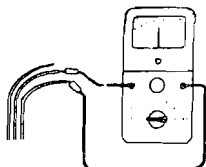
Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What it Means

If the amp draw exceeds the listed service factor amps (SFA) or if the current unbalance is greater than 5% between each leg on three-phase units, check for the following:

1. Burnt contacts on motor starter.
2. Loose terminals in starter or control box or possible cable defect. Check winding and insulation resistances
3. Supply voltage too high or low.
4. Motor windings are shorted.
5. Pump is damaged, causing a motor overload.

WINDING RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box or starter. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table E. Cable resistance values are in Table G.

What it Means

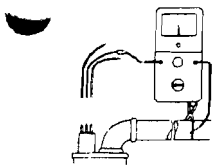
If all the ohm values are normal, and the cable colors correct, the windings are not damaged.

If any one ohm value is less than normal, the motor may be shorted.

If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open.

If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in Electrical Data, Table E.

INSULATION RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box or starter. Using an ohm or mega ohmmeter, set the scale selector to Rx100K and zero-adjust the meter.

Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).

What it Means

For ohm values, refer to table below. Motors of all HP, voltage, phase and cycle duties have the same value of insulation resistance.

OHM VALUE	MEGAOHM VALUE	CONDITION OF MOTOR AND LEADS
2,000,000 (or more)	2.0	Motor not yet installed: New Motor. Used motor which can be reinstalled in the well. Motor in well (Ohm readings are for drop cable plus motor): A motor in reasonably good condition. A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason. A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long. A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.
1,000,000 (or more)	1.0	
500,000 - 1,000,000	0.5 - 1.0	
20,000 - 500,000	0.02 - 0.5	
10,000 - 20,000	0.01 - 0.02	
less than 10,000	0 - 0.01	

Troubleshooting Chart

FAULT	POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
X. Pump Does Not Run	1. No power at pump panel.	Check for voltage at panel.	If no voltage at panel, check feeder panel for tripped circuits.
	2. Fuses are blown or circuit breakers are tripped.	Remove fuses and check for continuity with ohmmeter.	Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
	3. Motor starter overloads are burnt or have tripped out (three-phase only).	Check for voltage on line and load side of starter.	Replace burnt heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.
	4. Starter does not energize (three-phase only).	Energize control circuit and check for voltage at the holding coil.	If no voltage, check control circuit. If voltage, check holding coil for shorts. Replace bad coil.
	5. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
	6. Motor and/or cable are defective.	Turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values.	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
	7. Defective capacitor (single-phase only).	Turn off the power, then discharge capacitor. Check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.	If there is no needle movement, replace the capacitor.

(con't)

Troubleshooting Chart (continued)

FAULT	POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
Pump Runs But Does Not Deliver Water	1. Groundwater level in well is too low or well is collapsed.	Check well draw-down. Water level should be at least 3 ft. above pump inlet during operation.	If not, lower pump if possible, or throttle discharge valve and install water level control.
	2. Integral pump check valve is blocked.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shut-off. After taking reading, open valve to its previous position. Convert PSI to feet (For water: $\text{PSI} \times 2.31 \text{ ft/PSI} = \text{ft.}$), and add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.	If not close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and re-install.
	3. Inlet strainer is clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
	4. Pump is damaged.	Same as B.2 above.	If damaged, repair as necessary. Rinse out pump and re-install.
C. Pump Runs But at Reduced Capacity	1. Wrong rotation (three-phase only).	Check for proper electrical connection in control panel.	Correct wiring and change leads as required.
	2. Draw-down is larger than anticipated.	Check draw-down during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
	3. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
	4. Pump strainer or check valve are clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
	5. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.
D. Pump Cycles Too Much	1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts.	Re-adjust switch or replace if defective.
	2. Level control is not properly set or is defective.	Check setting and operation.	Re-adjust setting (refer to manufacturer data.) Replace if defective.
	3. Insufficient air charging or leaking tank or piping.	Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume.	Repair or replace damaged component.
	4. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.
	5. Tank is too small.	Check tank size. Tank volume should be approximately 10 gallons for each gpm of pump capacity.	If tank is too small, replace with proper size tank.

(con't)

Troubleshooting Chart (continued)

FAULT	POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
Fuses Blow or Circuit Breakers Trip	1. High or low voltage.	Check voltage at pump panel. If not within $\pm 10\%$, check wire size and length of run to pump panel.	If wire size is correct, contact power company. If not, correct and/or replace as necessary.
	2. Three-phase current unbalance.	Check current draw on each lead. Unbalance must be within $\pm 5\%$.	If current unbalance is not within $\pm 5\%$, contact power company.
	3. Control box wiring and components (single-phase only).	Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.	Correct as required.
	4. Defective capacitor (single-phase only).	Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If no meter movement, replace the capacitor.
	5. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

SECTION 9.

Technical Data

Table A

Minimum Water Flow Requirements for Submersible Pump Motors

MOTOR DIAMETER	CASING OR SLEEVE I.D. IN INCHES	MIN. FLOW PAST THE MOTOR (GPM)
4"	4	1.2
	5	7
	6	13
	7	21
	8	30
6"	6	10
	7	28
	8	45
	10	85
	12	140
	14	198
	16	275
8"	8	10
	10	55
	12	110
	14	180
	16	255
10"	10	30
	12	85
	14	145
	16	220
	18	305

- NOTES:**
1. A flow inducer or sleeve must be used if the water enters the well above the motor or if there is insufficient water flow past the motor.
 2. The minimum recommended water velocity over 4" motors is 0.25 feet per second.
 3. The minimum recommended water velocity over 6, 8, and 10" motors is 0.5 feet per second.

Table B

Guide for Engine-Driven Generators in Submersible Pump Applications

MOTOR HP FOR SINGLE OR THREE PHASE UNITS	MINIMUM KILOWATT RATING OF GENERATOR FOR THREE-WIRE SUBMERSIBLE PUMP MOTORS	
	EXTERNALLY REGULATED GENERATOR	INTERNALLY REGULATED GENERATOR
0.33 HP	1.5 KW	1.2 KW
0.50	2.0	1.5
0.75	3.0	2.0
1.0	4.0	2.5
1.5	5.0	3.0
2.0	7.5	4.0
3.0	10.0	5.0
5.0	15.0	7.5
7.5	20.0	10.0
10.0	30.0	15.0
15.0	40.0	20.0
20.0	60.0	25.0
25.0	75.0	30.0
30.0	100.0	40.0
40.0	100.0	50.0
50.0	150.0	60.0
60.0	175.0	75.0
75.0	250.0	100.0
100.0	300.0	150.0
125.0	375.0	175.0
150.0	450.0	200.0
200.0	600.0	275.0

- NOTES:**
1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single-phase and three-phase motors.
 2. Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.

Table C**Transformer Capacity Required for Three-Phase Submersible Pump Motors**

THREE-PHASE MOTOR HP	MINIMUM TOTAL KVA REQUIRED*	MINIMUM KVA RATING FOR EACH TRANSFORMER	
		2 TRANSFORMERS OPEN DELTA OR WYE	3 TRANSFORMERS DELTA OR WYE
1.5	3	2	1
2	4	2	1 ½
3	5	3	2
5	7 ½	5	3
7.5	10	7 ½	5
10	15	10	5
15	20	15	7 ½
20	25	15	10
25	30	20	10
30	40	25	15
40	50	30	20
50	60	35	20
60	75	40	25
75	90	50	30
100	120	65	40
125	150	85	50
150	175	100	60
200	230	130	75

* Pump motor KVA requirements only, and does not include allowances for other loads.

Table D**Submersible Pump Cable Selection Chart (60 Hz)**

The following tables list the recommended copper cable sizes and various cable lengths for submersible pump motors.

These tables comply with the 1978 edition of the National Electric Table 310-16, Column 2 for 75°C wire. The ampacity (current carrying properties of a conductor) have been

divided by 1.25 per the N.E.C., Article 430-22, for motor branch circuits based on motor amps at rated horsepower.

To assure adequate starting torque, the maximum cable lengths are calculated to maintain 95% of the service entrance voltage at the motor when the motor is running at maximum nameplate amps. Cable sizes larger than specified may always be used and will reduce power usage.

The use of cables smaller than the recommended sizes will void the warranty. Smaller cable sizes will cause reduced starting torque and poor motor operation.

SINGLE-PHASE MOTOR MAXIMUM CABLE LENGTH (Motor to service entrance) (2)

MOTOR RATING		COPPER WIRE SIZE												
VOLTS	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300
115	1/8	130	210	340	540	840	1300	1960	2910					
	1/2	100	160	250	390	620	960	1460	2160					
230	1/8	550	880	1390	2190	3400	5250	7960						
	1/2	400	650	1020	1610	2510	3880	5880						
	3/4	300	480	760	1200	1870	2890	4370	6470					
	1	250	400	630	990	1540	2380	3610	5360	6520				
	1 1/2	190	310	480	770	1200	1870	2850	4280	5240				
	2	150	250	390	620	970	1530	2360	3620	4480				
	3	120	190	300	470	750	1190	1850	2890	3610				
	5			180	280	450	710	1110	1740	2170				
	7 1/2				200	310	490	750	1140	1410				
	10					250	390	600	930	1160				

CAUTION: Use of wire size smaller than listed will void warranty.

FOOTNOTES:

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

(con't)

THREE-PHASE MOTOR MAXIMUM CABLE LENGTH (Motor to service entrance)(2)

MOTOR RATING		COPPER WIRE SIZE													
VOLTS	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300	
208	1½	310	500	790	1260										
	2	240	390	610	970	1520									
	3	180	290	470	740	1160	1810								
	5		170	280	440	690	1080	1660							
	7½			200	310	490	770	1180	1770						
	10				230	370	570	880	1330	1640					
	15					250	390	600	910	1110	1340				
	20						300	460	700	860	1050	1270			
	25							370	570	700	840	1030	1170		
30							310	470	580	700	850	970	1110		
230	1½	360	580	920	1450										
	2	280	450	700	1110	1740									
	3	210	340	540	860	1340	2080								
	5		200	320	510	800	1240	1900							
	7½			230	360	570	890	1350	2030						
	10				270	420	660	1010	1520	1870					
	15					290	450	690	1040	1280	1540				
	20						350	530	810	990	1200	1450			
	25						280	430	650	800	970	1170	1340		
30							350	540	660	800	970	1110	1270		
460	1½	1700													
	2	1300	2070												
	3	1000	1600	2520											
	5	590	950	1500	2360										
	7½	420	680	1070	1690	2640									
	10	310	500	790	1250	1960	3050								
	15			540	850	1340	2090	3200							
	20			410	650	1030	1610	2470	3730						
	25				530	830	1300	1990	3010	3700					
	30				430	680	1070	1640	2490	3060	3700				
	40						790	1210	1830	2250	2710	3290			
	50						640	980	1480	1810	2190	2650	3010		
	60							830	1250	1540	1850	2240	2540	2890	
	75								1030	1260	1520	1850	2100	2400	
	100									940	1130	1380	1560	1790	
	125											1080	1220	1390	
	150												1050	1190	
	200												1080	1300	
250													1080		
575	1½	2620													
	2	2030													
	3	1580	2530												
	5	920	1480	2330											
	7½	660	1060	1680	2650										
	10	490	780	1240	1950										
	15		530	850	1340	2090									
	20			650	1030	1610	2520								
	25			520	830	1300	2030	3110							
	30				680	1070	1670	2560	3880						
	40					790	1240	1900	2860	3510					
	50						1000	1540	2310	2840	3420				
	60						850	1300	1960	2400	2890	3500			
75							1060	1600	1970	2380	2890	3290			
100								1190	1460	1770	2150	2440	2790		

CAUTION: Use of wire size smaller than listed will void warranty.

NOTES:

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

Table E

Electrical Data

Submersible Pump Motors - 60Hz

GRUNDFOS MOTORS

HP	Ph	VOLT	S.F.	Circ. Brkr or Fuses		AMPERAGE		FULL LOAD		Max.	Nameplate	Grundfos
				Std.	Delay	Start	Max.	Eff.	Pwr	Thrust	No.	Product No.
								(%)	Fact.	(lbs)		
4-Inch, Single Phase, 2-Wire Motors (control box not required)												
1/3.	1	230	1.75	15	5	25.7	4.6	59	77	750	79952101	791595016
1/2.	1	230	1.60	15	7	34.5	6.0	62	76	750	79952102	791595026
3/4.	1	230	1.50	20	9	40.5	8.4	62	75	750	79952103	791595036
1	1	230	1.40	25	12	48.4	9.8	63	82	750	79952104	791595046
1 1/2	1	230	1.30	35	15	62	13.1	64	85	750	79952105	791595056
4-Inch, Single Phase, 3-Wire Motors												
1/3.	1	230	1.75	15	5	14	4.6	59	77	750	79453101	791545016
1/2.	1	230	1.60	15	7	21.5	6.0	62	76	750	79453102	791545026
3/4.	1	230	1.50	20	9	31.4	8.4	62	75	750	79453103	791545036
1	1	230	1.40	25	12	37	9.8	63	82	750	79453104	791545046
1 1/2	1	230	1.30	30	15	45.9	11.6	69	89	750	79453105	791545056
4-Inch, Three Phase, 3 Wire Motors												
1 1/2	3	230	1.30	15	8	40.3	7.3	75	72	750	79302005	791530056
		460	1.30	10	4	20.1	3.7	75	72	750	79362005	791536056
		575	1.30	10	4	16.1	2.9	75	72	750	79392005	791539056
2	3	230	1.25	20	10	48	8.7	76	75	750	79302006	791530066
		460	1.25	10	5	24	4.4	76	75	750	79362006	791536066
		575	1.25	10	4	19.2	3.5	76	75	750	79392006	791539066
3	3	230	1.15	30	15	56	12.2	77	75	1000	79304507	96405801
		460	1.15	15	7	28	6.1	77	75	1000	79354507	96405810
		575	1.15	15	6	22	4.8	77	75	1000	79394507	96405815
5	3	230	1.15	40	25	108	19.8	80	82	1000	79304509	96405802
		460	1.15	20	12	54	9.9	80	82	1000	79354509	96405811
		575	1.15	15	9	54	7.9	80	82	1000	79394509	96405816
7 1/2	3	230	1.15	60	30	130	25.0	81	82	1000	79305511	96405805
		460	1.15	35	15	67	13.2	81	82	1000	79355511	96405814
		575	1.15	30	15	67	10.6	81	82	1000	79395511	96405819
6-Inch, Three Phase, 3 Wire Motors												
7 1/2	3	230	1.15	60	35	119	26.4	80.5	76	1000	78305511	96405781
		460	1.15	30	15	59	13.2	80.5	76	1000	78355511	96405794
10	3	230	1.15	80	45	156	34.0	82.5	79	1000	78305512	96405782
		460	1.15	40	20	78	17.0	82	79	1000	78355512	96405795
15	3	230	1.15	125	60	230	49.0	82.5	82	4400	78305514	96405783
		460	1.15	60	30	115	24.5	82.5	82	4400	78355514	96405796
20	3	230	1.15	150	80	343	66.0	84	81	4400	78305516	96405784
		460	1.15	80	40	172	33.0	84	82	4400	78355516	96405797
25	3	460	1.15	100	50	217	41.0	84.5	80	4400	78355517	96405798
30	3	460	1.15	110	60	237	46.5	85	83	4400	78355518	96405799
40	3	460	1.15	150	80	320	64.0	85	82	4400	78355520	96405800

HITACHI MOTORS

6 Inch (Three Wire) Motors

60 Hz

HP	Ph	VOLTS	Service Factor	Circuit Breaker or Standard Fuse	Dual Element Fuse	AMPERAGE			FULL LOAD		Line-to-Line Resistance(Ohms)		KVA Code	Three-Phase Overload Protection		Maximum Thrust (lbs)	GRUNDFOS PART NO.
						Full Load	Locked Rotor	S.F. Amps	Eff.	Power Factor	Resistance(Ohms)			Starter Size	Furnas Amb. Comp		
											Blk-Yel	Red-Yel					
5	1	230	1.15	80	35	23.8	124	27.1	74.8	91.2	Delta 0.51 2.2		G	--	--	1500	82.4119H
	3	230	1.15	45	20	14.8	110	16.4	76.8	82.5	0.81		K	1	K58	1500	82.9115H3
	3	460	1.15	25	10	7.4	55	8.2	76.8	82.5	3.05		K	1	K43	1500	82.9115H6
7 1/2	1	230	1.15	125	45	35.2	167	40.9	72.9	94.9	0.40 1.40		F	--	--	1500	82.4121H
	3	230	1.15	70	30	21.8	144	24.4	78.5	81.8	0.65		J	1	K64	1500	82.9116H3
	3	460	1.15	35	15	10.9	72	12.2	78.5	81.8	2.43		J	1	K54	1500	82.9116H6
10	1	230	1.15	175	60	48.0	202	54.0	73.6	93.2	0.32 1.05		E	--	--	3500	82.4123H
	3	230	1.15	80	40	28.2	208	32.0	79.3	82.8	0.45		K	1.75	K68	3500	82.9117H3
	3	460	1.15	40	20	14.3	104	16.0	79.3	82.8	1.62		K	1	K58	3500	82.9117H6
15	1	230	1.15	250	100	70.8	275	84.9	73.7	93.2	0.23 0.68		D	--	--	3500	82.9118H3
	3	230	1.15	125	60	41.4	320	46.2	81.7	83.2	0.31		K	2	K74	3500	82.9118H3
	3	460	1.15	60	30	20.7	160	23.1	81.7	83.2	1.07		K	1.75	K63	3500	82.9118H6
20	3	230	1.15	175	70	53.0	392	63.0	83.2	84.9	0.26		K	2.5	K77	3500	82.9119H3
	3	460	1.15	90	35	26.5	196	30.0	83.2	84.9	0.86		K	2	K67	3500	82.9119H6
25	3	230	1.15	200	90	67.2	530	75.4	83.0	83.9	0.21		K	3	K83	3500	82.9120H3
	3	460	1.15	100	45	33.6	265	37.7	83.0	83.9	0.67		K	2	K72	3500	82.9120H6
30	3	230	1.15	250	110	80.8	610	90.6	82.5	84.3	0.16		K	3	K86	3500	82.9121H3
	3	460	1.15	125	50	40.4	305	45.3	82.5	84.3	0.55		K	2.5	K74	3500	82.9121H6
40	3	460	1.15	150	70	51.7	340	58.8	84.0	86.3	0.46		H	3	K76	5000	82.3228H
50	3	460	1.15	200	90	69.7	465	78.8	82.5	81.4	0.39		J	3	K83	5000	82.3229H
60	3	460	1.15	225	100	80.8	465	92.8	82.4	84.4	0.39		G	3.5	K86	5000	82.3230H

8 Inch Motors

40	3	460	1.15	150	70	54.3	380	60.9	83.9	82.1	0.37		J	3	K76	10,000	82.3270H
50	3	460	1.15	200	90	64.9	435	73.6	84.1	85.7	0.33		H	3	K78	10,000	82.3271H
60	3	460	1.15	225	100	77.8	510	88.5	84.7	85.3	0.28		H	3.5	K86	10,000	82.3272H
75	3	460	1.15	350	150	96.7	650	110	84.9	85.9	0.22		H	3.5	K88	10,000	82.3274H
100	3	460	1.15	400	175	127	795	145	85.2	86.6	0.16		H	4	K89	10,000	82.3275H
125	3	460	1.15	500	225	172.0	980	192	84.2	80.9	0.14		G	4.5	K28	10,000	82.36H042
150	3	460	1.15	600	250	187.0	1060	216	85.6	87.9	0.13		G	4.5	K29	10,000	82.36H043

10 Inch Motors

200	3	460	1.15	800	350	233.0	1260	270	87.2	92.2	0.09		F	5	K33	10,000	82.36H064
250	3	460	1.15	900	450	294.0	1500	344	86.5	92.1	0.08		E	6	K27	10,000	82.36H066

Franklin Motors

(refer to the Franklin Submersible Motors Application Maintenance Manual)

Table F**Example: Correcting for Three-Phase Power Unbalance**

Example: Check for current unbalance for a 230 volt, 3 phase, 60 Hz submersible pump motor, 18.6 full load amps.

Solution: Steps 1 to 3 measure and record amps on each motor drop lead for Hookups 1, 2 and 3.

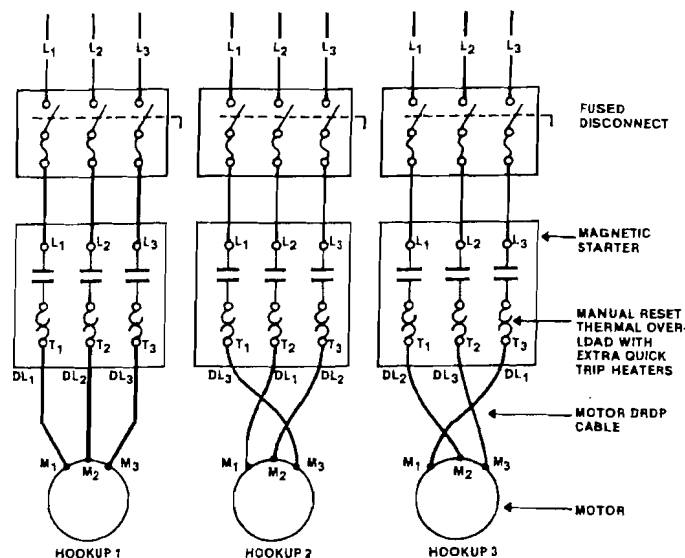
	Step 1 (Hookup 1)	Step 2 (Hookup 2)	Step 3 (Hookup 3)
(T ₁)	DL ₁ = 25.5 amps	DL ₃ = 25 amps	DL ₂ = 25.0 amps
(T ₂)	DL ₂ = 23.0 amps	DL ₁ = 24 amps	DL ₃ = 24.5 amps
(T ₃)	DL ₃ = 26.5 amps	DL ₂ = 26 amps	DL ₁ = 25.5 amps
Step 4	Total = 75 amps	Total = 75 amps	Total = 75 amps
Step 5	Average Current =	Total current = 3 readings	75 = 25 amps 3
Step 6	Greatest amp difference from the average:	(Hookup 1) = 25-23 = 2 (Hookup 2) = 26-25 = 1 (Hookup 3) = 25.5-25 = .5	
Step 7	% Unbalance	(HOOKUP 1) = 2/25 X 100 = 8 (HOOKUP 2) = 1/25 X 100 = 4 (HOOKUP 3) = .5/25 X 100 = 2	

As can be seen, Hookup 3 should be used since it shows the least amount of current unbalance. Therefore, the motor will operate at maximum efficiency and reliability.

By comparing the current values recorded on each leg, you will note the highest value was always on the same leg, L₃. This indicates the unbalance is in the power source. If the high current values were on a different leg each time the leads were changed, the unbalance would be caused by the motor or a poor connection.

If the current is greater than 5%, contact your power company for help.

* For a detailed explanation of three-phase balance procedures, see Three-Phase Motor, section 2, page 6.

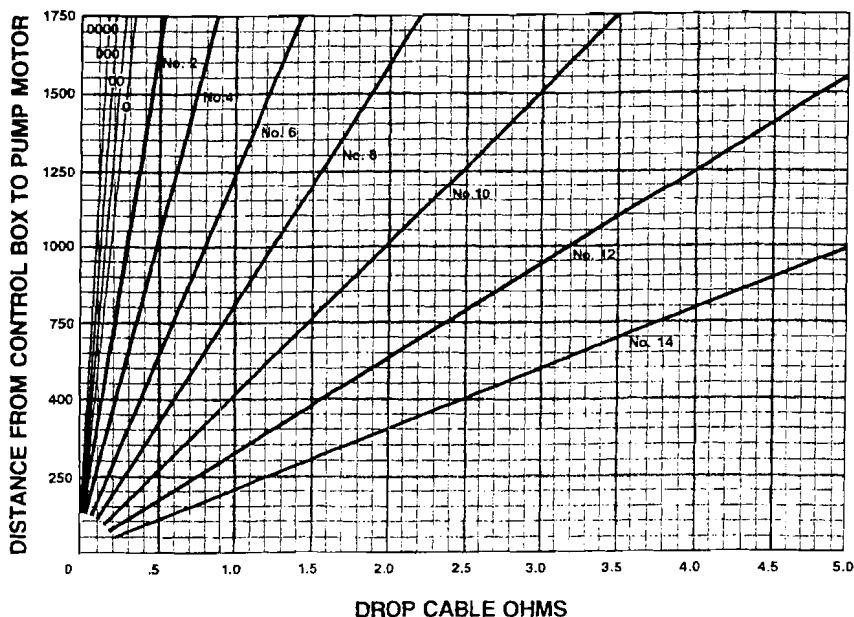
**Table G****Total Resistance of Drop Cable (OHMS)**

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the control box to the motor and back.

To determine the resistance:

1. Disconnect the drop cable leads from the control box or panel.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance. Motor resistances can be found in the Electrical Data Chart, Table E.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.

The measured values should be approximately equal to the calculated values.



Limited Warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, 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 jurisdiction to jurisdiction.

GRUNDFOS®



Leaders in Pump Technology

Grundfos Pumps Corporation • 3131 N. Business Park Avenue • Fresno, CA 93727

Customer Service Centers: Allentown, PA • Fresno, CA

Phone: (800) 333-1366 • Fax: (800) 333-1363

Canada: Oakville, Ontario • Mexico: Apodaca, N.L.



11319-02-A
RW-2 EXTRACTION PUMP SUBSTITUTION

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

Performance Curves

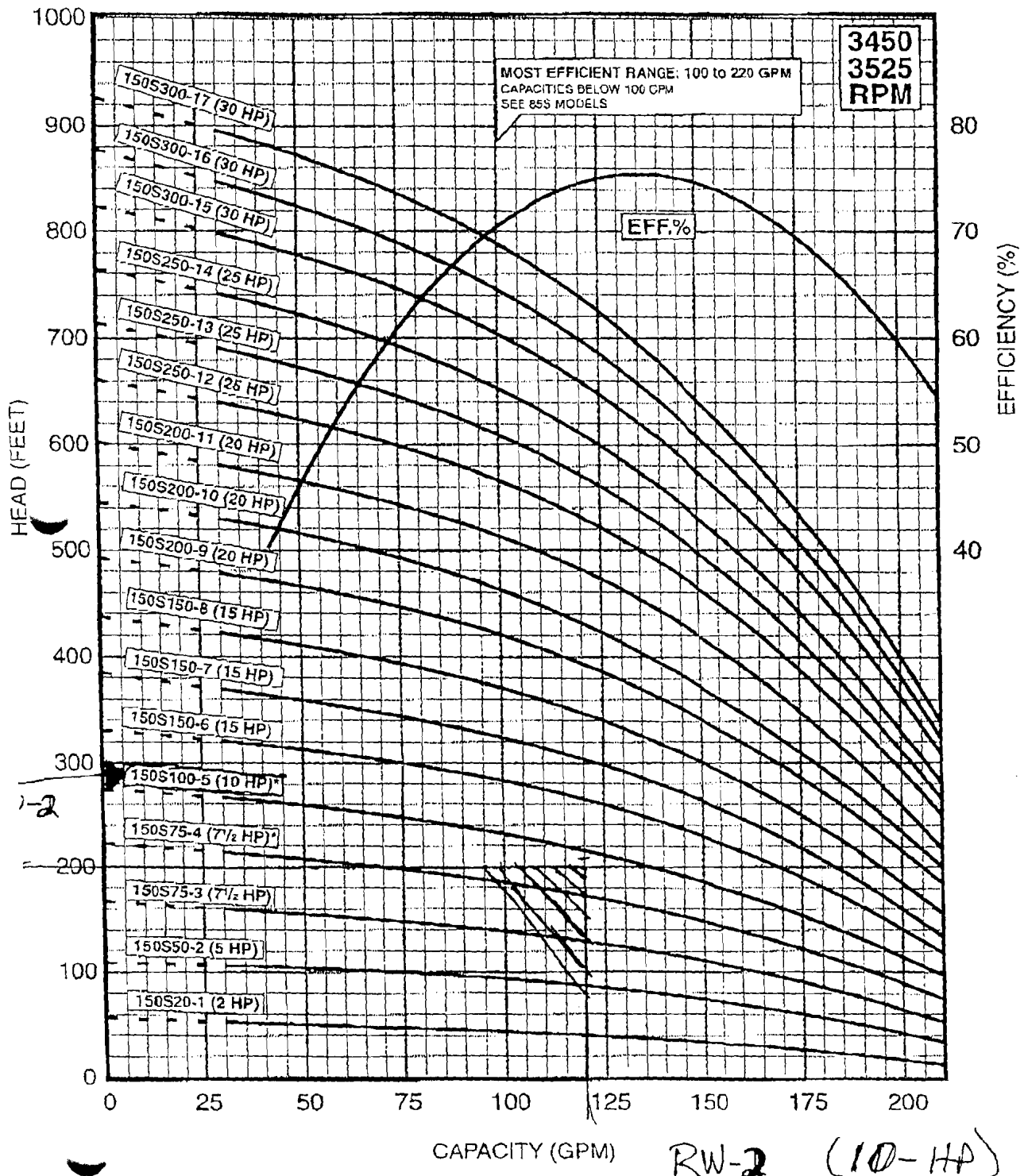
150 GPM

Model 150S

FLOW RANGE: 30 -220 GPM

OUTLET SIZE: 3" NPT

NOMINAL DIA. 6"



IFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

OR STANDARD, 2-10 HP/3450 RPM

OR STANDARD, 7.5-60 HP/3450 RPM.

OR STANDARD, 75 HP/3525 RPM.

TDH: 200 ft.

Static Head: 275 ft.

Performance conforms to ISO 2548 Annex B @ 5 ft. min. submergence.

Technical Data

150 GPM

Model 150S

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
150S20-1	A	2	4"	3" NPT	27.3	13.6	13.7	3.75	5.2	55
150S40-2	A	5	4"	3" NPT	41.1	23.6	17.5	3.75	5.2	75
150S75-3	A	7 1/2	4"	3" NPT	50.9	29.6	21.3	3.75	5.2	92
150S75-4	A	7 1/2	4"	3" NPT	54.7	29.6	25.1	3.75	5.2	97
150S100-5	A	10	4"	3" NPT	72.8	43.9	28.9	3.75	5.2	151
150S75-4	A	7 1/2	6"	3" NPT	49.9	24.2	25.7	5.38	5.6	135
150S100-5	A	10	6"	3" NPT	54.9	25.4	29.5	5.38	5.6	148
150S150-6	A	15	6"	3" NPT	61.3	28.0	33.3	5.38	5.6	167
150S150-7	A	15	6"	3" NPT	65.0	28.0	37.0	5.38	5.6	169
150S150-8	A	15	6"	3" NPT	68.8	28.0	40.8	5.38	5.6	174
150S200-9	A	20	6"	3" NPT	75.2	30.6	44.6	5.38	5.6	191
150S200-10	A	20	6"	3" NPT	79.0	30.6	48.4	5.38	5.6	193
150S200-11	A	20	6"	3" NPT	82.8	30.6	52.2	5.38	5.6	198
150S250-12	A	25	6"	3" NPT	89.0	33.1	55.9	5.38	5.6	235
150S250-13	A	25	6"	3" NPT	92.8	33.1	59.7	5.38	5.6	238
150S250-14	A	25	6"	3" NPT	96.6	33.1	63.5	5.38	5.6	242
150S300-15	A	30	6"	3" NPT	103.0	35.7	67.3	5.38	5.6	260
150S300-16	A	30	6"	3" NPT	106.8	35.7	71.1	5.38	5.6	262
150S300-17	A	30	6"	3" NPT	110.5	35.7	74.8	5.38	5.6	266
150S400-18	A	40	6"	3" NPT	119.4	40.8	78.6	5.38	5.6	306
150S400-19	A	40	6"	3" NPT	123.2	40.8	82.4	5.38	5.6	308
150S400-20	A	40	6"	3" NPT	127.0	40.8	86.2	5.38	5.6	323
150S400-21	A	40	6"	3" NPT	130.8	40.8	90.0	5.38	5.7	334
150S400-22	A	40	6"	3" NPT	134.5	40.8	93.7	5.38	5.7	338
150S400-23	A	40	6"	3" NPT	138.3	40.8	97.5	5.38	5.7	340
150S500-24	A	50	6"	3" NPT	162.2	57.8	104.4	5.38	6.1	442
150S500-25	A	50	6"	3" NPT	166.0	57.8	108.2	5.38	6.1	444
150S500-26	A	50	6"	3" NPT	169.8	57.8	112.0	5.38	6.1	446
150S500-27	A	50	6"	3" NPT	173.6	57.8	115.8	5.38	6.1	448
150S500-28	A	50	6"	3" NPT	183.4	63.8	119.6	5.38	7.1	450
150S600-29	A	60	6"	3" NPT	193.7	63.8	129.9	5.38	7.1	448
150S600-31	A	60	6"	3" NPT	201.3	63.8	137.5	5.38	7.1	452
150S600-33	A	60	6"	3" NPT	208.8	63.8	145.0	5.38	7.1	456
150S500-24	A	50	8"	3" NPT	143.2	38.8	104.4	7.50	7.5	492
150S500-25	A	50	8"	3" NPT	147.0	38.8	108.2	7.50	7.5	495
150S500-26	A	50	8"	3" NPT	150.8	38.8	112.0	7.50	7.5	497
150S500-27	A	50	8"	3" NPT	154.6	38.8	115.8	7.50	7.5	499
150S500-28	A	50	8"	3" NPT	158.4	38.8	119.6	7.50	7.5	501
150S600-29*	B	60	8"	3" NPT	169.7	41.8	127.9	7.50	7.5	539
150S600-31*	B	60	8"	3" NPT	177.3	41.8	135.5	7.50	7.5	543
150S600-33*	B	60	8"	3" NPT	184.8	41.8	143.0	7.50	7.5	547
150S750-36*	B	75	8"	3" NPT	201.8	47.4	154.4	7.50	7.5	592
150S750-39*	B	75	8"	3" NPT	213.1	47.4	165.7	7.50	7.5	598

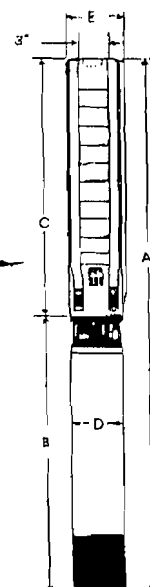


Fig. A

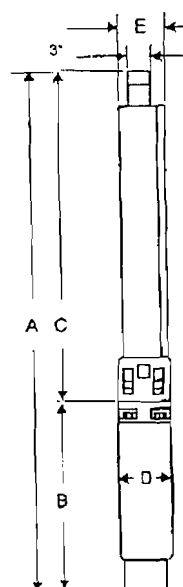


Fig. B

NOTES: All models suitable for use in 6" wells, unless otherwise noted.

Weights include pump end with motor in lbs.

* Built into sleeve 3" NPT discharge, 8" min. well dia.

TEFLON FITTED
BY
PUMPS OF OKLAHOMA
OKLAHOMA CITY
(405) 235-2695 • FAX (405) 235-9897

Installation and Operating Instructions

**Stainless Steel
Submersible Pumps**

GRUNDFOS 



1. Shipment
Inspection
■ Page 1

2. Pre-Installation
Checklist
■ Page 1

3. Wire Cable
Type
■ Page 2

4. Splicing the
Motor Cable
■ Page 2

5. Installation
■ Page 3

6. Electrical
■ Page 4

7. Start-up
■ Page 6

8. Trouble-
shooting
■ Page 7

9. Technical
Data

Installation and Operating Instructions

TABLE OF CONTENTS

SECTION 1	
Shipment Inspection	Page 1
SECTION 2	
Pre-Installation Checklist	Page 1
SECTION 3	
Wire Cable Type	Page 2
SECTION 4	
Splicing the Motor Cable	Page 2
SECTION 5	
Installation	Page 3
SECTION 6	
Electrical	Page 4
Engine Driven Generators	4
Control Box / Panel Wiring	4
High Voltage Surge Arresters	5
Control Box / Panel Grounding	5
Wiring Checks and Installation	5
SECTION 7	
Start-Up	Page 6
Three-Phase Motors	6
Developing the Well	6
Operation	7
SECTION 8	
Troubleshooting	Page 7
Preliminary Tests	7
Troubleshooting Chart	8
SECTION 9	
Technical Data	Page 10

Installation and Operation Instructions

GRUNDFOS STAINLESS STEEL SUBMERSIBLE PUMPS

Your Grundfos Submersible Pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

SECTION 1.

Shipment Inspection

Examine the components carefully to make sure no damage has occurred to the pump-end, motor, cable or control box during shipment.

This Grundfos Submersible Pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage. During unpacking and prior to installation, **make sure that the pump is not dropped or mishandled.**

The motor is equipped with an electrical cable. **Under no circumstance should the cable be used to support the weight of the pump.**

You will find a loose data plate wired to the pump. It should be securely mounted at the well or attached to the control box.

SECTION 2.

Pre-Installation Checklist

Before beginning installation, the following checks should be made. They are all critical for the proper installation of this submersible pump.

☒ **A. CONDITION OF THE WELL**

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. The stainless steel construction of the Grundfos submersible make it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy water.

If this pump is used to replace an oil-filled submersible or oil-lubricated line-shaft turbine in an existing well, **the well must be blown or bailed clear of oil.**

Determine the maximum depth of the well, and the draw-down level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

☒ **B. CONDITION OF THE WATER**

Submersible pumps are designed for pumping clear and cold water that is free of air and gases. Decreased pump performance and life expectancy can occur if the water is not cold and clear or contains air and gases.

Maximum water temperature should not exceed 102°F. Special consideration must be given to the pump and motor if it is to be used to pump water above 102°F.

The Grundfos stainless steel submersible is highly resistant to the normal corrosive environment found in some water wells. If water well tests determine the water has an excessive or unusual corrosive quality, or exceeds 102°F, contact your Grundfos representative for information concerning specially designed pumps for these applications.

☒ **C. INSTALLATION DEPTH**

A check should be made to ensure that the installation depth of the pump will always be at least three feet below the maximum draw-down level of the well. For flow rates exceeding 100 gpm, the NPSH may have to be considered. Refer to NPSH curves in the technical brochure.

The bottom of the motor should never be installed lower than the top of the well screen or within five feet of the well bottom.

If the pump is to be installed in a lake, pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in Table A.

☒ **D. ELECTRICAL SUPPLY**

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual electrical supply.

SECTION 3.

Wire Cable Type

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor may be solid or stranded. The cable may consist of individually insulated conductors twisted together, insulated conductors molded side by side in one flat cable or insulated conductors with a round overall jacket.

The conductor insulation should be type RW, RUW, TW, TWU or equivalent and must be suitable for use with submersible pumps. An equivalent Canadian Standards Association certified wire may also be used. See Table D for recommended sizes of cable lengths.

SECTION 4.

Splicing the Motor Cable

A good cable splice is critical to proper operation of the submersible pump and must be done with extreme care.

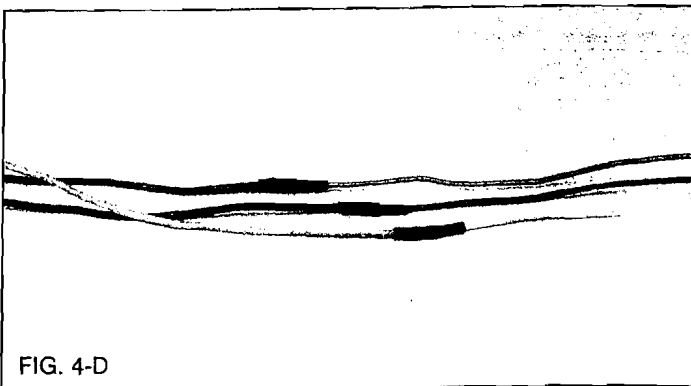
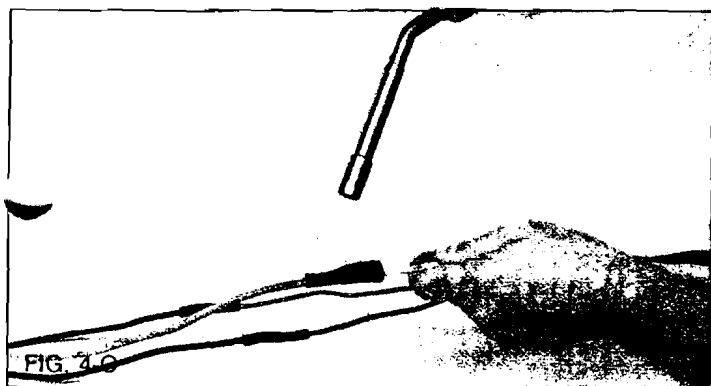
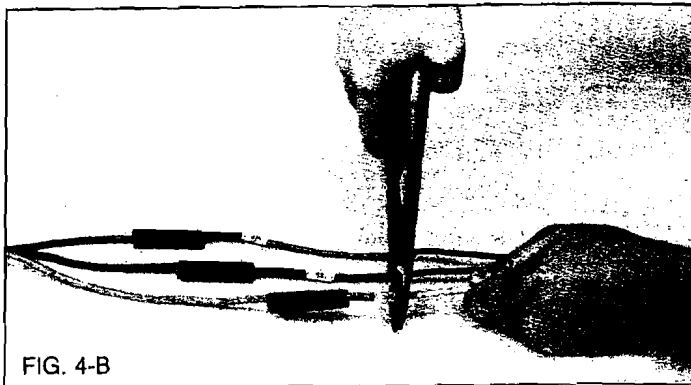
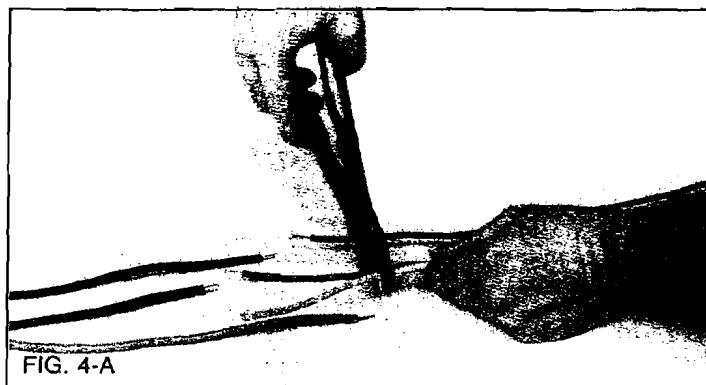
If the splice is carefully made, it will work as well as any other portion of the cable, and will be completely watertight.

Grundfos recommends using a heat shrink splice kit. The splice should be made in accordance with the kit manufacture's instructions. Typically a heat shrink splice can be made as follows:

1. Examine the motor cable and the drop cable carefully for damage.
2. Cut the motor leads off in a staggered manner. Cut the ends of the drop cable so that the ends match up with the motor leads (See Figure 4-A). On single-phase motors, be sure to match the colors.
3. Strip back and trim off $\frac{1}{2}$ inch of insulation from each lead, making sure to scrape the wire bare to obtain a good

connection. Be careful not to damage the copper conductor when stripping off the insulation.

4. Slide the heat shrink tubing on to each lead. Insert a properly sized "Sta-kon" type connector on each lead, making sure that lead colors are matched. Using a "Sta-kon" crimping pliers, indent the lugs (Figure 4-B). Be sure to squeeze hard on the pliers, particularly when using large cable.
5. Center the heat shrink tubing over the connector. Using a propane torch, lighter, or electric heat gun, uniformly heat the tubing starting first in the center working toward the ends (Figure 4-C).
6. Continue to apply the heat to the tubing using care not to let the flame directly contact the tubing. When the tubing shrinks and the sealant flows from the ends of the tubing, the splice is complete (Figure 4-D).



SECTION 5.

Installation

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

A back-up wrench should be used when the riser pipe is attached to the pump. The pump should be gripped only by the flats on the top of the discharge chamber. **The body of the pump, cable guard or motor should not be gripped under any circumstance.**

If Steel Riser Pipe is Used:

We recommend that steel riser pipes always be used with the larger submersibles. An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.** When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump-end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above and below the splice.

If Plastic or Flexible Riser Pipe is Used:

It is recommended that plastic type riser pipe be used **only** with the smaller domestic submersibles. The pipe manufacturer or representative should be contacted to insure the pipe type and physical characteristics are suitable for this use. Use the correct joint compound recommended by the pipe manufacturer. In addition to making sure that joints are securely fastened, the use of a torque arrester is recommended when using plastic pipe.

Do not connect the first plastic or flexible riser section directly to the pump. Always attach a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping and possible cable

damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above each joint.

IMPORTANT- Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe. Leave 3 to 4 inches of slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. As a general rule, you can estimate that plastic pipe will stretch to approximately 2% of its length. For example, if you installed 200 feet of plastic riser pipe, the pump may actually be down 204 feet. If the depth setting is critical, check with the manufacturer of the pipe to determine how to compensate for pipe stretch.

When plastic riser pipe is used, it is recommended that a safety cable be attached to the pump to lower and raise it. The discharge piece of a Grundfos 4 inch submersible is designed to accommodate this cable (Figure 5-A).

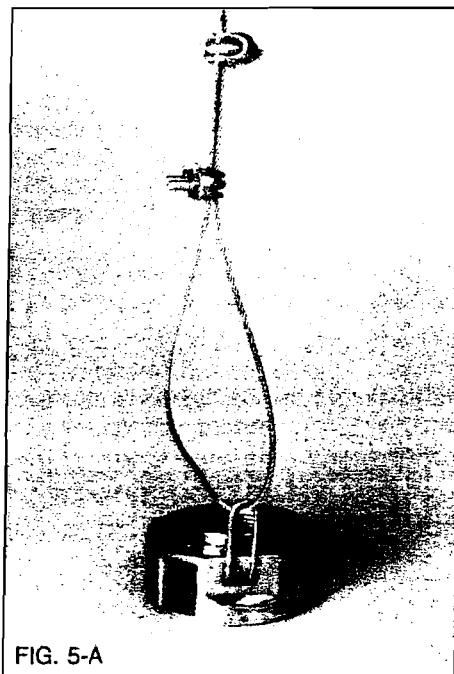


FIG. 5-A

Check valves:

A check valve should always be installed at the surface of the well. In addition, for installations deeper than 200 feet, check valves should be installed at no more than 200 foot intervals.

Protect the well from contamination:

To protect against surface water entering the well and contaminating the water source, the well should be finished off above grade, and a locally approved well seal or pitless adapter unit utilized.

SECTION 6.

Electrical

WARNING: To reduce the risk of electric shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in Table E.

If voltage variations are larger than $\pm 10\%$, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current. If direct on-line starting is not acceptable and reduced starting current is required, an auto-transformer or resistant starters should be used for 5 to 30 HP motors (depending on cable length). For motors over 30 HP, use auto-transformer starters.

Engine-Driven Generators

If the submersible pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contacted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

If power is going to be supplied through transformers, Table C outlines the minimum KVA rating and capacity required for satisfactory pump operation.

Control Box/Panel Wiring

1. Single-Phase Motors:

Single-phase motors must be connected as indicated in the motor control box. A typical single-phase wiring diagram using a Grundfos control box is shown (Figure 6-A).

2. Three-Phase Motors:

Three-phase motors must be used with the proper size and type of motor starter to ensure the motor is protected against damage from low voltage, phase failure, current unbalance and overload current. A properly sized starter with ambient-compensated extra quick-trip overloads must be used to give the best possible motor winding protection. **Each of the three motor legs must be protected with overloads.** The thermal overloads must trip in less than 10 seconds at locked rotor (starting) current. For starter and overload protection guide, see Table H. A three-phase motor wiring diagram is illustrated below (See Figure 6-B).

Pumps should NEVER be started to check rotation unless the pump is totally submerged. Severe damage may be caused to the pump and motor if they are run dry.

Single-Phase Wiring Diagram
for GRUNDFOS Control Boxes

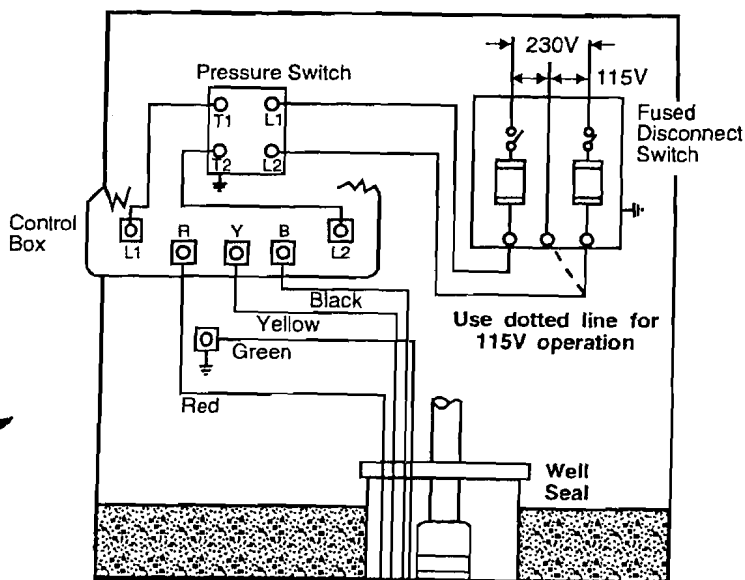


Figure 6-A

Three-Phase Wiring Diagram
for GRUNDFOS and FRANKLIN Motors

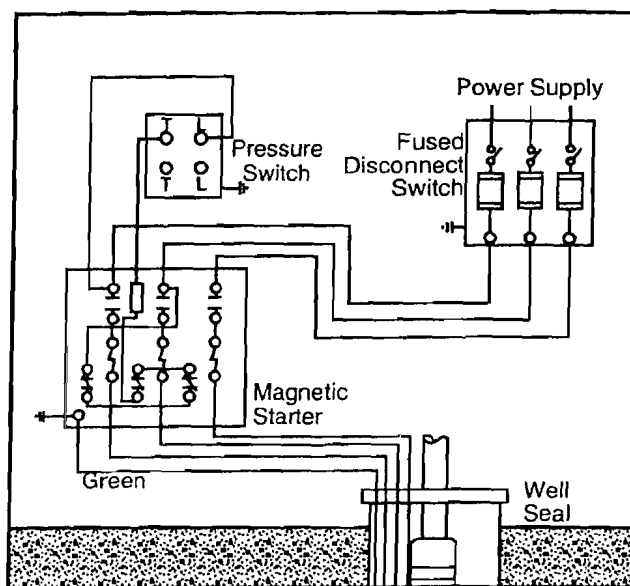


Figure 6-B

High Voltage Surge Arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges. Lightning voltage surges in power lines are caused when lightning strikes somewhere in the area. Switching surges are caused by the opening and closing of switches on the main high-voltage distribution power lines.

The correct voltage-rated surge arrester should be installed on the supply (line) side of the control box (Figure 6-C and 6-D). The arrester must be grounded in accordance with the National Electrical Code and local codes and regulations.

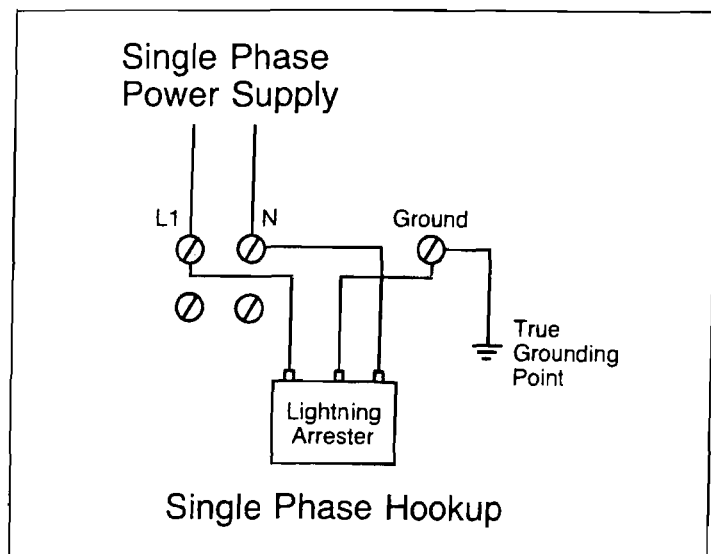


Figure 6-C

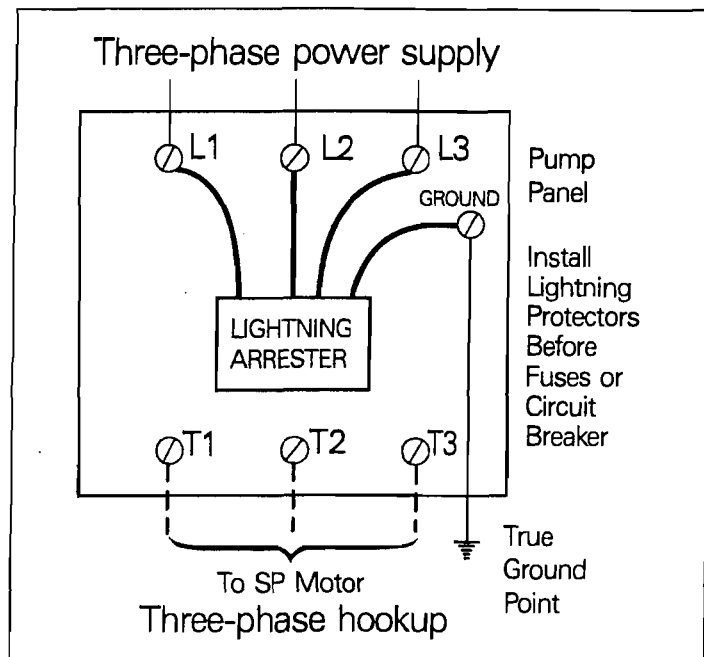


Figure 6-D

The warranty on all three-phase submersible motors is VOID if:

1. The motor is operated with single-phase power through a phase converter.
2. Three-leg ambient compensated extra quick-trip overload protectors are not used.
3. Three-phase current unbalance is not checked and recorded (See START-UP Section 7 for instructions.)
4. High voltage surge arresters are not installed.

Control Box/Panel Grounding

The control box or panel shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations. The ground wire should be a bare copper conductor at least the same size as the drop cable wire size. The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be: a grounding rod driven into the water strata, steel well casing submerged into the water lower than the pump setting level, and steel discharge pipes without insulating couplings. If plastic discharge pipe and well casing are used or if a grounding wire is required by local codes, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel. Do not ground to a gas supply line. Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.

Wiring Checks and Installation

Before making the final surface wiring connection of the drop cable to the control box or panel, it is a good practice to check the insulation resistance to ensure that the cable and splice are good. Measurements for a new installation must be at least 2,000,000 ohm. Do not start the pump if the measurement is less than this.

If it is higher than 2,000,000 ohm, the drop cable should then be run through the well seal by means of a conduit connector in such a way as to eliminate any possibility of foreign matter entering the well casing. Conduit should always be used from the pump to the control box or panel to protect the drop cable (See Figure 6-E). Finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box or panel and high voltage surge arrester have been grounded.

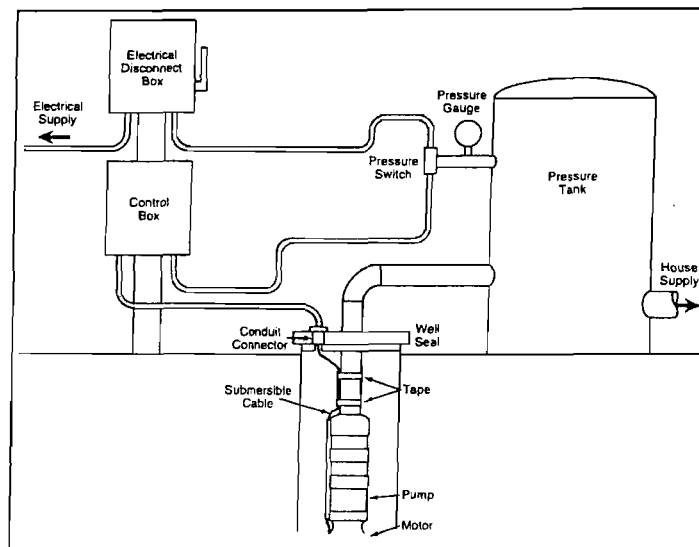


Figure 6-E

SECTION 7.

Start-Up

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

- A. Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.
- B. Adjust the gate valve one-third of the way open.
- C. On three-phase units, check direction of rotation and current unbalance according to the instructions below.

For single-phase units proceed directly to "Developing the Well".

- D. Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Three-Phase Motors

1. Check the direction of rotation

Three-phase motors can run in either direction depending on how they are connected to the power supply. When the three cable leads are first connected to the power supply, there is a 50% chance that the motor will run in the proper direction. **To make sure the motor is running in the proper direction, carefully follow the procedures below:**

- A. Start the pump and check the water quantity and pressure developed.
- B. Stop the pump and interchange any two leads.
- C. Start the pump and again check the water quantity and pressure.
- D. Compare the results observed. The wire connection which gave the highest pressure and largest water quantity is the correct connection.

2. Check for current unbalance

Current unbalance causes the motor to have reduced starting torque, overload tripping, excessive vibration and poor performance which can result in early motor failure. It is very important that current unbalance be checked in all three-phase systems. **Current unbalance between the legs should not exceed 5% under normal operating conditions.**

The supply power service should be verified to see if it is a two or three transformer system. If two transformers are present, the system is an "open" delta or wye. If three transformers are present, the system is true three-phase.

Make sure the transformer ratings in kilovolt amps (KVA) is sufficient for the motor load. See Table C.

The percentage of current unbalance can be calculated by using the following formulas and procedures:

$$\begin{aligned} \text{Average current} &= \frac{\text{Total of current values measured on each leg}}{3} \\ \text{\% Current unbalance} &= \frac{\text{Greatest amp difference from the average}}{\text{average current}} \times 100 \end{aligned}$$

To determine the percentage of current unbalance:

- B. Shift or roll the motor leads from left to right so the drop cable lead that was on terminal 1 is now on 2, lead on 2 is now on 3, and lead on 3 is now on 1 (hookup 2). Rolling the motor leads in this manner will not reverse the motor rotation. Start the pump, measure and record current reading on each leg. Disconnect power.
- C. Again shift drop cable leads from left to right so the lead on terminal 1 goes to 2, 2 to 3 and 3 to 1 (hookup 3). Start pump, measure and record current reading on each leg. Disconnect power.
- D. Add the values for each hookup.
- E. Divide the total by 3 to obtain the average.
- F. Compare each single leg reading from the average to obtain the greatest amp difference from the average.
- G. Divide this difference by the average to obtain the percentage of unbalance

Use the wiring hookup which provides the lowest percentage of unbalance. (See Table F for a specific example of correcting for three-phase power unbalance.)

Developing the Well

After proper rotation and current unbalance have been checked, start the pump and let it operate until the water runs clear of sand, silt and other impurities.

Slowly open the valve in small increments as the water clears until the desired flow rate is reached. Do not operate the pump beyond its maximum flow rating. **The pump should not be stopped until the water runs clear.**

If the water is clean and clear when the pump is first started, the valve should still be **slowly opened until the desired flow rate is reached**. As the valve is being opened, the drawdown should be checked to ensure the pump is always submerged. **The dynamic water level should always be more than 3 feet above the inlet strainer of the pump.**

Disconnect the temporary piping arrangements and complete the final piping connections.

Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Start the pump and test the system. Check and record the

Operation

1. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling and operation of controls.

2. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 8.

SECTION 8.

Troubleshooting

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following chart covers most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above-ground checks

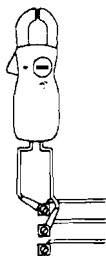
before pulling the pump from the well.

Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well. WARNING: Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.

Preliminary Tests

SUPPLY VOLTAGE



How to Measure

By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box or starter.

On single-phase units, measure between line and neutral.

On three-phase units measure between the legs (phases.)

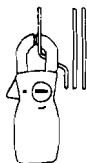
What it Means

When the motor is under load, the voltage should be within $\pm 10\%$ of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

CURRENT MEASUREMENT



How to Measure

By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box or starter. See Electrical Data, Table E, for motor amp draw information.

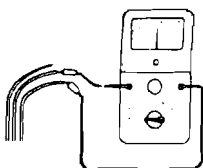
Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What it Means

If the amp draw exceeds the listed service factor amps (SFA) or if the current unbalance is greater than 5% between each leg on three-phase units, check for the following:

1. Burnt contacts on motor starter.
2. Loose terminals in starter or control box or possible cable defect. Check winding and insulation resistances
3. Supply voltage too high or low.
4. Motor windings are shorted.
5. Pump is damaged, causing a motor overload.

WINDING RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box or starter. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table E. Cable resistance values are in Table G.

What it Means

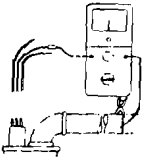
If all the ohm values are normal, and the cable colors correct, the windings are not damaged.

If any one ohm value is less than normal, the motor may be shorted.

If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open.

If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in Electrical Data, Table E.

INSULATION RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box or starter. Using an ohm or mega ohmmeter, set the scale selector to Rx100K and zero-adjust the meter.

Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).

What it Means

For ohm values, refer to table below. Motors of all HP, voltage, phase and cycle duties have the same value of insulation resistance.

OHM VALUE	MEGAOHM VALUE	CONDITION OF MOTOR AND LEADS
2,000,000 (or more)	2.0	Motor not yet installed: New Motor. Used motor which can be reinstalled in the well.
1,000,000 (or more)	1.0	
500,000 - 1,000,000	0.5 - 1.0	Motor in well (Ohm readings are for drop cable plus motor): A motor in reasonably good condition. A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason. A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long. A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.
20,000 - 500,000	0.02 - 0.5	
10,000 - 20,000	0.01 - 0.02	
less than 10,000	0 - 0.01	

Troubleshooting Chart

FAULT	POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
A. Pump Does Not Run	1. No power at pump panel.	Check for voltage at panel.	If no voltage at panel, check feeder panel for tripped circuits.
	2. Fuses are blown or circuit breakers are tripped.	Remove fuses and check for continuity with ohmmeter.	Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
	3. Motor starter overloads are burnt or have tripped out (three-phase only).	Check for voltage on line and load side of starter.	Replace burnt heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.
	4. Starter does not energize (three-phase only).	Energize control circuit and check for voltage at the holding coil.	If no voltage, check control circuit. If voltage, check holding coil for shorts. Replace bad coil.
	5. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
	6. Motor and/or cable are defective.	Turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values.	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
	7. Defective capacitor (single-phase only).	Turn off the power, then discharge capacitor. Check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.	If there is no needle movement, replace the capacitor.

(con't)

Troubleshooting Chart (continued)

FAULT	POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
B. Pump Runs But Does Not Deliver Water	1. Groundwater level in well is too low or well is collapsed.	Check well draw-down. Water level should be at least 3 ft. above pump inlet during operation.	If not, lower pump if possible, or throttle discharge valve and install water level control.
	2. Integral pump check valve is blocked.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shut-off. After taking reading, open valve to its previous position. Convert PSI to feet (For water: $\text{PSI} \times 2.31 \text{ ft/PSI} = \text{ft.}$), and add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.	If not close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and re-install.
	3. Inlet strainer is clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
	4. Pump is damaged.	Same as B.2 above.	If damaged, repair as necessary. Rinse out pump and re-install.
C. Pump Runs But at Reduced Capacity	1. Wrong rotation (three-phase only).	Check for proper electrical connection in control panel.	Correct wiring and change leads as required.
	2. Draw-down is larger than anticipated.	Check draw-down during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
	3. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
	4. Pump strainer or check valve are clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
	5. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.
D. Pump Cycles Too Much	1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts.	Re-adjust switch or replace if defective.
	2. Level control is not properly set or is defective.	Check setting and operation.	Re-adjust setting (refer to manufacturer data.) Replace if defective.
	3. Insufficient air charging or leaking tank or piping.	Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume.	Repair or replace damaged component.
	4. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.
	5. Tank is too small.	Check tank size. Tank volume should be approximately 10 gallons for each gpm of pump capacity.	If tank is too small, replace with proper size tank.

(con't)

Troubleshooting Chart (continued)

FAULT	POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
E. Fuses Blow or Circuit Breakers Trip	1. High or low voltage.	Check voltage at pump panel. If not within $\pm 10\%$, check wire size and length of run to pump panel.	If wire size is correct, contact power company. If not, correct and/or replace as necessary.
	2. Three-phase current unbalance.	Check current draw on each lead. Unbalance must be within $\pm 5\%$.	If current unbalance is not within $\pm 5\%$, contact power company.
	3. Control box wiring and components (single-phase only).	Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.	Correct as required.
	4. Defective capacitor (single-phase only).	Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If no meter movement, replace the capacitor.
	5. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

SECTION 9.

Technical Data

Table A

Minimum Water Flow Requirements for Submersible Pump Motors

MOTOR DIAMETER	CASING OR SLEEVE I.D. IN INCHES	MIN. FLOW PAST THE MOTOR (GPM)
4"	4	1.2
	5	7
	6	13
	7	21
	8	30
6"	6	10
	7	28
	8	45
	10	85
	12	140
	14	198
8"	16	275
	8	10
	10	55
	12	110
	14	180
10"	16	255
	10	30
	12	85
	14	145
	16	220
	18	305

- NOTES:**
1. A flow inducer or sleeve must be used if the water enters the well above the motor or if there is insufficient water flow past the motor.
 2. The minimum recommended water velocity over 4" motors is 0.25 feet per second.
 3. The minimum recommended water velocity over 6, 8, and 10" motors is 0.5 feet per second.

Table B

Guide for Engine-Driven Generators in Submersible Pump Applications

MOTOR HP FOR SINGLE OR THREE PHASE UNITS	MINIMUM KILOWATT RATING OF GENERATOR FOR THREE-WIRE SUBMERSIBLE PUMP MOTORS	
	EXTERNALLY REGULATED GENERATOR	INTERNALLY REGULATED GENERATOR
0.33 HP	1.5 KW	1.2 KW
0.50	2.0	1.5
0.75	3.0	2.0
1.0	4.0	2.5
1.5	5.0	3.0
2.0	7.5	4.0
3.0	10.0	5.0
5.0	15.0	7.5
7.5	20.0	10.0
10.0	30.0	15.0
15.0	40.0	20.0
20.0	60.0	25.0
25.0	75.0	30.0
30.0	100.0	40.0
40.0	100.0	50.0
50.0	150.0	60.0
60.0	175.0	75.0
75.0	250.0	100.0
100.0	300.0	150.0
125.0	375.0	175.0
150.0	450.0	200.0
200.0	600.0	275.0

- NOTES:**
1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single-phase and three-phase motors.
 2. Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.
 3. If the generator rating is in KVA instead of kilowatts, multiply the above ratings by 0.85 to obtain KW.

Table C**Transformer Capacity Required for Three-Phase
Submersible Pump Motors**

THREE-PHASE MOTOR HP	MINIMUM TOTAL KVA REQUIRED*	MINIMUM KVA RATING FOR EACH TRANSFORMER	
		2 TRANSFORMERS OPEN DELTA OR WYE	3 TRANSFORMERS DELTA OR WYE
1.5	3	2	1
2	4	2	1 ½
3	5	3	2
5	7 ½	5	3
7.5	10	7 ½	5
10	15	10	5
15	20	15	7 ½
20	25	15	10
25	30	20	10
30	40	25	15
40	50	30	20
50	60	35	20
60	75	40	25
75	90	50	30
100	120	65	40
125	150	85	50
150	175	100	60
200	230	130	75

* Pump motor KVA requirements only, and does not include allowances for other loads.

Table D**Submersible Pump Cable Selection
Chart (60 Hz)**

The following tables list the recommended copper cable sizes and various cable lengths for submersible pump motors.

These tables comply with the 1978 edition of the National Electric Table 310-16, Column 2 for 75°C wire. The ampacity (current carrying properties of a conductor) have been

divided by 1.25 per the N.E.C., Article 430-22, for motor branch circuits based on motor amps at rated horsepower.

To assure adequate starting torque, the maximum cable lengths are calculated to maintain 95% of the service entrance voltage at the motor when the motor is running at maximum nameplate amps. Cable sizes larger than specified may always be used and will reduce power usage.

The use of cables smaller than the recommended sizes will void the warranty. Smaller cable sizes will cause reduced starting torque and poor motor operation.

SINGLE-PHASE MOTOR MAXIMUM CABLE LENGTH (Motor to service entrance) (2)

MOTOR RATING		COPPER WIRE SIZE												
VOLTS	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300
115	1/3	130	210	340	540	840	1300	1960	2910					
	1/2	100	160	250	390	620	960	1460	2160					
230	1/3	550	880	1390	2190	3400	5250	7960						
	1/2	400	650	1020	1610	2510	3880	5880						
	3/4	300	480	760	1200	1870	2890	4370	6470					
	1	250	400	630	990	1540	2360	3610	5360	6520				
	1 1/2	190	310	480	770	1200	1870	2850	4280	5240				
	2	150	250	390	620	970	1530	2360	3620	4480				
	3	120	190	300	470	750	1190	1850	2890	3610				
	5			180	280	450	710	1110	1740	2170				
	7 1/2				200	310	490	750	1140	1410				
	10					250	390	600	930	1160				

CAUTION: Use of wire size smaller than listed will void warranty.

FOOTNOTES:

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

(con't)

THREE-PHASE MOTOR MAXIMUM CABLE LENGTH (Motor to service entrance)(2)

MOTOR RATING		COPPER WIRE SIZE												
VOLTS	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300
208	1½	310	500	790	1260									
	2	240	390	610	970	1520								
	3	180	290	470	740	1160	1810							
	5		170	280	440	690	1080	1660						
	7½			200	310	490	770	1180	1770					
	10				230	370	570	880	1330	1640				
	15					250	390	600	910	1110	1340			
	20						300	460	700	860	1050	1270		
	25							370	570	700	840	1030	1170	
	30							310	470	580	700	850	970	1110
230	1½	360	580	920	1450									
	2	280	450	700	1110	1740								
	3	210	340	540	860	1340	2080							
	5		200	320	510	800	1240	1900						
	7½			230	360	570	890	1350	2030					
	10				270	420	660	1010	1520	1870				
	15					290	450	690	1040	1280	1540			
	20						350	530	810	990	1200	1450		
	25						280	430	650	800	970	1170	1340	
	30							350	540	660	800	970	1110	1270
460	1½	1700												
	2	1300	2070											
	3	1000	1600	2520										
	5	590	950	1500	2360									
	7½	420	680	1070	1690	2640								
	10	310	500	790	1250	1960	3050							
	15			540	850	1340	2090	3200						
	20			410	650	1030	1610	2470	3730					
	25				530	830	1300	1990	3010	3700				
	30				430	680	1070	1640	2490	3060	3700			
	40						790	1210	1830	2250	2710	3290		
	50						640	980	1480	1810	2190	2650	3010	
	60							830	1250	1540	1850	2240	2540	2890
	75								1030	1260	1520	1850	2100	2400
	100									940	1130	1380	1560	1790
	125											1080	1220	1390
	150												1050	1190
	200												1080	1300
	250													1080
575	1½	2620												
	2	2030												
	3	1580	2530											
	5	920	1480	2330										
	7½	660	1060	1680	2650									
	10	490	780	1240	1950									
	15		530	850	1340	2090								
	20			650	1030	1610	2520							
	25			520	830	1300	2030	3110						
	30				680	1070	1670	2560	3880					
	40					790	1240	1900	2860	3510				
	50						1000	1540	2310	2840	3420			
	60						850	1300	1960	2400	2890	3500		
	75							1060	1600	1970	2380	2890	3290	
	100								1190	1460	1770	2150	2440	2790

CAUTION: Use of wire size smaller than listed will void warranty.

FOOTNOTES:

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

Table E

Electrical Data

Submersible Pump Motors - 60Hz

GRUNDFOS MOTORS

HP	Ph	VOLT	S.F.	Circ. Brkr or Fuses		AMPERAGE		FULL LOAD		Max.	Nameplate	Grundfos
				Std.	Delay	Start	Max.	Eff.	Pwr	Thrust	No.	Product No.
								(%)	Fact.	(lbs)		
4-Inch, Single Phase, 2-Wire Motors (control box not required)												
1/3.	1	230	1.75	15	5	25.7	4.6	59	77	750	79952101	791595016
1/2.	1	230	1.60	15	7	34.5	6.0	62	76	750	79952102	791595026
3/4.	1	230	1.50	20	9	40.5	8.4	62	75	750	79952103	791595036
1	1	230	1.40	25	12	48.4	9.8	63	82	750	79952104	791595046
1 1/2	1	230	1.30	35	15	62	13.1	64	85	750	79952105	791595056
4-Inch, Single Phase, 3-Wire Motors												
1/3.	1	230	1.75	15	5	14	4.6	59	77	750	79453101	791545016
1/2.	1	230	1.60	15	7	21.5	6.0	62	76	750	79453102	791545026
3/4.	1	230	1.50	20	9	31.4	8.4	62	75	750	79453103	791545036
1	1	230	1.40	25	12	37	9.8	63	82	750	79453104	791545046
1 1/2	1	230	1.30	30	15	45.9	11.6	69	89	750	79453105	791545056
4-Inch, Three Phase, 3 Wire Motors												
1 1/2	3	230	1.30	15	8	40.3	7.3	75	72	750	79302005	791530056
		460	1.30	10	4	20.1	3.7	75	72	750	79362005	791536056
		575	1.30	10	4	16.1	2.9	75	72	750	79392005	791539056
2	3	230	1.25	20	10	48	8.7	76	75	750	79302006	791530066
		460	1.25	10	5	24	4.4	76	75	750	79362006	791536066
		575	1.25	10	4	19.2	3.5	76	75	750	79392006	791539066
3	3	230	1.15	30	15	56	12.2	77	75	1000	79304507	96405801
		460	1.15	15	7	28	6.1	77	75	1000	79354507	96405810
		575	1.15	15	6	22	4.8	77	75	1000	79394507	96405815
5	3	230	1.15	40	25	108	19.8	80	82	1000	79304509	96405802
		460	1.15	20	12	54	9.9	80	82	1000	79354509	96405811
		575	1.15	15	9	54	7.9	80	82	1000	79394509	96405816
7 1/2	3	230	1.15	60	30	130	25.0	81	82	1000	79305511	96405805
		460	1.15	35	15	67	13.2	81	82	1000	79355511	96405814
		575	1.15	30	15	67	10.6	81	82	1000	79395511	96405819
6-Inch, Three Phase, 3 Wire Motors												
7 1/2	3	230	1.15	60	35	119	26.4	80.5	76	1000	78305511	96405781
		460	1.15	30	15	59	13.2	80.5	76	1000	78355511	96405794
10	3	230	1.15	80	45	156	34.0	82.5	79	1000	78305512	96405782
		460	1.15	40	20	78	17.0	82	79	1000	78355512	96405795
15	3	230	1.15	125	60	230	49.0	82.5	82	4400	78305514	96405783
		460	1.15	60	30	115	24.5	82.5	82	4400	78355514	96405796
20	3	230	1.15	150	80	343	66.0	84	81	4400	78305516	96405784
		460	1.15	80	40	172	33.0	84	82	4400	78355516	96405797
25	3	460	1.15	100	50	217	41.0	84.5	80	4400	78355517	96405798
30	3	460	1.15	110	60	237	46.5	85	83	4400	78355518	96405799
40	3	460	1.15	150	80	320	64.0	85	82	4400	78355520	96405800

HITACHI MOTORS

6 Inch (Three Wire) Motors

60 Hz

HP	Ph	VOLTS	Service Factor	Circuit Breaker or Standard Fuse	Dual Element Fuse	AMPERAGE			FULL LOAD		Line-to-Line Resistance(Ohms)		KVA Code	Three-Phase Overload Protection		Maximum Thrust (lbs)	GRUNDFOS PART NO.
						Full Load	Locked Rotor	S.F. Amps	Eff.	Power Factor	Resistance(Ohms)			Starter Size	Furnas Amb. Comp		
											Blk-Yel	Red-Yel					
Delta																	
5	1	230	1.15	80	35	23.8	124	27.1	74.8	91.2	0.51	2.2	G	--	--	1500	82.4119H
	3	230	1.15	45	20	14.8	110	16.4	76.8	82.5	0.81		K	1	K58	1500	82.9115H3
	3	460	1.15	25	10	7.4	55	8.2	76.8	82.5	3.05		K	1	K43	1500	82.9115H6
7 1/2	1	230	1.15	125	45	35.2	167	40.9	72.9	94.9	0.40	1.40	F	--	--	1500	82.4121H
	3	230	1.15	70	30	21.8	144	24.4	78.5	81.8	0.65		J	1	K64	1500	82.9116H3
	3	460	1.15	35	15	10.9	72	12.2	78.5	81.8	2.43		J	1	K54	1500	82.9116H6
10	1	230	1.15	175	60	48.0	202	54.0	73.6	93.2	0.32	1.05	E	--	--	3500	82.4123H
	3	230	1.15	80	40	28.2	208	32.0	79.3	82.8	0.45		K	1.75	K68	3500	82.9117H3
	3	460	1.15	40	20	14.3	104	16.0	79.3	82.8	1.62		K	1	K58	3500	82.9117H6
15	1	230	1.15	250	100	70.8	275	84.9	73.7	93.2	0.23	0.68	D	--	--	3500	82.9118H3
	3	230	1.15	125	60	41.4	320	46.2	81.7	83.2	0.31		K	2	K74	3500	82.9118H3
	3	460	1.15	60	30	20.7	160	23.1	81.7	83.2	1.07		K	1.75	K63	3500	82.9118H6
20	3	230	1.15	175	70	53.0	392	63.0	83.2	84.9	0.26		K	2.5	K77	3500	82.9119H3
	3	460	1.15	90	35	26.5	196	30.0	83.2	84.9	0.86		K	2	K67	3500	82.9119H6
25	3	230	1.15	200	90	67.2	530	75.4	83.0	83.9	0.21		K	3	K83	3500	82.9120H3
	3	460	1.15	100	45	33.6	265	37.7	83.0	83.9	0.67		K	2	K72	3500	82.9120H6
30	3	230	1.15	250	110	80.8	610	90.6	82.5	84.3	0.16		K	3	K86	3500	82.9121H3
	3	460	1.15	125	50	40.4	305	45.3	82.5	84.3	0.55		K	2.5	K74	3500	82.9121H6
40	3	460	1.15	150	70	51.7	340	58.8	84.0	86.3	0.46		H	3	K76	5000	82.3228H
50	3	460	1.15	200	90	69.7	465	78.8	82.5	81.4	0.39		J	3	K83	5000	82.3229H
60	3	460	1.15	225	100	80.8	465	92.8	82.4	84.4	0.39		G	3.5	K86	5000	82.3230H

8 Inch Motors

40	3	460	1.15	150	70	54.3	380	60.9	83.9	82.1	0.37		J	3	K76	10,000	82.3270H
50	3	460	1.15	200	90	64.9	435	73.6	84.1	85.7	0.33		H	3	K78	10,000	82.3271H
60	3	460	1.15	225	100	77.8	510	88.5	84.7	85.3	0.28		H	3.5	K86	10,000	82.3272H
75	3	460	1.15	350	150	96.7	650	110	84.9	85.9	0.22		H	3.5	K88	10,000	82.3274H
100	3	460	1.15	400	175	127	795	145	85.2	86.6	0.16		H	4	K89	10,000	82.3275H
125	3	460	1.15	500	225	172.0	980	192	84.2	80.9	0.14		G	4.5	K28	10,000	82.36H042
150	3	460	1.15	600	250	187.0	1060	216	85.6	87.9	0.13		G	4.5	K29	10,000	82.36H043

10 Inch Motors

200	3	460	1.15	800	350	233.0	1260	270	87.2	92.2	0.09		F	5	K33	10,000	82.36H064
250	3	460	1.15	900	450	294.0	1500	344	86.5	92.1	0.08		E	6	K27	10,000	82.36H066

Franklin Motors

(refer to the Franklin Submersible Motors Application Maintenance Manual)

Table F

Example: Correcting for Three-Phase Power Unbalance

Example: Check for current unbalance for a 230 volt, 3 phase, 60 Hz submersible pump motor, 18.6 full load amps.

Solution: Steps 1 to 3 measure and record amps on each motor drop lead for Hookups 1, 2 and 3.

	Step 1 (Hookup 1)	Step 2 (Hookup 2)	Step 3 (Hookup 3)
(T ₁)	DL ₁ = 25.5 amps	DL ₃ = 25 amps	DL ₂ = 25.0 amps
(T ₂)	DL ₂ = 23.0 amps	DL ₁ = 24 amps	DL ₃ = 24.5 amps
(T ₃)	DL ₃ = 26.5 amps	DL ₂ = 26 amps	DL ₁ = 25.5 amps
Step 4	Total = 75 amps	Total = 75 amps	Total = 75 amps
Step 5	Average Current =	Total current = 3 readings	75 = 25 amps 3
Step 6	Greatest amp difference from the average:	(Hookup 1) = 25-23 = 2 (Hookup 2) = 26-25 = 1 (Hookup 3) = 25.5-25 = .5	
Step 7	% Unbalance	(HOOKUP 1) = 2/25 X 100 = 8 (HOOKUP 2) = 1/25 X 100 = 4 (HOOKUP 3) = .5/25 X 100 = 2	

As can be seen, Hookup 3 should be used since it shows the least amount of current unbalance. Therefore, the motor will operate at maximum efficiency and reliability.

By comparing the current values recorded on each leg, you will note the highest value was always on the same leg, L₃. This indicates the unbalance is in the power source. If the high current values were on a different leg each time the leads were changed, the unbalance would be caused by the motor or a poor connection.

If the current is greater than 5%, contact your power company for help.

* For a detailed explanation of three-phase balance procedures, see Three-Phase Motor, section 2, page 6.

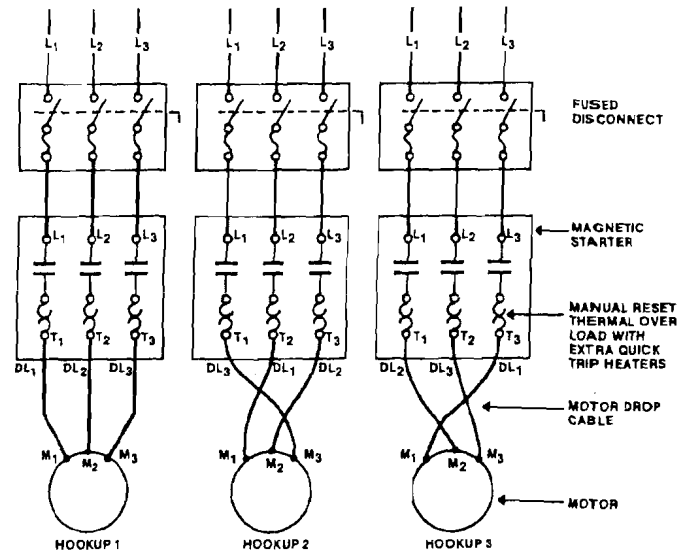


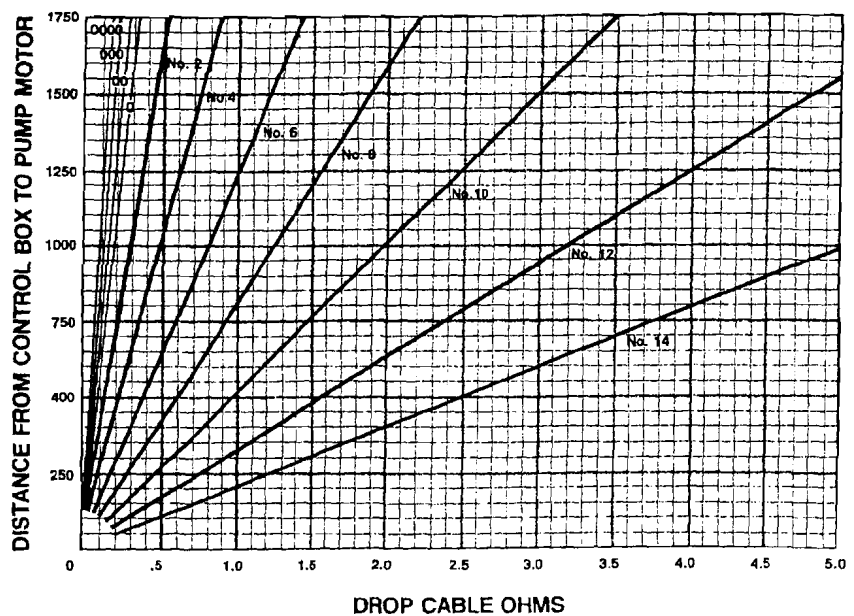
Table G

Total Resistance of Drop Cable (OHMS)

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the control box to the motor and back.

To determine the resistance:

1. Disconnect the drop cable leads from the control box or panel.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance. Motor resistances can be found in the Electrical Data Chart, Table E.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.
6. The measured values should be approximately equal to the calculated values.



Limited Warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, 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 jurisdiction to jurisdiction.

GRUNDFOS®



Leaders in Pump Technology

Grundfos Pumps Corporation • 3131 N. Business Park Avenue • Fresno, CA 93727

Customer Service Centers: Allentown, PA • Fresno, CA

Phone: (800) 333-1366 • Fax: (800) 333-1363

Canada: Oakville, Ontario • Mexico: Apodaca, N.L.



13720-01-B

13720-01-B
AIR STRIPPER RE-SUBMITTAL

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)

June 28, 2001

Ref. No. 10620-LAW-BWE
Via Fed Ex – Page 1 of 2

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square – Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

We are pleased to provide this *revised* submittal data per ERM comments dated 06-20-01 for Submittal No. 13720-01-A for the Air Stripper towers. Reference is made to CGL transmittal dated 06-20-01 (which contained the current drawing for the Air Stripper Tower, Drawing No. BE-1021, Rev. A). Details as follows (letter references same as ERM comments dated 06-20-01, Item 3):

- A. Packing Material – The Rauschert packing will provide equal or better performance to the specified Jaeger Tripack packing. The air stripper performance specification *will be met* using the Rauschert HiFlow packing detailed in the submittal.
- B. Liquid redistribution rings / wipers. Rev. A of the stripper drawing (already submitted by CGL on 06-20-01) *correctly shows* one (1) wiper ring, agreeing with the “Mechanical Details” section of the Branch air stripper submittal. This is the clarification requested by ERM for this item.
- C. Air Stripper Sump – ERM’s comment correctly notes that the volume of the sump shown on the stripper drawing is 470 gallons with connection “G” (= overflow) set at the elevation of 5’-0” as shown on the drawing. All copyholders are requested to change the elevation of “G” to be 5’-4”. This change increases the sump volume to 500 gallons per specification requirements. BWE is requested to return one copy of the stripper drawing marked “*Approved As Noted*” showing this change. The stripper supplier, Branch Environmental, will show this change on the final “as built” drawing for the stripper to be issued.

- D. Removal Performance Guarantee – Please see the attached calculations from Branch Environmental for the impact of operation of the air stripper with a water temperature of 55°F and an ambient air temperature of 0°F. The maximum impact per the attached calculation is that the water temperature cools slightly from 55°F to around 53.66°F. **Most** of this cooling takes place in the **last (bottom) 5 feet** of the first 25 ft. packed bed (where the cold ambient air **enters** the first tower). The remaining $20 + 25 = 45$ feet of packed bed remain at a temperature very close to 55°F (only affected by the very minor heat loss through the shell). Thus, per the attached calculation (and based on **many** years of experience with cold weather operation all over the country), CGL and Branch can state with **complete confidence** that the strippers for this site on Long Island in New York will perform as required – even on the occasional (rare) 0°F ambient air temperature day. CGL and Branch are pleased to assure BWE, Law, ERM and the NYSDEC that the air stripper **will perform** per the specification as designed & submitted.
- E. Spare Parts – There are no spare parts *per se* required for the air stripper towers. Extra tower packing material will be supplied to fill the towers to the proper packed bed height should extra settling occur when the packing is loaded into the towers.
- F. Blower – A separate submittal will be issued for the blower. The Branch submittal is only for the air stripper towers.
- G. Warranty – As with all items to be supplied by CGL on this order, the air stripper towers will have a one-year warranty as specified.
- H. O&M Manual – Will be provided by Branch Environmental as part of the final documentation package to be issued for the air strippers.
- I. Electrical Schematic – **All** electrical items will be shown on the electrical drawing & submittals to be made next week by our controls supplier, Sigma Controls. A separate “schematic electrical diagram” just for the air strippers does not apply.

Per previous discussion with Mark, one (1) copy of the submittal will be sent to LAW and four (4) copies sent to BWE. BWE will make the formal re-submittal to ERM for review and approval. Once we receive a copy of the attached submittals marked “approved as noted” per item “C” above, we will release the stripper for fabrication. Lead-time **after** release is six (6) weeks.

Additional equipment submittals by CGL to follow. Please call if you have any questions.

Regards,


Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Calculations Provided by Branch Environmental for the Impact of Air Stripper Operation with Water Temperature = 55°F and Ambient Air Temperature = 0°F

Treating the first air stripper as a heat exchanger, there will be two temperature impacts:

(1) the change in water and air temperatures to reach equilibrium (i.e., the air will “warm up” and the water will “cool down” until they reach the same temperature, based on their relative thermal mass), and (2) the heat loss through the stripper fiberglass shell to the ambient air.

(1) The design air to water volumetric ratio is 40:1. This equates to 3 lb. air to 62.4 lb. water (i.e., 40 cu.ft. of air weighs 3 lbs.; 1 cu.ft. of water weighs 62.4 lbs.)

To reach temperature equilibrium, we take $W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$

Where W = Weight of air (or water) in lbs.

C_p = Specific heat of air (or water)

ΔT = Temperature difference in the air (or water) in °F

We need to set up the equation find T_2 (the final temperature for the air & water at equilibrium):

$$W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$$

$$(3) (0.25) (T_2 - 0) = (62.4) (1) (55 - T_2)$$

Solving the equation gives $T_2 = \underline{54.35^\circ\text{F}}$ (1)

(2) Heat loss through the fiberglass shell is calculated by $Q = U_o A \Delta T$

Where Q = Heat loss in BTU/hr

U_o = Overall heat transfer coefficient (value for FRP material is between 3 and 5)

A = Area in sq.ft. of the heat exchanger (in this case, the cylindrical tower shell)

ΔT = Temperature difference in the air in °F

$$Q = U_o A \Delta T$$

$$= (5) (314) (55 - 0) = 86,350 \text{ BTU/hr}$$

This heat loss is offset by the heat given up by the water = $W C_p \Delta T_W$

Where W = Weight of the water (= 250 gpm x 60 min/hr x 8.33 lb./gal) = 124,950 lb/hr.

$$\begin{aligned} \text{Therefore, } 86,350 \text{ BTU/lb.} &= W C_p \Delta T_W \\ &= (124,950 \text{ lb./hr}) (1 \text{ BTU/lb.}) \end{aligned}$$

Solving for ΔT_W gives the temperature difference of the water (i.e., the temperature *decrease* in the water as a result of heat loss through the stripper shell = 0.69°F (2)

This gives a final water temperature of 54.35°F minus 0.69°F = 53.66°F

when the ambient air temperature is 0°F. *The air stripper will perform as designed & will be guaranteed per the specification even if the water temperature drops to 50°F.*

Calculations Provided by Branch Environmental for the Impact of Air Stripper
Operation with Water Temperature = 55°F and Ambient Air Temperature = 0°F

Treating the first air stripper as a heat exchanger, there will be two temperature impacts:

(1) the change in water and air temperatures to reach equilibrium (i.e., the air will “warm up” and the water will “cool down” until they reach the same temperature, based on their relative thermal mass), and (2) the heat loss through the stripper fiberglass shell to the ambient air.

(1) The design air to water volumetric ratio is 40:1. This equates to 3 lb. air to 62.4 lb. water (i.e., 40 cu.ft. of air weighs 3 lbs.; 1 cu.ft. of water weighs 62.4 lbs.)

To reach temperature equilibrium, we take $W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$

Where W = Weight of air (or water) in lbs.

C_p = Specific heat of air (or water)

ΔT = Temperature difference in the air (or water) in °F

We need to set up the equation find T_2 (the final temperature for the air & water at equilibrium):

$$W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$$

$$(3) (0.25) (T_2 - 0) = (62.4) (1) (55 - T_2)$$

Solving the equation gives $T_2 = \underline{54.35^\circ\text{F}}$ (1)

(2) Heat loss through the fiberglass shell is calculated by $Q = U_o A \Delta T$

Where Q = Heat loss in BTU/hr

U_o = Overall heat transfer coefficient (value for FRP material is between 3 and 5)

A = Area in sq.ft. of the heat exchanger (in this case, the cylindrical tower shell)

ΔT = Temperature difference in the air in °F

$$\begin{aligned} Q &= U_o A \Delta T \\ &= (5) (314) (55 - 0) = 86,350 \text{ BTU/hr} \end{aligned}$$

This heat loss is offset by the heat given up by the water = $W C_p \Delta T_W$

Where W = Weight of the water (= 250 gpm x 60 min/hr x 8.33 lb./gal) = 124,950 lb/hr.

$$\begin{aligned} \text{Therefore, } 86,350 \text{ BTU/lb.} &= W C_p \Delta T_W \\ &= (124,950 \text{ lb./hr}) (1 \text{ BTU/lb.}) \end{aligned}$$

Solving for ΔT_W gives the temperature difference of the water (i.e., the temperature *decrease* in the water as a result of heart loss through the stripper shell = 0.69°F (2)

This gives a final water temperature of 54.35 °F minus 0.69 °F = 53.66 °F

when the ambient air temperature is 0 °F. *The air stripper will perform as designed & will be guaranteed per the specification even if the water temperature drops to 50 °F.*

Calculations Provided by Branch Environmental for the Impact of Air Stripper
Operation with Water Temperature = 55°F and Ambient Air Temperature = 0°F

☛ Treating the first air stripper as a heat exchanger, there will be two temperature impacts:

(1) the change in water and air temperatures to reach equilibrium (i.e., the air will “warm up” and the water will “cool down” until they reach the same temperature, based on their relative thermal mass), and (2) the heat loss through the stripper fiberglass shell to the ambient air.

(1) The design air to water volumetric ratio is 40:1. This equates to 3 lb. air to 62.4 lb. water (i.e., 40 cu.ft. of air weighs 3 lbs.; 1 cu.ft. of water weighs 62.4 lbs.)

To reach temperature equilibrium, we take $W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$

Where W = Weight of air (or water) in lbs.

C_p = Specific heat of air (or water)

ΔT = Temperature difference in the air (or water) in °F

We need to set up the equation find T_2 (the final temperature for the air & water at equilibrium):

$$W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$$

$$(3) (0.25) (T_2 - 0) = (62.4) (1) (55 - T_2)$$

Solving the equation gives $T_2 = \underline{54.35^\circ\text{F}}$ (1)

☛ (2) Heat loss through the fiberglass shell is calculated by $Q = U_o A \Delta T$

Where Q = Heat loss in BTU/hr

U_o = Overall heat transfer coefficient (value for FRP material is between 3 and 5)

A = Area in sq.ft. of the heat exchanger (in this case, the cylindrical tower shell)

ΔT = Temperature difference in the air in °F

$$\begin{aligned} Q &= U_o A \Delta T \\ &= (5) (314) (55 - 0) = 86,350 \text{ BTU/hr} \end{aligned}$$

This heat loss is offset by the heat given up by the water = $W C_p \Delta T_W$

Where W = Weight of the water (= 250 gpm x 60 min/hr x 8.33 lb./gal) = 124,950 lb/hr.

$$\begin{aligned} \text{Therefore, } 86,350 \text{ BTU/lb.} &= W C_p \Delta T_W \\ &= (124,950 \text{ lb./hr}) (1 \text{ BTU/lb.}) \end{aligned}$$

Solving for ΔT_W gives the temperature difference of the water (i.e., the temperature *decrease* in the water as a result of heart loss through the stripper shell = 0.69°F (2)

☛ This gives a final water temperature of 54.35 °F minus 0.69 °F = 53.66 °F

when the ambient air temperature is 0 °F. *The air stripper will perform as designed & will be guaranteed per the specification even if the water temperature drops to 50 °F.*

Calculations Provided by Branch Environmental for the Impact of Air Stripper
Operation with Water Temperature = 55°F and Ambient Air Temperature = 0°F

Treating the first air stripper as a heat exchanger, there will be two temperature impacts:

(1) the change in water and air temperatures to reach equilibrium (i.e., the air will “warm up” and the water will “cool down” until they reach the same temperature, based on their relative thermal mass), and (2) the heat loss through the stripper fiberglass shell to the ambient air.

(1) The design air to water volumetric ratio is 40:1. This equates to 3 lb. air to 62.4 lb. water (i.e., 40 cu.ft. of air weighs 3 lbs.; 1 cu.ft. of water weighs 62.4 lbs.)

To reach temperature equilibrium, we take $W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$

Where W = Weight of air (or water) in lbs.

C_p = Specific heat of air (or water)

ΔT = Temperature difference in the air (or water) in °F

We need to set up the equation find T_2 (the final temperature for the air & water at equilibrium):

$$W_A C_{pA} \Delta T_A = W_W C_{pW} \Delta T_W$$

$$(3) (0.25) (T_2 - 0) = (62.4) (1) (55 - T_2)$$

Solving the equation gives $T_2 = \underline{54.35^\circ\text{F}}$ (1)

(2) Heat loss through the fiberglass shell is calculated by $Q = U_o A \Delta T$

Where Q = Heat loss in BTU/hr

U_o = Overall heat transfer coefficient (value for FRP material is between 3 and 5)

A = Area in sq.ft. of the heat exchanger (in this case, the cylindrical tower shell)

ΔT = Temperature difference in the air in °F

$$\begin{aligned} Q &= U_o A \Delta T \\ &= (5) (314) (55 - 0) = 86,350 \text{ BTU/hr} \end{aligned}$$

This heat loss is offset by the heat given up by the water = $W C_p \Delta T_W$

Where W = Weight of the water (= 250 gpm x 60 min/hr x 8.33 lb./gal) = 124,950 lb/hr.

$$\begin{aligned} \text{Therefore, } 86,350 \text{ BTU/lb.} &= W C_p \Delta T_W \\ &= (124,950 \text{ lb./hr}) (1 \text{ BTU/lb.}) \end{aligned}$$

Solving for ΔT_W gives the temperature difference of the water (i.e., the temperature *decrease* in the water as a result of heart loss through the stripper shell = 0.69°F (2)

This gives a final water temperature of 54.35 °F minus 0.69 °F = 53.66 °F

when the ambient air temperature is 0 °F. *The air stripper will perform as designed & will be guaranteed per the specification even if the water temperature drops to 50 °F.*

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)

June 28, 2001

Ref. No. 10620-LAW-BWE
Via Fed Ex - Page 1 of 1

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square - Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

Per a request from Angie this date, attached please find a one (1) page detail sheet showing the bolt circle for the four (4) x 7/8" dia. air stripper tower foundation bolts. This detail has been added to Revision "B" of the stripper drawing and will appear in the record copies of the as-built drawing to be issued prior to shipment of the stripper.

Please use the attached detail to set the foundation bolts in the concrete pad for the air stripper towers. As always, please call if you have any questions on the above or attached.

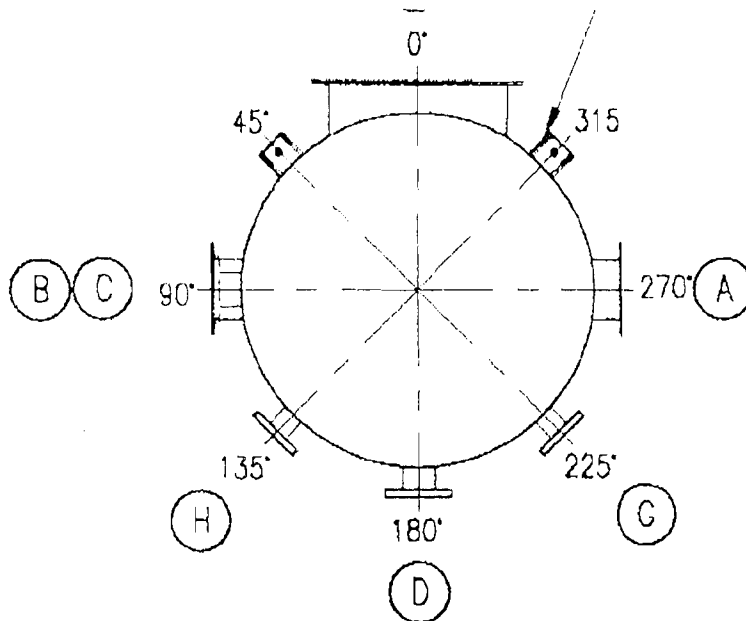
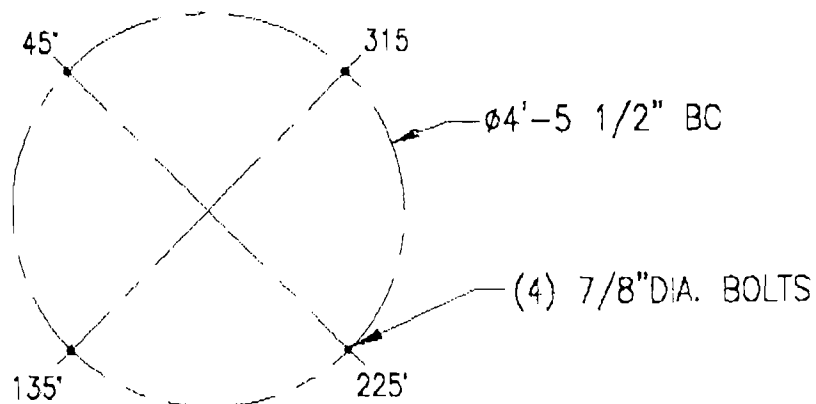
Regards,



Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Attachment: One (1) page follows as noted above

Copy (letter only) to: CGL, Portland, OR

PLAN VIEWMOUNTING BOLTS LAYOUT

DETAIL FOR AIR
STRIPPER TOWER
PER ANGIE GERSHMAN
REQUEST 6-28-01

Joseph M. Battaglia
Cameron Great Lakes, Inc.
166 Sandybrooke Drive
Langhorne, PA 19047
Tel 215-752-2246 (fax 2247)

Cameron Great Lakes SO # 77977
Blue Water Env'tal PO # 02370-109
Law Project # 22000-0-0019 Ph. 300
Active Industrial Site - NYSDDEC

02-A

13720-01-B

ADDENDUM TO AIR STRIPPER SUBMITTAL

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)

June 20, 2001

Ref. No. 10620-LAW-BWE
Via Fed Ex - Page 1 of 1

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square - Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

Please find attached the submittal drawings & data for the following items:

1. A complete **new submittal** for the 3,000 gallon HCL storage/recirculation tank with secondary containment basin (four (4) drawings and seven (7) pages of text/specification). Note that this is the **exact tank** as reference in Section 11246 of the Specifications. I have added the connections to the tank (sizes & service) as directed by Angie (shown on the plan view & listed in the table).
Please discard the previous submittal on the Snyder Industries tank.
2. A **revised drawing** for the Branch Corp. Air Stripper tower, Branch Drawing No. BE-1021. The revision was to remove the domed top & vertical outlet flange and replace it with a flat top and side mounted outlet flange. This lowers the tower overall height to 36'-4". The balance of the previous submittal package for the Air Strippers remains the same and applies.

Per previous discussion with Mark, one (1) copy of the submittal will be sent to LAW and four (4) copies sent to BWE. BWE will make the formal submittal to ERM for their review and approval. Once we receive a copy of the attached submittals marked "approved" or "approved as noted", we will release these items for fabrication.

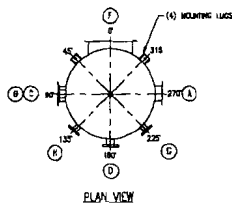
Additional equipment submittals by CGL to follow. Please call if you have any questions.

Regards,



Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Copy (letter only) to: CGL, Portland, OR



NOZZLE SCHEDULE											
JOB/NOTATION		ITEMS									
NO.	CONC. CMT.	WALL THICK.	FLANGE THICK.	WELD TYPE	WELD DIA.	QTY.	REMARKS	PROTECTION	PAINTING	PLAN	REMARKS
1	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
2	CAL. STITCH	6	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
3	LEAKS	6	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
4	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
5	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
6	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
7	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
8	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
9	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
10	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
11	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
12	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
13	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
14	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
15	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
16	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
17	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
18	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
19	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
20	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
21	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
22	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
23	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
24	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
25	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
26	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
27	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
28	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
29	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
30	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
31	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
32	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
33	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
34	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
35	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
36	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
37	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
38	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
39	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
40	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
41	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
42	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
43	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
44	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
45	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
46	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
47	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
48	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
49	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
50	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
51	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
52	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
53	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
54	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
55	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
56	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
57	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
58	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
59	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
60	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
61	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
62	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
63	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
64	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
65	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
66	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
67	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
68	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
69	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
70	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
71	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
72	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
73	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
74	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
75	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
76	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
77	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
78	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
79	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
80	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
81	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
82	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
83	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
84	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
85	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
86	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
87	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
88	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
89	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
90	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
91	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
92	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
93	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
94	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
95	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
96	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
97	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
98	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
99	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
100	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
101	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
102	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
103	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
104	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
105	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
106	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
107	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
108	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
109	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
110	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
111	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
112	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
113	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
114	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
115	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
116	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
117	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
118	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
119	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
120	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
121	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
122	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
123	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
124	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
125	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
126	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
127	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
128	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
129	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
130	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
131	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
132	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
133	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
134	GR. BOLT	8	12 3/8"	1"	W 8	8	1/2"	1"			P515-160
135	GR. BOLT										

NOTES:

MATERIALS - FIBERGLASS
PACKING - #2 11-101 POLYPROPYLENE
DISTRIBUTION TRAY - PVC
WAST COLLECTION - PVC

WEIGHT: 2449 LBS - 80.20 lb.
OPERATING - 11735 lb.

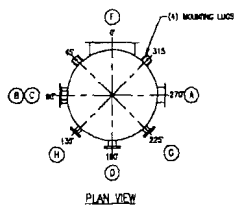
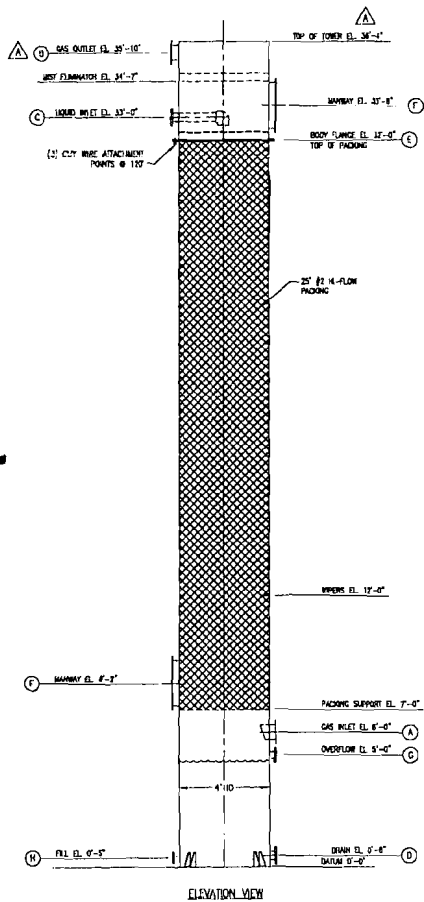
BLUE WATER ENVIRONMENTAL, P.O. NO. 02370-109
LAW GARD PROJECT NO. 22000-D-0019 PH. 300
ACTIVE INDUSTRIAL SITE - NYSDEC

BRANCH
ENVIRONMENTAL CORP

COOL SALES ORDER NUMBER 77977 / BWC
CAMERON GREAT LAKES P.O. NO. 20428

DATE	TIME	PACKED TOWER MODEL # 48T-25H TYPICAL FOR BOTH UNITS
NAME	NO.	BE-102

NAME	POSITION	NO. OF GAMES	NO. OF POINTS	NO. OF REBOUNDS	NO. OF ASSISTS	NO. OF STEALS	NO. OF BLOCKS	NO. OF Fouls	NO. OF MINUTES	NO. OF SECONDS	NO. OF POINTS PER GAME	NO. OF REBOUNDS PER GAME	NO. OF ASSISTS PER GAME	NO. OF STEALS PER GAME	NO. OF BLOCKS PER GAME	NO. OF Fouls PER GAME	NO. OF MINUTES PER GAME	NO. OF SECONDS PER GAME	NO. OF POINTS PER MINUTE	NO. OF REBOUNDS PER MINUTE	NO. OF ASSISTS PER MINUTE	NO. OF STEALS PER MINUTE	NO. OF BLOCKS PER MINUTE	NO. OF Fouls PER MINUTE
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON	FORWARD	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
JOHN WATSON</																								



NOZZLE SCHEDULE										
NO.	DESCRIPTION	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE	NOZZLE SIZE
A	GAS INLET	12	12	12	12	12	12	12	12	12
B	GAS OUTLET	12	12	12	12	12	12	12	12	12
C	LIQUID INLET	12	12	12	12	12	12	12	12	12
D	DRAIN	12	12	12	12	12	12	12	12	12
E	BODY FLANGE	12	12	12	12	12	12	12	12	12
F	(C) MANWAY	12	12	12	12	12	12	12	12	12
G	OVERFLOW	12	12	12	12	12	12	12	12	12
H	FEEL	12	12	12	12	12	12	12	12	12

NOTES:
 MATERIALS - FIBERGLASS
 PACKING - #2 1/4-FLUX POLYPROPYLENE
 DISTRIBUTION CHART - PVC
 MIST ELIMINATOR - PVC
 WEIGHT SHIPPING - 6820 LB.
 SHIPPING - 11750 LB.

BLUE WATER ENVIRONMENTAL P.O. NO. 02170-106
 LAR GEBI PROJECT NO. 22000-0-0018 PM. 300
 ACTIVE INDUSTRIAL SITE - MYSOC

BRANCH
 ENVIRONMENTAL CORP.

COI. SALES ORDER NUMBER 77877 / DMC
 CAMERON GREAT LAKES P.O. NO. 20478

PACKED TOWER
 MODEL 48T-25H
 TYPICAL FOR BOTH UNITS
 BE-1021

This drawing is confidential property of BRANCH ENVIRONMENTAL CORP. Any reproduction, disclosure, or use of this drawing in violation of the terms of the license to BRANCH ENVIRONMENTAL CORP. shall be deemed to be a breach of the license and shall be subject to the terms of the license to BRANCH ENVIRONMENTAL CORP. as amended in compliance of order or other purposes for which it is furnished.

Approved

OS-A

13720-01-B-

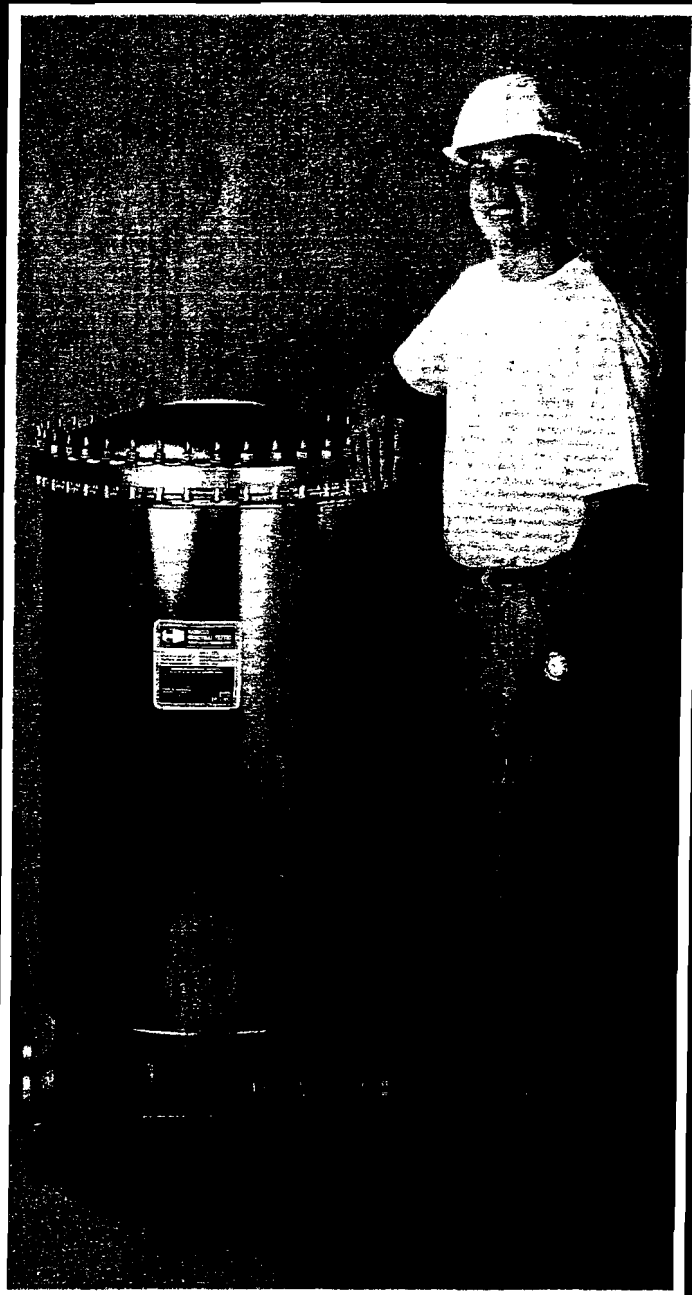
TOWER AIR STRIPPING SYSTEM GUY WIRE SYSTEM COMPONENTS

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

Material List

Material Description	Supplier/Part Number	Quantity	Units
<u>GUY WIRE HARDWARE</u>			
<u>Tower Guy-Wires Specified</u>	<u>TOWER CONNECTIONS, INC.</u>	2-cuts of wire	
3/4" 19 Strand EHS Galv. Guy (B2237) - 75'	34EHS 3/4" 58,300lbs	80	ft.
7/16" 19 Strand EHS Galv. Guy (B2237) - 200'	716EHS 7/16" 20,800lbs	200	ft.
Type G-450 Galv. Wire Rope Clips	34CC 3/4"	16	ea.
Type G-450 Galv. Wire Rope Clips	716CC 7/16"	32	ea.
Screw Pin Anchor Shackles	34S 3/4" 4 3/4 ton	6	ea.
Heavy Duty Thimbles	34THH 3/4"	4	ea.
Heavy Duty Thimbles	716THH 7/16"	8	ea.
Valmont Microflect Jaw-Eye Turnbuckle w/eye removed (B1022)	34TBE&J 3/4x12" Eye & Jaw, 26,000lbs	6	ea.
Preformed End Sleeves, Ice Clips	GC65269 3/4"	4	ea.
Preformed End Sleeves, Ice Clips	GC65265 7/16"	8	ea.
A.B. Chance Helical Soil Anchor	<i>TO BE SPECIFIED</i>	4	ea.

Harmsco® Industrial Filters



INSTALLATION
AND
OPERATION
MANUAL

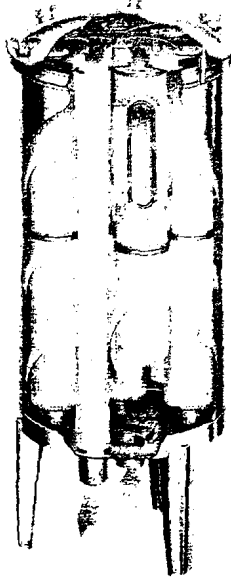
UP-FLOW FILTRATION

A Design So Superior It's Patented!

Understand how up-flow filters work, follow the diagram shown at right.

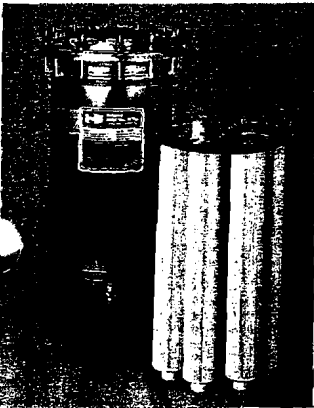
Fluid enters the filter under pressure and flows upward, forcing all air and the liquid through the filtration media, the holes in the center tubes and perforations in the rods that hold the cartridges in place. As the fluid continues its path, it flows past the top seal into the clean fluid chamber where it exits the filter through the standpipe. Notice the top of the standpipe is at the high point of the filter. Note the filter cartridges are sealed at the bottom and held in place with straight thread pipe caps on the Harmsco model shown in this diagram.

U.S. Patent No's 3,720,322 and 4,187,179. Existing foreign patents in effect and others pending.



TWO TYPES

Harmsco Industrial Filters are constructed using two basic designs as shown below.



Cartridge Cluster Filters
Models HIF-7, 14, 16, 21, 24



High Capacity Filters
Models HIF-42, 75, 100, 150-FL, 200-FL

SPECIFICATIONS

Construction: 304 electro-polished stainless steel
Pressure Rating: Rated to 150 psi
Temperature Ratings: *Rate to 140°F (60°C) with CPVC rods, caps and standpipes. To 200° (93°C) with stainless steel internal components

Cartridge holding rods, lifters, & pipe caps: Made of CPVC or stainless steel
O-rings, seals and gaskets: Standard filters have Buna-n o-rings; EPDM rim gaskets and top seals; bottom seals are natural gum rubber

Flow Rates: Typically 3-6 GPM per 9-3/4" Harmsco cartridge, depending on fluid being filtered, viscosity, suspended solids and length of filter run desired. See recommended flow charts above to be used for general guidelines only

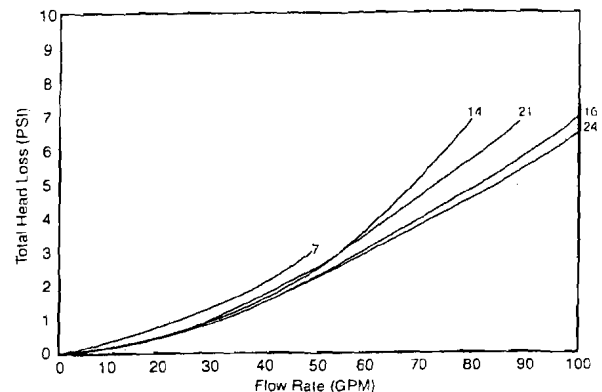
*NOTE: Actual limits may vary depending upon material used, temperature conditions, pressure and time under load.

Model	Flow Rate (GPM)	Model	Flow Rate (GPM)
HIF-7	Up to 30 GPM	HIF-42	Up to 175 GPM
HIF-14	Up to 60 GPM	HIF-75	Up to 300 GPM
HIF-16	Up to 75 GPM	HIF-100	Up to 400 GPM
HIF-21	Up to 90 GPM	HIF-150-FL	Up to 600 GPM
HIF-24	Up to 100 GPM	HIF-200-FL	Up to 800 GPM

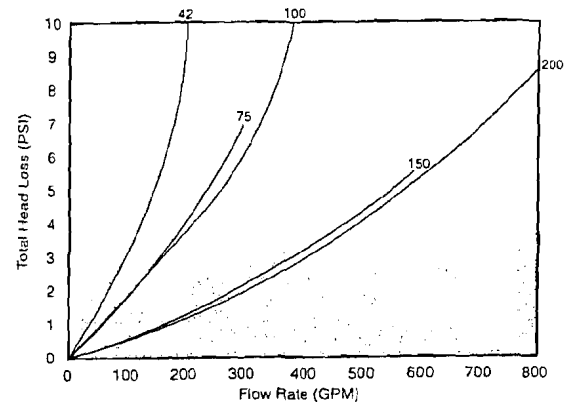
Pressure Drop

Pressure drop data for Harmsco Industrial Filters and 20 micron cartridges with clean water are shown below:

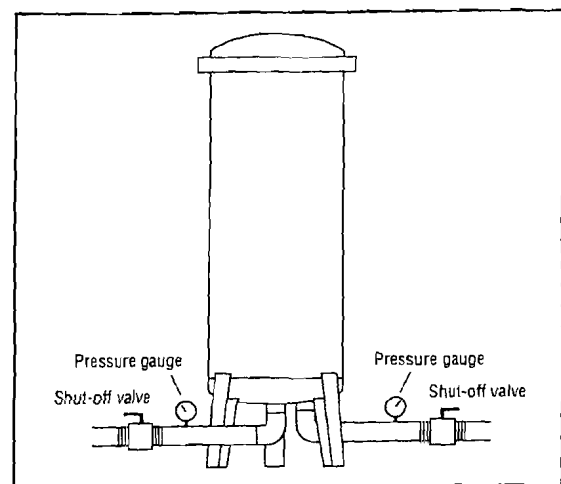
Pressure Drop - Harmsco Cluster Filters (HIF-7, 14, 16, 21, 24)



Pressure Drop - Harmsco High Capacity Filters (HIF-42, 75, 100, 150, 200)



INSTALLATION GUIDELINES



1. Install filter housing on the pressure side of pump.
2. Install 90° elbow on inlet and outlet pipe fittings.
3. Install 90° elbow on drain (or cap if drain is not needed).
4. Connect pipe from discharge of pump to inlet fitting.
5. Connect discharge pipe to outlet fitting.
6. Ground filter housing using grounding lug provided.

Note:

Pressure gauges to indicate cartridge change-out and shut off valves are recommended, as shown above.

06
13720-02-A

AN

TOWER AIR STRIPPING SYSTEM BLOWER SKID

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)

Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)

For additional information on CGL products & services, please visit our website: camerongreatlakes.com

August 1, 2001

Ref. No. 10801-LAW-BWE

ⓧ Via Fed Ex – Page 1 of 2

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square – Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

Re: Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

Please find attached submittal drawings & data for the following items:

1. **Revised** submittal data for the control system from Sigma Controls. Please update the blue Sigma Controls “binders” previously submitted with the enclosed pages. Once the Memo and updated pages are inserted into the blue binders, the controls “package” will be ready to submit to ERM for their review, comments and approval. (total 17 pages)

2. **Notes for Blower Sizing.** The following values were used to size the blower pressure rating:

- Pressure drop through air strippers @ 3” per tower x 2 towers =	6” w.g. (*)
- Pressure drop through carbon cells @ 3” per cell x 2 towers =	6” w.g. (**)
- Pressure drop through 8” duct, fittings & valves (per Angie) =	3” w.g.
- Pressure drop through 110 gallon knock-out drum (max.) =	1” w.g.
<u>Subtotal</u> , above pressure losses:	16” w.g.
<u>ADD</u> : 25% safety factor:	4” w.g.
<u>Blower pressure rating per submittal:</u>	<u>20” w.g.</u>

(*) Actual loss through each tower is only 2” per the data sheet in the first section of the Branch Env'tal submittal package on file & approved by ERM, LAW, and BWE.

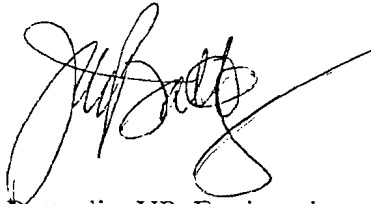
(**) Please refer to the enclosed attachment titled **“Determining Pressure Drop In Vapor Phase Activated Carbon Adsorbers”** (2 pages) to follow how the pressure drop for the carbon cells was determined: 1350 CFM airflow / 48 sq.ft. carbon bed area = 28.125 fpm face velocity

onto the carbon. From the pressure drop curve for 4 x 8 carbon, read a pressure drop of 0.5" w.g. loss per foot of carbon bed depth. Maximum bed depth = 4 ft. for the unit quoted with a carbon bed weight of 5000 pounds. Therefore, pressure drop through each carbon bed is 4 ft. depth x 0.5" per ft. of bed depth = 2" drop through the carbon bed plus 1" (maximum) for inlet & outlet losses = 3" total pressure drop per carbon cell.

Per previous discussion with Mark, one (1) copy of the submittal will be sent to LAW and four (4) copies sent to BWE. BWE will make the formal submittal to ERM for their review and approval. Once we receive a copy of the submittals "approved" or "approved as noted", we will release these items for procurement & fabrication.

Additional submittals by CGL to follow. Please call if you have any questions.

Regards,

A handwritten signature in black ink, appearing to read 'J. Battaglia', with a large, sweeping flourish extending from the bottom right.

Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - *Eastern Regional Office*

Copy (letter only) to: CGL, Portland, OR

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)
For additional information on CGL products & services, please visit our website: camerongreatlakes.com

August 2, 2001

Ref. No. 10802-LAW-BWE
Via Fax Only – Page 1 of 1

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square – Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

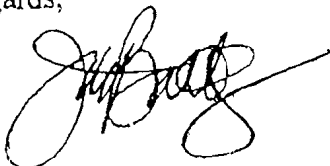
Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

This FAX follows up on our conference call yesterday concerning improving the corrosion resistance of the blower. Cincinnati Fan can supply an air-dry epoxy coating on the air stream surfaces on the Model PB-18 aluminum material blower submitted. **The coating is Sherman Williams Tile-Clad B62WZ.** This is a high solids, high build, two part epoxy-polyamide coating with a high gloss finish. Dry film thickness is minimum 3 mils. Maximum exposure temperature is 200°F. CGL uses similar two-part epoxy coatings on liquid phase carbon vessels with *wet, abrasive* contact between the carbon and water containing solvents (such as TCE) and other VOCs. **There is absolutely no doubt that a two-part epoxy coating on the air side of the blower will provide more than satisfactory service and corrosion resistance for this project. CGL will warrant the blower with this optional coating for three (3) years.**

We look forward to receipt of the blower submittal marked "approved as noted" (with the note being the addition of the air dry epoxy air side coating as described above).

Regards,



Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Copy to: CGL, Portland, OR

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)

Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)

For additional information on CGL products & services, please visit our website: camerongreatlakes.com

July 31, 2001

Ref. No. 10731-LAW-BWE

Via Fed Ex – Page 1 of 1

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square – Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

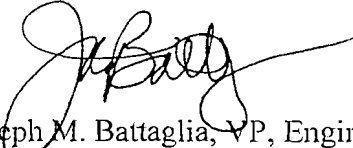
Dear Angie & Mark:

Please find attached submittal drawings & data for the following items:

1. **Revised** submittal data for pumps P-1 & P-2 (15 hp) and P-3 (5 hp). These pumps are now all Magnatex Teflon-lined magnetic drive pumps suitable for use with the 10% HCL backwash solution. (total 7 pages)
2. **New** submittal data for the 10-hp blower for the airside of the air stripper. The blower selection is for a Cincinnati Fan Model PB-18 pressure blower with cast aluminum housing & wheel and Teflon shaft seal. This blower meets the specification requirement for "corrosion resistant" material of construction. (total 4 pages)

Per previous discussion with Mark, one (1) copy of the submittal will be sent to LAW and four (4) copies sent to BWE. BWE will make the formal submittal to ERM for their review and approval. Once we receive a copy of the submittals "approved" or "approved as noted", we will release these items for procurement & fabrication.

Additional submittals by CGL to follow. Please call if you have any questions. Regards,


Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Copy (letter only) to: CGL, Portland, OR



FAN SELECTION And PERFORMANCE

Your Cincinnati Fan Representative:
John Conley
Systech Design Inc
300 N. Pottstown Pike
Exton, PA 19341

610-524-9048 Phone
610-524-7355 Fax

Cameron Great Lakes SO # 77977
Blue Water Env'tal PO # 02370-109
Law Project # 22000-0-0019 Ph. 300
Active Industrial Site - NYSDEC

July 31, 2001

Job Name:
Reference:

Operating Requirements

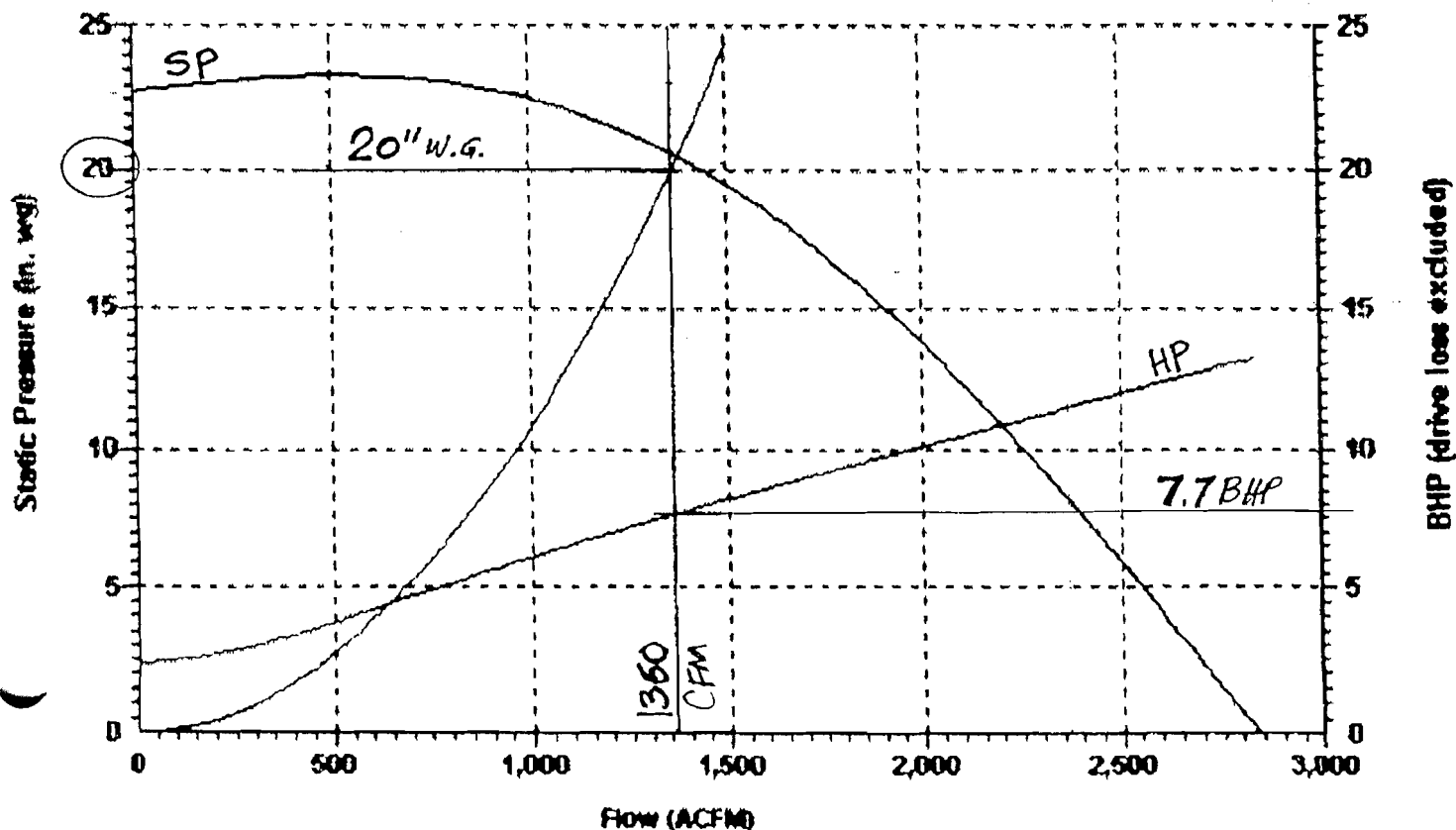
1,360 ACFM, Volume
20.0 in. W.G., Static Pressure
0.0750 lb./ft.³ Density
70 °F, Operating Temperature
0 ft. ASL, Site Altitude
0 %, Relative Humidity
1.000 Specific Gravity
0.0 in. W.G., Inlet Pressure
#4 (Direct) AMCA Arrangement No.
60 Hz, Motor Frequency
70 °F, Start-Up Temperature

Fan Selection and Specifications

Model	PB-18
Inlet Diameter, in.	8.00
Wheel Description	18 X 4.375 Radial
Wheel Width %	100%
Fan RPM	3,450
Fan BHP	7.7
Static Efficiency %	55.4%

Performance Graph

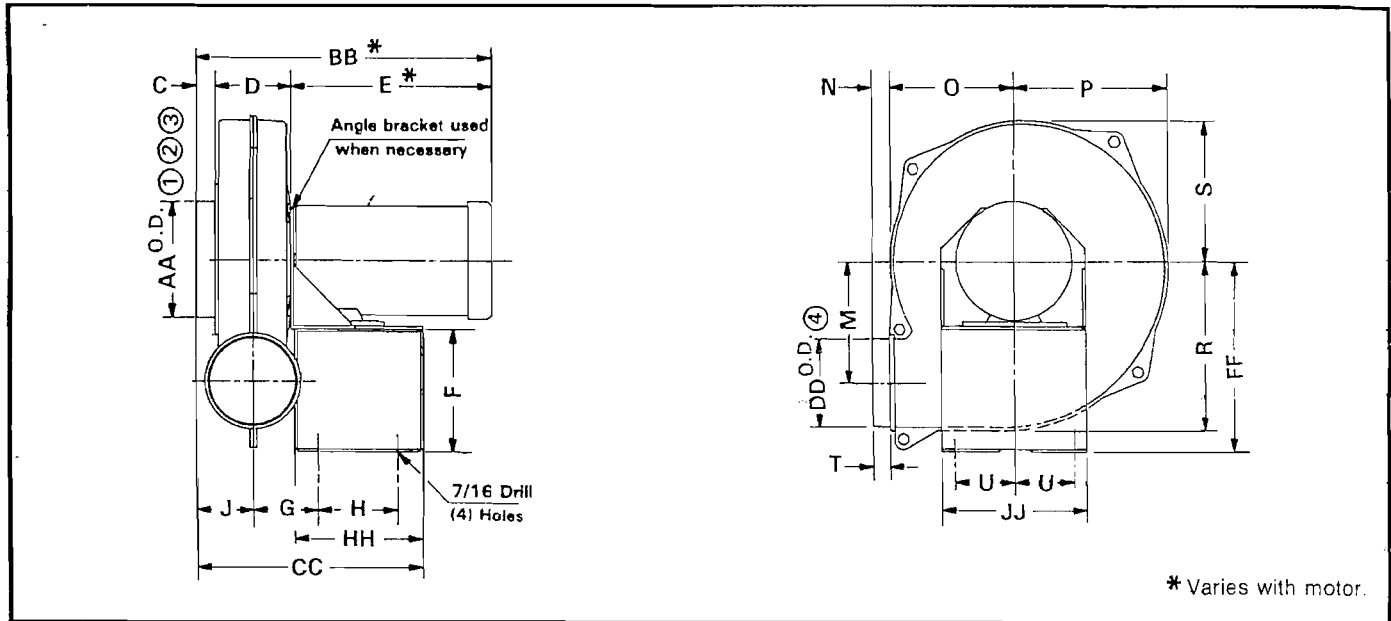
Cincinnati Fan Model PB-18 with 18 X 4.375 Radial Wheel (Full Width) @ 3,450 RPM
Rating Point: 1,360 ACFM @ 20.0 in. WG SP, 0.0750 lb./ft.³ Density, 7.7 BHP, 8.0 in. Inlet





DIMENSIONS and SPECIFICATIONS

Arrangement #4, Direct Drive



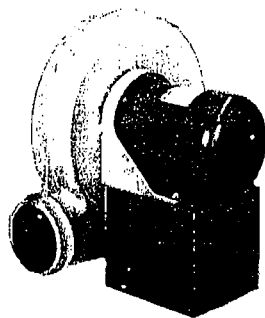
DIMENSIONS IN INCHES $\pm 1/8"$

DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE.

DO NOT CHANGE WITHOUT NOTICE																																	
MODEL	MOTOR FRAME	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP	QQ	RR	SS	TT	UU	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	MM	
PB-18	182T-184T	1 1/4	6 1/4	15 1/2	9 1/4	5 1/2	8 3/4	4 3/8	10 1/2	1 5/8	10 1/2	12 1/8	13 3/4	11 3/8	1	4 1/8	8 1/2	23	20 1/4	6	15 3/8	11 3/4	12	19 1/8	14 1/2	11 1/2	16 1/2	16	16 1/2	16	16 1/2	16	16 1/2
	213T-215T			16														23 1/2															4 1/8
	254T-256T			19	8 1/4		13											26 1/2	24 1/2														

Standard Arrangement

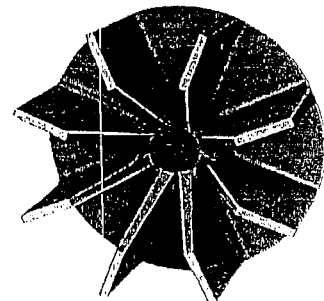
BLOWER WHEEL



Arrangement 4
(Flange mount-footless motor)



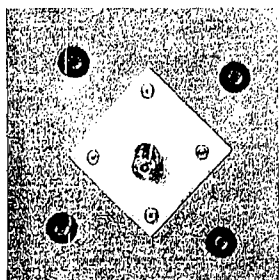
Arrangement 4
(Foot mounted motor)



CAST ALUMINUM RADIAL

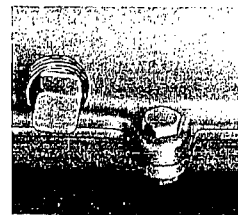
OPTIONAL ACCESSORIES

Cameron Great Lakes SO # 779-
Blue Water Env'tal PO # 02370-109
Law Project # 22000-0-0019 Ph. 300
Active Industrial Site - NYSDEC



TEFLON SHAFT SEAL

1/8" thick teflon shaft seal good to 400°F.
Ceramic fiber gasket material with steel cover plate above 400°F.



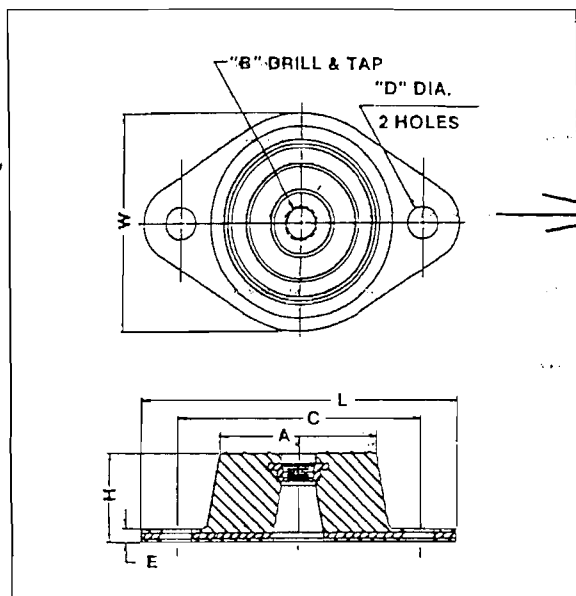
DRAIN

1/2" drain with plug. Not required on bottom horizontal discharges.



DIMENSIONS and SPECIFICATIONS

RUBBER-IN-SHEAR (RIS) VIBRATION ISOLATORS



TYPE R NEOPRENE IN-SHEAR MOUNTINGS										
TYPE	MAX. LOAD EACH LBS.	DEFLECTION IN INCHES	DIMENSION IN INCHES							
			R	L	W	H	A	B	C	E
R1	BLUE 35	0.20	3 1/8	1 3/4	1	1 1/4	5/16" - 18NC	2 3/8	1 1/32	3/16
	BLACK 45									
	RED 70									
	GREEN 120									
R2	BLUE 135	0.25	3 7/8	2 3/8	1 1/4	1 3/4	3/8" - 16NC	3	1 1/32	7/32
	BLACK 170									
	RED 240									
	GREEN 380									
R3	BLACK 250	0.25	5 1/2	3 3/8	1 3/4	2 1/2	1/2" - 13NC	4 1/8	9/16	1/4
	RED 525									
	GREEN 750									
	GRAY 1100									
R4	BLACK 1500	0.25	6 1/2	4 1/4	1 3/4	3 3/4	5/8" - 11NC	5	9/16	1/4
	RED 2250									
	GREEN 3000									
	GRAY 4000									

$$312 \div 4 = 78 \text{ LBS LOAD}$$

PER MOUNT

APPROXIMATE SHIPPING WEIGHT IN POUNDS*

MODEL	ARR-1 (No motor)	ARR-2 (No motor)	ARR-4	ARR-4HM	ARR-8	ARR-9	NOMINAL MOTOR HP - WT.
PB-8	60	30	50	42	130	104	1/3-21
PB-9	66	37	57	48	138	111	1/2-22
PB-10A	78	43	63	54	150	126	1-22
PB-12A	85	61	91	75	187	157	2-41
PB-14A	140	84	139	118	259	226	3-54
PB-15A	155	99	176	155	296	273	5-76
PB-18	163	105	190	181	320	299	7 1/2-87
PB-18WA	197	—	262	197 (1)	399	389	10-122

* ARRANGEMENTS 4, 4HM, 8, and 9 WEIGHTS INCLUDE NOMINAL HP AND CORRESPONDING MOTOR WEIGHT INDICATED IN COLUMN EIGHT, MAKE CORRECTIONS AS NECESSARY BY DEDUCTING NOMINAL WEIGHT AND ADDING WEIGHT OF ACTUAL MOTOR TO BE USED.

(1) WITH 7 1/4 HP MOTOR MAX. CONSULT FACTORY FOR LARGER SIZES.

$$\text{Total weight} = 190 + 122 = 312 \text{ lbs}$$

FEATURES/BENEFITS OF CAST ALUMINUM

Cincinnati Cast Aluminum Blowers are a smart buy now and for many years to come because Aluminum is:

NON-SPARKING

Cincinnati Cast Aluminum Blowers are AMCA Type B spark resistant. With the addition of a non-sparking shaft, they meet AMCA Type A requirements. **See Page 5.**

CORROSION FREE

No painting required. Maintenance free in moist environments.

LIGHT WEIGHT

Aluminum is 1/3 the weight of steel and, therefore, less structural support is required.

NON-TOXIC

Aluminum is friendly to foods, beverages and medicines. Cast Aluminum Blowers are used in many food processing applications where cleanliness is important.

STRONG

Aluminum's strength is exhibited in products such as highway guard rails, truck trailers and baseball bats. In high speed blower wheels, aluminum is alloyed with magnesium and other metals for greater strength.

ATTRACTIVE

Aluminum's natural appearance is desirable. No other metal accepts a greater variety of finishes.

It can be brushed, buffed, colored by anodizing and has excellent paint adhesion.

NON-MAGNETIC

Resists magnetism even in magnetic fields making it ideal in electronic applications where prevention of interference is very important.

WORKABLE

Aluminum can be machined by every known metal working process. This makes future modifications easier.

NOT AFFECTED BY COLD

Unlike many materials that become brittle when super cold, Aluminum alloys can actually become stronger. Cast aluminum blowers are used in many sub-zero applications.

AVAILABLE

Approximately eight percent of the earth's crust contains aluminum making it the most common metal on earth.

SUGGESTED SPECIFICATIONS FOR CAST ALUMINUM BLOWERS

Blowers shall be cast with commercial grade 319 cast aluminum, having a 3/16" minimum wall thickness. Housing halves should be attached with tapered lugs having a minimum 45 degree taper from centerline for additional strength. Inlets and outlets shall be round for convenient slip fit of duct work or hose. Blower sizes 14A and larger shall have a reversible housing that is rotatable. Blowers shall be AMCA type B spark resistant or better. Blower performance shall be derived from data as tested per AMCA Standard 211.

Blower wheels with tip speeds up to 13,000 feet per minute shall be 319 cast aluminum. Blower wheels with tip speeds over 13,000 feet per minute shall be 356 aluminum with a T6 heat treatment. Wheel hub shall be an integral part of the wheel casting. Wheels shall be locked onto the motor or fan shaft with two, knurled, cup point set screws with a locking patch or nylon insert. Set screws shall be 90° — 120° apart with one over shaft keyway. Up to 13" diameter wheels shall have 5/16-18 set screws torqued to 100 inch pounds. Wheels over 13" in diameter shall have 3/8-16 set screws torqued to 155 inch pounds.

Balancing shall be accomplished by removal of material only — no additional weights are to be used in the balancing process. Wheel diameters up to 13" shall be statically balanced. Wheel diameters above 13" shall be dynamically balanced.

Fan motor and bearing cap vibration levels shall not exceed 1.5 mils displacement at 3450 RPM.

All fan bases shall be a minimum of 12 gauge steel.

All motors shall be continuous duty type.

Inlet or outlet flanges (if required) shall be 319 cast aluminum and shall meet ANSI bolt circle and outside diameter dimensions (see dimensions on page 20).

DANGER

All fans & blowers shown have rotating parts and pinch points. Severe personal injury can result if operated without guards. Stay away from rotating equipment unless it is disconnected from its power source.

Read operating instructions.

Cameron Great Lakes SO # 77977

Blue Water Env'tal PO # 02370-109

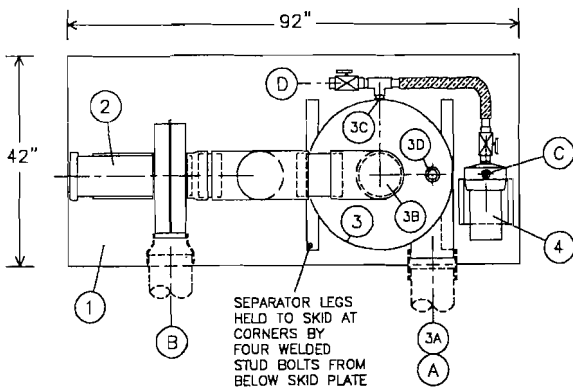
Law Project # 22000-0-0019 Ph. 300

13720-02-B 08-A

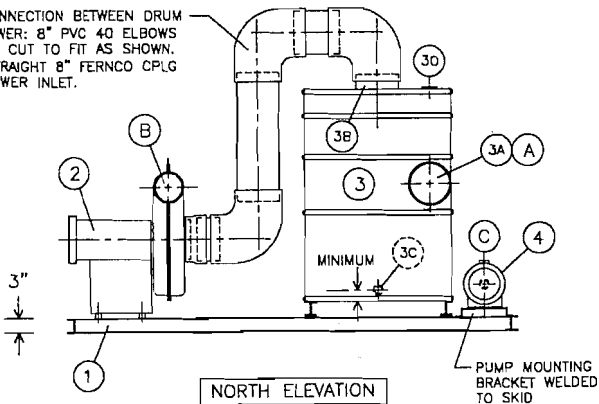
TOWER AIR STRIPPING SYSTEM BLOWER SKID

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

PLAN VIEW



AIR CONNECTION BETWEEN DRUM & BLOWER: 8" PVC 40 ELBOWS & PIPE CUT TO FIT AS SHOWN. USE STRAIGHT 8" FERNCO CPLG AT BLOWER INLET.



NORTH ELEVATION

PARTS IDENTIFICATION & FABRICATION NOTES

- 1 SKID - 11 GA. C.S. PLATE ON 3C4.1 BASE FRAME. CHANNELS AT PERIMETER & ALONG CENTER THE LONG WAY. FINISH: STD. SHOP PREP. PRIME & FINISH PAINT SAFETY BLUE COLOR ENAMEL PAINT. INCLUDES 9" x 9" x 1.5" HEIGHT PUMP MOUNTING BRACKET WELDED TO SKID PLATE.
- 2 MODEL PB-18 PRESSURE BLOWER WITH 10 HP TEFC MOTOR. BLOWER MOUNTED TO SKID ON FOUR (4) R.I.S. VIBRATION ISOLATORS.
- 3 MOISTURE SEPARATOR - 110 GALLON OPEN HEAD DRUM WITH TWO X 30" LENGTH LEGS OF S3x5.7 I-BEAM STITCH WELDED TO BOTTOM. SEPARATOR LEGS BOLTED TO SKID PLATE AT THE FOUR CORNERS. BOLT HEADS TO BE BACK WELDED UNDER SKID PLATE TO PROVIDE RIGID STUB BOLT FACING UP TO MOUNT DRUM LEGS. FINISH PAINT DRUM & BASE TO MATCH SKID. CONNECTIONS ON MOISTURE SEPARATOR DRUM:
 - 3A AIR INLET - 8" SCH. 40 STEEL PIPE CUT & FIT TO BE TANGENT TO DRUM O.D. AS SHOWN. MINIMUM PROJECTION = 3" ON SHORT LEG TO DRUM BODY.
 - 3B AIR OUTLET - 8" SCH. 40 STEEL PIPE WELDED AT TOP CENTER. MINIMUM 3" PROJECTION FROM LID.
 - 3C DRAIN/PUMP INLET - 1-1/4" NPT HALF CPLG WELDED AT BOTTOM OF SIDEWALL. 1-1/4" PLUMBING PARTS OUTSIDE DRUM: GALV. CLOSE NIPPLE, GALV. TEE, GALV. CLOSE NIPPLE TO PVC 40 THREADED MANUAL DRAIN VALVE, POLYPRO MPT x HOSE NIPPLE, PUMP SUCTION HOSE WITH S.S. HOSE CLAMPS, POLYPRO MPT x HOSE NIPPLE TO PVC 40 PUMP ISOLATION VALVE, 3" LENGTH GALV. NIPPLE INTO PUMP INLET.
 - 3D MULTI-LEVEL FLOAT SWITCH - 2" NPT HALF CPLG WELDED AT 10.8 INCHES FROM CENTER OF LID.
- 4 MOISTURE CONDENSATE PUMP (P-4) WITH 1/2 HP TEFC MOTOR. PUMP BASE HAS FOUR HOLES FOR BOLTING THRU MOUNTING BRACKET.

CUSTOMER CONNECTIONS & FIELD NOTES

- A AIR INLET FROM AIR STRIPPER - 8" SCH. 40 PIPE FOR USE WITH 8" STRAIGHT FERNCO CPLG TO CONNECT TO PVC 40 AIR INLET PIPE.
- B AIR OUTLET TO DUAL CELL VAPOR PHASE CARBON VESSEL - 6" O.D. SLEEVE AT BLOWER OULET FOR USE WITH 6" x 8" FERNCO CPLG TO CONNECT TO 8" PVC 40 PIPE OUT TO CARBON UNIT.
- C WATER OUT FROM P-4 - 1" NPT COUPLING ON TOP OF PUMP.
- D MANUAL DRAIN - 1-1/4" NPTF ON PVC 40 DRAIN VALVE

GENERAL ARRANGEMENT & DETAILS

BLOWER, MOISTURE SEPARATOR & CONDENSATE PUMP (P-4) SKID

TITLE
 CGL SALES ORDER NO. 77977
 BLUE WATER ENVIRONMENTAL
 1610 NEW HIGHWAY
 FARMINGDALE, NY 11735
 TEL: 631-732-2145 (FAX 3008)
 BWE P.O. NO. 02370-107
 LAW # 22000-0-0019 PH. 300
 NYSDCC-ACTIVE INDUSTRIAL SITE

CAMERON GREAT LAKES, INC.
 2335 BY 20A AVE PORTLAND, OR 97219
 TEL 503-777-4044 FAX 503-225-9137
 PROPRIETARY DRAWING
 DRAWING MAY NOT BE USED
 OR REPRODUCED WITHOUT
 WRITTEN PERMISSION OF
 CAMERON GREAT LAKES, INC.
 SUBMITTING TOLERANCE = +/- 1/8 IN.
 DATE
 BY
 REV

Submittal No.: 13720-04-A



Building Sump Pump

Zoeller Pump Co., Model #J161 with integral float
0.5-HP, 200-208 Volt/3-Phase,
Simplex 3-Phase Control Panel
Zoeller Variable Level Float Switch.

Aug. 13, 2001

Attention: Joe Battaglia/CGL

Ref: CGL Sales Order #77977, BWE PO #02370-109.

Cameron Great Lakes SO # 77977

Blue Water Env'tal PO # 02370-109

Law Project # 22000-0-0019 Ph. 300

Active Industrial Site - NYSDEC

Theoretical Isotherm Prediction for Vapor Phase Adsorption

The following data has been generated by Cameron Carbon's T.L.P. Model (except those compounds preceded by ###, which are best estimates due to lack of specific data). The carbon capacities to saturation have been used to compute the carbon exhaustion rate in lb/hr.

Flow (CFM) 1,350.00
System Temperature (C) 20.00
System Pressure (mm Hg) 760
Relative Humidity (% RH) <65
Water Flow = 200 gpm

WITH THE 10°F RISE ACROSS
THE BLOWER, WE WILL ALWAYS
BE AT $RH \leq 65\%$

Compound	Mol wt	Mass Flow (lb/hr)	ppm (v/v)	Sorption (% w/w)	Carbon Saturated (lb/hr)
Trichloroethene	131.39	5.90E-01	1.99E+01	3.38E+01	1.745
Tetrachloroethene	165.83	6.80E-01	1.82E+01	6.23E+01	1.091
trans-1,2-Dichloroethene	96.94	2.80E-01	1.28E+01	8.36E+00	3.350
1,1,1-Trichloroethane	133.41	1.10E-01	3.65E+00	2.18E+01	0.505
o-Xylene	106.17	1.20E-01	5.01E+00	3.84E+01	0.312
Vinyl chloride	62.50	2.00E-02	1.42E+00	1.14E-01	17.474
		1.80E+00	6.09E+01		24.476

FROM
TABLE 1
PAGE
01010-6

IGNORE
THE
VC

FROM:

Joseph M. Battaglia
Cameron Great Lakes, Inc.
166 Sandybrooke Drive
Langhorne, PA 19047
Tel 215-752-2246 (fax 2247)

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square - Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145 or 631-249-1872 ext. 266
Fax: 631-752-3008 (Cell 516-315-3467)

-17.474 ←
7.002 LB/HR ACTUAL
EXPECTED
X 24 HR/DAY
X 30 DAYS
5041 LB./MO
↑
"LEAD"
BED

PREPARED BY:

Joseph M. Battaglia
Cameron Great Lakes, Inc.
166 Sandybrooke Drive
Langhorne, PA 19047
Tel 215-752-2246 (fax 2247)

USING A PSYCHOMETRIC CHART TO DETERMINE:

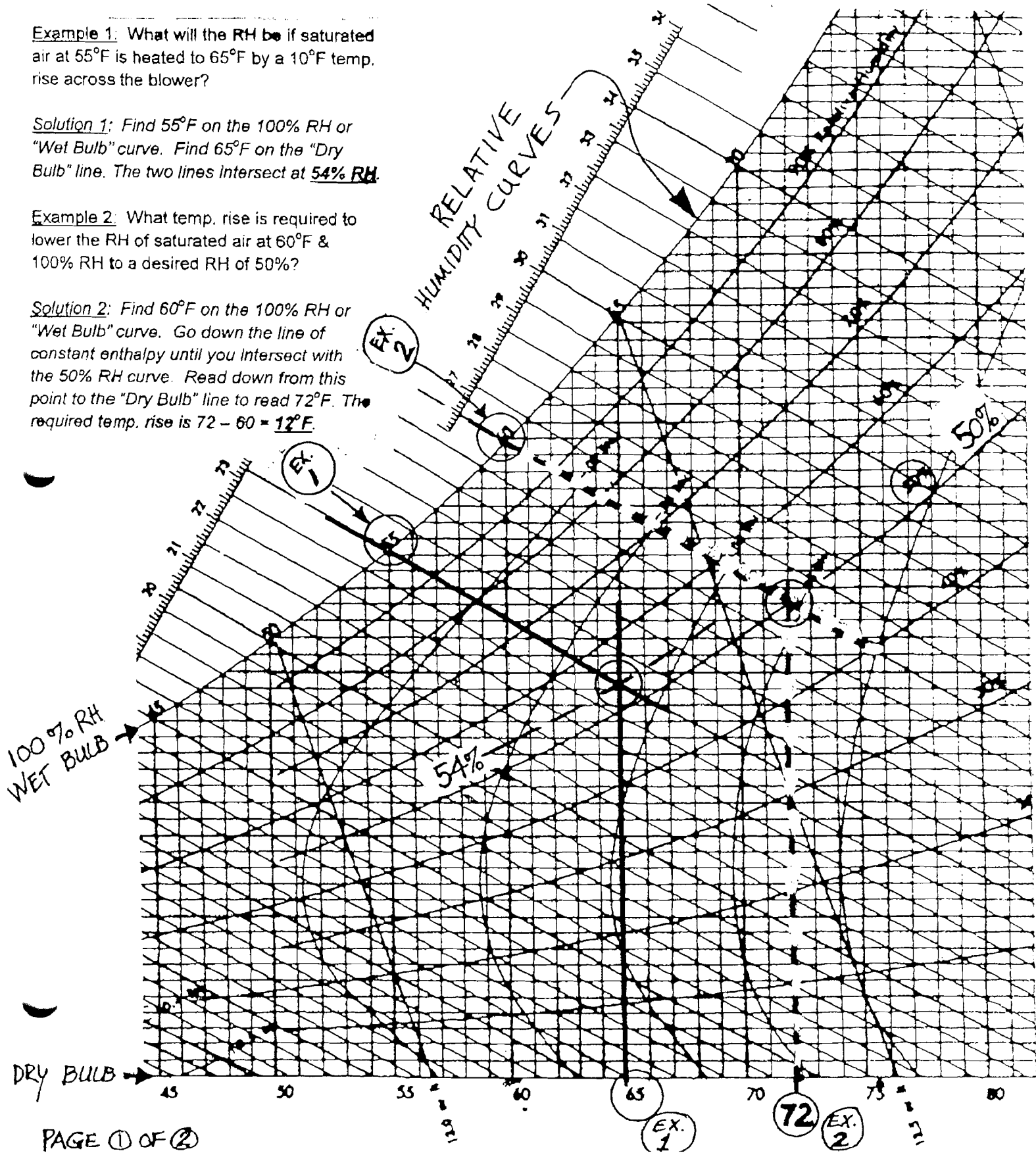
- (1) RELATIVE HUMIDITY (RH) AFTER AIR TEMP.
RISE ACROSS A BLOWER, OR
- (2) TEMP. RISE REQUIRED TO LOWER 100% RH TO
A DESIRED LOWER RH

Example 1: What will the RH be if saturated air at 55°F is heated to 65°F by a 10°F temp. rise across the blower?

Solution 1: Find 55°F on the 100% RH or "Wet Bulb" curve. Find 65°F on the "Dry Bulb" line. The two lines intersect at 54% RH.

Example 2: What temp. rise is required to lower the RH of saturated air at 60°F & 100% RH to a desired RH of 50%?

Solution 2: Find 60°F on the 100% RH or "Wet Bulb" curve. Go down the line of constant enthalpy until you intersect with the 50% RH curve. Read down from this point to the "Dry Bulb" line to read 72°F. The required temp. rise is $72 - 60 = 12^\circ\text{F}$.



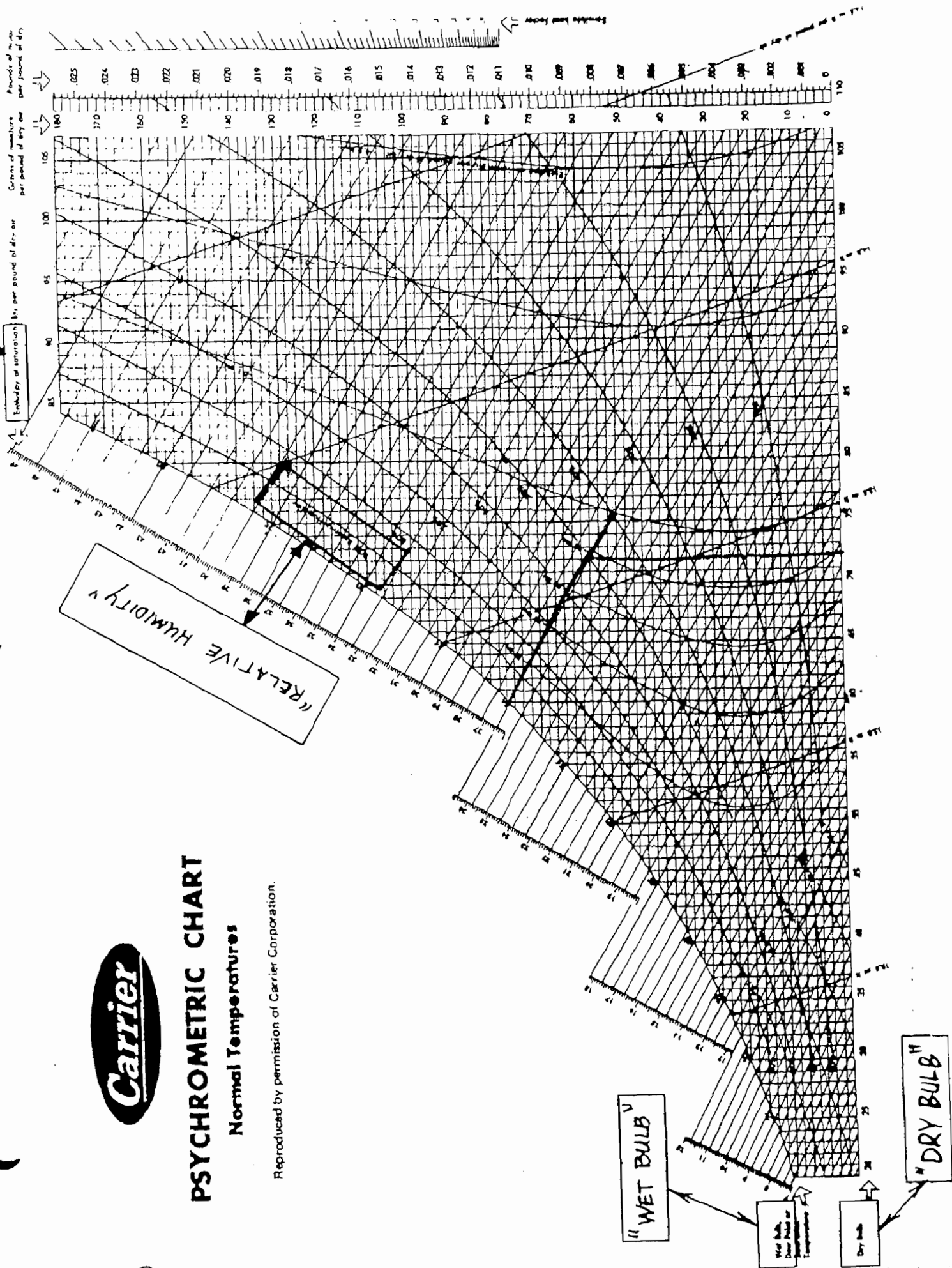


PSYCHROMETRIC CHART

Normal Temperatures

Reproduced by permission of Carrier Corporation.

"ENTHALPY AT SATURATION"



OPERATING & MAINTENANCE INSTRUCTIONS AND PARTS LIST

for
PB - Cast Aluminum Pressure Blowers
SPB - Stamped Steel Pressure Blowers
PBS - Fabricated Steel Pressure Blowers
LM - Volume Blowers

CONTENTS

I	General Safety Notes	Page 2
II	Receiving	Page 2
III	Handling	Page 2
IV	General Installation Instructions	Page 2
V	Operation	Page 3
VI	General Maintenance	Page 3
VII	V-belt Drives	Page 4-5
VIII	Fan Bearing Maintenance	Page 5
IX	Warranty	Page 5
X	Ordering Replacement Parts	Page 6
XI	Fan Trouble Shooting	Page 6
XII	Assembly Drawings	Page 7-8



DANGER

ALL FANS AND BLOWERS SHOWN HAVE ROTATING PARTS AND PINCH POINTS. SEVERE PERSONAL INJURY CAN RESULT IF OPERATED WITHOUT GUARDS. STAY AWAY FROM ROTATING EQUIPMENT UNLESS IT IS DISCONNECTED FROM ITS POWER SOURCE AND ALL ROTATING PARTS HAVE STOPPED MOVING.

READ ALL OPERATING INSTRUCTIONS CONTAINED HEREIN
BEFORE INSTALLING EQUIPMENT.



DANGER

NO GUARANTEE OF ANY LEVEL OF SPARK RESISTANCE IS IMPLIED BY SPARK RESISTANT CONSTRUCTION. IT HAS BEEN DEMONSTRATED THAT ALUMINUM IMPELLERS RUBBING ON RUSTY STEEL MAY CAUSE HIGH INTENSITY SPARKS. AIR STREAM MATERIAL AND DEBRIS OR OTHER SYSTEM FACTORS MAY ALSO CAUSE SPARKS.



PART # 01111
CATALOG # PMA-793
SUPERSEDES: PMA-292

I GENERAL SAFETY NOTES

1. Rotating parts including shaft and V-belt drives must be properly guarded to prevent personal injury.
2. Electrical wiring must be accomplished by a qualified electrician in accordance with all applicable codes.
3. Care should be taken:
 - Not to run fan above its safe speed (See Performance Tables in Sales Catalog or call CF sales office).
 - Not to operate in excessive temperatures (See limitations in Sales Catalog or call CF sales office).
 - Not to operate in dangerous environments.
 - Read all instructions carefully.

II RECEIVING

Receiving Inspection

When unit is received, inspect immediately for damaged or missing parts. Even though all units are carefully inspected and prepared for shipment at the factory, rough handling enroute may cause concealed damage or cause nuts, set screws, bolts or locking collars to work loose. Be certain all fasteners are

tightened securely. Rotate wheel by hand to verify that it rotates freely and that there are no obstructions.

Inspect all shipments carefully for damage. **The receiver must note any damage on the carrier's bill of lading and file a claim immediately with the freight company in the case of damage.** Keep a record of all equipment received, including inspection details and date of receipt because of the possibility of partial shipments.

III HANDLING

Handle your equipment with care. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps or well-padded chains and cables which protect the fan's coating and housing. Spreader bars should be used when lifting large parts.

Centrifugal fans are best lifted using one strap under the fan's scroll and another strap around the bearing base.

DO NOT LIFT CENTRIFUGAL FANS BY THE FAN SHAFT, WHEEL, FLANGES, INLET SUPPORT, OR MOTOR EYE BOLT.

IV GENERAL INSTALLATION INSTRUCTIONS

Foundations

Fan foundation must be flat, level and rigid. Where foundation is not completely flat, shims must be placed under fan support at each anchor bolt as required. Bolting fan to an uneven foundation distorts alignment and causes vibration.

Structural steel foundations should be heavily cross-braced for load support.

Table #1

TORQUE VALUES FOR TAPERED BUSHINGS		
Bushing Size	MINIMUM RECOMMENDED TORQUE (INCH-LBS)	
	Steel Parts	Alum. Parts
H	95	60
P	192	80
Q	350	155
R	350	155

Table #2

SET SCREW TORQUE VALUES			
SET SCREW SIZE		MINIMUM REQUIRED TORQUE (INCH-LBS)	
Diameter & No. of Threads/Inch	Hex Size Across Flats (Allen Wrench)	Steel Set Screw Into Steel Threads	Steel Set Screw Into Aluminum Threads or Stainless Steel Set Into Stainless Steel Threads
1/4-20	1/8"	65	65
5/16-18	5/32"	165	100
3/8-16	3/16"	228	155
7/16-14	7/32"	348	230
1/2-13	1/4"	504	330
5/8-11	5/16"	1104	700

NOTE If wheel set screws are loosened and/or wheel is removed from shaft, set screws must be replaced. Set screws cannot be used more than once. Use knurled, cup point set screws with a locking patch.

V OPERATION

Before Connecting Power

1. Inspect all fasteners and retighten if necessary:
 - a. Foundation bolts.
 - b. Set screws in fan wheel, bearings and V-belt drive (See Tables #1 & #2 on preceding page).
 - c. Housing, bearing and motor mounting.
2. Any inspection doors should be tight and sealed.
3. Bearings should be checked for alignment and lubrication (See Fan Bearing Maintenance, page 5).
4. Turn rotating assembly by hand to insure that it does not strike housing. If the wheel strikes the housing, the wheel may have moved on the shaft or the bearings may have shifted in transit. Correction must be made prior to start up.
5. Check motor to insure proper speed and electrical characteristics.
6. Check V-belt drive for alignment and correct belt tension.
7. After wiring, energize motor for 1 second to check for proper rotation.

VI GENERAL MAINTENANCE

CAUTION

Before any maintenance or service is performed, assure that unit is disconnected from power source to prevent accidental starting.

The key to good fan maintenance is a regular and systematic inspection of all fan parts. Severity of the application should determine frequency of inspection. The components requiring service are generally the moving parts which include bearings, fan wheel, belts, sheaves and motor.

Cast Aluminum & Metal Parts

Cast aluminum and steel parts usually do not require maintenance during the life of the unit except painted metal surfaces that may require periodic repainting. In a severe, dirty operation, the wheel should be cleaned with a wire brush to prevent an accumulation of foreign matter that could result in fan unbalance. After cleaning wheel, inspect for possible cracks or excessive wear, which can cause unbalance. DO NOT operate a wheel that is cracked, chipped, has broken blades or excessive wear. **NOTE** If wheel set screws are loosened and/or wheel is removed from shaft, set screws must be replaced. Set screws cannot be used more than once. Belts on V-belt drive units require periodic inspection and replacement when worn. For multiple belt drives, belts should be replaced with matched sets.

Motor Maintenance

1. Disconnect power to motor.
2. Removing dust and dirt: Blow out open type motor windings with low pressure air to remove dust or dirt. Air pressure above 50 P.S.I. should not be used as high pressure may damage insulation and blow dirt under loosened tape. Dust accumulation can cause excessive insulation temperatures.
3. Lubrication: The motor bearings and the fan bearings on the belt drive fans should be greased at regular intervals. Motor manufacturers' greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not overgrease. Use only 1 or 2 shots with a hand gun in most cases. Maximum hand gun rating 40 P.S.I. Rotate bearings during lubrication where good safety practice permits. **NOTE:** On motors with non-regreasable sealed bearings, no lubrication is required for the life of the bearings.

To prevent rusting of bearing parts, the motor shaft must be rotated at regular intervals (30 days) to assure these parts are well covered with oil or grease.

A WORD OF CAUTION ABOUT MOTORS

Using your hand to test the running temperature of a motor can be a very painful experience:

Normal body temperature	98.6°F
Threshold of pain caused by heat	120.0°F
Average temperature of hot tap water	140.0°F
Average temperature of hot coffee	180.0°F
Normal operating temperature of a fully loaded electric motor, open type, 70°F ambient temperature	174.0°F

V-belt drive assembly can be mounted as follows:

1. Clean motor and fan shafts. Be sure they are free from corrosive material. Clean bore of sheaves and coat with heavy oil for ease of shaft entry. Remove oil, grease, rust or burrs from sheaves.
2. Place fan sheave on fan shaft and motor sheave on its shaft. **Do not pound sheaves on** as this may damage bearings. Tighten sheaves per Table # 1 or # 2 on page 2.
3. Move motor on slide base so belts can be placed in grooves of both sheaves without forcing. Do not roll belts or use a tool to force belts over the grooves.
4. Align fan and motor shafts so they are parallel. The belts should be at right angles to the shafts. A straight edge or taut cord placed across the face of the sheaves will aid in alignment.
5. Tighten belts by adjusting motor base. Correct tension gives the best drive efficiency. Excessive tension causes undue bearing pressure.
6. Start the fan and run it at full speed. Adjust belt tension until only a slight bow appears on the slack side of the belts. If slippage occurs, a squeal will be heard at start-up. Eliminate this squeal by **disconnecting power** and tightening up the belts.
7. Give belts 2-3 days running time to become seated in sheave grooves, then readjust belt tension.

If the shafts become scratched or marked, carefully remove sharp edges and high spots such as burrs with fine emery cloth or honing stone. Avoid getting emery dust in the bearings.

Do not apply any belt dressing unless it is recommended by the drive manufacturer. V-belts are designed for frictional contact between the grooves and sides of the belts. Dressing will reduce this friction.

Belt tension on an adjustable pitch drive is obtained by moving the motor, not by changing the pitch diameter of the adjustable sheave.

VIII FAN BEARING MAINTENANCE

Sealed Bearings

Sealed for life bearings are pre-lubricated with the correct amount of manufacturer approved ball bearing grease, and are designed for application where relubrication is not required.

Relubricatable Bearings

The motor bearings and fan bearings on belt drive fans should be greased at regular intervals. Motor manufacturers greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. **Do not over grease.**

NOTE: On motors with non-regreasable, sealed bearings, no lubrication is required for the life of the bearing.

Table #3 (page 4) lists the time intervals between fan bearing greasing to insure proper lubrication in adverse conditions of heat and dust. Use only 1 or 2 shots with a hand gun in most cases. Maximum handgun rating 40 P.S.I.

IX WARRANTY

Cincinnati Fan & Ventilator Company warrants products of its own manufacture against defects of material and workmanship under normal use and service for a period of eighteen (18) months from date of shipment or twelve (12) months from date of installation, whichever occurs first.

This warranty does not cover ordinary wear and tear, abuse, misuse, overloading, negligence, alteration or systems and/or materials not of Seller's manufacture. Expenses incurred by Buyer(s) in repairing or replacing any defective product will not be allowed except where authorized in writing and signed by an officer of the Seller.

The obligation of Seller under this warranty shall be limited to repairing or replacing F.O.B. Seller's plant, or allowing credit at Seller's option. This warranty is expressly in lieu of all other warranties expressed or implied including the warranties of merchantability and fitness for use and of all other obligations and liabilities of the Seller. The Buyer acknowledges that no other representations were made to him or relied upon him with respect to the quality or function of the products herein sold.

On equipment furnished by the Seller, but manufactured by others, such as motors, Seller extends the same warranty as Seller receives from the manufacturer thereof. Repairs for motors should be obtained from nearest authorized motor service station for the make of motor furnished. All motors used are products of well-known manufacturers with nationwide service facilities. Check the yellow pages of your telephone directory for the location of the nearest service shop.

Cincinnati Fan & Ventilator Company assumes no responsibility for material returned to our plant without our prior written permission.

X ORDERING REPLACEMENT PARTS

Replacement or spare parts may be ordered through your local Cincinnati Fan representative. (Refer to drawings that begin on page 7.)

The following information should accompany parts orders:

1. Motor horsepower, frame size, motor speed, voltage, phase, cycle and enclosure. Motor manufacturer's model number from motor nameplate.
2. Fan Speed (if V-belt driven).
3. Fan serial and model numbers from the fan nameplate and a complete description of the part.

An adequate stock of repair parts is maintained where possible. **If your fan is vital to production or to plant operation, it is advisable to have all spare parts on hand to minimize the possibility of downtime.**

XI FAN TROUBLE SHOOTING

In the event that trouble is experienced in the field, the following are the most common fan difficulties. These points should be checked in order to prevent needless delay and expense.

1. CAPACITY OR PRESSURE BELOW RATING

- a. Incorrect direction of wheel rotation.
- b. Speed too slow.
- c. Dampers not properly adjusted.
- d. Poor fan inlet or outlet conditions (elbows, restrictions).
- e. Air leaks in system.
- f. Damaged wheel.
- g. Total resistance of system higher than anticipated.
- h. Wheel mounted backwards on shaft.
- i. Fan not properly selected for a high temperature and/or high altitude application.

2. VIBRATION AND NOISE

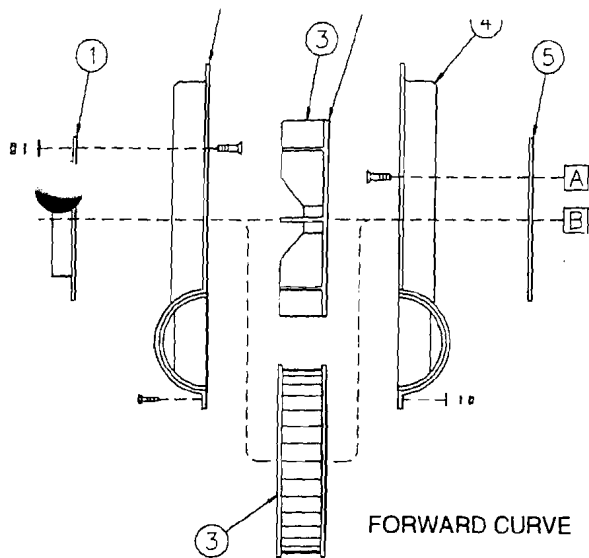
- a. Misalignment of bearings, coupling, wheel or V-belt drive.
- b. Unstable foundation or supports.
- c. Foreign material in fan causing unbalance.
- d. Worn bearings.
- e. Damaged wheel or motor.
- f. Broken or loose bolts and set screws.
- g. Bent shaft.
- h. Worn coupling.
- i. Fan wheel or drive unbalanced.
- j. 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
- k. Fan delivering more than rated capacity.
- l. Loose dampers.
- m. Speed too high or fan rotating in wrong direction.
- n. Vibration transmitted to fan from some other source.

3. OVERHEATED BEARINGS

- a. Check bearing lubrication.
- b. Poor alignment.
- c. Damaged wheel or drive.
- d. Bent shaft.
- e. Abnormal end thrust.
- f. Dirt in bearings.
- g. Excessive belt tension.

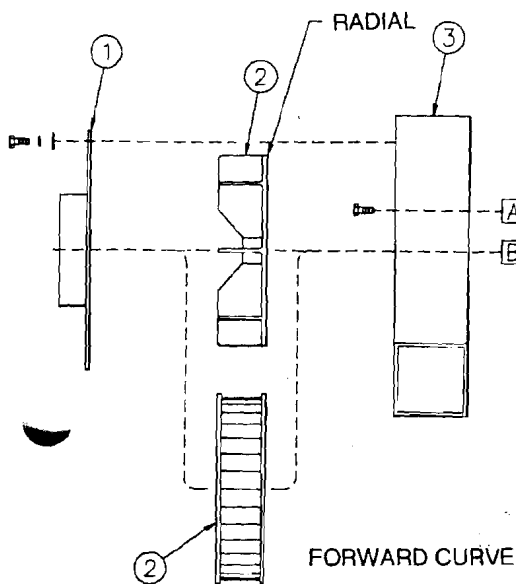
4. OVERLOAD ON MOTOR

- a. Speed too high.
- b. Fan over capacity due to existing system resistance being lower than original rating.
- c. Specific gravity or density of gas above design value.
- d. Wrong direction of wheel rotation.
- e. Shaft bent.
- f. Poor alignment.
- g. Wheel wedging or binding on fan housing.
- h. Bearings improperly lubricated.
- i. Motor improperly wired.
- j. Defective motor. Motor must be tested by motor manufacturer's authorized repair shop.



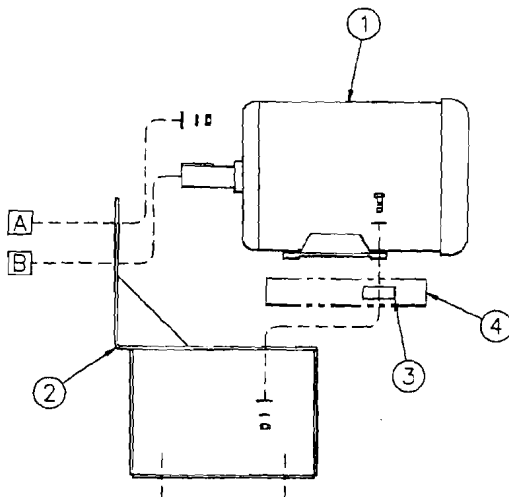
MODELS PB, SPB & LM
HOUSING/WHEEL COMPONENTS
All arrangements

- *1. Inlet side plate (if required).
- *2. Housing, inlet side.
- *3. Wheel (Radial or Forward Curve).
- 4. Housing, drive side.
- 5. Drive side plate (if required).
- NOTE: Rotation determined by viewing blower from drive side, **not** looking into inlet.



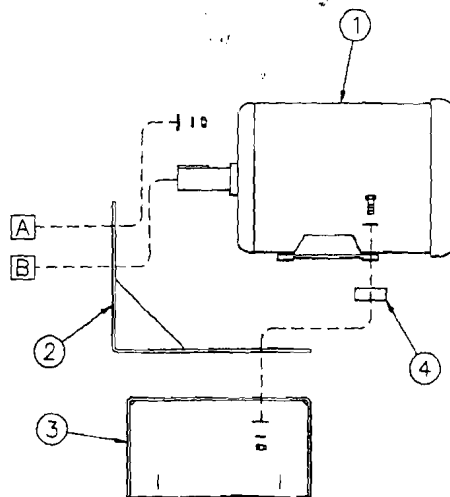
MODEL PBS
FABRICATED HOUSING/WHEEL COMPONENTS
All arrangements

- *1. Inlet side plate.
- *2. Wheel (Radial or Forward Curve).
- 3. Housing, non-reversible (CW or CCW).
- NOTE: Rotation determined by viewing blower from drive side, **not** looking into inlet.



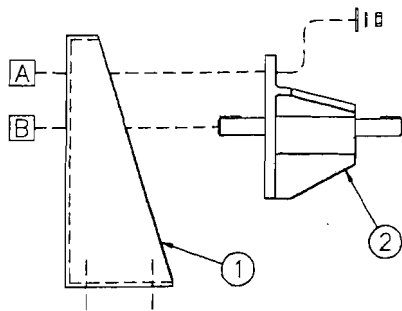
Arrangement 4 — Type 1
BASE COMPONENTS

- 1. Motor.
- 2. Combo base.
- 3. Riser blocks (if required).
- 4. Riser base, 1-3/4" (if required).



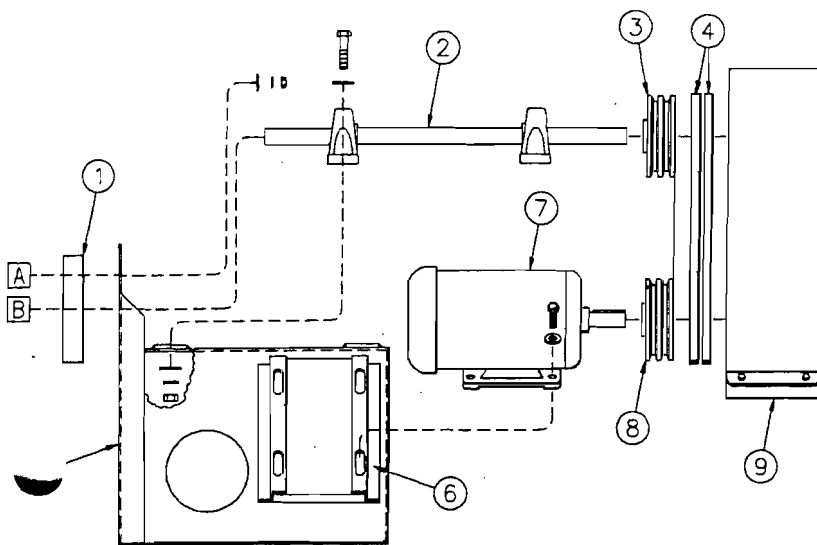
Arrangement 4 — Type 2
BASE COMPONENTS

- 1. Motor.
- 2. Angle bracket (if required).
- 3. Bottom base.
- 4. Riser blocks (if required).



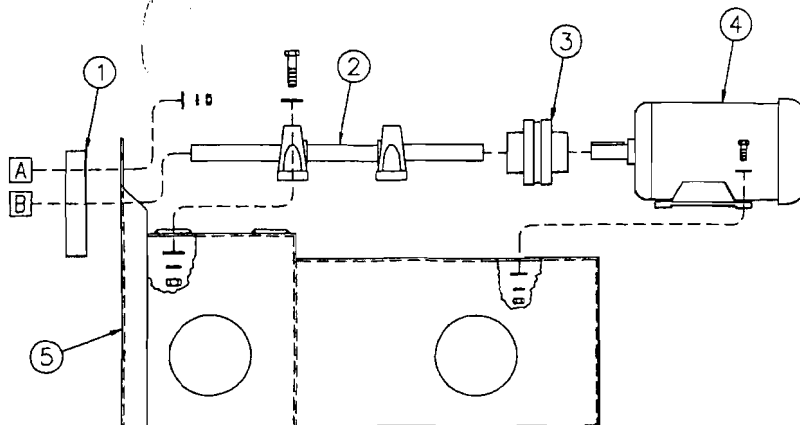
Arrangement 2 BASE COMPONENTS

1. Upright base.
2. Shaft/bearing assembly.



Arrangements 1 & 9 BASE COMPONENTS

1. Spacer ring (not required for PBS blowers).
2. Shaft/bearing assembly.
3. Fan sheave. (Arr. 9 only).
4. Belt(s). (Arr. 9 only).
5. Bearing base.
6. Motor slide base. (Arr. 9 only).
7. Motor. (Arr. 9 only).
8. Motor sheave. (Arr. 9 only).
9. Belt guard. (Arr. 9 only).



Arrangement 8 BASE COMPONENTS

1. Spacer ring (not required for PBS blowers).
2. Shaft/bearing assembly.
3. Shaft coupling.
4. Motor.
5. Base.

FRICITION LOSS
Sump Pump Sizing - Losses
Active Industrial Uniform Site, Lindenhurst, NY
LAW Project No. 22000-0-0019

Pipe Length (ft)	20 GPM		270 GPM	
	Headloss/100' (ft)	Headloss (ft)	Headloss/100' (ft)	Headloss (ft)
<u>1.5" Pipe</u>				
Straight Pipe 19.8				
Fittings 31.66				
51.46	2.95	1.520	NA	NA
<u>4" Pipe</u>				
Straight Pipe 44.4				
Fittings 98.33				
142.73	0.1	0.143	7.50	10.705
Total 194.20		1.66		10.7

Q: h _z :	20 gpm		270 gpm	
	Min	Max	Min	Max
Static Head:	36	38	36	38
Friction Head:	1.66	1.66	12.22	12.22
TDH:	37.66	39.66	48.22	50.22

Prepared/Date: AKG 6/11/01
Checked/Date: DMS 6/12/01

FITTINGS EQUIVALENT LENGTH CALCULATION

Sump Pump Sizing - Losses

Active Industrial Uniform Site, Lindenhurst, NY

LAW Project No. 22000-0-0019

Fittings	No. Fittings	L/D	Equivalent Lengths (L)/unit	Total Equivalent Lengths
<u>1.5-inch Piping/20 gpm Flow</u>				
90° Elbows	3	30	4.03	12.08
45° Elbows	1	16	2.15	2.15
Ball Valve	2	15	2.01	4.03
Check Valve	1	100	13.42	13.42
				31.66
<u>4-inch Piping/270 gpm Flow</u>				
1.5" -> 4" Reducer	1	20	6.67	6.67
90° Elbows	2	30	10.00	20.00
Tee (thru)	1	20	6.67	6.67
Tee (branch)	3	60	20.00	60.00
Ball Valve	1	15	5.00	5.00
				98.33

Prepared/Date: AKG 6/11/01

Checked/Date: DMS 6/12/01

SYSTEM CURVE TABLE
Sump Pump Sizing - Losses
Active Industrial Uniform Site, Lindenhurst, NY
LAW Project No. 22000-0-0019

Q (gpm)	Q (cu. ft /sec)	1.5-inch Piping			4-inch Piping			Min Static Head (ft)	Min TDH (ft)	Max Static Head (ft)	Max TDH (ft)
		Velocity (ft/sec)	C=100 Friction/100' (ft)	Friction per 51.46 ft (ft)	Velocity (ft/sec)	C=100 Friction/100' (ft)	Friction per 136.07 ft (ft)				
0	0	0	0	0	0	0	0.00	36	36.00	38	38.00
10	0.022	1.81	0.833	0.43	0.25	0	0.00	36	36.43	38	38.43
20	0.044	3.62	2.95	1.52	0.51	0.1	0.14	36	37.66	38	39.66
30	0.067	5.43	6.27	3.23	0.76	0.131	0.19	36	39.42	38	41.42
40	0.089	7.24	10.73	5.52	1.02	0.224	0.32	36	41.84	38	43.84
50	0.111	9.05	16.49	8.49	1.27	0.338	0.48	36	44.97	38	46.97
60	0.133	10.86	23.55	12.12	1.53	0.475	0.68	36	48.80	38	50.80
70	0.156	12.68	31.63	16.28	1.78	0.631	0.90	36	53.18	38	55.18
80	0.178	14.49	40.6	20.88	2.04	0.808	1.15	36	58.03	38	60.03
90	0.200	16.30	50.7	26.12	2.29	1.01	1.44	36	63.56	38	65.56
100	0.222	18.11	62.1	31.93	2.55	1.22	1.74	36	69.68	38	71.68
125	0.278	22.64	95.5	49.15	3.18	1.85	2.64	36	87.79	38	89.79
150	0.333				3.82	2.59	3.70	36	39.70	38	41.70
175	0.389				4.46	3.44	4.91	36	40.91	38	42.91
200	0.444				5.09	4.41	6.29	36	42.29	38	44.29
225	0.500				5.73	5.48	7.82	36	43.82	38	45.82
250	0.556				6.37	6.67	9.52	36	45.52	38	47.52
275	0.611				7.00	7.96	11.36	36	47.36	38	49.36

Prepared/Date: AKG 6/11/01

Checked/Date: DMS 6/12/01

"QUALITY PUMPS SINCE 1939"

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.



SECTION: 2.20.000

FML

0300

Supersedes

0798

MAIL TO: P.O. BOX 16347 • Louisville, KY 40256-0347
SHIP TO: 3649 Cane Run Road • Louisville, KY 40211-1961
(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

visit our web site:
<http://www.zoeller.com>

COMPARE THESE FEATURES

- Non-clogging bronze vortex impeller design.
- Durable cast construction. Cast iron switch case, base, motor and pump housing.
- Castings - Cast iron class 25-30 (25,000# tensile strength). Impeller, bronze class 85-5-5-5.
- Corrosion resistant powder coated epoxy finish.
- 20 foot UL listed 3-wire neoprene cord and plug. Longer cords available in lengths of 25-35-50 feet.
- Automatic reset thermal overload protection. (1 Ph only).
- Oil-filled motor - hermetically sealed.
- Carbon and ceramic shaft seal.
- Maximum temperature for effluent or dewatering, 130° F. / 54° C. (ED 140° F. / 60° C).
- 3450 RPM, 60 cycle.
- Major width 12 3/4". Height 18 7/16". (Single seal pumps)
- No screens to clog.
- Square Ring & Gasket - Neoprene.
- Bearings - Lower ball & upper sleeve.
- Stainless steel screws, bolts, float rod, handle guard, arm and seal assembly.
- Passes 3/4" spherical solids.
- 1 1/2" NPT discharge with 2" or 3" flange available.
- Automatic units available with float operated, submersible (NEMA 6) 2 - pole mechanical switch. On point 14 1/4" - Off point 5".
- Available in single or double seal designs.
- 100% of units are computerized tested.

MODELS 4161-4163-4165

DOUBLE SEAL PUMPS (Note 1 only)

- Protects motor from seal leaks.
- Improved bearing lubrication.
- Helps eliminate seal and bearing damage from dry runs.
- Major width 12 3/4". Height 20 7/16".

Note: The sizing of effluent systems normally requires variable level float(s) controls and properly sized basins to achieve required pumping cycles.

AUTOMATIC UNITS NOT RECOMMENDED FOR USE IN EFFLUENT SYSTEMS.

161 - 163 - 165 Single Seal Series 4161 - 4163 - 4165 Double Seal Series (For Pump Prefix Identification see News & Views 0052)



HIGH HEAD



"FLOW-MATE"

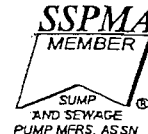


FOR SEPTIC TANK • LOW PRESSURE PIPE (LPP)
AND ENHANCED FLOW STEP SYSTEMS

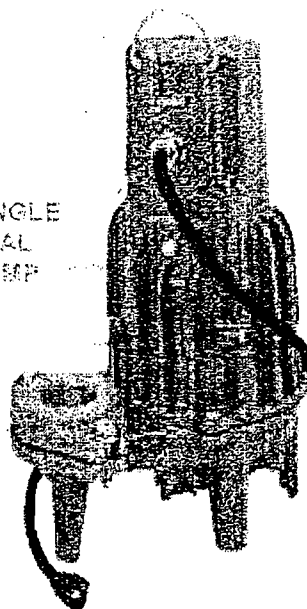
EFFLUENT

OR DEWATERING PUMP • SUBMERSIBLE

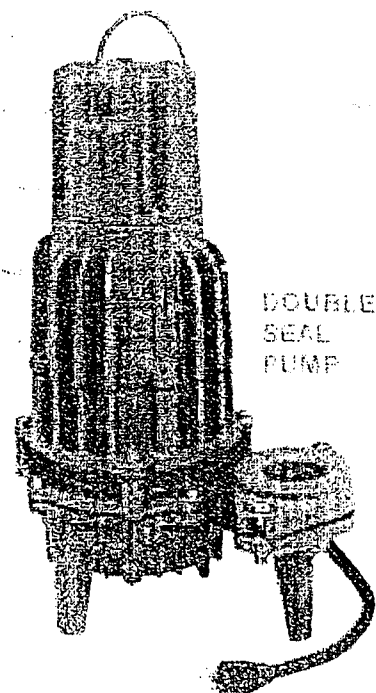
1 1/2" NPT DISCHARGE STANDARD • 2" AND 3" NPT FLANGE AVAILABLE



SINGLE
SEAL
PUMP



DOUBLE
SEAL
PUMP



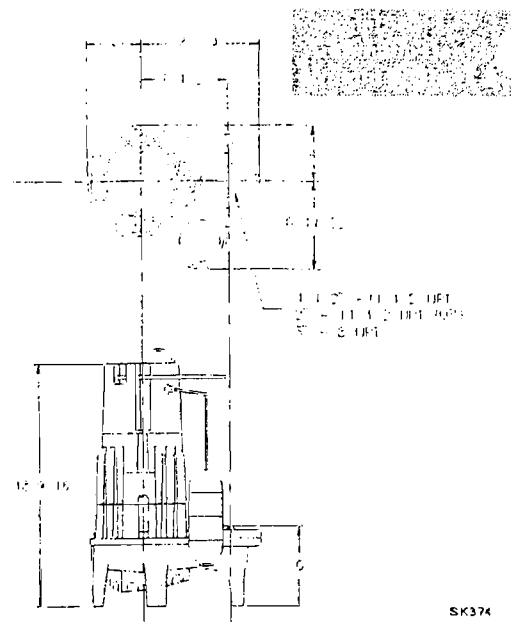
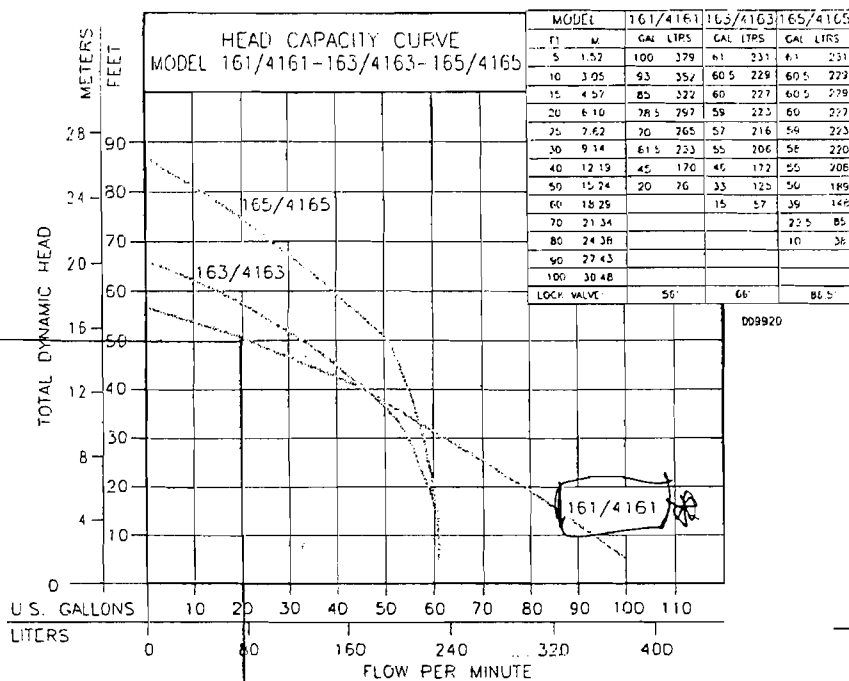
• Automatic (Single Seal Only) or Nonautomatic

161-163 and 4161-4163 Series

165 and 4165 Series

- 1/2 H.P., 1 Ph, 115V, 200-208V or 230V
- 1/2 H.P., 3 Ph, 200-208V, 230V or 460V

- 1 H.P., 1 Ph, 200-208V or 230V
- 1 H.P., 3 Ph, 200-208 230V or 460V



Standard all models - 20 ft. cord - 1/4 HP.

161 MODELS	4161 MODELS	Control Selection						Listings	
Single Seal	Double Seal	Volts -	Ph	Mode	Amps	Simplex	Duplex	CSA	UL
M161	-----	115	1	Auto	15.5	-----	-----	Y	Y
N161	N4161	115	1	Non	15.5	-----	3 or 5 & 6	Y	Y ⁽¹⁾
D161	-----	230	1	Auto	7.5	-----	-----	Y	Y
E161	E4161	230	1	Non	7.5	-----	3 or 5 & 6	Y	Y
* H161	-----	200-208	1	Auto	8.8	-----	-----	Y	N
* I161	* I4161	200-208	1	Non	8.8	-----	3 or 5 & 6	Y	N
* J161	* J4161	200-208	3	Non	6.4	4 & 6	3 & 4 or 5 & 6	Y	Y
* F161	* F4161	230	3	Non	5.2	4 & 6	3 & 4 or 5 & 6	Y	Y
* G161	* G4161	460	3	Non	2.9	4 & 6	3 & 4 or 5 & 6	Y	Y

Standard all models - 20 ft. cord - 1/4 HP.

163 MODELS	4163 MODELS	Control Selection						Listings	
Single Seal	Double Seal	Volts -	Ph	Mode	Amps	Simplex	Duplex	CSA	UL
M163	-----	115	1	Auto	15.0	-----	-----	Y	Y
N163	N4163	115	1	Non	15.0	-----	3 or 5 & 6	Y	Y ⁽¹⁾
D163	-----	230	1	Auto	7.5	-----	-----	Y	Y
E163	E4163	230	1	Non	7.5	-----	3 or 5 & 6	Y	Y
* H163	-----	200-208	1	Auto	8.5	-----	-----	Y	N
* I163	* I4163	200-208	1	Non	8.5	-----	3 or 5 & 6	Y	N
* J163	* J4163	200-208	3	Non	6.0	4 & 6	3 & 4 or 5 & 6	Y	Y
* F163	* F4163	230	3	Non	4.8	4 & 6	3 & 4 or 5 & 6	Y	Y
* G163	* G4163	460	3	Non	2.9	4 & 6	3 & 4 or 5 & 6	Y	Y

Standard all models - 20 ft. cord - 1/4 HP.

165 MODELS	4165 MODELS	Control Selection						Listings	
Single Seal	Double Seal	Volts -	Ph	Mode	Amps	Simplex	Duplex	CSA	UL
D165	-----	230	1	Auto	10.2	-----	-----	Y	Y
E165	E4165	230	1	Non	10.2	-----	3 or 5 & 6	Y	Y
* H165	-----	200-208	1	Auto	12.6	-----	-----	Y	N
* I165	* I4165	200-208	1	Non	12.6	-----	3 or 5 & 6	Y	N
* J165	* J4165	200-208	3	Non	7.5	4 & 6	3 & 4 or 5 & 6	Y	Y
* F165	* F4165	230	3	Non	7.4	4 & 6	3 & 4 or 5 & 6	Y	Y
* G165	* G4165	460	3	Non	3.7	4 & 6	3 & 4 or 5 & 6	Y	Y
* BA165	* BA4165	575	3	Non	3.0	4 & 6	3 & 4 or 5 & 6	N	N

* No Mated Plug

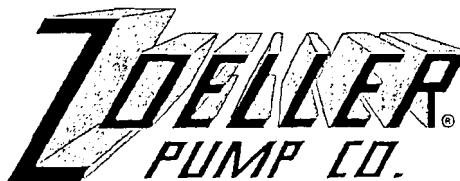
⁽¹⁾ UL listed unit available with 20 Amp plug

For information on additional Zoeller products refer to catalog on Piggyback Variable Level Float Switches, FM0477; Electrical Alternator, FM0486; Mechanical Alternator, FM0495; Alarm Package, FM0732; and Sump/Sewage Basins, FM0487

1. Integral float operated 2-pole mechanical switch, no external control required.
2. Single piggyback variable level float switch or double piggyback variable level float switch. Refer to FM0477.
3. Mechanical alternator M-Pak 10-0072 or 10-0075. Refer to FM0495
4. Simplex three phase control panel. Refer to FM1228.
5. See FM0712 for correct model of Electrical Alternator.
6. Variable level control switch 10-0225 used as control activator, specify simplex (3) float or duplex (3) or (4) float system.

"QUALITY PUMPS SINCE 1939"

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.



SECTION: 5.10.280

FM05

020.

Supersedes

0300

MAIL TO: P.O. BOX 16347 • Louisville, KY 40256-0347
SHIP TO: 3649 Cane Run Road • Louisville, KY 40211-1961
(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

visit our web site:
<http://www.zoeller.com>

SPECIFICATIONS

EFFLUENT/SUMP SIMPLEX SYSTEM

ZOELLER SUBMERSIBLE DEWATERING OR EFFLUENT PUMPS

SEAL	SOLIDS	DISCHARGE	MATERIAL	MODELS							
Single	1/2"	1 1/2" NPT	Cast Iron	53	57	98	140				
Single	1/2"	1 1/2" NPT	Cast Bronze	55	59						
Single	5/8"	1 1/2" NPT	Cast Iron	137	191						
Single	5/8"	1 1/2" NPT	Cast Bronze	139							
Single	3/4"	1 1/2" NPT	Cast Iron	152	153						
Single	3/4"	1 1/2", 2", or 3 NPT	Cast Iron	161	163	165	185	186	188	189	
Double	1/2"	1 1/2"	Cast Iron	4140							
Double	3/4"	1 1/2", 2", or 3 NPT	Cast Iron	4161	4163	4165	4185	4186	4188	4189	

SIMPLEX SYSTEM

Furnish a Zoeller Submersible Pump Model 161 Single Seal or Model Double Seal, with a capacity of 20 GPM against a Total Dynamic Head of 50 feet. Motor Specification: 200 Voltage, 60 Cycles, 3 Phase, 0.5 HP. Discharge to be X 1 1/2 inch NPT. Optional 2" NPT or 3" NPT (161/4161 - 189/4189). Cord length to be 50 feet. Pumps will pass 1/2 inch solids (53, 55, 57, 59, 98 & 140/4140 Series) or 5/8 inch solids (137 & 139 Series) or X 3/4 inch solids (152, 153, 161/4161, 163/4163, 165/4165, 185/4185, 186/4186, 188/4188 & 189/4189 Series.) Pumps shall be X UL listed, CSA approved, SSPMA certified, State of Wisc. approved, other (Specify).

SINGLE PHASE PUMPS

GENERAL

Pump motor shall be hermetically sealed, submersible type operating in a high quality dielectric oil for cooling the windings and for lubrication of the motor bearings and ceramic-carbon shaft seal. Single phase motor shall have internal automatic resetting, thermal overload protection. Construction shall be of Cast Iron (or Cast Bronze). All fasteners and external metal parts shall be of stainless steel. Impeller shall be of vortex non-clog design. (Addition noted below.)

Check Applicable Series:

- 53 (cast iron) 55 (cast bronze) Series- Pump shall have a shaded pole motor. Impeller, with metal insert, and base shall be of glass reinforced molded material. Switch case shall be of cast or molded material. Guard and handle shall be of stainless steel.
- 57 (cast iron) 59 (cast bronze) Series- Pump shall have a shaded pole motor. Guard and handle shall be of stainless steel.
- 98 (cast iron) Series- Pump shall have 1/2 HP PSC motor.
- 137 (cast iron) 139 (cast bronze) Series- Pump shall have 1/2 HP split phase motor with current sensing, starting relay enclosed in switch housing.
- 152 (1 HP) 153 (1/2 HP) series pump shall have a permanent split capacitor motor. The impeller shall be glass reinforced thermoplastic. Motor housing shall be cast iron.
- 140 (Cast Iron) Series Pump shall have a 1 HP permanent split capacitor motor with capacitor in the switch housing attached to the pump. The impeller shall be cast bronze. Motor housing shall be cast iron. Discharge shall be a permanently affixed 1 1/2" female NPT hub.
- 4140 (Cast Iron) Series Pump with double carbon/ceramic shaft seals shall have a 1 HP permanent split capacitor motor with capacitor in the switch housing

attached to the pump. The impeller shall be cast bronze. Motor housing shall be cast iron. Discharge shall be a permanently affixed 1 1/2" female NPT hub. The lower seal cavity shall be oil-filled.

- 161 (1/2 HP) 163 (1/2 HP) 165 (1 HP) Cast Iron Series- Pump shall have a permanent split capacitor motor with run capacitor and magnetic contactor enclosed in switch housing. Impeller shall be of cast bronze. Motor housing shall be finned for extra cooling capability.
- 4161 (1/2 HP) 4163 (1/2 HP) 4165 (1 HP) Cast iron series pump with double carbon/ceramic shaft seals shall have a permanent split capacitor motor with run capacitor and magnetic contactor enclosed in the switch housing. Impeller shall be cast bronze. Motor housing shall be finned for extra cooling capability. The lower seal cavity shall be oil-filled.
- 185 (1 HP) 186 (1 1/2 HP) 188 (1 1/2 HP) 189 (2 HP) Cast Iron Series- Pump shall have a permanent split capacitor motor with run capacitor and magnetic contactor enclosed in switch housing. Impeller shall be of cast bronze. Motor housing shall be finned for extra cooling capability.
- 4185 (1 HP) 4186 (1 1/2 HP) 4188 (1 1/2 HP) 4189 (2 HP) Cast iron series pump with double carbon/ceramic shaft seals shall have a permanent split capacitor motor with run capacitor and magnetic contactor enclosed in the switch housing. Impeller shall be cast bronze. Motor housing shall be finned for extra cooling capability. The lower seal cavity shall be oil-filled.
- 191 (2 HP) Cast iron series pump with carbon/ceramic shaft seals shall have a permanent split capacitor motor with run capacitor enclosed in the switch housing. Impeller shall be cast bronze and the housing shall be epoxy coated. Impeller shall be of a closed type construction. Motor housing shall be finned for extra cooling capability.

AUTOMATIC CONTROL - INTEGRAL FLOAT TYPE

Single phase pump shall have an integral mechanical float switch, which shall require no adjustment, nor require additional equipment for operation.

AUTOMATIC CONTROL PIGGYBACK VARIABLE LEVEL FLOAT SWITCH

A Zoeller _____ Piggyback Variable Level Float Switch with a fifteen (15) foot SJOWA cord and molded plug shall be furnished to control a nonautomatic pump. Control shall be constructed of durable plastic and be omnidirectional. Control shall be fastened to discharge pipe with plastic tie mounting strap and shall require no extra wiring. (Addition Noted Below.)

Check Applicable Control:

_____ 10-0034 (115V/Max. 1/2 HP) or _____ 10-0035 (230V/Max. 2 HP) (For use on 115V or 230V, 1 Phase, nonautomatic Zoeller pump). Designed for automatic pump operation with the appropriate voltage and horsepower, single phase, Zoeller pump.

_____ 10-0229 (115V/Max. 1 HP) or _____ 10-0230 (230V/Max. 2 HP) (For use on 115V or 230V, 1 Phase, nonautomatic Zoeller pump.) Double float system shall have an adjustable pumping range. Pumping range shall be a minimum of one (1) inch to a maximum of forty-eight (48) inches.

SIMPLEX CONTROL PANEL

A Zoeller _____ Simplex Control Panel shall be furnished to control a nonautomatic pump. The panel shall have a Nema 4x enclosure, pump run indicator light, high water alarm, selector switches, float switches, and UL label. Panel will be sized for Zoeller Model _____, _____ Volt, _____ Cycle, _____ Phase, _____ HP, _____ FLA pump.

THREE PHASE SYSTEM

(FOR USE WITH 130, 160/4160, or 180/4180 SERIES ZOELLER PUMP)

GENERAL

Pump motor shall be hermetically sealed, submersible type, operating in a high quality dielectric oil for cooling the windings and for lubrication of the motor bearings and ceramic-carbon shaft seal. Pump motor shall have external magnetic contactor and overload protection. All fasteners and external metal parts shall be of stainless steel. Impeller shall be of vortex non-clog design.

_____ 137 (cast iron) model _____ 139 (cast bronze) model _____ shall have a 4-pole squirrel cage induction motor.

~~_____ 161 (1/2 HP) _____ 163 (1/2 HP) _____ 165 (1 HP) cast iron series shall have a 2-pole squirrel cage induction motor. Impeller shall be cast bronze. Motor housing shall be finned for extra cooling capability.~~

_____ 4161 (1/2 HP) _____ 4163 (1/2 HP) _____ 4165 (1 HP) cast iron series pump with double carbon/ceramic

shaft seals shall have a 2-pole squirrel cage induction motor. Impeller shall be cast bronze. Motor housing shall be finned for extra cooling capability. The lower seal cavity shall be oil-filled.

_____ 185 (1 HP) _____ 186 (1 1/2 HP) _____ 188 (1 1/2 HP) _____ 189 (2 HP) _____ cast iron series shall have 2-pole squirrel cage induction motor. Impeller shall be cast bronze. Motor housing shall be finned for extra cooling capability.

_____ 4185 (1 HP) _____ 4186 (1 1/2 HP) _____ 4188 (1 1/2 HP) _____ 4189 (2 HP) _____ cast iron series pump with double carbon/ceramic shaft seals shall have 2-pole squirrel cage induction motor. Impeller shall be cast bronze. Motor housing shall be finned for extra cooling capability. The lower seal cavity shall be oil-filled.

SIMPLEX CONTROL PANEL

A Zoeller ~~3 Phase~~ Simplex Control Panel with three 10-0225 Control Switches shall be furnished to control a nonautomatic pump. The panel shall have a Nema 4X enclosure, pump run indicator light, high water alarm, selector switches, and a UL label. Panel will be sized for Zoeller Model ~~10-1081~~ 200 Volt, 60 Cycle, 3 Phase, 0.5 HP, 6.4 FLA pump.

Panels used with double seal pumps with optional moisture sensors will require a seal leak detector light.

CONTROL SWITCHES

A Zoeller Variable Level Float Switch shall be furnished to operate control circuit. Float shall be omnidirectional and include a fifteen (15) foot SJOWA cord and plastic tie mounting strap.

ACCESSORIES/MISCELLANEOUS UNICHECK

_____ 30-0200, (Clamp union valve) (1 1/4/1 1/2 inch) full flow check valve, rated at 4.3 psi (10 feet TDH) at 130° deg. F. shall be furnished to fit 1 1/4 inch 1 1/2 inch ABS, PVC, CPVC, steel or copper piping. Unichheck shall have valve body and seat of ABS plastic and shall be assembled with thru bolts. Gasket and flapper shall be neoprene with brass backing plates and stainless steel rivet. Unichheck shall include two (2) neoprene unions and four (4) stainless steel clamps and fasteners.

_____ 30-0021, (Clamp union valve) (2 inch) full flow check valve, rated at 4.3 psi (10 feet TDH) at 130° deg. F. shall be furnished to fit 2 inch ABS, PVC, CPVC, steel or copper piping. Unichheck shall have valve body and seat of ABS plastic and shall be assembled with thru bolts. Gasket and flapper shall be neoprene with brass backing plates and stainless steel rivet. Unichheck shall include two (2) neoprene unions and four (4) stainless steel clamps and fasteners.

30-0015 (Compression Union Valve) 1½ inch IPS full flow check valve shall be furnished to fit 1½ inch IPS pipe. Unichex body and compression and fittings shall be constructed of PVC. Flapper and end seals shall be Buna-N. Valve shall include no metallic parts. Pressure rated at 25 PSI (57 feet TDH) at 130° F.

30-0152, (2 inch) cast iron full flow check valve with 2" female N.P.T. Rated at 50 PSI (115 feet TDH) at 130° F. Neoprene polyester reinforced flapper with cast iron and brass backing plates and stainless steel fastener.

30-0160 (3 inch) cast iron full flow check valve with 3" female N.P.T. Rated at 50 PSI (115 feet TDH) at 130° F. Neoprene polyester reinforced flapper with cast iron and brass backing plates and stainless steel fastener.

OPTIONAL ALARM SYSTEM

An audible high water alarm system shall include a Zoeller _____ 10-0015 (115V) or _____ 10-0016 (230V) A-Pak and a 10-0225 Variable Level Float Switch. The A-Pak shall include a six (6) inch steel alarm bell, which shall sound sixty-eight (68) decibels at a distance of ten (10) feet and a dual mount transformer, which shall step down 115V or 230V 1 PH line voltage to 8V. The 10-0225 Variable Level Float Switch shall be constructed of plastic and shall be omnidirectional. Float shall include fifteen (15) foot SJOWA cord and shall be fastened to discharge pipe with plastic tie mounting strap.

10-0053 (115V/1Ph) A-Pak complete with sensor float and Nema 1 metal enclosure (cord and plug). Solid state warning light and horn, which can be manually turned off. UL listed and CSA certified on complete alarm system.

10-0126 (115V/1Ph) High level Alarm complete with Nema 4x enclosure, alarm bell, Alarm light, Silence switch, and sensor float switch with 15' cord. Entire unit is UL Listed and CSA Certified.

10-0623 (115V/1PH) High Level Alarm rated for Indoor/Outdoor use per UL 864. The alarm will include an alarm horn, alarm light, silence and test buttons, and a 15' float switch.

10-0682 (115V/1Ph) deluxe high level alarm rated for indoor/outdoor use per UL 864. The alarm will include an alarm horn, alarm light, silence and test buttons, a 20' float switch, 6' power cord, and watertight connectors.

SUMP BASIN

A Zoeller _____ polyethylene basin, .200 inch thick, .94. CC dense, or Zoeller _____ fiberglass basin, 3/16 inch thick, .058 pounds/cubic feet dense, _____ inches inside diameter by _____ inches deep shall be furnished. The basin shall include _____ four (4) inch cast iron caulk inlet hubs with anticorrosion coating. The center-line of the hub(s) shall be located nine (9) inches from the top of the basin. The basin shall also include a .115 inch thick steel sump cover. An optional pump installation plate can be provided on covers twenty-four (24) inches in diameter or larger. Optional anti-floitation ring can also be provided. Also included shall be a neoprene seal for pump cord, neoprene seal for vent and discharge flange, foam cover seal and plated steel fasteners. Cover shall include a _____ inch vent a _____ inch discharge flange with mounting hardware.

PIPING & POWER WIRING

All piping shall be rigid and permanent in nature and shall be furnished and installed by the contractor. A unichex shall be installed in the discharge pipe. A 3/16" vent hole shall be drilled in the discharge pipe below the check valve and pit cover to purge the system of trapped air. Power wiring shall be supplied by electrical contractor. Power wiring for pump-ing system and alarm system shall be connected to separate circuits.

EXTRA DUTY

Where conditions require, specify extra duty for adverse conditions.

HIGH TEMPERATURE PUMPS

For applications up to 200° F. continuous operation, specify High Temperature Zoeller Pump Co. models. See literature on High Temperature pumps, FM0806 and FM0807, for additional information. For 200° F. specification sheet, see FM0817.

PUMP DISCONNECTS AND RAIL SYSTEMS

Where conditions, due to safety, health and the economy of maintenance require pump disconnects or rail systems specify:

- _____ 39-0001, 1½" NPT Disconnect (Non-pump Supporting)
- _____ 39-0002, 2" Disconnect (Non-pump Supporting)
- _____ 39-0003, 1½" NPT Rail System (Non-pump Supporting)
- _____ 39-0004, 2" NPT Rail System (Non-pump Supporting)
- _____ 39-0085, 1½" NPT Galv. Ez Out (Pump Supporting)
- _____ 39-0086, 1½" NPT S.S. Ez Out (Pump Supporting)
- _____ 39-0083, 2" NPT Galv. Ez Out (Pump Supporting)
- _____ 39-0084, 2" NPT S.S. Ez Out (Pump Supporting)
- _____ 39-0074, 3" NPT Galv. Ez Out (Pump Supporting)
- _____ 39-0075, 3" NPT S.S. Ez Out (Pump Supporting)

Square Guide Rail Systems shall include single rigid stainless steel square rail design, red brass disconnect fitting, cast iron angle arm bracket and guide plates _____ Galvanized or _____ stainless piping, PVC ball valve, cast iron check valve. Rail system shall be for a Zoeller Model _____ with a _____ inch discharge. Rail system will be for a _____ inch diameter basin.

Drain filter housing, remove wing-nuts and lid for easy access to filter cartridges.



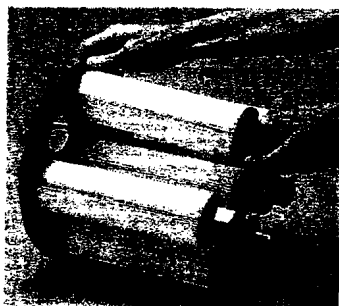
LID REMOVAL WITH HEX NUT CLOSURE

If hex nuts are used for lid closure, a speed wrench may be used for fast lid removal.

Note: Hex nuts were standard on HIF-150-FL and HIF-200-FL filters prior to 6/95. Wing nuts are now standard with these two filter models.



CARTRIDGE INSTALLATION



Cluster Filters

Install cartridges on holding rods and secure with straight thread pipe cap.



High Capacity Filters

Install cartridges on cartridge lifters, one stack at a time.

LID REPLACEMENT

Replace wing or hex nuts systematically, working opposite to one another. With wing-nuts, "hand-tight" is normally sufficient. However, in extreme duty applications it may be necessary to tighten to 75 inch lbs.* of torque. Over-tightening can cause damage to rim gaskets and top seals; do not use pry bars.

* It is imperative to use inch pounds. NOT foot pounds.



HARMSCO® REPLACEMENT FILTER CARTRIDGES

A full line of Harmsco replacement cartridges are available for a wide range of applications, featuring pleated design for low pressure drop, increased filter areas, long filter runs and lower filtration costs.

Application & Tips

Harmsco filter cartridges are cleanable and reusable in most applications and most micron ratings. For best results, clean cartridges when pressure differential is 12-15 psi above start up differential. If cartridges are to be replaced allow pressure differential to climb to 25-30 psi above start-up differential or when flow has diminished to an unacceptable level, indicating cartridge is at capacity.

Cartridge Cleaning in Aqueous Applications:

Clean cartridges with pressure nozzle using standard hose. Direct spray at an angle to remove particulate. Follow these directions for best results:

Oils in aqueous solution: Soak cartridges in a solution of tri-sodium phosphate or similar strong detergent (2 lbs. to ten gallons of water). Soak up to twelve hours. Rinse after soaking.

Organic matter and algae in aqueous solutions: Use tri-sodium phosphate or similar strong detergent as described above, plus one pint of liquid chlorine to kill organic matter and algae. Soak cartridges one hour or longer until surface is no longer slippery. Rinse after soaking.

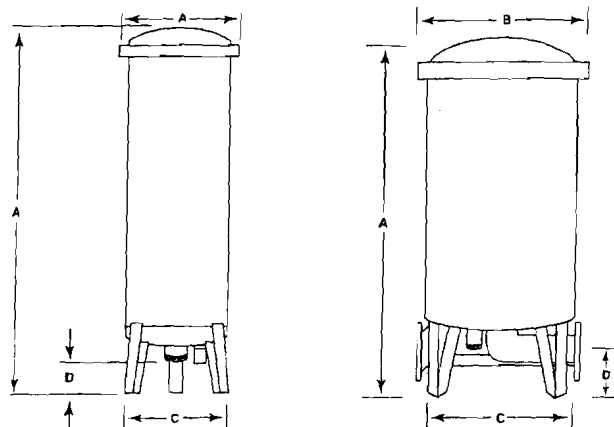
Calcium & mineral deposits: Follow the directions for oils described above. Rinse cartridges thoroughly for approximately ten minutes in a solution of one part of muriatic acid to twenty parts of water. Rinse cartridge thoroughly with water.

Caution:

Do not rinse cartridges with acid until oils and organic matter are removed. Use detergent first and follow with acid soak for mineral removal. Flush cartridges with water after muriatic or tri-sodium phosphate baths.

It is not advisable to clean Harmsco cartridges when filtering petroleum base liquids, toxic substances and when using one micron and sub-micron cartridges.

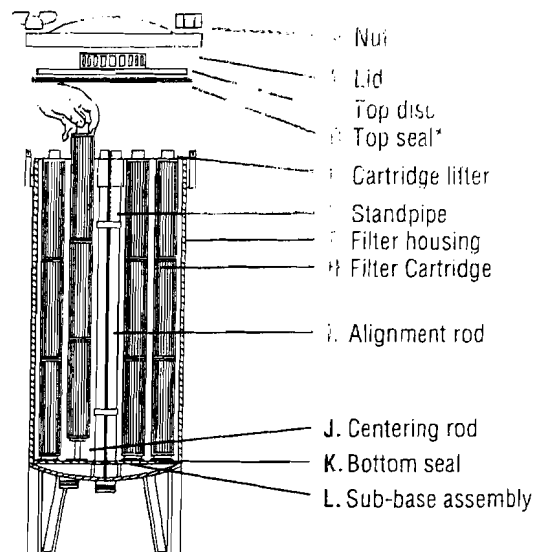
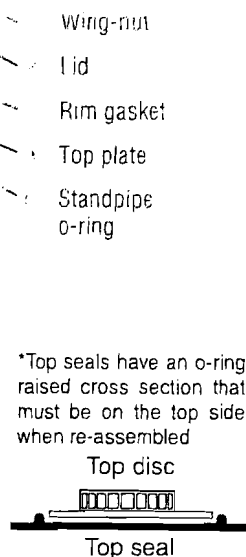
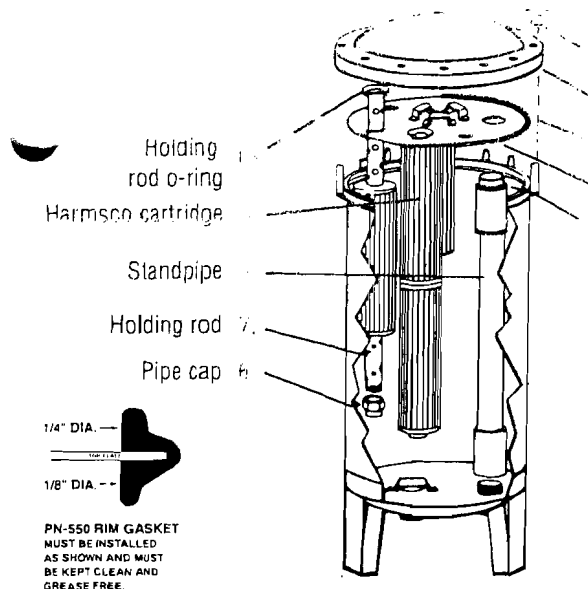
DIMENSIONS



HIF-150-FL, HIF-200-FL

Model	A	B	C	D	Service Ht. Clear	Inlet/Outlet	Drain
HIF-7	19-1/2"	13"	13"	3-1/2"	35"	1-1/2" NPT	1" NPT
HIF-14	28"	13"	13"	3-5/16"	48"	1-1/2" NPT	1" NPT
HIF-16	28"	13"	13"	3-7/8"	48"	2" NPT	1" NPT
HIF-21	37"	13"	13"	3-1/2"	68"	1-1/2" NPT	1" NPT
HIF-24	37"	13"	13"	4"	68"	2" NPT	1" NPT
HIF-42	40"	18"	18"	5-3/8"	68"	2" NPT	1" NPT
HIF-75	42"	20"	20"	6-3/8"	70"	3" NPT	1-1/2" NPT
HIF-100	52"	20"	20"	5-7/8"	87"	3" NPT	1-1/2" NPT
HIF-150-FL	48"	28"	28"	5-3/16"*	76"	4" flange	1-1/2" NPT
HIF-200-FL	58"	28"	28"	5-3/16"*	93"	4" flange	1-1/2" NPT

* To center of flanged fitting.



Replacement Part Numbers for Cluster Filters

Item	HIF-7 Part	Qty.	HIF-14 Part	Qty.	HIF-16 Part	Qty.	HIF-21 Part	Qty.	HIF-24 Part	Qty.
1	202-B	12	202-B	12	202-B	12	202-B	12	202-B	12
2	530-A	1	530-A	1	530-A	1	530-A	1	530-A	1
3	550-E	1	550-E	1	550-E	1	550-E	1	550-E	1
4	519-SS	1	519-SS	1	901-SS	1	519-SS	1	901-SS	1
5	551-B	1	551-B	1	930-B	1	551-B	1	930-B	1
6	513-C	7	513-C	7	513-C	8	513-C	7	513-C	8
	555-C	7	512-C	7	512-C	8	534-C	7	534-C	8
	560-C	1	531-C	1	965-C	1	532-C	1	1445-C	1
9	Cart.	7	Cart.	14	Cart.	16	Cart.	21	Cart.	24
10	552-B	7	552-B	7	552-B	8	552-B	7	552-B	8

** And 20, 202-BT wing nuts; or 40, 202-H hex nuts.

Replacement Part Numbers for High Capacity Filters

Item	HIF-42 Part	Qty.	HIF-75 Part	Qty.	HIF-100 Part	Qty.	HIF-150-FL Part	Qty.	HIF-200-FL Part	Qty.
A	202-B	16	202-B	20	202-B	20	202-B	20**	202-B	20**
B	611-A	1	669-A	1	669-A	1	613-A	1	613-A	1
C	633-SS	1	670-SS	1	670-SS	1	651-SS	1	651-SS	1
D*	635-E	1	671-E	1	671-E	1	653-E	1	653-E	1
E	622-C	14	622-C	25	623-C	25	622-C	50	623-C	50
F	630-C	1	672-C	1	673-C	1	646-C	1	647-C	1
G	601-A	1	674-A	1	675-A	1	606-A	1	607-A	1
H	Cart.	42	Cart.	75	Cart.	100	Cart.	150	Cart.	200
I	None		678-3	1	679-3	1	678-4	1	679-4	1
J	625-P	14	625-P	25	625-P	25	625-P	50	625-P	50
K	639-N	14	639-N	25	639-N	25	639-N	50	639-N	50
L	637-SS	1	677-SS	1	677-SS	1	638-SS	1	638-SS	1

Harmsco Inc. Industrial Filters Limited Warranty

- Harmsco, Inc. warrants its line of Industrial Filters to be free of defects in material and workmanship for a period of one year from the date of installation.
- The warranty for Industrial Filters ordered with special coatings is limited only to the recoating of the defective parts due to failure in materials or workmanship for one year from date of installation.
- This warranty does not cover any equipment purchased for use in applications in which the product is not suited. It is the responsibility of the buyer to determine if a product is suitable for a particular application.
- THIS WARRANTY EXCLUDES THE FOLLOWING:**
 - Any fresh water unit installed for salt water use.
 - Damage caused by improper installation, operation or care.
 - Chemical attack.
 - Rubber type parts and normal wear items i.e. "O" rings, rim gaskets, wing-nuts, pipe caps, holding rods.
 - Any costs of labor or expenses expended in the removal and/or installation of unit, or any surrounding device.
 - Damage caused by galvanic or electrolytic attack.
 - Altering or removing the Harmsco, Inc. information label.
 - Any unit not grounded.
- Service under this warranty is to be provided by the distributor who sold the unit to the user. If the distributor is unable to provide warranty service, contact:

Harmsco, Inc., P.O. Box 14066
North Palm Beach, Florida, 33408, U.S.A.
Phone: (561) 848-9628 • Fax: (561) 845-2474

A Returned Goods Authorization (RGA) number must be received from the above office and placed on all shipments to and correspondence with Harmsco, Inc. Please be prepared with the following information: 1. Model number and serial number. 2. Date of installation. 3. Name of installer. 4. Nature of problem. 5. Your address and telephone number.

Available from:

Harmsco is a registered trademark of Harmsco, Inc.
©1999 Harmsco, Inc. Printed in U.S.A. Literature No. IO1299-5M

Toll Free: (800) 327-3248
Fax: (561) 845-2474
Local: (561) 848-9628
E-mail: info@harmasco.com



Harmsco® Industrial Filters

P.O. Box 14066, North Palm Beach, Florida 33408

15064-02-A
PIPING APPURTENANCE – CARTRIDGE FILTER

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)
For additional information on CGL products & services, please visit our website: camerongreatlakes.com

August 14, 2001

Ref. No. 10813-LAW-BWE
Via Fax Only – Page 1 of 3 to BWE

TO: Angie Gershman (Letter only)
Law Engineering & Env'tal Svcs (LAW)
One Summit Square – Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145 or 631-249-1872 ext. 266
Fax: 631-752-3008 (Cell 516-315-3467)

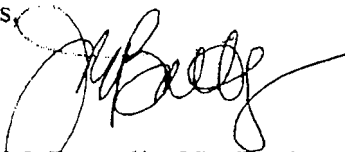
Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

This FAX message follows up on my telephone conversation this morning with Mark. Attached please find a catalog cut and a general arrangement drawing for the Harmsco Model HIF-75 Cartridge Filter. This is the same filter & drawing Angie used for her drawings. We will supply qty 75 x 10 micron rated cartridge filter elements to be field installed in this filter housing after installation at the site. (I could not find a specific micron rating in the spec. I normally use 10 micron filters for this service.)

It is our understanding that upon receipt and review of this information by BWE and ERM that the filter can be released by BWE for fabrication. *We look forward to receipt of this release.*

Regards,

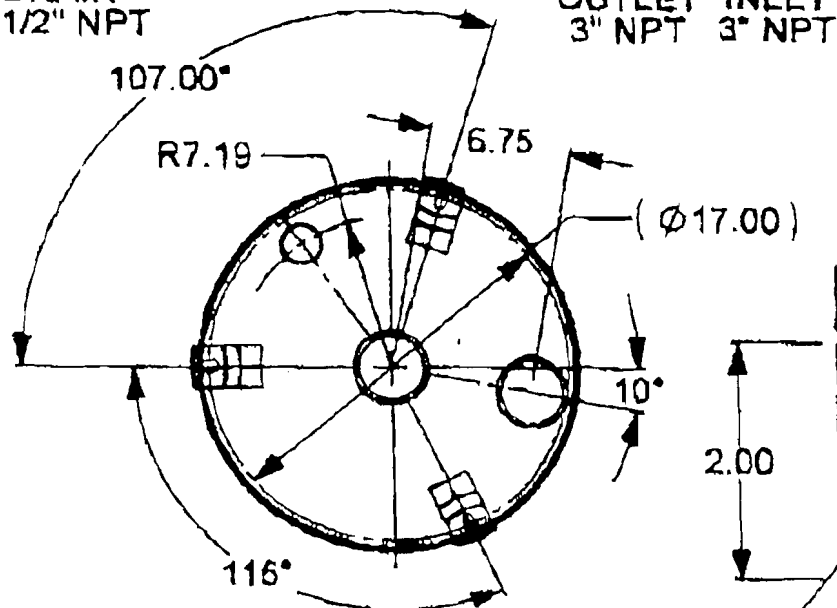
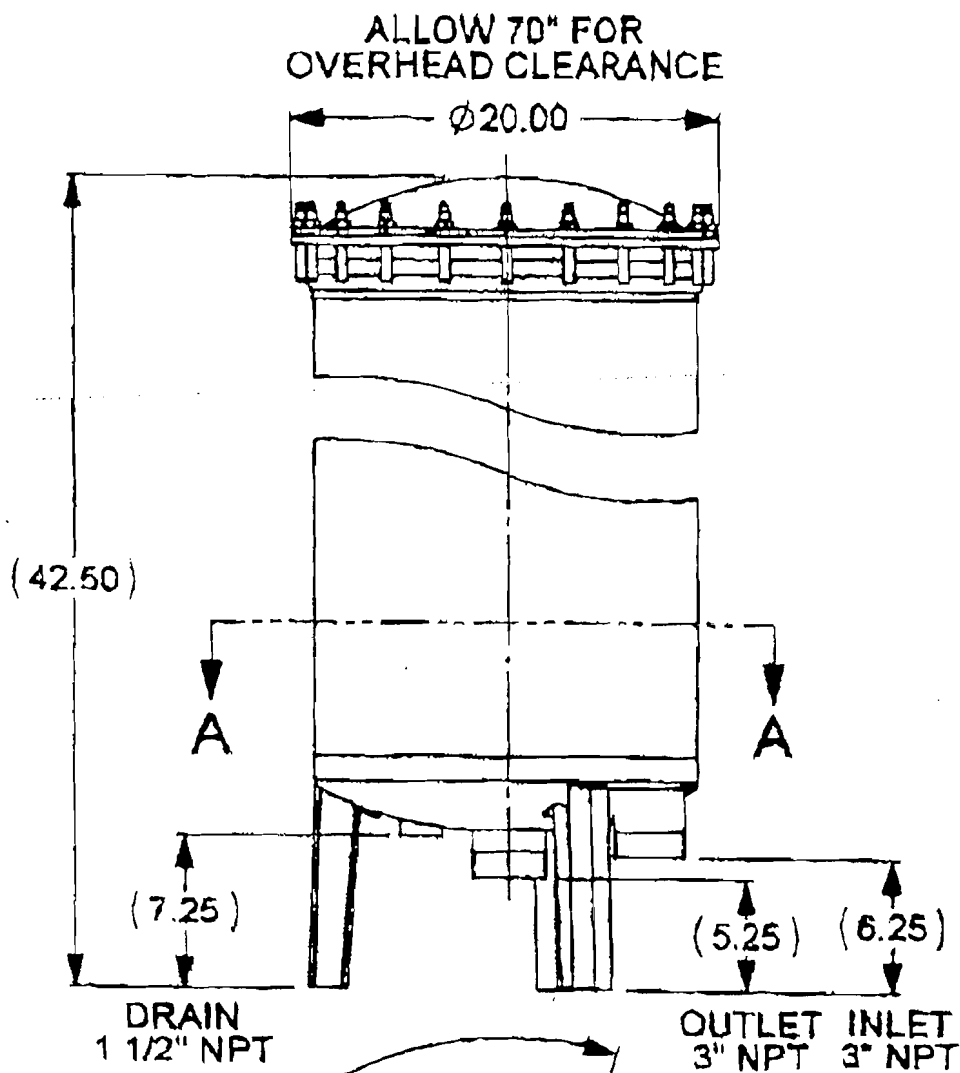


Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Copy to: CGL, Portland, OR

CHG	WAS	DATE	CHG	WAS	DATE

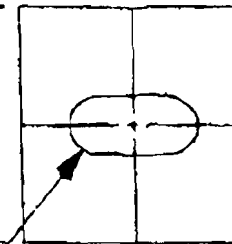
Cameron Great Lakes SO # 77977
Blue Water Env'tal PO # 02370-109
Law Project # 22000-0-0019 Ph. 300
Active Industrial Site - NYSDEC



LEG SLOT

1.75

2.00



SLOT .50 X 1.00

HARMSCO INC.

P.O. BOX 14086 N. PALM BEACH, FLA.

PART NAME
INSTALLATION
DIAGRAM

SCALE
8:1

PART #
HIF 75

DATE

APR 4/19/00

TOLERANCE
FRACTIONAL .125
DECIMAL .125
EXCEPT AS NOTED

DUFF CO.

WATER TREATMENT

HARMSCO UP-FLOW CARTRIDGE FILTRATION

A Design So Superior It's Patented!

Harmsco's up-flow design out performs conventional filters! Fluid enters the filter under pressure and flows through the filter media, holes in the center tubes and perforations in the rods that hold the cartridges in place. As the fluid continues its path, it flow upward past the top seal where it spills over into the standpipe as it hits the filter's domed lid. The top of the standpipe is at the high point of the filter. Also, note the the filter cartridges are sealed at the bottom and held in place with threaded pipe caps.

UP-FLOW Stainless Steel Industrial "filter Housings

Cartridge filters (304 stainless steel, CPVC standpipes, CPVC cartridge holders and threaded caps)

Cartridge cluster filters (to remove entire set of cartridges at one time for cleaning or replacement)

***No Air Entrapment**

***No Vents**

***No Fluid By-Pass**

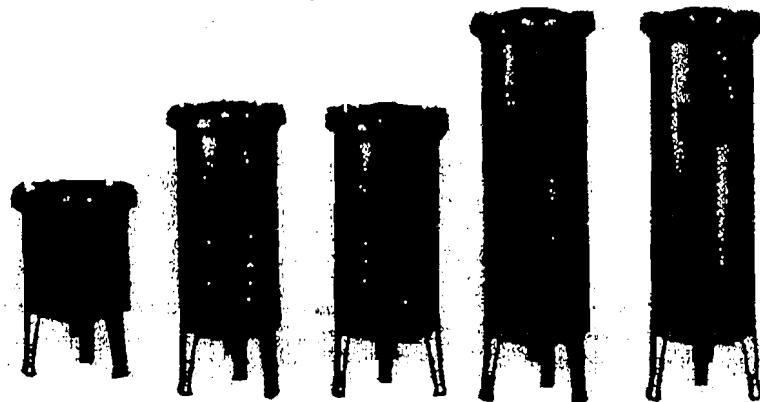
During Servicing

***Electro-Polished**

***Fail-Safe Lids**



Cartridge cluster filter with easy cartridge removal for cleaning or replacement.



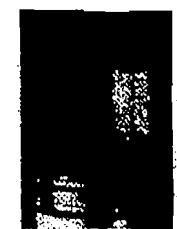
	HIF-7	HIF-14	HIF-16	HIF-21	HIF-24
Flow rate (GPM)	Up to 30	Up to 60	Up to 75	Up to 90	Up to 105
No. of Std. Cartridges	7	14	16	21	24
Alternative cartridge	Single Only	7 doubles	8 doubles	7 triples	8 triples
Pipe size (Male NPT)	1 1/2"	1 1/2"	2"	1 1/2"	2"
Filter Height	19.5"	28"	28"	37"	37"
Floor Space Req'd	13"x13"	13"x13"	13"x13"	13"x13"	13"x13"
Service hght clearance	35"	48"	48"	68"	68"
Shipping wght (appx)	29 lbs.	39 lbs.	39 lbs.	50 lbs.	50 lbs.
Pressure rating	150 psi	150psi	150 psi	150 psi	150 psi
FIG. NO.	5 1 2 4 0	5 8 4 9 5	5 8 4 9 6	-	5 5 9 3 6

Large capacity filters with cartridge filters for easy cartridge removal

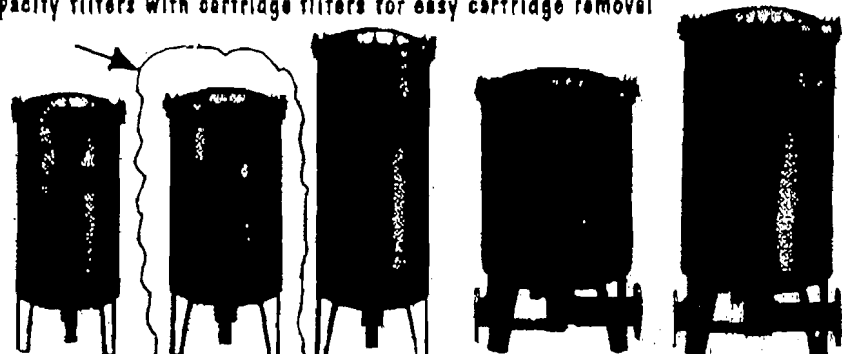
***Compact Design**

***Pressure Rated to**

150 psi



Large capacity filter with lifting rods to remove a single stand of cartridges at a time.



***Cartridge Cluster Filters**

HARMSCO MODEL	HIF-42	HIF-75	HIF-100	HIF-150-FL	HIF-200-FL
Flow rate (GPM)	Up to 175	Up to 300	Up to 400	Up to 600	Up to 800
No. of Std. Cartridges	42	75	100	150	200
Alternative cartridge	14 triples	25 triples	50 doubles	50 triples	100 doubles
Pipe size (Male NPT)	2"	3"	3"	4" flanged	4" flanged
Filter Height	40"	42"	52"	48"	58"
Floor Space Req'd	18"x18"	20"x20"	20"x20"	28"x28"	28" x 28"
Service hght clearance	68"	70"	87"	76"	93"
Shipping wght (appx)	100 lbs.	129 lbs.	188 lbs.	274 lbs.	321 lbs.
Pressure rating	150 psi	150 psi	150 psi	150 psi	150 psi
FIG. NO.	6 9 9 3 5	6 6 8 6 7	-	-	-

NOTES: *With built-in 1/2" NPT plug for air bleed. Filters rated for temperatures to 140°F (60°C) with standard Harmsco cartridges and 200°F (93°C) with high-temp cartridges. Limits vary and

Page 482

Cameron Great Lakes SO # 77977

Blue Water Env'tal PO # 02370-109

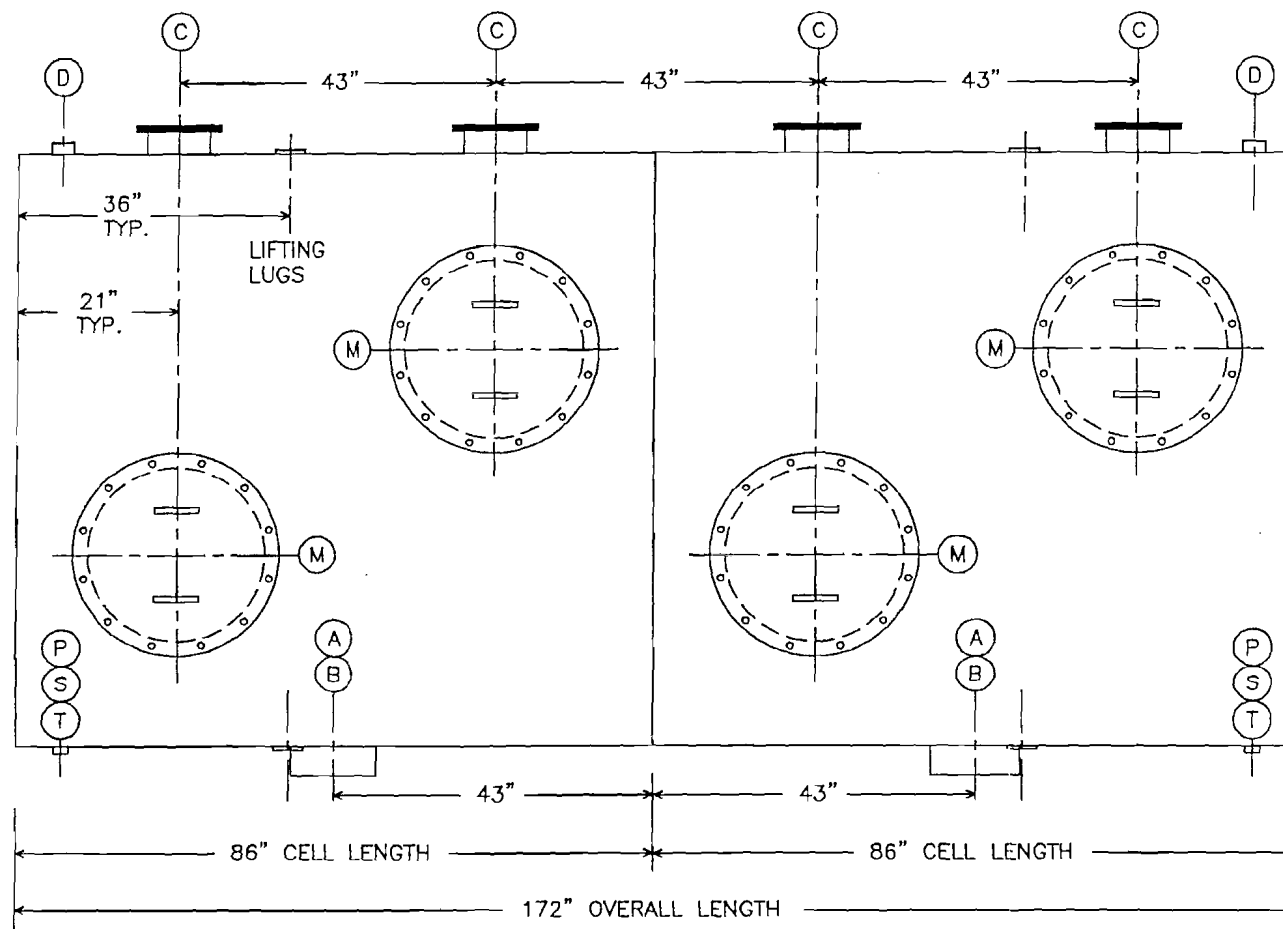
Law Project # 22000-0-0019 Ph. 300

Active Industrial Site - NYSDEC

7
13720-03-A

VAPOR PHASE GRANULATED ACTIVATED CARBON OFF-GAS TREATMENT
SYSTEM

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134



PLAN VIEW



CAMERON GREAT LAKES, INC.

2335 NW 29th AVE PORTLAND, OR 97210
TEL: 800-777-4044 FAX: 503-225-0137

PROPRIETARY DRAWING

DRAWING MAY NOT BE USED
OR REPRODUCED WITHOUT
WRITTEN AUTHORIZATION OF
CAMERON GREAT LAKES, INC.

DIMENSIONAL TOLERANCE = +/- 1/8 IN.

REV.	DATE	BY	REMARKS
--	08/02/01	JMB	ORIGINAL ISSUE

CGL REF. CGL SALES ORDER NO. 77977

CUST. BLUE WATER ENVIRONMENTAL
1610 NEW HIGHWAY
FARMINGDALE, NY 11735
TEL: 631-752-2145 (FAX 3008)
BWE P.O. NO. 02370-107
LAW # 22000-0-0019 PH. 300
NYSDEC-ACTIVE INDUSTRIAL SITE

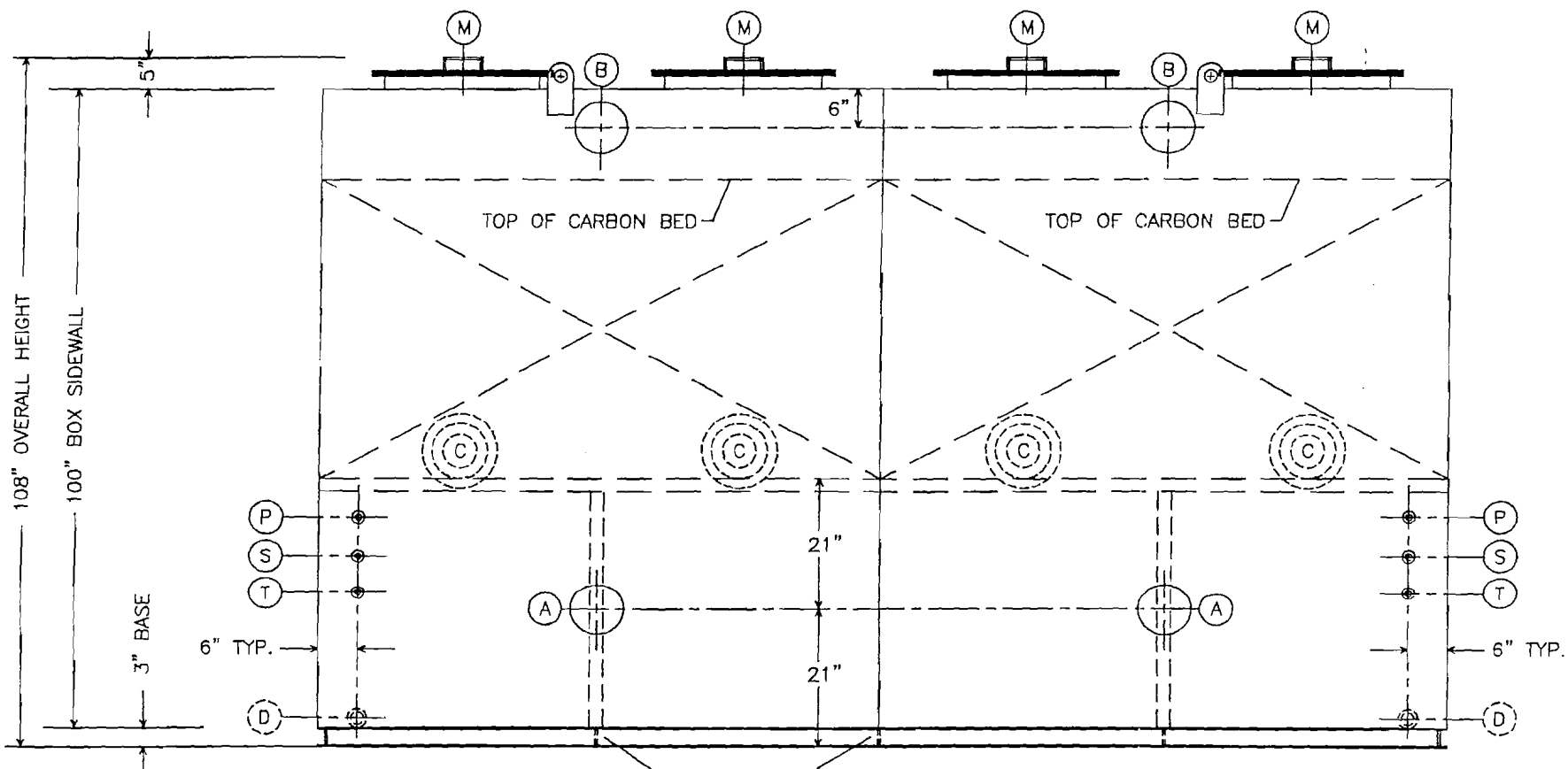
TITLE:

GENERAL ARRANGEMENT & DETAILS
MODEL VS7.2x6.7x8.6-5000-DUAL
VAPOR SCRUB ACTIVATED
CARBON ADSORPTION VESSEL

SHEET 1 OF 4 - PLAN VIEW

SCALE: N.T.S.

DWG NO. VS7.2x6.7x8.6-5000-DUAL



S3x7.5 BASE BEAMS AT PERIMETER, AT
CENTER OF EACH CELL AND AT CENTER
COMMON WALL BETWEEN CELLS

SOUTH ELEVATION



CAMERON GREAT LAKES, INC.

2335 NW 29th AVE
TEL: 800-777-4044

PORTLAND, OR 97210
FAX: 503-225-0137

PROPRIETARY DRAWING

DRAWING MAY NOT BE USED
OR REPRODUCED WITHOUT
WRITTEN AUTHORIZATION OF
CAMERON GREAT LAKES, INC.

VISIONAL TOLERANCE = +/- 1/8 IN.

REV.	DATE	BY	REMARKS
--	08/02/01	JMB	ORIGINAL ISSUE

CGL REF. CGL SALES ORDER NO. 77977

CUST.: BLUE WATER ENVIRONMENTAL
1610 NEW HIGHWAY
FARMINGDALE, NY 11735
TEL: 631-752-2145 (FAX 3008)
BWE P.O. NO. 02370-107
LAW # 22000-0-0019 PH. 300
NYSDEC-ACTIVE INDUSTRIAL SITE

TITLE:

GENERAL ARRANGEMENT & DETAILS
MODEL VS7.2x6.7x8.6-5000-DUAL
VAPOR SCRUB ACTIVATED
CARBON ADSORPTION VESSEL

SHEET 2 OF 4 - SOUTH ELEVATION

SCALE:

N.T.S.

DWG NO.

VS7.2x6.7x8.6-5000-DUAL

NOZZLE SCHEDULE

MARK	SERVICE	SIZE	TYPE/REMARKS	QUANTITY
A	AIR INLET	7.8" O.D.	HOSE SLIP ON	2
B	AIR OUTLET	7.8" O.D.	HOSE SLIP ON	2
C	CARBON OUT	8" FL.	BOLTED COVER *	4
D	DRAIN	2" NPT	HALF CPLG. w/PLUG	2
M	MAN WAY	24" I.D.	BOLTED COVER w/ TWO (2) HANDLES *	4
P	PRESSURE GA.	1" NPT	HALF CPLG w/PLUG	2
S	AIR SAMPLE	1" NPT	HALF CPGL w/PLUG	2
T	TEMPERATURE GA.	1" NPT	HALF CPGL w/PLUG	2

*) COVERS INCLUDE NEOPRENE GASKETS & HARDWARE

APPROXIMATE EMPTY WEIGHT = 6000 LBS

PARTS IDENTIFICATION AND NOTES

CF - CARBON OUT FLANGE - 8" DIA. x 1.5x1.5x3/16 PUNCHED
ANGLE RING EXTENDED TO 3" TOTAL PROJECTION FROM SIDEWALL

CC - CARBON OUT COVER - 3/16 CS PLATE PUNCHED TO MATCH
RING

MF - MAN WAY FLANGE - 24" DIA. x 1.5x1.5x3/16 PUNCHED RING

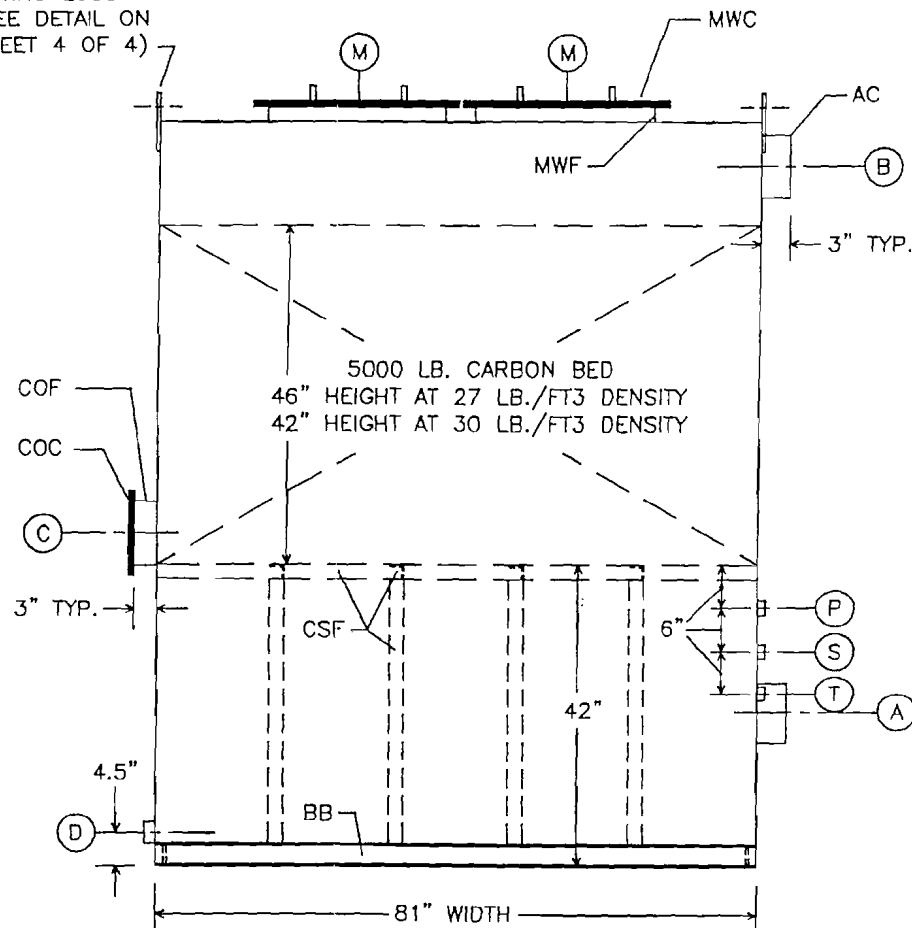
MC - MAN WAY COVER - 1/4 CS PLATE PUNCHED TO MATCH RING
WITH TWO (2) HANDLES FROM 1/2" ROUND BAR

- AIR CONNECTION - 3/16 CS ROLLED TO 7.8" O.D. TUBE
PROJECTING 3" FROM SIDEWALL

FF - CARBON SUPPORT FRAME - 2x2x1/4 ANGLE (SEE SHEET 4 OF 4)

- BASE BEAMS - S3x7.5 AT PERIMETER, AT CENTER OF EACH
CELL, AND AT CENTER COMMON WALL BETWEEN CELLS

FOUR (4)
LIFTING LUGS
(SEE DETAIL ON
SHEET 4 OF 4)



WEST ELEVATION



CAMERON GREAT LAKES, INC.

2335 NW 29th AVE
TEL: 800-777-4044

PORTLAND, OR 97210
FAX: 503-225-0137

PROPRIETARY DRAWING

DRAWING MAY NOT BE USED
OR REPRODUCED WITHOUT
WRITTEN AUTHORIZATION OF
CAMERON GREAT LAKES, INC.

DESIGN TOLERANCE = +/- 1/8 IN.

REV.	DATE	BY	REMARKS
08/02/01	JMB	ORIGINAL ISSUE	

CGL REF. CGL SALES ORDER NO. 77977

CUST. BLUE WATER ENVIRONMENTAL
1610 NEW HIGHWAY
FARMINGDALE, NY 11735
TEL: 631-752-2145 (FAX 3008)
BWE P.O. NO. 02370-107
LAW # 22000-0-0019 PH. 300
NYSDEC-ACTIVE INDUSTRIAL SITE

TITLE

GENERAL ARRANGEMENT & DETAILS
MODEL VS7.2x6.7x8.6-5000-DUAL
VAPOR SCRUB ACTIVATED
CARBON ADSORPTION VESSEL

SHEET 3 OF 4 - WEST ELEVATION,
PARTS I.D. & NOZZLE SCHEDULE

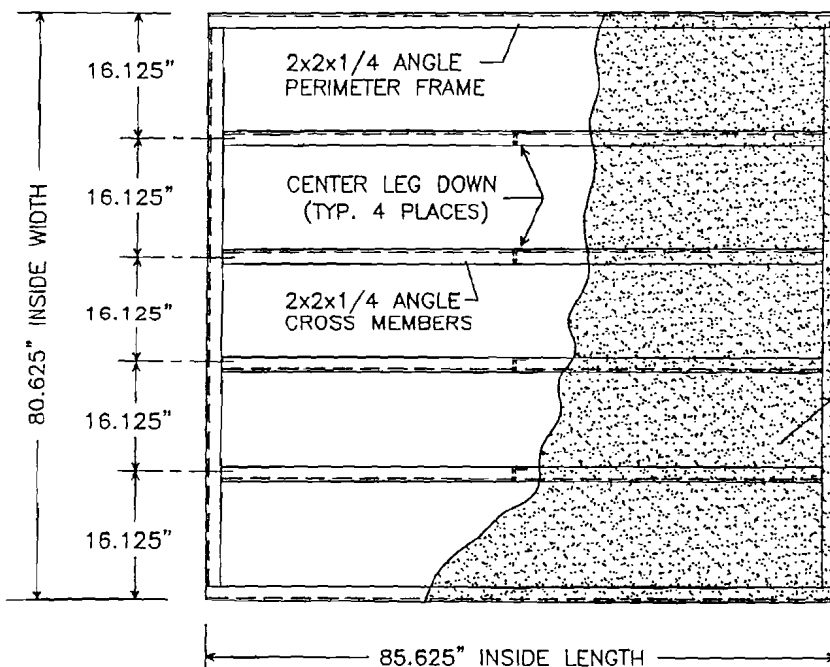
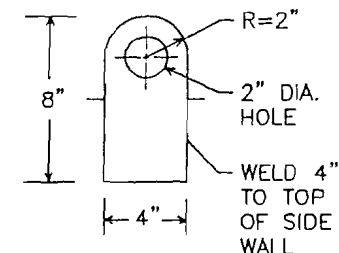
SCALE: N.T.S.

DWG NO.

VS7.2x6.7x8.6-5000-DUAL

1. 7 GA. CARBON STEEL. FINISH: BLAST SP-6, PRIME & ENAMEL PAINT INSIDE & OUT. COLOR: SAFETY BLUE
2. WELDS AT PRESSURE BOUNDARIES TO BE SMOOTH AND CONTINUOUS - DYE PENETRANT TEST TO INSURE FREEDOM FROM LEAKS & PINHOLES.
3. STITCH WELD BASE CHANNELS TO BOTTOM OF UNIT AND INTERNAL ANGLE STEEL CARBON BED SUPPORT FRAME TO VESSEL SIDES.
4. LOCATE INVERT OF NOZZLE "C" TO BE EVEN WITH TOP OF CARBON BED SCREEN.
5. NOZZLES LABELED FOR AIR "DOWNFLOW" OPERATION. UNIT CAN BE OPERATED AIR "UPFLOW" AS WELL.

DETAIL FOR LIFTING LUG
4 x 8 x 1/2" THICK BAR



INTERNAL PLAN VIEW OF ONE (1)
CELL SHOWING DETAILS FOR
CARBON BED SUPPORT ANGLE
FRAME AND PERFORATED SCREEN

CARBON BED SCREEN

22 GA. GALV. PERF. STEEL WITH
1/16" HOLES ON 3/32" STAG.
CENTERS, 41% OPEN AREA.
ATTACH TO ANGLE FRAME WITH
3/8" DIA. SELF DRILLING, SELF
TAPPING SCREWS WITH WASHER
HEADS ON 6" CENTERS.



CAMERON GREAT LAKES, INC.

2335 NW 29th AVE PORTLAND, OR 97210
TEL: 800-777-4044 FAX: 503-225-0137

PROPRIETARY DRAWING

DRAWING MAY NOT BE USED
OR REPRODUCED WITHOUT
WRITTEN AUTHORIZATION OF
CAMERON GREAT LAKES, INC.

DIMENSIONAL TOLERANCE = +/- 1/8 IN.

REV.	DATE	BY	REMARKS
---	08/02/01	JMB	ORIGINAL ISSUE

CGL REF. CGL SALES ORDER NO. 77977

CUST. BLUE WATER ENVIRONMENTAL
1610 NEW HIGHWAY
FARMINGDALE, NY 11735
TEL: 631-752-2145 (FAX 3008)
BWE P.O. NO. 02370-107
LAW # 22000-0-0019 PH. 300
NYSDEC-ACTIVE INDUSTRIAL SITE

TITLE:

GENERAL ARRANGEMENT & DETAILS
MODEL VS7.2x6.7x8.6-5000-DUAL
VAPOR SCRUB ACTIVATED
CARBON ADSORPTION VESSEL

SHEET 4 OF 4 - NOTES & DETAILS

SCALE: N.T.S.

DWG NO.

VS7.2x6.7x8.6-5000-DUAL



CAMERON GREAT LAKES, INC.

MOLECULAR FILTRATION SPECIALISTS

CGL/CP48

DESCRIPTION: A bituminous coal based pelletized activated carbon of high adsorptive capacity. It has a well-developed pore structure for the adsorption of a wide range of volatile organic compounds.

APPLICATIONS: It is ideally suited for critical applications such as gas purification, solvent vapor recovery and catalyst support.

PHYSICAL PROPERTIES:

ACTIVITY FOR CCL ₄ (ASTM D-3467)	60 - 65% TYPICAL
BULK DENSITY, TYPICAL	28 LBS/CU FT.
MOISTURE CONTENT (ASTM D2867-95)	2%, AS PACKED
HARDNESS (ASTM D3802-79)	98 MINIMUM
ASH CONTENT, TYPICAL	10 - 12%

PACKAGING OPTIONS:

55 pound bags,
200 pound fiber drums,
1,000 pound super sacks

This information has been gathered from standard reference materials and/or test procedures and is believed to be true and accurate. It is offered solely for your consideration and verification. None of the information presented shall be construed as constituting a warranty or representation, expressed, written, or implied, for which we assume legal responsibility or that the information or goods described is fit for any particular use either alone or in combination with other goods or processes, or that its use does not conflict with existing patent rights. No license is granted to infringe on any patent rights or practice any patent invention.

Corporate Office
2335 NW 29th Ave., Portland, OR 97210
Phone: (800) 762-0501
Fax: (503) 225-0137

Mid-West Office
PO Box 488, Elburn, IL 60119
Phone: (800) 777-4044
Fax: (630) 365-0950

Eastern Office
166 Sandybrooke Drive
Langhorne, PA 19047
Tel. 215-752-2246 (fax 2247)

MATERIAL SAFETY DATA SHEET

SECTION I

MANUFACTURER:

CAMERON GREAT LAKES, Inc.

2335 NW 29th Avenue

Portland, OR 97210

EMERGENCIES:

Tel. 503-241-8037 (Fax 503-225-0137)

PRODUCT IDENTIFICATION: CGL SERIES: CCS, CCR, CP, CPR, CG, CGR, WP, MR, CGAW

HMS RATING: H=1, F=1 R=1, PP=E

SECTION II

HAZARDOUS INGREDIENTS: NONE

INGREDIENTS:

Chemical Name (CAS#)	%	PEL(OSHA)	TLV(ACGIH)	Other
Carbon* (7440-44-0)	100	N/A	N/A	N/A

*ACGIH (TWA) for respirable dust is 2.5 mg/m³

SECTION III

PHYSICAL DATA:

Specific Gravity, (H ₂ O = 1)	1.8 - 2.1
Solubility in water:	None
Percent volatile:	0
pH:	5.0 - 10.0
Appearance and Odor:	Black granular, powder, or extruded pellet, no odor.

SECTION IV

FIRE & EXPLOSION DATA:

Flash Point:	Non -flammable
Extinguishing media:	In case of fire use foam, CO ₂ or dry chemical.
Special Firefighting procedures:	Exercise caution when responding to any chemical fire. Respiratory protection is essential.
Unusual fire & explosion hazards:	Contact with strong oxidizers may cause rapid combustion.

SECTION V

HEALTH HAZARD DATA:

Route (s) of Entry:

Ingestion:	Carbon is non- toxic through ingestion.
Inhalation:	The physical nature of carbon may irritate the respiratory system.
Skin	Carbon is non-toxic through skin absorption.

Eye Irritation: The physical nature of carbon may cause eye irritation.

SECTION V cont'd

EMERGENCY & FIRST AID PROCEDURES:

In case of inhalation remove to fresh air. Seek medical attention if irritation persists.

In case of eye contact flush with lukewarm water for at least 15 minutes. If irritation persists seek medical attention.

SECTION VI

REACTIVITY DATA:

Incompatibility:	Strong oxidizers such as ozone or liquid oxygen.
Stable:	Yes
Hazardous polymerization:	Will not occur.

SECTION VII

SPILL & LEAK PROCEDURES:

Steps to be taken in the event if a spill:	Sweep up and discard in protected refuse container.
Waste Disposal Method:	Dispose of in accordance with local, state, and federal regulations.

SECTION VIII

SPECIAL PROTECTION INFORMATION:

Respiratory Protection:	Standard precaution against dust; respirator or dust mask.
Ventilation/Local Exhaust:	Essential in confined areas.
Protective Gloves:	Not required.
Eye Protection:	Safety goggles or glasses.

SECTION IV

SPECIAL PRECAUTIONS:

Precautions to be taken in handling and storage:

Avoid contact with eyes. No precautions required for disposal of shipping containers. Avoid excessive contact with moisture.

Other precautions:

Wet activated carbon depletes oxygen from the air creating a severe hazard to workers in enclosed or confined spaces. Sampling and work procedures for low oxygen levels should be taken whenever workers entering carbon vessels, enclosed or confined spaces.

07
13720-03-B

ISOTHERMS AND RELATIVE HUMIDITY NOTES FOR VPGAC OFF-GAS SYSTEM

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)
For additional information on CGL products & services, please visit our website: camerongreatlakes.com

August 13, 2001

Ref. No. 10813-LAW-BWE
Via Fax Only - Page 1 of 3

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square - Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145 or 631-249-1872 ext. 266
Fax: 631-752-3008 (Cell 516-315-3467)

Re: Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

This FAX message follows up on my telephone conversation this morning with Angie. Per a FAX to Mark Soliman from John R. Conley of Systech Design (our Cincinnati Fan sales rep) dated 08-10-01, we have established that the expected temperature rise across the Model PB-18 pressure blower will be around 10°F at the design discharge pressure of 20" w.g.

This 10°F temperature rise will act to *lower* the RH of the saturated air coming from the air stripper. The air entering the blower from the stripper will be at ~55°F & 100% RH (i.e. saturated). I have attached a (reduced size) copy of a complete Psychometric Chart and an enlarged portion of the chart with notations for the temperature range of interest. As noted in Example 1 on the enlarged section, heating the air from 55°F to 65°F will lower the RH from 100% to around 54%. *This lower RH is perfectly acceptable for efficient VOC adsorption by vapor phase carbon.*

It is our understanding that upon receipt and review of this information that the vapor phase carbon unit can be released by BWE for fabrication. *We look forward to receipt of this release.*

Regards,


Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Copy to: CGL, Portland, OR



Exton Office Court, Suite 220, 300 North Pottstown Pike, Exton, PA 19341
Tel: (610) 524-9048 Fax: (610) 524-7355 E-mail: systechdesign@erols.com

August 10, 2001

Mr. Mark Soliman, Project Engineer

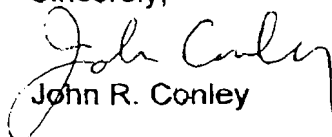
Blue Water Environmental
1810 New Highway
Farmingdale, NY 11735

RE: Cincinnati Fan Model PB-18, 10 HP

Dear Mr. Soliman,

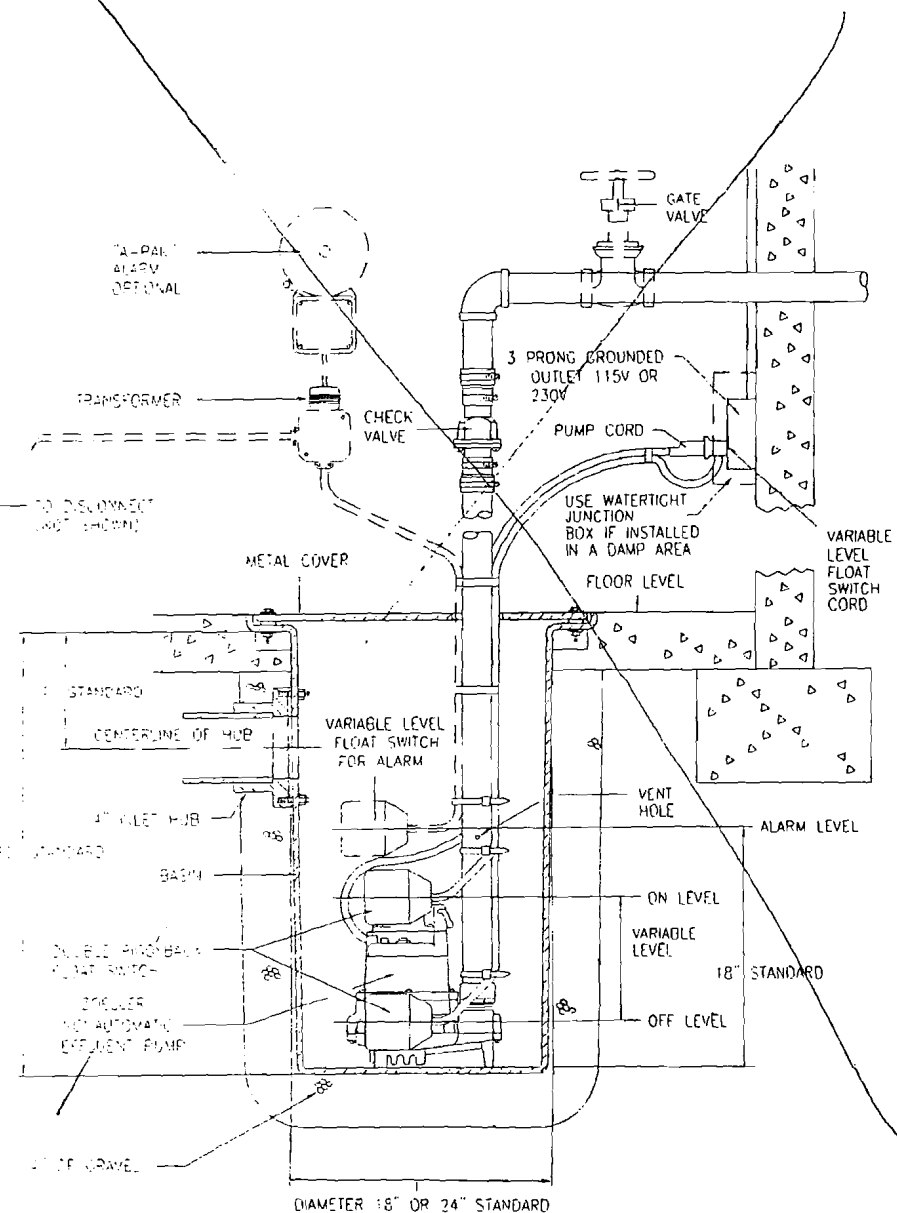
I have been requested by Mr. Joe Battaglia of Cameron-Great Lakes to address the issue of temperature rise when selecting /installing pressure blowers. The fan/blower industry generally uses one (1) degree temperature rise for every 2 to 2.5 inches of total pressure. The fan in question is sized for 1360 CFM at 20 inches total pressure or approximately 10 degrees temperature rise maximum. I've attached a section of an engineering guide for you review and understanding. If you need additional information please let me know.

Sincerely,


John R. Conley

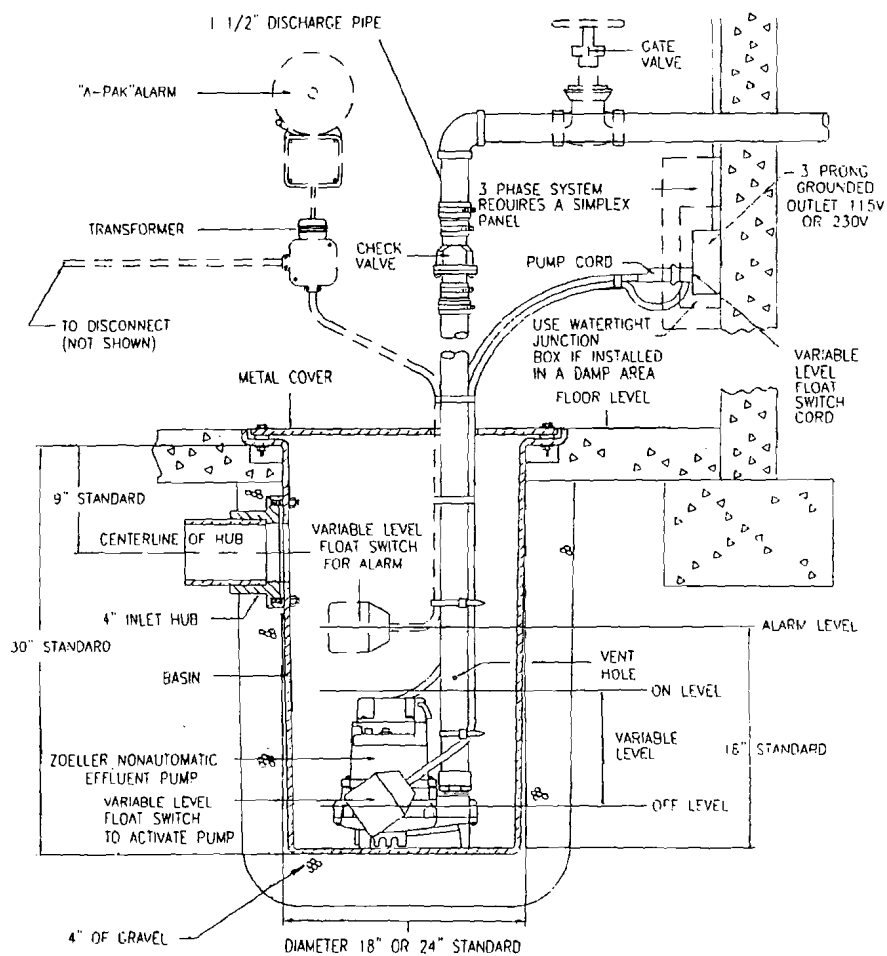
Cc: J. Battaglia, Cameron-Great lakes

SUMP SIMPLEX SYSTEM WITH DOUBLE VARIABLE LEVEL FLOAT SWITCH (SINGLE PHASE)



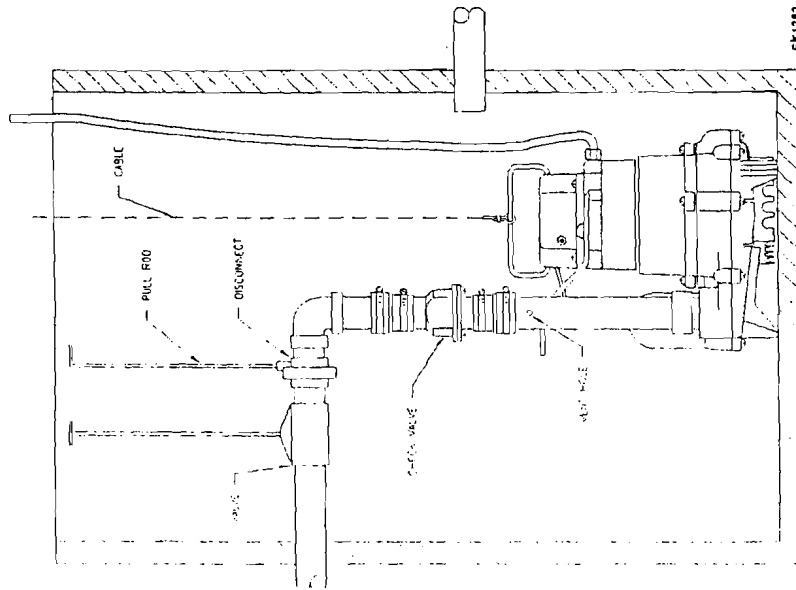
SK454

SUMP SIMPLEX SYSTEM WITH SINGLE VARIABLE LEVEL FLOAT SWITCH (SINGLE OR THREE PHASE)

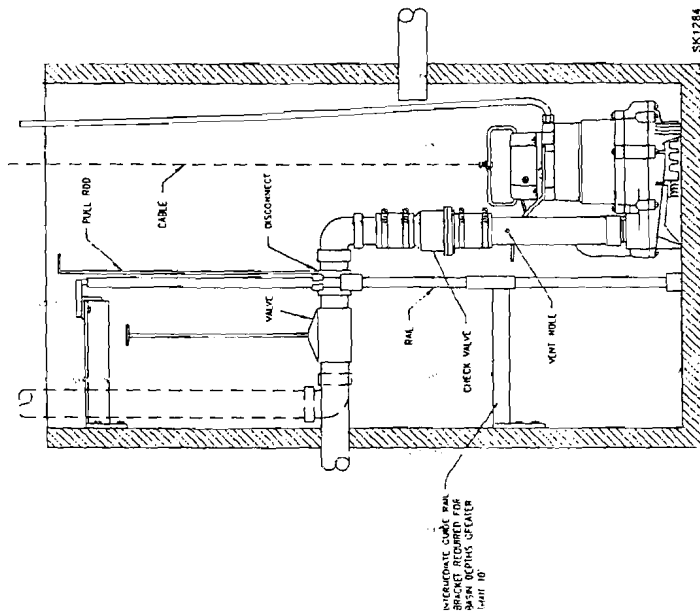


SK453

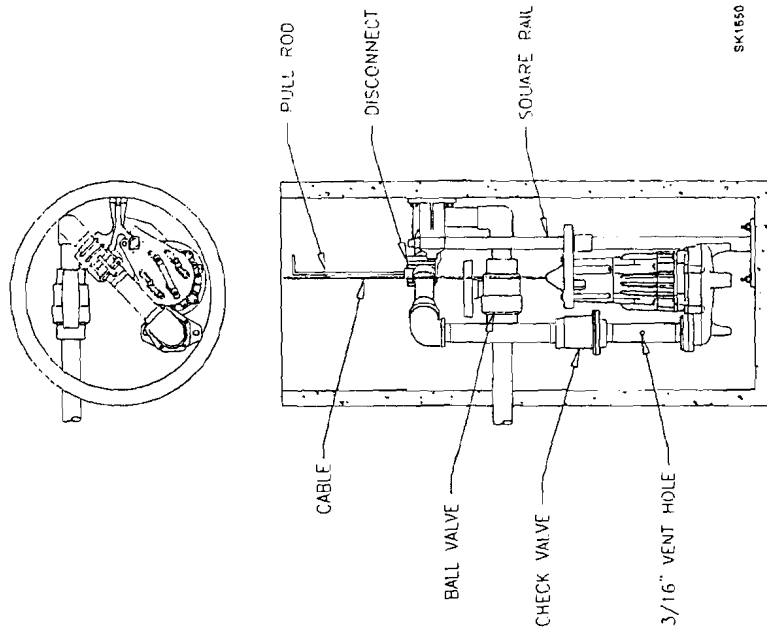
PUMP DISCONNECT SYSTEM



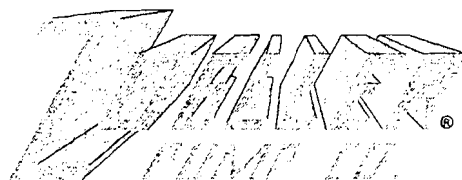
PUMP DISCONNECT WITH RAIL SYSTEM



SQUARE GUIDE RAIL SYSTEM



"QUALITY PUMPS SINCE 1939"



SECTION: 4.10.005

FM1596

0301

Supersedes

1097

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.

MAIL TO: P.O. BOX 16347 • Louisville, KY 40256-0347
SHIP TO: 3649 Cane Run Road • Louisville, KY 40211-1961
(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

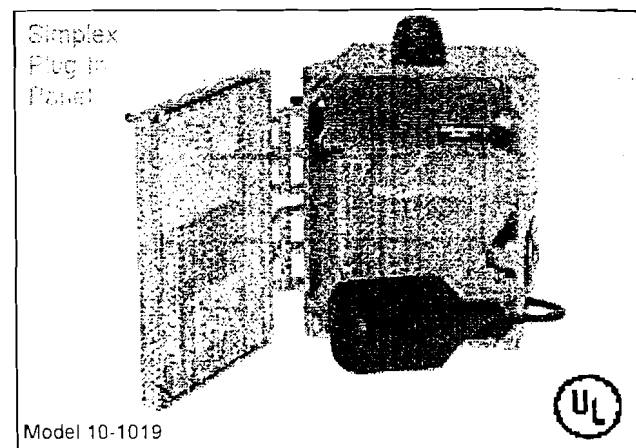
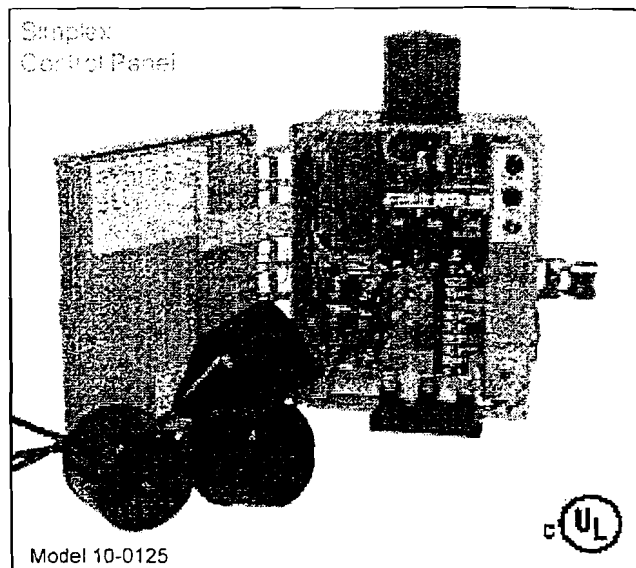
visit our web site:
<http://www.zoeller.com>

ELECTRICAL CONTROL PANELS - FOR SIMPLEX INSTALLATIONS

An Electrical Control Panel is used on a Simplex pump application where automatic electrical cycling of the pump is desired for added protection in residential or commercial applications. A Control Panel is required for all systems using a nonautomatic pump. The built-in alarm system, a standard feature, will activate when the water level becomes unusually high. All electrical systems must be installed by a qualified electrician and according to the National Electrical Code. (See Section 430-71 through 430-113, plus any others that apply.)

SINGLE PHASE CONTROL PANEL FEATURES

- 115-208-230 Volts.
- Clear dead front panel.
- Complete with (3) 20 ft. control float switches.
- Equipment disconnect.
- Motor contactor (all models except 10-1019 and 10-1023)
- NEMA 4X watertight enclosure with lockable latch.
- Top mounted alarm light.
- Alarm horn provides audio warning of alarm condition (83 to 85 decibel rating).
- Pump run indicator light.
- Horn silence and alarm test toggle switches.
- HOA switch.
- Complete installation instructions included.
- U.L. listed for US & Canada.
- Lockable Latch.
- 2 Year Warranty.
- Dry auxiliary contacts.



SINGLE PHASE SIMPLEX PLUG IN CONTROL PANEL

- 115V model 10-1019 or 230V model 10-1023.
- NEMA 4X enclosure with hinged cover.
- Receptacle for use with piggyback pump switch.
- Alarm Horn (83 to 85 decibel rating).
- Terminal strip.
- Horn silence switch to turn alarm on or off.
- Alarm Float only.

SINGLE PHASE SIMPLEX PUMP CONTROL/ALARM SYSTEM

Model #	Volts	Amp Range	Float Switches Included	Features
10-1019	115V	0-15	Alarm Float Only	Plug-In
10-1023	230V	0-15	Alarm Float Only	Plug-In
10-1036	115V, 208-230V	0-7	Three-20' Control Floats	Circuit Breaker Disconnect
10-1037	115V, 208-230V	7-15	Three-20' Control Floats	Circuit Breaker Disconnect
10-1038	115V, 208-230V	15-20	Three-20' Control Floats	Circuit Breaker Disconnect
10-0125*	115V, 208-230V	0-20	Three-20' Control Floats	Pull Out Disconnect

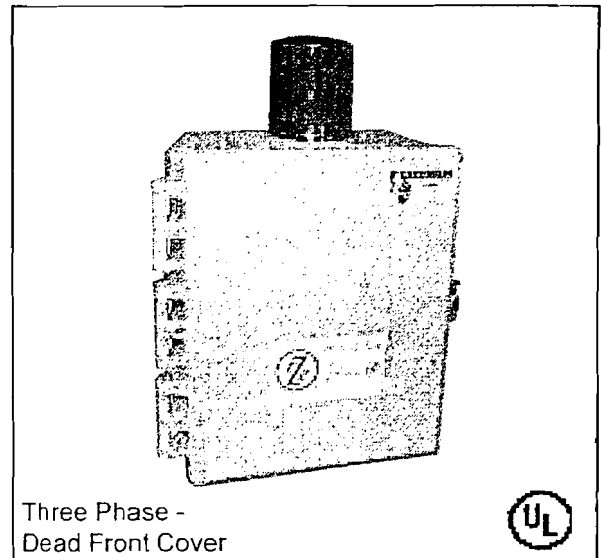
NOTE: 600 and 700 Series single phase pumps require special panels that include start components. See Selection Guide FM1228 for correct panel selection

(1) Alarm Float Switch not included, purchase separately. See FM0526.

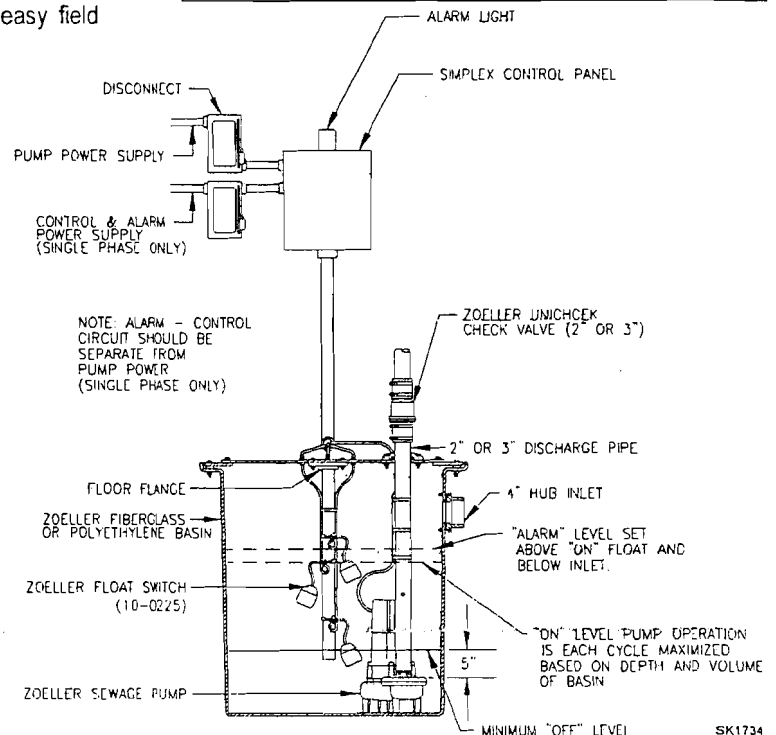
* 10-0125 Branch Circuit Protection provided by the installing electrician

THREE PHASE SIMPLEX CONTROL PANEL FEATURES

- 208-230-460-575 Volts.
- Nema 4X - watertight enclosure with lockable latch.
- Hand-off-toggle switch.
- Green pump run light.
- Alarm test & silence switches.
- Red alarm beacon and audible alarm for a high water condition (83 to 85 decibel rating).
- Motor protection switch with overload protection.
- Magnetic starter.
- Numbered terminal strip for connecting pumps and variable level float switches.
- Dry auxiliary contacts for remote alarm devices.
- Three or four float operation (floats not included - See FM0526).
- UL Listed.
- The use of off-the-shelf components provide for relatively easy field maintenance and repair.
- 2 Year Warranty.



THREE PHASE SIMPLEX PUMP CONTROL PANELS			
MODEL #	DIMENSIONS	VOLTS	AMP RANGE
10-1074	12 X 10 X 6	208/230/460	1.1 - 1.6
10-1075	12 X 10 X 6	208/230/460	1.4 - 2.0
10-1076	12 X 10 X 6	208/230/460	1.8 - 2.5
10-1077	12 X 10 X 6	208/230/460	2.2 - 3.2
10-1078	12 X 10 X 6	208/230/460	2.8 - 4.0
10-1079	12 X 10 X 6	208/230/460	3.5 - 5.0
10-1080	12 X 10 X 6	208/230/460	4.5 - 6.3
10-1081	12 X 10 X 6	208/230/460	5.5 - 8.0
10-1082	12 X 10 X 6	208/230/460	7.0 - 10.0
10-1083	12 X 10 X 6	208/230/460	9.0 - 12.5
10-1084	12 X 10 X 6	208/230/460	11.0 - 16.0
10-1085	12 X 10 X 6	208/230/460	14.0 - 20.0
10-1133	12 X 10 X 6	575	2.2 - 3.2
10-1134	12 X 10 X 6	575	2.8 - 4.0



SEQUENCE OF OPERATION FOR SIMPLEX PANEL

- Operation can begin after the following:
 - Correct voltage is supplied to Panel
 - A good ground is supplied to Panel
 - Pump is connected correctly to Panel or Starter Pak
 - Panel Circuit Breaker is closed
 - Floats are installed properly
 - Overload Protection is adjusted to Pump nameplate amps
 - Pump HOA Switch is set to "Auto"
 - Control On/Off Switch is set to "On"
- When the "Stop" and "Start" floats are closed the Pump will energize and the External Pump Run Light will illuminate. The Pump will remain operational until the "Stop" float opens.
- In the event the liquid level continues to rise the "Alarm" float will be closed. When the "Alarm" float is closed the following will occur:
 - The External High Water Light will illuminate
 - The Audible High Water Horn will sound
 - The Auxiliary Dry Contacts will close

- The Audible High Water Horn can be silenced by pressing the Alarm Silence Button. When the "Alarm" float is opened the External High Water Light, Audible High Water Horn and Dry Auxiliary Contacts will be reset.
- If the Pump is equipped with a Thermal Cutout Circuit the Pump will deactivate in the event the motor temperature becomes excessive.
- If the Pump is equipped with a Seal Failure Relay the Seal Failure Indicator will illuminate in the event the Pump lower seal fails.

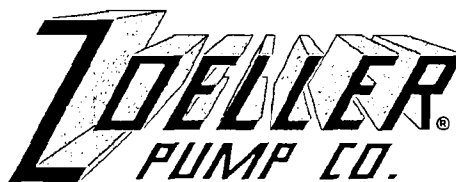
NOTE: The Seal Failure Relay does not deactivate the Pump.

*A Three Phase Panel has a multi-tap transformer with secondary fusing.

Refer to FM1228 for correct selection of Simplex Panels.

"QUALITY PUMPS SINCE 1939"

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.



SECTION: 4.10.006

FM1228

0101

Supersedes

1000

MAIL TO: P.O. BOX 16347 • Louisville, KY 40256-0347
SHIP TO: 3649 Cane Run Road • Louisville, KY 40211-1961
(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

visit our web site:
<http://www.zoeller.com>

SIMPLEX CONTROL PANEL RECOMMENDED APPLICATIONS

SINGLE PHASE					SIMPLEX CONTROL PANELS		
MODEL #	VOLTS	PHASE	AMPS	HP	Plug-In Panel*	Pull-Out Disconnect	Circuit Breaker Disconnect
N53	115	1	8.0	0.3	10-1019	10-0125	10-1037
E53	230	1	4.0	0.3	10-1023	10-0125	10-1036
N55	115	1	8.0	0.3	10-1019	10-0125	10-1037
E55	230	1	4.0	0.3	10-1023	10-0125	10-1036
N57	115	1	8.0	0.3	10-1019	10-0125	10-1037
E57	230	1	4.0	0.3	10-1023	10-0125	10-1036
N59	115	1	8.0	0.3	10-1019	10-0125	10-1037
E59	230	1	4.0	0.3	10-1023	10-0125	10-1036
N98	115	1	9.4	0.5	10-1019	10-0125	10-1037
E98	230	1	4.7	0.5	10-1023	10-0125	10-1036
N137	115	1	10.7	0.5	10-1019	10-0125	10-1037
E137	230	1	5.8	0.5	10-1023	10-0125	10-1036
I137	208	1	6.2	0.5	—	10-0125	10-1036
N139	115	1	10.7	0.5	10-1019	10-0125	10-1037
E139	230	1	5.8	0.5	10-1023	10-0125	10-1036
I139	208	1	5.5	0.5	—	10-0125	10-1036
N140	115	1	15.0	1.0	10-1019	10-0125	10-1038
E140	230	1	7.5	1.0	10-1023	10-0125	10-1037
N161	115	1	15.5	0.5	—	10-0125	10-1038
E161	230	1	7.5	0.5	10-1023	10-0125	10-1037
I161	208	1	8.8	0.5	—	10-0125	10-1037
N163	115	1	15.0	0.5	10-1019	10-0125	10-1038
E163	230	1	7.5	0.5	10-1023	10-0125	10-1037
I163	208	1	8.5	0.5	—	10-0125	10-1037
E165	230	1	10.2	1.0	10-1023	10-0125	10-1037
I165	208	1	12.6	1.0	—	10-0125	10-1037
E185	230	1	9.8	1.0	10-1023	10-0125	10-1037
I185	208	1	11.5	1.0	—	10-0125	10-1037
E186	230	1	13.7	1.0	10-1023	10-0125	10-1037
E188	230	1	13.3	1.5	10-1023	10-0125	10-1037
I188	208	1	16.8	1.5	—	10-0125	10-1038
E189	230	1	17.1	2.0	—	10-0125	10-1038
I189	208	1	20.5	2.0	—	—	10-1201
N264	115	1	9.4	0.4	10-1019	10-0125	10-1037
E264	230	1	4.7	0.4	10-1023	10-0125	10-1036
N266	115	1	10.4	0.5	10-1019	10-0125	10-1037
E266	230	1	5.5	0.5	10-1023	10-0125	10-1036
I266	208	1	6.2	0.5	—	10-0125	10-1036
N267	115	1	10.4	0.5	10-1019	10-0125	10-1037
E267	230	1	5.5	0.5	10-1023	10-0125	10-1036
I267	208	1	6.2	0.5	—	10-0125	10-1036
N268	115	1	10.4	0.5	10-1019	10-0125	10-1037
E268	230	1	5.5	0.5	10-1023	10-0125	10-1036
I268	208	1	6.2	0.5	—	10-0125	10-1036
N270	115	1	15.0	1.0	10-1019	10-0125	10-1038
E270	230	1	7.5	1.0	10-1023	10-0125	10-1037
N282	115	1	10.3	0.5	10-1019	10-0125	10-1037
E282	230	1	5.0	0.5	10-1023	10-0125	10-1036
I282	208	1	6.1	0.5	—	10-0125	10-1036
E284	230	1	8.9	1.0	10-1023	10-0125	10-1037
I284	208	1	9.3	1.0	—	10-0125	10-1037
N292	115	1	15.0	0.5	10-1019	10-0125	10-1038
E293	230	1	10.2	1.0	10-1023	10-0125	10-1037
I293	208	1	12.0	1.0	—	10-0125	10-1037
E294	230	1	13.7	1.5	10-1023	10-0125	10-1037
I294	208	1	17.8	1.5	—	10-0125	10-1038
E295	230	1	17.1	2.0	—	10-0125	10-1038
I295	208	1	20.5	2.0	—	—	10-1201
E404	230	1	12.9	2.0	10-1023	10-0125	10-1037
I404	208	1	14.4	2.0	—	10-0125	10-1037
E405	230	1	19.0	3.0	—	10-0125	10-1038
I405	208	1	20.2	3.0	—	—	10-1201

* Order with piggyback float switch or (B) model pump

SINGLE PHASE					SIMPLEX CONTROL PANEL ⁽⁵⁾
MODEL #	VOLTS	PHASE	AMPS	HP	
E611	230	1	6.3	1.0	10-0920
E621	230	1	8.7	1.5	10-0921
E631	230	1	12.0	2.0	10-0922
E641	230	1	17.0	3.0	10-0923
E651	230	1	28.0	5.0	10-0924

THREE PHASE					CONTROL PANEL
MODEL #	VOLTS	PHASE	AMPS	HP	
F137	230	3	2.6	0.5	10-1077
G137	460	3	1.4	0.5	10-1074
J137	200	3	2.6	0.5	10-1077
F139	230	3	2.6	0.5	10-1077
G139	460	3	1.2	0.5	10-1074
J139	200	3	2.6	0.5	10-1077
F161	230	3	5.2	0.5	10-1080
J161	200	3	6.4	0.5	10-1081
G161	460	3	2.9	0.5	10-1077
F163	230	3	4.8	0.5	10-1079
J163	200	3	6.0	0.5	10-1080
G163	460	3	2.9	0.5	10-1077
F165	230	3	7.4	1.0	10-1082
J165	200	3	7.5	1.0	10-1082
G165	460	3	3.7	1.0	10-1079
BA165	575	3	3.0	1.0	10-1134
F185	230	3	7.4	1.0	10-1082
J185	200	3	7.5	1.0	10-1082
G185	460	3	3.7	1.0	10-1078
BA185	575	3	3.3	1.0	10-1134
F186	230	3	9.2	1.0	10-1082
J186	200	3	10.3	1.0	10-1083
G186	460	3	4.6	1.0	10-1079
F188	230	3	8.9	1.5	10-1082
J188	200	3	10.3	1.5	10-1083
G188	460	3	4.6	1.5	10-1080
BA188	575	3	3.5	1.5	10-1134
F189	230	3	11.2	2.0	10-1083
J189	200	3	13.2	2.0	10-1084
G189	460	3	6.0	2.0	10-1081
BA189	575	3	5.8	2.0	10-1136
F266	230	3	2.6	0.5	10-1077
G266	460	3	1.5	0.5	10-1075
J266	200	3	2.6	0.5	10-1077
F267	230	3	2.6	0.5	10-1077
G267	460	3	1.5	0.5	10-1075
J267	200	3	2.6	0.5	10-1077
F268	230	3	2.6	0.5	10-1077
G268	460	3	1.5	0.5	10-1075
J268	200	3	2.6	0.5	10-1077
F282	230	3	3.0	0.5	10-1078
J282	200	3	3.6	0.5	10-1078
G282	460	3	1.7	0.5	10-1075
F284	230	3	5.0	1.0	10-1080
J284	200	3	5.5	1.0	10-1080
G284	460	3	2.6	1.0	10-1077

THREE PHASE					CONTROL PANEL
MODEL #	VOLTS	PHASE	AMPS	HP	
F293	230	3	7.6	1.0	10-1082
J293	200	3	8.2	1.0	10-1082
G293	460	3	4.0	1.0	10-1079
BA293	575	3	3.3	1.0	10-1134
F294	230	3	9.5	1.5	10-1082
J294	200	3	10.8	1.5	10-1083
G294	460	3	4.8	1.5	10-1080
BA294	575	3	3.8	1.5	10-1135
F295	230	3	12.2	2.0	10-1084
J295	200	3	14.3	2.0	10-1084
G295	460	3	6.1	2.0	10-1081
BA295	575	3	4.9	2.0	10-1136
F404	230	3	13.1	2.0	10-1084
J404	200	3	13.8	2.0	10-1084
G404	460	3	5.2	2.0	10-1080
BA404	575	3	4.1	2.0	10-1135
F405	230	3	12.2	3.0	10-1083
J405	200	3	14.8	3.0	10-1084
G405	460	3	6.1	3.0	10-1081
BA405	575	3	4.8	3.0	10-1136
F611	230	3	3.7	1.0	10-1078
G611	460	3	1.9	1.0	10-1076
J611	200	3	4.3	1.0	10-1079
BA611	575	3	1.6	1.0	10-1131
F621	230	3	5.1	1.5	10-1080
G621	460	3	2.6	1.5	10-1077
J621	200	3	5.9	1.5	10-1080
BA621	575	3	2.0	1.5	10-1132
F631	230	3	6.8	2.0	10-1081
G631	460	3	3.4	2.0	10-1078
J631	200	3	7.8	2.0	10-1082
BA631	575	3	2.7	2.0	10-1133
F641	230	3	9.6	3.0	10-1083
G641	460	3	4.8	3.0	10-1080
J641	200	3	11.0	3.0	10-1083
BA641	575	3	3.9	3.0	10-1135
F651	230	3	15.2	5.0	10-1084
G651	460	3	7.6	5.0	10-1082
J651	200	3	17.5	5.0	10-1085
BA651	575	3	6.1	5.0	10-1136
F661	230	3	22.0	7.5	10-1087
G661	460	3	11.0	7.5	10-1083
J661	200	3	25.3	7.5	10-1174
BA661	575	3	9.0	7.5	10-1138

NOTE: For Pump Prefix Identification see News & Views 0052

⁽¹⁾ Single Piggyback Variable Level Float Switch included with Control and Alarm Panel/15 Amp Max.

⁽²⁾ Double Piggyback Variable Level Float Switch included with Control and Alarm Panel/15 Amp Max.

⁽³⁾ Magnetic Contactor Control with 3 Variable Level Float Switches included with Control and Alarm 20 Amp Max.

⁽⁴⁾ Can Be Used With SPB, DPB or Pumps require special panels that include Start Components. See Selection Guide FM1228 for correct panel selection.

⁽⁵⁾ 600 Series single phase pumps require special panels that include start components

⁽⁶⁾ Control panels referenced for Model 112 are not intrinsically safe

11318-01-C

~~113318-01-C~~

CENTRIFUGAL PUMPS RE-SUBMITTAL

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

QUOTATION

CUSTOMER: CAMERON GREAT LAKES
ADDRESS: 166 SANDY BROOKE DRIVE
LANGHORNE, PA 19047

YOUR INQUIRY NO.:
OUR PROPOSAL NO.: T-1597B
DATE: 7/16/2001

ATTENTION: JOE BATTAGLIA 215-752-2246

USER:
FACILITY: LINDENHURST, NJ

ITEM NO.: 1
SERVICE:

**PUMP P1, P2
DATA SHEET**

QTY. 2	SERIES: TEXEL MTA LINED ANSI			MATERIALS OF CONSTRUCTION					
	MODEL NO. MTA-A10-P-Y20-2-FE CLOSE-COUPLED PUMP			CASING PFA-LINED	IMPELLER PFA	SHAFT SiC	GASKETS PTFE		
DESIGN CONDITIONS				REAR CASING	BUSHING BEARINGS	THRUST RINGS	SHAFT SLEEVES		
LIQUID 10% HCl		CAPACITY 250 GPM	TDH 160'	PFA	C-PTFE	SiC	N/A		
TEMP. °F 85°F	SPECIFIC GRAVITY 1.0	VISCOSITY 1 cP	SPECIFIC HEAT BTU LB.°F THERMAL CONDUCTIVITY BTU IN. H.°F	BEARING HOUSING LUBRICATION N/A	MAGNETS RARE EARTH				
DESIGN PRESSURES				PERFORMANCE					
SUCTION 0 PSIG	DISCHARGE 72 PSIG	VAPOR -	NPSHA ADVISE	H.P. DESIGN 14.8	H.P. MAX 17.5	NPSHR 21'	CURVE NO. T230	RPM 3550	IMP. DIA. 6.5"
LIMITATIONS				NOZZLE SIZE & LOCATION					
MAX W.P. 150 PSIG	MAX TEMP. °F 250°F	MIN. CAP. 11 GPM	ROTATION CW	SUCTION 3" 150# RF		DISCHARGE 2" 150# RF		DRAIN OPTIONAL	
DRIVER SPECIFICATIONS									
H.P. 15	RPM 3550	ENCLOSURE TEFC	FRAME 254TC	PH/Hz/VOLT 3/60/208/230/460		SERVICE FACTOR 1.15	DUTY CONT	FURNISHED BY MAGNATEX US MOTORS OR EQUAL	
COMMENTS									
Cameron Great Lakes SO # 77977 Blue Water Env'tal PO # 02370-109 Law Project # 22000-0-0019 Ph. 300 Active Industrial Site - NYSDEC *SUBJECT TO PRIOR SALE.				ITEM				WEIGHT	
				CLOSE-COUPLED PUMP AND MOTOR ASSEMBLY.				615#	
				TOTAL 2 UNITS.				1230#	
				BASE, IF REQUIRED.					

LOCAL REPRESENTATIVE:

KRIEBEL ENGINEERED EQUIPMENT LTD.
140 IVY LANE
KING OF PRUSSIA, PA 19406
PH 610-337-8995 FAX -8996

APPROX. DELIVERY: **1-2 WEEKS, ARO***

MAGNATEX PUMPS, INC. is committed to the TOTAL QUALITY MANAGEMENT process and therefore, serious about meeting our delivery commitments. Please confirm the delivery schedule at time of order.

FOB: **HOUSTON, TX; FREIGHT ALLOWED**

TERMS: **NET 30 DAYS**

VERY TRULY YOURS,

Taxes & Tariffs Extra

[Signature]

P. O. Box 770845
Houston, Texas 77215
Phone 713-972-8885
Fax 713-972-8885

**MAGNATEX
Pumps Inc.**

All quotations are subject to the terms and conditions on the reverse side hereof

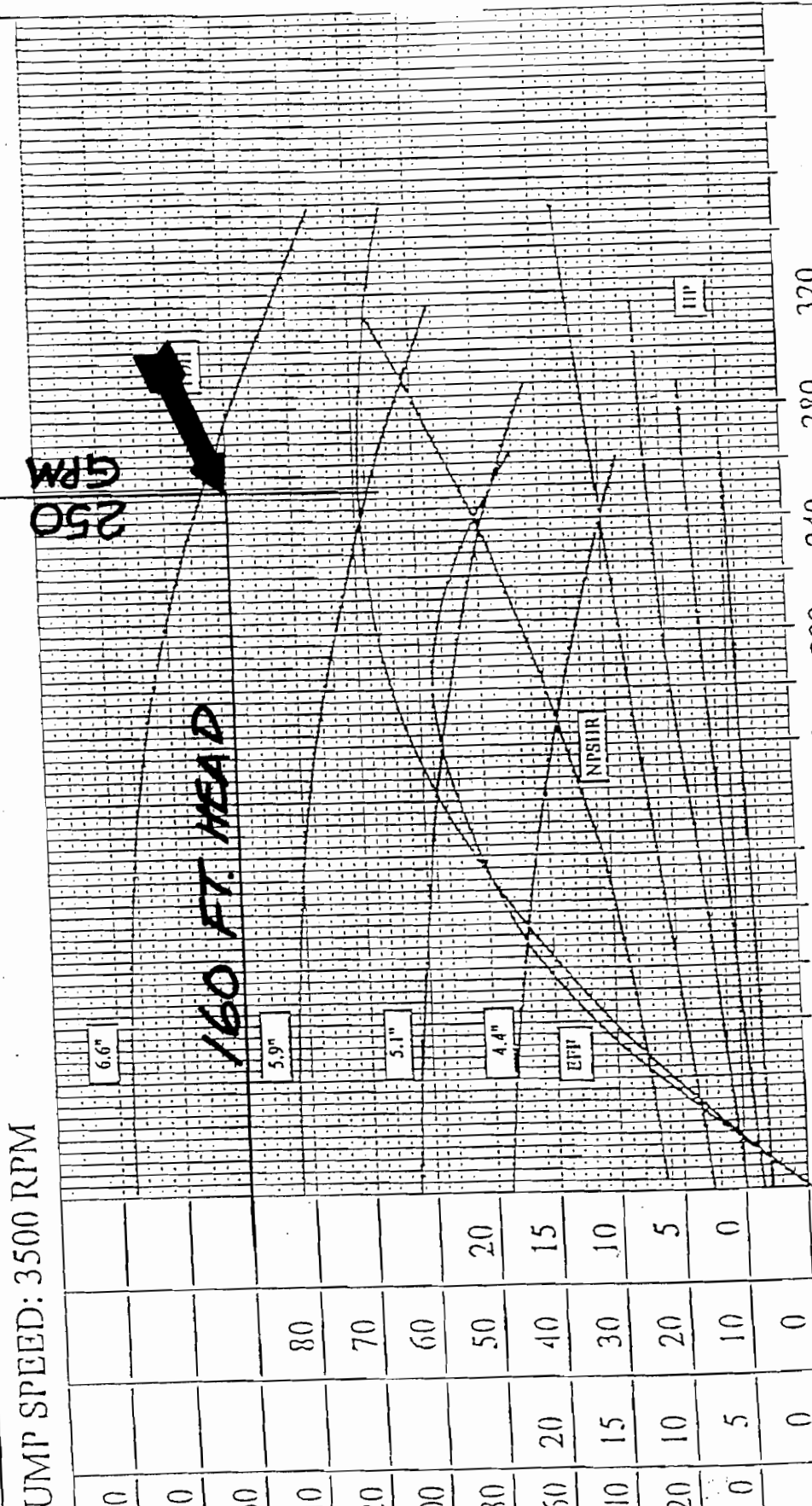
Visit our WEBSITE: www.magnatexpumps.com or CONTACT US VIA E-MAIL: sales@magnatexpumps.com

P-1; P-2

MAGNETEX[®] PERFORMANCE CURVE

MODEL: MTA-A10 3 x 2 x 6 Pumps Inc.

UMP SPEED: 3500 RPM



HEAD (FT)	POWER (HP)	EFFICIENCY (%)	NPSH (FT)	FLUID: WATER	S.G. = 1.0 VISC. = 1.0 CP	PUMP SIZE: MTA-A10	MAGNET SIZE: T-230	DATE PRINTED: 2-28-2000
0	0	0	0					
20	5	10	0					
40	10	20	5					
60	15	30	10					
80	20	40	15					
100	25	50	20					
120	30	60	25					
140	35	70	30					
160	40	80	35					

Cameron Great Lakes SO # 77977
Blue Water Env'tal PO # 02370-109
Law Project # 22000-0-0019 Ph. 300
Active Industrial Site - NYSDEC

PAGE NO. VI-22
01 Feb 2000

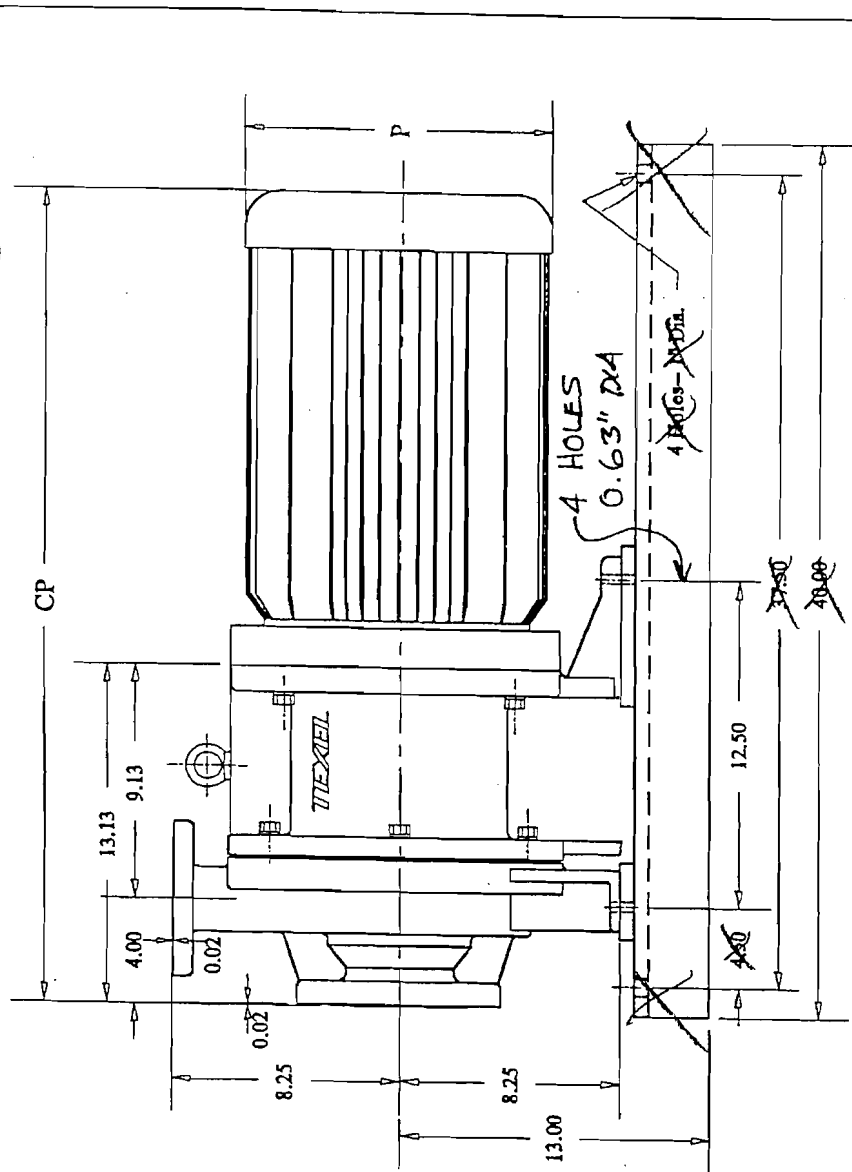
P. 2 of 7

COPYRIGHT 1998 MAGNETEX PUMPS, INC.

Cameron Great Lakes SO # 77977
 Que Water Env'tal PO # 02370-109
 Law Project # 22000-0-0019 Ph. 300
 Active Industrial Site - NYSDEC

P-1; P-1

PUMP, MOTOR AND BASEPLATE



**NOTE: Pump & motor only.
 BASEPLATE NOT INCLUDED.**

NEMA MOTOR FRAME: 254TC / 256TC / 284TSC

FRAME	CP	P	WEIGHT (PUMP, MOTOR AND BASEPLATE)	REVISIONS			MAGNETIX® Pumps Inc.
				NO	DATE	REV.	
254TC	33.9	12.2	573 LBS	1			OUTLINE DIMENSIONS TEXEL MTA SERIES CLOSE-COUPLED PUMPS DRAWN BY: R. TAMBOONG DATE: 2-29-2000 REV.: MTA-A10 BP-2090
256TC	35.6	12.2	613 LBS	3			
284TSC	37.6	14.42	673 LBS	4			
				5			

ALL DIMENSIONS IN INCHES. NOT FOR CONSTRUCTION PURPOSES UNLESS APPROVED.

QUOTATION

CUSTOMER: CAMERON GREAT LAKES
ADDRESS: 166 SANDY BROOKE DRIVE
 LANGHORNE, PA 19047

YOUR INQUIRY NO.:
OUR PROPOSAL NO.: T-1597B
DATE: 7/16/2001

ATTENTION: JOE BATTAGLIA 215-752-2246

USER:
FACILITY:

ITEM NO.: 2
SERVICE:

PUMP P-3 DATA SHEET

QTY. 1	SERIES: TEXEL MTA LINED ANSI			MATERIALS OF CONSTRUCTION					
	MODEL NO. MTA-A10-P-F5-2-FE CLOSE-COUPLED PUMP			CASING PFA-LINED	IMPELLER PFA	SHAFT SIC	GASKETS PTFE		
DESIGN CONDITIONS				REAR CASING	BUSHING BEARINGS	THRUST RINGS	SHAFT SLEEVES		
LIQUID 10% HCL		CAPACITY 125 GPM	TDM 58'	PFA	C-PTFE	SIC	N/A		
TEMP. °F 85°F	SPECIFIC GRAVITY 1.05	VISCOSITY 1 CP	SPECIFIC HEAT BTU/°F N/A	BEARING HOUSING LUBRICATION N/A	MAGNETS RARE EARTH				
DESIGN PRESSURES			NPSHA	H.P. DESIGN	H.P. MAX	NPSHR	CURVE NO.	RPM	IMP. DIA.
SUCTION 0 PSIG	DISCHARGE 26 PSIG	VAPOR -	ADVISE	4.2	5.2	11'	T230	3550	4.3"
LIMITATIONS				NOZZLE SIZE & LOCATION					
MAX W.P. 150 PSIG	MAX TEMP. °F 250°F	MIN. CAP. 11 GPM	ROTATION CW	SUCTION 3" 150# RF		DISCHARGE 2" 150# RF		DRAIN OPTIONAL	
DRIVER SPECIFICATIONS									
H.P. 5	RPM 3550	ENCLOSURE TEFC	FRAME 184TC	PH/KHZ/VOLT 3/60/208/230/460		SERVICE FACTOR 1.15	DUTY CONT	FURNISHED BY MAGNATEX US MOTORS OR EQUAL	
COMMENTS				ITEM					
Cameron Great Lakes SO # 77977 Blue Water Env'tal PO # 02370-109 Law Project # 22000-0-0019 Ph. 300 Active Industrial Site - NYSDEC				CLOSE-COUPLED PUMP AND MOTOR ASSEMBLY.					
				BASE, IF REQUIRED.					
				WEIGHT 310#					

LOCAL REPRESENTATIVE:

KRIEBEL ENGINEERED EQUIPMENT LTD.
 140 IVY LANE
 KING OF PRUSSIA, PA 19406
 PH 610-337-8995 FAX -8996

APPROX. DELIVERY: 1-2 WEEKS, ARO*

MAGNATEX PUMPS, INC. is committed to the TOTAL QUALITY MANAGEMENT process and therefore, serious about meeting our delivery commitments. Please confirm the delivery schedule at time of order.

FOB: HOUSTON, TX; FREIGHT ALLOWED

TERMS: NET 30 DAYS

VERY TRULY YOURS

Taxes & Tariffs Extra

[Signature]

P.O. Box 770845 Phone 713-872-8866
 Houston, Texas 77215 Fax 713-872-8866

**MAGNATEX
Pumps Inc.**

All quotations are subject to the terms and conditions on the reverse side hereof.

Visit our WEBSITE: www.magnatexpumps.com or CONTACT US VIA E-MAIL: sales@magnatexpumps.com

Cameron Great Lakes SO # 77977
 Blue Water Env'tal PO # 02370-109
 Law Project # 22000-0-0019 Ph. 300
 Active Industrial Site - NYSDEC

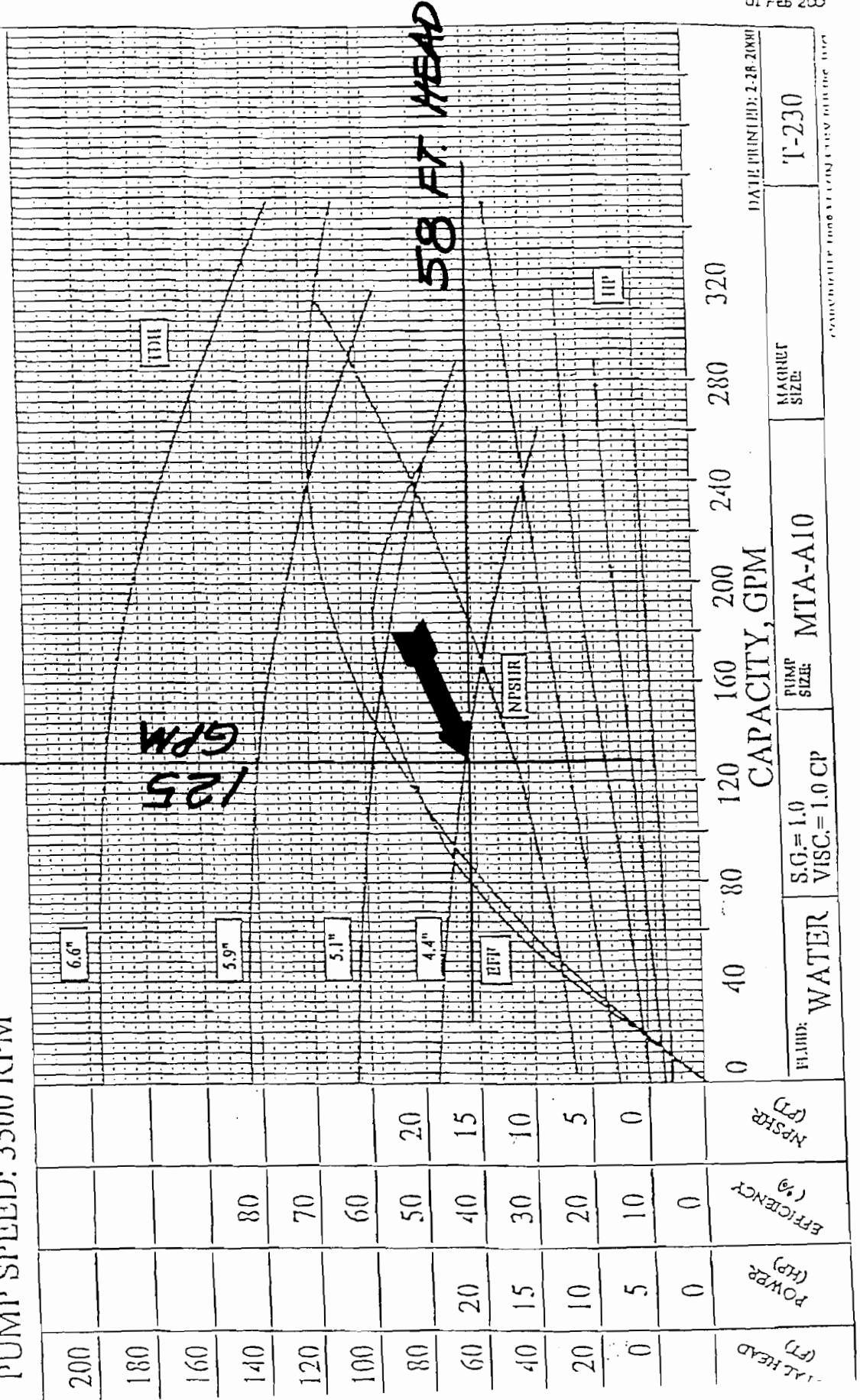
PAGE NO. VT-2
 01 Feb 200

MAGNATEX[®] Pumps Inc.

TEXTEL[®] PERFORMANCE CURVE

MODEL: MTA-A10 3 x 2 x 6

PUMP SPEED: 3500 RPM



DATE PRINTED: 2-28-2000

T-230

MAGNET SIZE

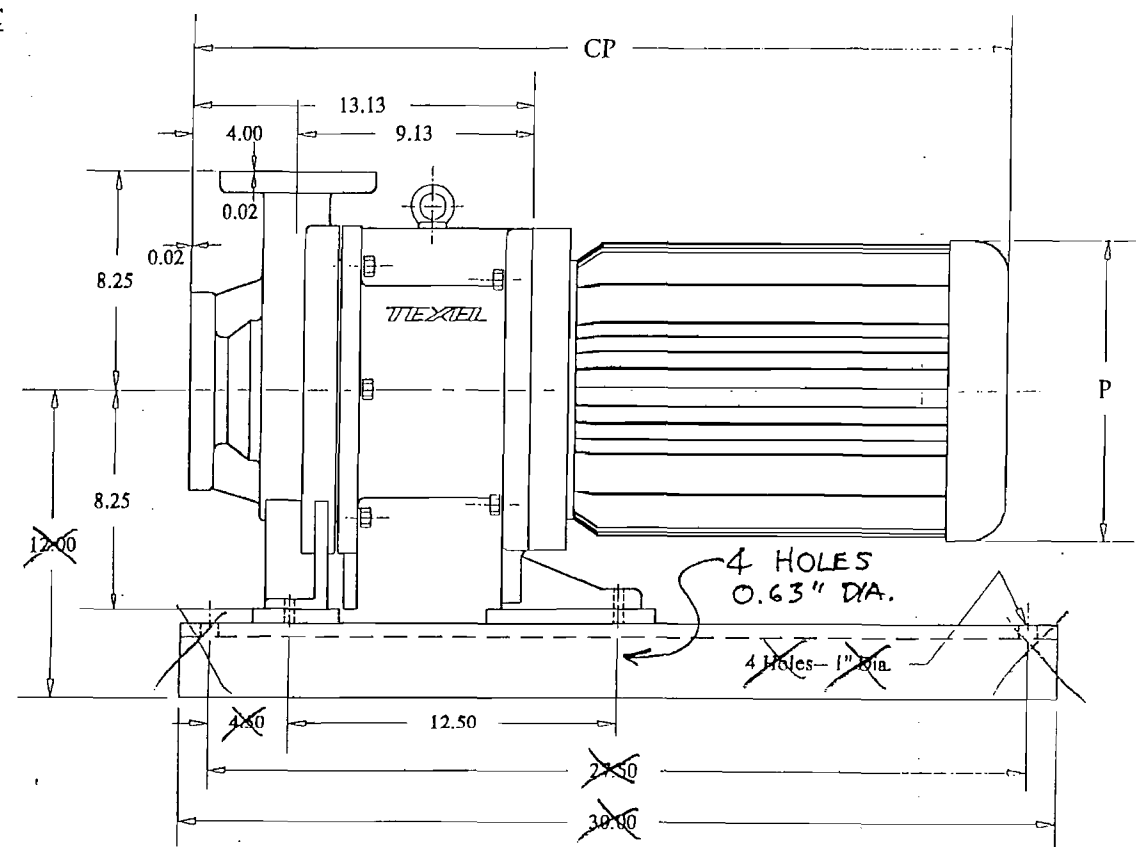
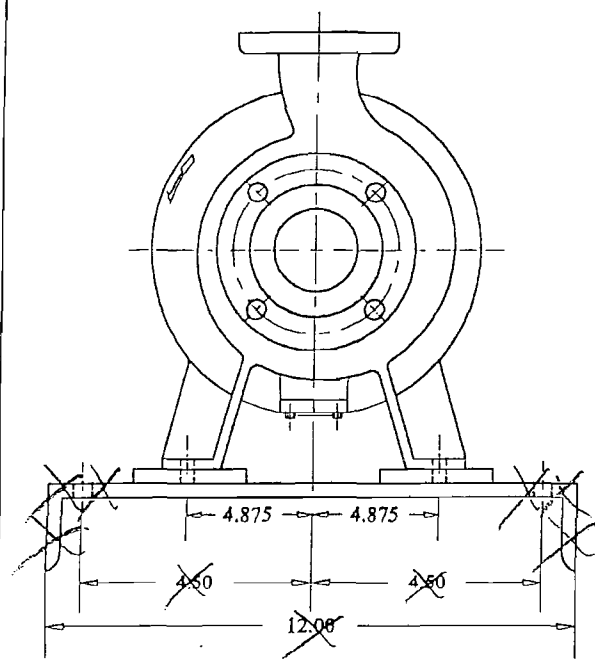
PUMP SIZE MTA-A10

S.G. = 1.0
 VISC. = 1.0 CP

FLUID: WATER

P-1

PUMP, MOTOR AND BASEPLATE



NEMA MOTOR FRAME: 143TC / 145TC / 182TC / 184TC

**NOTE: Pump & motor only
 BASEPLATE NOT INCLUDED.**

ALL DIMENSIONS IN INCHES. NOT FOR CONSTRUCTION PURPOSES UNLESS APPROVED.

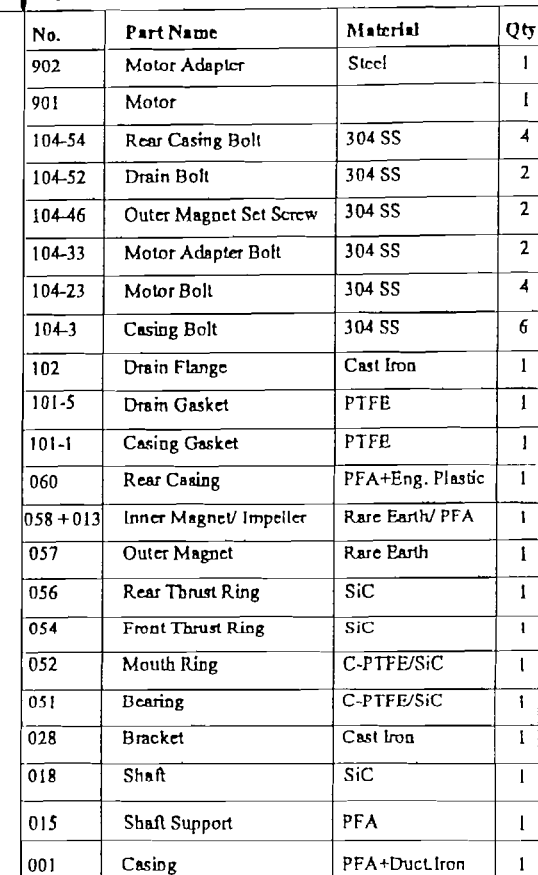
FRAME	CP	P	WEIGHT (PUMP, MOTOR AND BASEPLATE)
143TC	24.0	6.9	290 LBS
145TC	25.0	6.9	290 LBS
182TC	26.3	8.7	310 LBS
184TC	27.3	8.7	310 LBS



REVISIONS		MAGNATEX® Pumps Inc. OUTLINE DIMENSIONS TEXEL MTA SERIES CLOSE-COUPLED PUMPS		
NO.	DATE			
1		DRAWN BY: R. TAMBOONG DATE: 2-29-2000 REV.: MTA-A10 BP-2070		
2				
3				
4				

P. 6 of 7

P-1, P-2, P-3



REVISIONS

NO.	DATE
1	
2	
3	
4	
5	

SECTIONAL DRAWING

TEXEL MTA SERIES CLOSE-COUPLED PUMPS

DRAWN BY:
R. TAMBOONG

DATE:	3-09-2000
-------	-----------

REV.:	0
-------	---

MTA-A10

SD-5290

PAGE NO. VI-6
01 Feb 2000

P. 7 of 7

Notice to installing contractor: Instructions must remain with installation.

"QUALITY PUMPS SINCE 1939"

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.



MAIL TO: P.O. BOX 16347 • Louisville, KY 40256-0347
SHIP TO: 3649 Cane Run Road • Louisville, KY 40211-1961
(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

visit our web site:
<http://www.zoeller.com>

SECTION: 6.10

FM

Supers

NOTICE: VENT HOLE
FOR CHECK VALVE
SEE #10 BELOW
AND #6 PAGE 2

INSTALLATION INSTRUCTIONS

RECOMMENDED MODELS

DATE INSTALLED:

MODEL NUMBER:

SEWAGE	EFFLUENT*	DEWATERING
264 Series 266, 267, 268, 270, 4270 Series 282, 284, 4282, 4284 Series 292, 293, 294, 295, 4292, 4293, 4294, 4295 Series	50 Series 70 Series 98 Series 137, 139, 140, 4140, Series 150 Series 161, 163, 165, 4161, 4163, 4165 Series 185, 186, 188, 189, 191, 4185, 4186, 4189 Series	All Models

*Effluent systems should specify that pumps should not handle solids exceeding three fourths inch (3/4") in order to prevent large solids from entering leaching fields, mound systems etc. (70 Series have 3/8", 50/90 Series have 1/2", 130 Series have 5/8", 150 Series have 3/4" solids capability, 160/4160/180/4180 Series have 1/2" solids capability.) Where codes per sewage pumps can be used for effluent systems. Nonautomatic pump(s) with external level control recommended for septic tank effluent applications.

PREINSTALLATION CHECKLIST - ALL INSTALLATIONS

1. Inspect your pump. Occasionally, products are damaged during shipment. If the unit is damaged, contact your dealer before using. DO NOT remove the test plugs in the cover nor the motor housing.

2. Carefully read the literature provided to familiarize yourself with specific details regarding installation and use. These materials should be retained for future reference.

3. **WARNING** Make sure there is a properly grounded receptacle available. All pumps are furnished with provisions for proper grounding to protect you against the possibility of electrical shock. (SEE WARNING BELOW)

4. **WARNING** Make certain that the receptacle is within the reach of the pump's power supply cord. DO NOT USE AN EXTENSION CORD. Extension cords that are too long or too light do not deliver sufficient voltage to the pump motor. But, more important, they could present a safety hazard if the insulation were to become damaged or the connection end were to fall into the sump.

5. **CAUTION** Check to be sure your power source is capable of handling the voltage requirements of the motor, as indicated on the pump name plate.

6. **WARNING** Make sure the pump electrical supply circuit is equipped with fuses or circuit breakers of proper capacity. A separate branch circuit is recommended, sized according to the "National Electrical Code" for the current shown on the pump nameplate.

7. **WARNING** Testing for ground. As a safety measure, each electrical outlet should be checked for ground using an Underwriters Laboratory Listed circuit analyzer which will indicate if the power, neutral and ground wires are correctly connected to your outlet. If they are not, call a qualified licensed electrician.

8. **WARNING** For Added Safety. Pumping and other equipment with a 3-prong grounded plug must be connected to a 3-prong grounded receptacle. For added safety the receptacle may be protected with a ground-fault circuit interrupter. When a pump needs to be connected in a watertight junction box, the plug can be removed and spliced to the supply cable with proper grounding. For added safety this circuit may be protected by a ground-fault circuit interrupter. The complete installation must comply with the National Electrical Code and all applicable local codes and ordinances.

9. **CAUTION** The installation of automatic pumps with variable level float switches or nonautomatic pumps using auxiliary variable level float switches is the responsibility of the installing party and care should be taken that the tethered float switch will not hang up on the pump apparatus or pit peculiarities and is secured so that the pump will shut off. It is recommended to use rigid piping and fittings and the pit be 18" or larger in diameter.

10. **CAUTION** Information - vent hole purpose. It is necessary that all submersible sump, effluent, and sewage pumps capable of handling various sizes of solid waste be of the bottom intake

checked periodically for clogging. The 50 or 90 Series pumps have a vent located in the pump housing opposite the float, adjacent to a housing lug, but an additional vent hole is recommended. The vent on a High Head application may cause too much turbulence. You may not want to drill one. If you do not drill a vent hole, be sure the pump case and impeller is covered with liquid before connecting pipe to the check valve and no inlet comes air to the pump intake. **NOTE: THE HOLE MUST BE BELOW THE BASIN COVER AND CLEANED PERIODICALLY.**

WARNING FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM POWER SOURCE BEFORE HANDLING. Single phase pumps are supplied with a 3-prong grounded plug to help protect you against the possibility of electrical shock. DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE GROUND PIN. The 3-prong plug must be inserted into a mating 3-prong grounded receptacle. If the installation does not have such a receptacle, it must be changed to the proper type, and grounded in accordance with the National Electrical Code and all applicable local codes and ordinances. Three phase pumps require motor starting devices with motor overload protection. See FM0514 for similar installations or FM0486 for duplex installations. Pumps must be installed in accordance with the National Electrical Code and all applicable local codes and ordinances. Pumps are not to be installed in locations classified as hazardous in accordance with National Electrical Code, ANSI/NFPA 70.

WARNING "Risk of electrical shock" Do not remove power supply cord and relief or connect conduit directly to the pump.

WARNING Installation and servicing of electrical circuits and hardware should be performed by a qualified licensed electrician.

WARNING Pump installation and servicing should be performed by a qualified person.

CAUTION Pump should be checked frequently for debris and/or build up which may interfere with the float "on" or "off" position. Repair and service should be performed by Zoeller Pump Company Authorized Service Station only

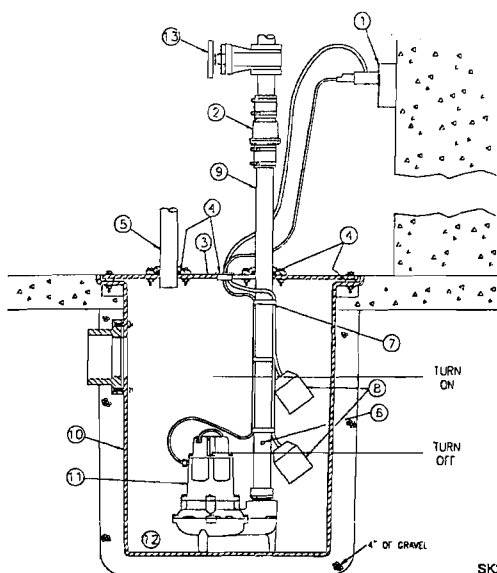
CAUTION Dewatering and effluent sump pumps are not designed for use in pits handling sewage.

CAUTION Maximum operating temperature for standard model pumps must not exceed 130°F (54°C). Except for 70 Series. The 70 Series max temperature must not exceed 110°F (43°C)

CAUTION Pump models 186/4188, 189/4189, and 295/4295 nonautomatic pump must not be submerged and CSA certified pumps must be operated submerged with "off - on" level controls.

CAUTION Pump models 266, 267, 268, 137 and 139 must be operated in an upright position and not attempt to start pump when tilted or laying on its side.

TYPICAL SEWAGE INSTALLATION-RECOMMENDED INSTALLATION

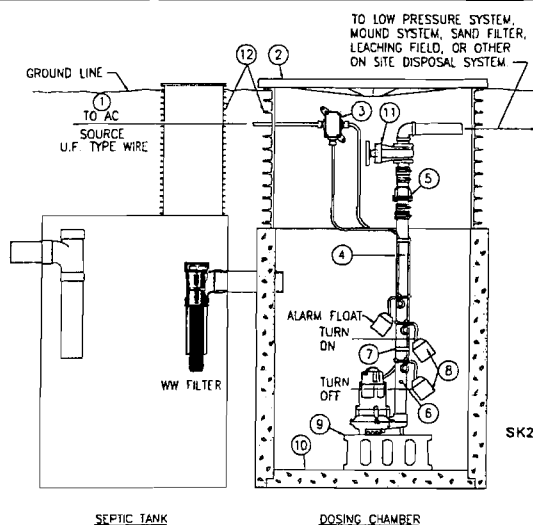


SK280

- (1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.
- (2) Install proper Zoeller unichek (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head or below cover installation is required use 30-0152 on 1 1/2" and 2" pipe and 30-0160 on 3" pipe. See (6) below.
- (3) All installations require a basin cover to prevent debris from falling into the basin and to prevent accidental injury.
- (4) Gas tight seals are required in all sewage installations to contain gases and odors.
- (5) Vent gases and odors to the atmosphere through vent pipe.
- (6) When a Unichek is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. NOTE: THE HOLE MUST ALSO BE BELOW THE BASIN COVER AND CLEANED PERIODICALLY (High Head unit see #10 on front page).
- (7) Securely tape or clamp power cord to discharge pipe.
- (8) Locate float switches as shown in sketch to left. The best place for the "off" point is above the motor housing and positioned 180° from the inlet. Never put "off" point below discharge on pump. NOTE: FOR AUTOMATIC PUMPS, USE DEWATERING INSTALLATION SKETCH BELOW.
- (9) Use full-size discharge pipe.
- (10) Basin must be in accordance with applicable codes and specifications.
- (11) Pump must be level and float mechanism clear of sides of basin before starting pump.
- (12) Basin must be clean and free of debris after installation.
- (13) Gate Valve or Ball Valve to be supplied by installer and installed according to any and all codes.

NOTE: Always refer to Zoeller FM0551 and/or SSPMA Recommended Sewage Pump Installation and Maintenance.

TYPICAL EFFLUENT INSTALLATION-RECOMMENDED INSTALLATION

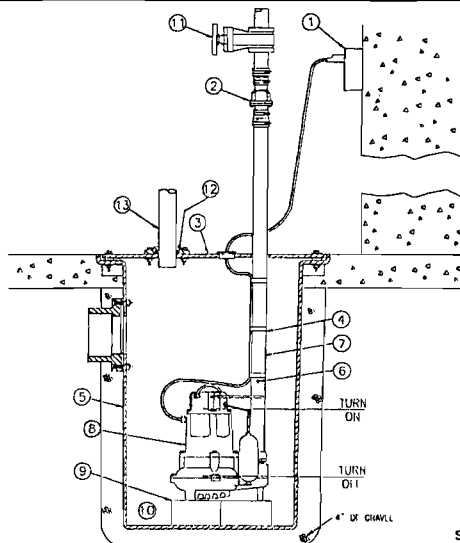


SK291

- (1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.
- (2) All installations require a basin cover to prevent debris from falling into the basin, and to minimize accidental injury.
- (3) Wire pump to power through a Zoeller watertight junction box or watertight splice. NOTE: Watertight enclosure is a must in damp areas. See FM0732. See No. 8 on front page.
- (4) Use full-size discharge pipe.
- (5) Install proper Zoeller unichek (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head or below cover installation is required use 30-0152 on 1-1/2" and 2" pipe and 30-0160 on 3" pipe. See (6) below.
- (6) When a Unichek is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. The 50 and 90 Series pumps have a built in vent hole. NOTE: THE HOLE MUST ALSO BE BELOW THE BASIN COVER AND CLEANED PERIODICALLY (High Head unit see #10 on front page).
- (7) Securely tape or clamp power cord to discharge pipe.
- (8) Refer to SSPMA Effluent Sizing Manual for determining "on" - "off" switches.
- (9) Install blocks or bricks under pump to provide a settling basin.
- (10) Basin must be clean and free of debris after installation.
- (11) Gate Valve or Ball Valve to be supplied by installer and installed according to any and all codes.
- (12) Septic tank risers must be used for easy pump and filter access.

NOTE: See FM0531, FM0732 & FM1420 for Alarms, Controls & Junction Boxes.

TYPICAL DEWATERING INSTALLATION-RECOMMENDED INSTALLATION



SK292

- (1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.
- (2) Install proper Zoeller unichek (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head or below cover installation is required use 30-0152 on 1-1/2" and 2" pipe and 30-0160 on 3" pipe. See (6) below.
- (3) All installations require a basin cover to prevent debris from falling into the basin, and to prevent accidental injury.
- (4) Securely tape or clamp power cord to discharge pipe clear of the float mechanism.
- (5) Minimum 18" dia. x 24" deep basin. Larger depths may be required.
- (6) When a Unichek is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. The 50 and 90 series pumps have a built in vent hole. NOTE: THE HOLE MUST ALSO BE BELOW THE BASIN COVER AND CLEANED PERIODICALLY (High Head unit see #10 on front page).
- (7) Use a full-size discharge pipe.
- (8) Pump must be level and float mechanism clear of sides of basin before starting pump.
- (9) Install blocks or bricks under pump to provide a settling basin.
- (10) Basin must be clean and free of debris after installation.
- (11) Gate Valve or Ball Valve to be supplied by installer and installed according to any and all codes.
- (12) Gas tight seals are required in all sewage installations to contain gases and odors.
- (13) Vent gases and odors to the atmosphere through vent pipe.

NOTE: See FM0531, FM0732 & FM1420 for Alarms, Controls & Junction Boxes.

DOUBLE SEAL PUMPS (4000 SERIES ONLY)

- (1) Double seal pumps offer extra protection from damage caused by seal failure.
- (2) Pumps should be serviced on a periodic preventative maintenance schedule.
- (3) Oil in the motor housing and lower seal cavity must be changed when pump is serviced. If oil from the motor housing contains water or other contaminant both seals should be replaced during maintenance. Always replace with new factory recommended oil and service parts. All repairs must be made by Zor Authorized Service Stations.

Single Phase Wiring Instructions



⚠ WARNING FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM ITS POWER SOURCE BEFORE HANDLING. Single phase pumps are supplied with a 3-prong grounded plug to help protect you against the possibility of electrical shock. **DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE GROUND PIN.** The 3-prong plug must be inserted into a mating 3-prong grounded receptacle. If the installation does not have such receptacle, it must be changed to the proper type, wired and grounded in accordance with the National Electrical Code and all applicable local codes and ordinances.



⚠ WARNING "Risk of electrical shock" Do not remove power supply cord and strain relief or connect conduit directly to the pump.
⚠ WARNING Installation and checking of electrical circuits and hardware should be performed by a qualified licensed electrician.

Three Phase Wiring Instructions



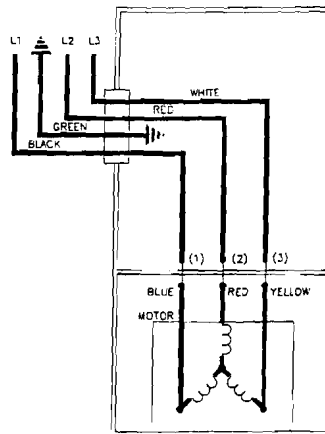
⚠ WARNING FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM ITS POWER SOURCE BEFORE HANDLING.

To automatically operate a nonautomatic three phase pump, a control panel is required. Follow the instructions provided with the panel to wire the system. For automatic three phase pumps see automatic 3 phase wiring diagram located to the far right.

Before installing a pump, check the pump rotation to insure that wiring has been connected properly to power source, and that the green lead of power cord (See wiring diagram), is connected to a valid ground. Momentarily energize the pump, observing the directions of kick back due to starting torque. Rotation is correct if kick back is in the opposite direction of rotation arrow on the pump casing. If rotation is not correct, switching of any two power leads other than ground, should provide the proper rotation.

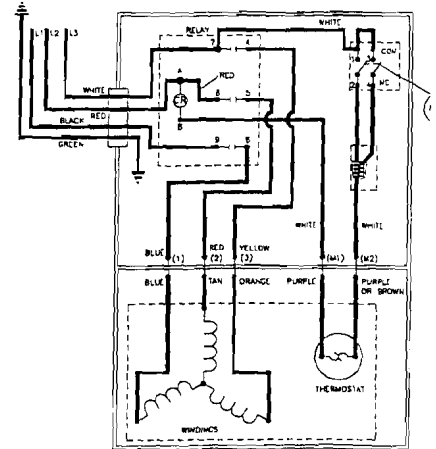
All three phase pumps require motor starting devices with motor overload protection. See FM0514 for simplex installations or FM0486 for duplex installations. Pumps **must** be installed in accordance with the National Electrical Code and all applicable local codes and ordinances. Pumps are not to be installed in locations classified as hazardous in accordance with National Electrical Code, ANSI/NFPA 70.

NONAUTOMATIC 3 PHASE



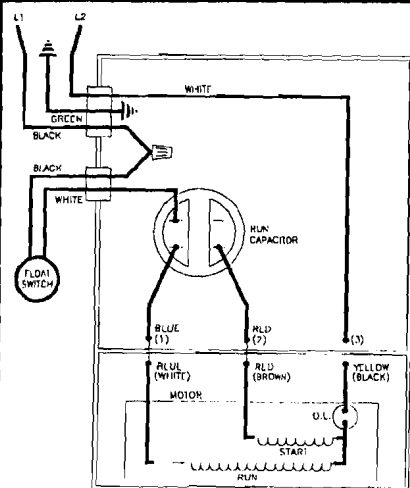
006848

AUTOMATIC 3 PHASE



011

WD & WH Model Installation



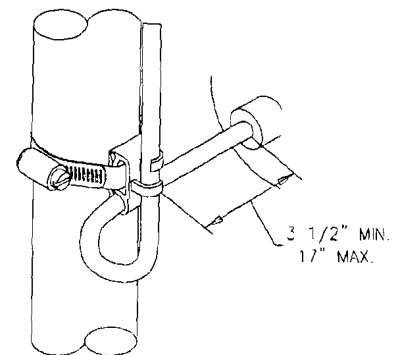
011835

WIRING DIAGRAM FOR MODELS
WD - 230V, 1 PH, 60 HZ

Determining Pumping Range in Inches (1 inch - 2.5 cm)

tether length	5	10	14	18	22
	min.				max.
pumping range	9	13	17	21	24

Use only as a guide. Due to weight of cable, pumping range above horizontal is not equal to pumping range below horizontal. Ranges are based on testing in non-turbulent conditions. Range may vary due to water temperature and cord shape. As tether length increases, so does the variance of the pumping range.



15" MIN. TETHER AND 22" MAXIMUM TETHER FOR P/N 10-0748

SK3

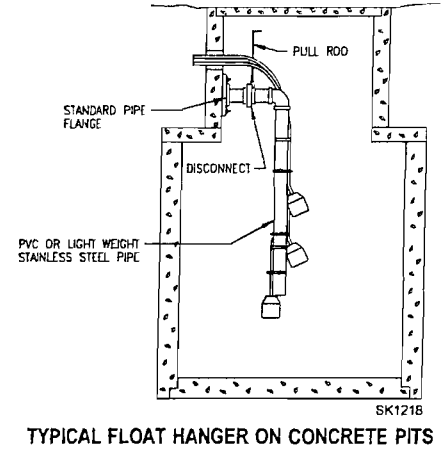
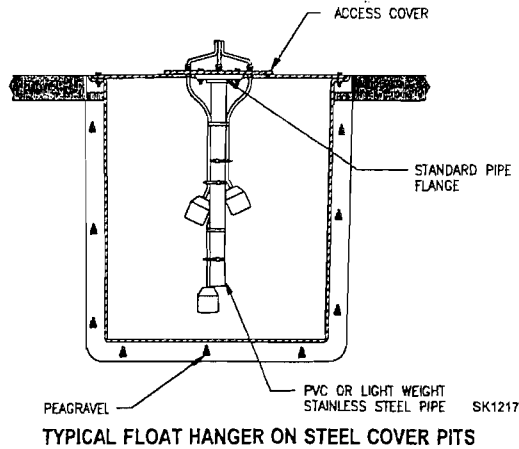
Models WD & WH are fully automatic. A float switch is included and factory wired in the pump circuit to provide automatic operation once the float switch is secured properly to the outlet pipe. Use the diagram above to secure the float switch properly and obtain the

Note: Failure to keep within proper tether limit may prevent reliable switch operation.

Note: Cable must be mounted in horizontal position.

SUGGESTED METHODS OF FLOAT INSTALLATION

On some installations it may be desirable to install an independent hanger for the level control switches to avoid possible hang ups on the pumps, piping, valves, etc. Float hangers can be fabricated from standard pipe and fittings which also facilitate easy removal for maintenance.



"EXTRA PROTECTION SYSTEMS"

TWO PUMP SYSTEM

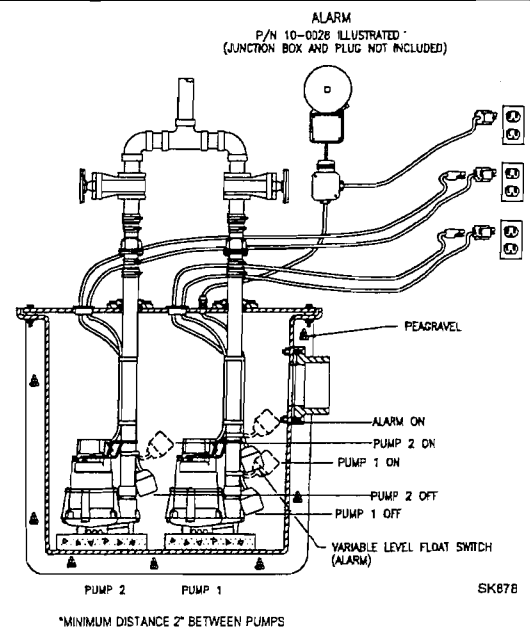
The "Extra Protection" Two Pump system is an economical solution to the costly duplex alternating pump system and it's easy to install.

The "Extra Protection" Two Pump Systems consists of:

- The two nonautomatic pumps with VLFS of your choice
- One Alarm System
- Two Unicheck Valves as required

ADVANTAGES

- (1) The Two pump systems offers high pump performance without the high price. It is a system that fits your needs and your budget.
- (2) Delivers more dependability than a single pump system and greatly reduces the chance of costly and time consuming problems associated with wear out or damages and the resulting system failures.
- (3) Affords greater satisfaction and peace of mind to all concerned by providing state of the art protection for costly and expensive surroundings.
- (4) Ability to change lead and lag positions by changing pump plug connection.
- (5) Easy and economical to install.



THE BASEMENT SENTRY

12 Volt backup sump pump system model 507 & model 510

Application - For Clear Water, emergency backup usage when power is off or primary pump fails.

Extra Protection - When the primary AC pump fails due to power outages or system problems.

- Storms
- Brownouts
- Wiring or electrical problems

Extra Protection - When the primary pump fails to keep up with excessive water due to rain or overloading.

Includes:

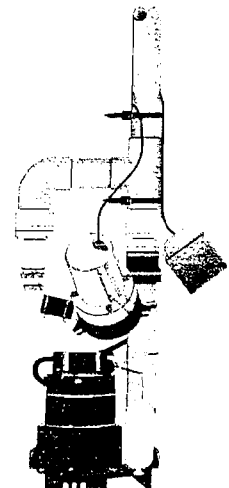
- Pump and control
 - Charger
 - Fittings
 - Battery Case
- (Battery Not Included)

MODEL 507	
Ft. Head	Capacity GPM
5	23.2
10	12.5
14	Lock Valve

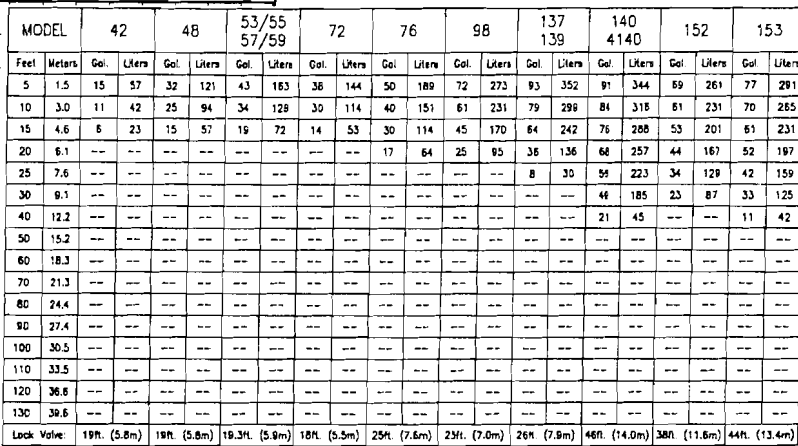
MODEL 510	
Ft. Head	Capacity GPM
5	33.8
10	21.6
15	10.6
19.9	Lock Valve

For submersible or pedestal installations.

See FM1311 (507) or FM1139 (510) for information. Suitably sized basin required.

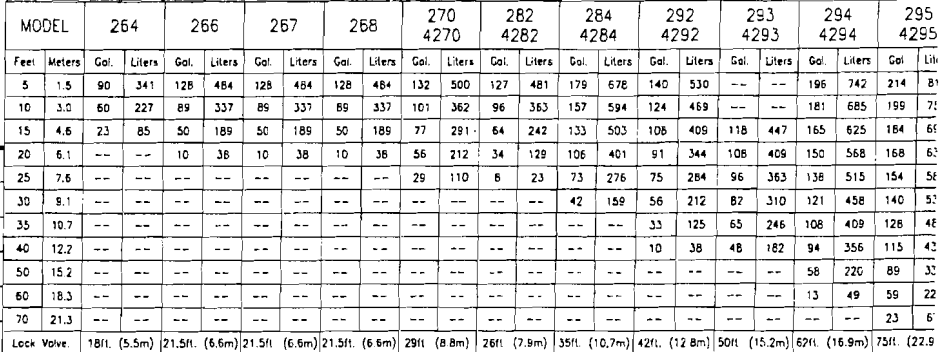


HEAD CAPACITY
CURVE
SUMP / EFFLUENT
MODELS
3/8", 1/2" & 3/4"
SOLIDS PASSING
CAPACITY



161 4161	163 4163	165 4165	185 4185	186 4186	188 4188	189 4189	191
Gal. Liters	Gal. Liters	Gal. Liters	Gal. Liters	Gal. Liters	Gal. Liters	Gal. Liters	Gal. Liters
100 379 61 231 61 231 --- --- 58 220 145 549 145 549 45							
83 352 61 231 61 231 --- --- 58 220 140 530 140 530 45							
85 322 60 227 61 231 --- --- 58 220 134 507 135 511 45							
79 299 59 223 60 227 --- --- 58 220 128 484 131 496 45							
70 265 57 216 59 223 --- --- 58 220 122 462 125 473 45							
62 235 55 206 58 220 85 322 58 220 116 438 120 454 45							
45 170 46 172 55 206 70 285 58 220 104 384 109 413 45							
20 76 33 125 50 189 51 193 58 220 90 341 97 367 45							
--- --- 15 57 39 148 32 121 58 220 71 289 85 322 45							
--- --- --- 23 87 9 34 52 34 51 193 69 261 45							
--- --- --- 10 36 --- --- 45 170 26 106 51 193 45							
--- --- --- --- --- 31 117 2 8 34 129 45							
--- --- --- --- --- 16 80 --- --- 17 64 40							
--- --- --- --- --- 4 15 --- --- --- 30							
--- --- --- --- --- --- --- --- --- 20							
--- --- --- --- --- --- --- --- --- 10							
56L (17.1m) 66L (20.1m) 89L (26.4m) 73L (22.3m) 114L (34.7m) 91L (27.7m) 110L (33.5m) 137L (41.1m)							

NOTE: For Head Capacity on Model 112, Industrial column explosion proof pump, see FM0219.



HEAD CAPACITY CURVE

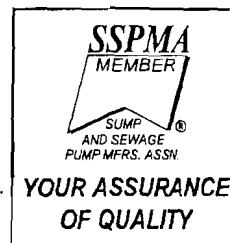
SEWAGE MODELS

2" SOLIDS PASSING CAPACITY

⚠ CAUTION Model 293/4293 should not be subjected to less than 15 feet TDH.

EASY DO'S & DON'T'S FOR INSTALLING A SUMP PUMP

- DO read thoroughly all installation material provided with the pump.
- DO inspect pump for any visible damage caused by shipping. Contact dealer if pump appears to be damaged.
- DO clean all debris from the sump. Be sure that the pump will have a hard, flat surface beneath it. DO NOT install on sand, gravel or dirt.
- DO be sure that the sump is large enough to allow proper clearance for the level control switch(es) to operate properly.
- DO Always Disconnect Pump From Power Source Before Handling.
DO always connect to a separately protected and properly grounded circuit.
DO NOT ever cut, splice, or damage power cord (Only splice in a watertight junction box).
DO NOT carry or lift pump by its power cord.
DO NOT use an extension cord with a sump pump.
- DO install a check valve and a union in the discharge line.
DO NOT use a discharge pipe smaller than the pump discharge.
- DO NOT use a sump pump as a trench or excavation pump, or for pumping sewage, gasoline, or other hazardous liquids.
- DO test pump immediately after installation to be sure that the system is working properly.
- DO cover sump with an adequate sump cover.
- DO review all applicable local and national codes and verify that the installation conforms to each of them.
- DO consult manufacturer for clarifications or questions.
- DO consider a Two Pump System with an alarm (Page 5) where an installation may become overloaded or primary pump failure would result in property damages.
- DO consider a D.C. Backup System (See the Basement Sentry page 5) where a sump or dewatering pump is necessary for the prevention of property damages from flooding due to A.C. Power disruptions, mechanical or electrical problems or system overloading.



Service Checklist



⚠ WARNING ELECTRICAL PRECAUTIONS- Before servicing a pump, always shut off the main power breaker and then unplug the pump - making sure you are not standing in water and wearing insulated protective sole shoes. Under flooded conditions, contact your local electric company or a qualified licensed electrician for disconnecting electrical service prior to pump removal.

⚠ WARNING Submersible pumps contain oils which becomes pressurized and hot under operating conditions - allow 2½ hours after disconnecting before attempting service.

CONDITION	COMMON CAUSES
A. Pump will not start or run.	Check fuse, low voltage, overload open, open or incorrect wiring, open switch, impeller or seal bound mechanically, defective capacitor or relay when used, motor or wiring shorted. Float assembly held down. Switch defective, damaged, or out of adjustment.
B. Motor overheats and trips overload or blows fuse.	Incorrect voltage, negative head (discharge open lower than normal) impeller or seal bound mechanically, defective capacitor or relay, motor shorted.
C. Pump starts and stops too often.	Float tight on rod, check valve stuck or none installed in long distance line, overload open, level switch(s) defective, sump pit too small.
D. Pump will not shut off.	Debris under float assembly, float or float rod bound by pit sides or other, switch defective, damaged or out of adjustment.
E. Pump operates but delivers little or no water.	Check strainer housing, discharge pipe, or if check valve is used vent hole must be clear. Discharge head exceeds pump capacity. Low or incorrect voltage. Incorrect motor rotation. Capacitor defective. Incoming water containing air or causing air to enter pumping chamber.
F. Drop in head and/or capacity after a period of use.	Increased pipe friction, clogged line or check valve. Abrasive material and adverse chemicals could possibly deteriorate impeller and pump housing. Check line. Remove base and inspect.

If the above checklist does not uncover the problem, consult the factory - Do not attempt to service or otherwise disassemble pump. Service must be by Zoeller Authorized Service Stations.

Limited Warranty

Zoeller Pump Company warrants, to the purchaser and subsequent owner during the warranty period, every new Zoeller Pump Company product to be free from defects in material and workmanship under normal use and service, when properly installed, used and maintained, for 1) Standard Warranty - a period of one year from date of installation or 18 months from date of manufacturer, whichever comes first OR 2) Optional Three (3) Year Warranty - a period of three (3) years from date of installation or 42 months from date of manufacturer whichever comes first. Parts that fail, (within standard or three (3) year optional warranty) that inspections determine to be defective in material or workmanship, will be repaired, replaced or remanufactured at Zoeller Pump Company's* option, provided however, that by so doing we will not be obligated to replace an entire assembly, the entire mechanism or the complete unit. No allowance will be made for shipping charges, damages, labor or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled without prior approval of Zoeller Pump Company, subjected to misuse, misapplication, neglect, alteration, accident or act of God; that has not been installed, operated or maintained in accordance with Zoeller Pump Company installation instructions; that has been exposed to but not limited to the following: sand,

warranty is in lieu of all other warranties expressed or implied; and we do not authorize any representative or other person to assume for us any other liability in connection with our products. Contact Zoeller Pump Company, 3649 Cane Run Road, Louisville, Kentucky 40211-1961, Attention: Customer Service Department to obtain any needed repair or replacement of part(s) or additional information pertaining to our warranty.

ZOELLER PUMP COMPANY EXPRESSLY DISCLAIMS LIABILITY FOR SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES OR BREACH OF EXPRESSED OR IMPLIED WARRANTY; AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND OF MERCHANTABILITY SHALL BE LIMITED TO THE DURATION OF THE EXPRESSED WARRANTY.

Some states do not allow limitations on the duration of an implied warranty, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from

"QUALITY PUMPS SINCE 1939"

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.



ZOELLER

PUMP CO.



SECTION: 6.1

FI

Super

MAIL TO: P.O. BOX 16347 • Louisville, KY 40256-0347
SHIP TO: 3649 Cane Run Road • Louisville, KY 40211-1961
(502) 778-2731 • 1 (800) 928-PUMP • FAX (502) 774-3624

visit our web site:
<http://www.zoeller.com>

AUTHORIZED SERVICE STATIONS

ALABAMA	B & D Elec. Mtr. Co.	2320 4th Ave. South 35233	205-251-6241	Joliet	Pohlert Industrial Elec.	510 Ruby St. 60435	815-726
Birmingham	Brannon Elec. Mtr. Co.	3022 6th Ave. South 35233	205-322-0485	Joliet	R & A Elec. Serv.	571 N. Chicago St. 60432	815-727
Dothan	Robbins Elec. Mtr. Serv.	1305 S. Oates St. 36301	205-792-1555	Montgomery	Industrial Motor Service Corp.	2000 Albright Road 60538	630-892
Huntsville	Keisley Elec. Mtr. Serv.	4644 Commercial Dr. N.W. 35814	205-837-6150	Mundelein	P M B Battery Sales	666 Hawley St. 60060	847-970
Jasper	Martin Electric	508 18th Street 35501	205-221-9852	North Brook	Trans-Tek Sales, Inc.	3680 Commercial Ave. 60062	847-555
Magnolia	Armington Electric	129 So. Clay St. 71753	501-234-8735	Peoria (East)	Foremost Elec. & Trans. Inc.	111 Carverlane 61611	309-696
Mobile	Horner Elec. Mtr. Co.	1200 Hulson Dr. 36609	205-344-6496	Rockford	Imperial Mtr. & Armature	2700 Potter Street 61109	815-389
Montgomery	Jay Elec.	421 Randolph Street 36197	205-263-0277	Rock Island	Rock Island Electric Motor Repair	211 31st Street 61201	309-788
Muscle Shoals	B & E Electric Mtr.	102 Broadway 35661	205-386-7252	South Elgin	Floto Electric	510 Stevenson Rd. 60177	847-695
Opelika	Mid State Electric Motor	1801 Market St. 36803	334-745-6838	Springfield	First Electric Motor Shop Inc.	1130 W. Reynolds 62702	217-698
ALASKA	Alaska Pump & Supply	261 East 56th Ave. 99502	907-563-3424	Streator	D & D Service Co.	1804 E. Main 61364	815-672
Anchorage				W. Frankfort	Sanders Electric Co.	903 E. St. Louis St. 62896	618-932
ARIZONA	Hayden Electric Mtr. Ser. Ctr	6944 West Belmont Ave 85303	623-934-0565	Worth	Accurate Elec. Mtr. & Pump	6955 W. 111th St. 60482	708-448
Glendale	Hemco Motors	3936 E. Pima 85712	502-881-1108	INDIANA			
Tucson				Anderson	Hobbs Electric Inc.	544 Broadway 46012	765-622
ARKANSAS				Edinburgh	EMR Corporation	111 E. Center Cros 46124	812-526
Ft. Smith	Electric Motor Center	1231 South 11th St. 72901	501-785-2536	Greenfield	Eastside Pump Co.	6278 W. 400 No. 46140	317-894
Hot Springs Village	Grinder Pump Repair	44 Magellan Drive 71009	501-984-1321	Hammond	Mills Electric Co.	4828 Calumet Ave. 46327	219-931
Jonesboro	Davis Electric Motor	102 Miller St. 72401	501-935-0056	Highland	IT Pump Repair	2543 Hwy. Ave. 46322	219-838
Little Rock	C & W Tool Equip	1417 Main 72202	501-376-2310	Indianapolis	Eskeew Enterprises Inc.	1447 N. Harding St. 46202	317-264
N Little Rock	Kaeling Co.	4227 East 43rd St. 72117	501-945-4511	Indianapolis	Home Electric Co.	1521 E. Washington St. 46201	317-639
Pine Bluff	Jefferson Electric	2703 Persimmon St. 71603	501-879-5180	Indianapolis	Hydra-Serv	4303 S. High School Rd. 46241	317-487
Rogers	Evan Electric	2001 N. 13th St. 72756	501-636-0721	Indianapolis	Koch's Electric Inc.	1301 East 10th St. 46202	317-639
Russellville	Electric Motor Center	Hwy. 7-T 72801	501-968-2532	Munster	Roberts Plumbing & Repair	8328 Jackson 46321	219-836
Springdale	Tool Hospital	3670 Elem Spring Rd. 72762	501-927-0400	Portage	F & L Electric Mtr. Serv. Inc.	2221 Crisman Road 46368	219-763
Van Buren	Allied Electrical & Power	2320 Industrial Park Rd. 72956	501-474-5271	South Bend	Northern Electric Co.	116 N. Hill St. 46617	219-289
CALIFORNIA				Van Buren	Wright Nash Repairs	106 West Main St. 46991	765-934
Brisbane	Simonds Machinery Co.	304 Industrial Way 94005	415-468-4830	IOWA			
Carson	Dominquez Machine Shop	24418 S. Main Street 90745	310-549-3203	Ames	Reese Elec. Mtr. Co. Inc.	202 East Ave. 50010	515-232
Redondo Beach	Refondo Electric	11808 Brainer Ave. 90250	310-675-5452	Burlington	Industrial Electric Mtrs.	1511 Mt. Pleasant St. 52601	319-752
Hawthorne	Roto Rooter	1205 Chrysler Dr. 90403	310-675-5452	Burlington	Larrys Elec. Mtr. Ser.	802 Washington Box 926 52601	319-752
Menlo Park	Arucke Elec. Mtrs. Inc.	7548 Santa Monica Blvd. 90046	310-675-5452	Cedar Rapids	Hump Electric Mtr. Co.	275 33rd Ave. S.W. 52404	319-366
Los Angeles	Steve's Electric	4514 Fountain Ave. 90029	323-666-6972	Clear Lake	Beafr's Mtr. Rewinding	600 West Beach 50102	712-225
Mission Hills	Macs of California	9006 Woodley Ave. 91395	818-892-5571	Des Moines	Knorr Electric Motor Service	318 South 20th Street 50428	515-357
Oakland	East Bay Pump	4900 E. 12th Street 94601	510-532-1800	Fort Dodge	Electric Pump & Tool Serv.	4280 N. E. 14th Street 50313	515-265
Petaluma	Electrical Equip. Co.	300 East "D" St.	707-762-2863	Ida City	Larsen Elec. Mtr. Serv.	1229 First Ave. So. 50501	515-573
Santa Ana	Barrett Engineered Pumps	1695 National Ave. 92113	619-232-7887	Marshalltown	Electric Mtrs.	R.R. #3 Box 253 52632	319-354
Santa Ana	Orange County Pumps	1310 Harbor Blvd. 92703	714-554-1722	Meiwa	Quality Electric Motor	171st Ave. 51350	515-752
Sun Valley	Electrical Electric	7616 San Fernando Rd. 91352	818-504-0838	New Hampton	Egleston Electric Co.	1208 E. Main St. 50158	712-736
Van Nuys	H & P Electric Mtr. Service	14750 Armita Street 91402	818-786-8226	Ottumwa	At Electric Co.	402 S. Iowa Ave. 52501	515-684
COLORADO				Sioux Falls	Mohawk Electric	925 North Lynn 50659	641-394
Boulder	Boulder Elec. Mtr.	3867 Walnut St. 80302	303-443-1331	Tipton	Hellyer Electric Co.	402 S. Iowa Ave. 52501	515-684
Denver	Bob's Electric Mtr.	1221 South Bannock 80223	303-744-3297	Waterloo	Thorp Sales & Service	1024 Fifth St. 51101	712-258
Ft. Collins	Larimer Electric Mtr.	1808 E. Lincoln Ave. 80524	970-484-8411	KANSAS	Tipton Elec. Motor Inc.	107 W. 2nd St. 52771	319-886
CONNECTICUT				Waterloo	Motor Winding Inc.	1819 Falls Ave. 50701	319-232
Ansonia	B & J Elec. Mtr. Repair	30-38 Maple St. 06401	203-734-1695	KANSAS			
Danbury	Industrial Electric Mtrs.	50 Shelter Rock Rd. 06810	203-743-9611	Hutchinson	Gibson Industrial Controls Inc.	125 West Ave. F 79504	316-663
Ellington	Shaw's Pump Co.	20 Lyons Pump Co. 06029	806-872-6891	Kansas City	Allen Amature & Elec. Co.	10 S. 18th St. 66102	913-371
Hamden	Bar Craft Electric Co.	12 Alstun St. 06514	203-624-9815	Topeka	F & F Elec. Mtr. Rpr.	4004 West 21st St. 66604	913-272
Hartford	Reliable Elec. Mtr. Inc.	285 Murphy Road 06114	860-522-2257	Wichita	B & B Elec. Mtr. Co.	332 Lulu 67211	316-267
Newington	Gulimartin Elec. Inc.	106 Liberty St. 06111	860-667-8024	KENTUCKY			
Stamford	Palmer Electric Mtr. Inc.	44 Garden St. 06902	203-348-7378	Allen	Porter Industries Inc.	Rail Road Street 41601	606-874
Stratford	Electric Enterprise, Inc.	1410 Stratford Ave. 06497	203-377-4960	Benlon	Semco, Inc.	5060 Mayfield Highway 42025	270-527
FLORIDA				Danville	Indus. Elec. Mtrs. of Danville	U.S. 150 By-Pass 40422	606-238
Bradenton	Lee Foss Electric, Inc.	6111 15th St. East, Bldg. C 34203	941-756-1121	Elizabethtown	E-Town Electric	217 Ring Road 42701	502-737
Clearwater	Bud's Electric Motor Serv.	405 S. Missouri Ave. 33756	927-446-3130	Hardinsburg	Wheeler Electric	1016 Hillview 40143	502-756
Ft. Lauderdale	AAA Electric	1131 NE 45th Street 33334	934-772-7501	Lexington	City Elect. of Lexington	631 Kennedy Road 40511	606-254
Jacksonville	Halls Pump	3010 West Beaver St. 32254	904-388-7657	Lexington	Kentucky Serv. Co.	622 S. Mill St. 40508	606-254
Kissimmee	Kissimmee Electric Inc.	2469 N Dixie Hwy. 34744	407-846-6532	Louisville	Hall Pump & Supply	3944 Cane Run Road 40211	502-778
Miami	Cindy San Corp.	9270 S.W. 58 Terr. 33173	305-270-0985	Louisville/Lyndon	Quality Elec. Mtr.	8020 Vincennes Ave. 40222	502-426
Miami	Denuiter Electric Motor Co.	14261 So. Dixie Hwy. 33176	305-235-5000	Loyal	Herren Electric	169 Good Neighbor Road 40854	606-573
Ocala	King Electric Mtr. Serv.	280 N. W. 5th St. 33127	352-734-6802	Middlesboro	Kentucky Amature & Mtr. Work	209 Winchester Ave 40965	606-248
Orlando	Merion Elec. Mtr.	3159 S. W. 5th St. 34474	352-734-6802	Morehead	Morehead Elec.	6307 Flemingburg 40351	606-784
Panama City	Florida Electric Mtr. Serv.	1128 Atlanta Ave. 32806	407-425-8160	Owensboro	Electrical Equip. Repair	1330 East 2nd Street 42303	502-684
Pensacola	AAG Service	2312 Industrial Drive 32405	850-763-9386	Owensboro	Owensboro Amature Wks.	609 East 14th St. 42301	502-683
Port Richey	M & W Elec. Mtr. Serv.	1250 Babranas Ave. 32501	904-433-0400	Paducah	Warden Electric Co.	604 N. 7th St. 42002	502-443
Tampa	ACE Pump Company Inc.	6241 Ridge Rd. 34668	727-842-6343	Park Hills	A-1 Elec. Mtr. Serv. Inc.	1461 Dixie Hwy. 41011	606-291
GEORGIA	United Electric Mtr.	4725 North Nebraska Ave. 33603	813-238-0944	LOUISIANA			
Acworth	Lake City Mtr. Work	4676 S. Main Street 30101	770-974-5111	Baton Rouge	Lastor Electronics	7724 Commerce Ave. Ste. 8 70815	225-927
Atlanta	AAA Electric Mtr.	741 Edgewood Ave. 30307	404-521-0763	Carencro	Gulf Coast Monitoring & Elec., Inc.	617 Hector Connolly Rd. 70520	337-896
Atlanta	Industrial Electric Co. of GA	1397 Blashfield St. SE 30315	404-622-1441	Kenner	Precision PSI, Inc.	2316 Kingston St. 70062	504-469
Augusta	Barnett Supply	635 Brad Street 30902	706-727-5716	Lawtell	Thibodeaux Electric	Hwy 190 West 70550	318-543
Augusta	Electric Equipment	1441 Green Street 30903	706-722-6685	New Orleans	G & M Electric	1725 Confl. Street 70112	504-586
Columbus	Hunter Elec. Mtr. & Elect. Supply	628 South Oakview Ave. 31901	706-322-0648	Scott	Electrical Technologies Inc.	237 E. Savonne Dr. 70583	318-237
Elberton	Adams Electric	1748 Washington Hwy. 30635	706-283-9599	Shreveport	Tench Elec. Mtr. Works	1616 Market St. 71101	318-221
Fitzgerald	Wynn Electric	Colony Drive 31750	912-423-5495	Suphur	Joe's Elec. Power Tools	808 E. Carlton St. 70663	318-527
Macon	Wilson Electric Co.	557 Pine Street 31213	912-746-5654	West Monroe	Ouchita Elec. Serv.	122 Wassan St. 71292	318-323
Marietta	Precision Tool & Repair	1726 B Hazelwood Dr. 30067	770-568-6811	MAINE			
Norcross	Aquaflo Service	4220 Steve Reynolds Blvd. 30093	770-935-8442	Bangor	Errol Cleveland & Son	76 Harvard St. 04401	207-942
Rome	Southern Industrial Electric	36 Shorter Industrial Blvd. 30165	706-235-3003	Lewiston	Motor Power, Inc.	1505 Lisbon St. 04240	207-782
Winston	Jay Electric	7940 Highway #78 30187	404-942-2584	Madison	Elholm Pumps	Rt. 43 04950	207-474
HAWAII				Portland	Electric Motor Works	1129 Forest Ave. 04103	207-780
Honolulu	Starr & Co.	680 Kakoi St. 96819	808-839-3002	MARYLAND			
IDAHOO				Baltimore	Camden Pumps & Systems LLC	1701 Ridgely St. 21320	410-752
Boise	Missman Elec. Co.	7910 Overland 83709	208-322-5822	Cambridge	Hills Electric Mtr. Service	5203 Poplar Dr. 21613	410-228
Caldwell	Presl Electric	412 Simplot Blvd. 83605	208-459-6351	Cumersland	Alleghany Mtr. & Pump Service	150 Wineow St. 21502	301-777
Coeur D'Alene	R C Worst	625 Best Ave. 83814	208-664-2133	Mechanicsville	Wengers Electric Motor Service	41175 Bishop Road 20659	301-373
ILLINOIS				MASSACHUSETTS			
Bloomington	The Struck Co.	1106 E. Bell St. 61701	309-827-4691	Braintree	Sandman Electric	530 West St. 02184	617-848
Champaign	Floyd Elec. Inc.	133 W. Kenyon Rd. 61820	217-352-0571	Cambridge	Cambridge Electric	300 Bent St. 02141	617-896
Chicago	All Elec. Mtr. Repair	6726 S. Ashland Ave 60636	773-925-2040	Cambridge	City Pump & Motor Service	46R New Street 01238	617-491
Danville	Modern Machine Shop	123-125 N. Hazel St. 61832	217-446-0742	Chelsea	New England Electric Mtr. Service	214 Arlington Street 02150	617-884
Elk Grove Vll.	Fluid Pump Serv.	1000 Lee Street 60007	847-228-0750	Dedham	Boston Electric Motor Pump Co.	200 Milton St. 02026	781-461
Freeport	Koyan Elec. Mtr.	417 S. Locust Street 61032	815-233-0611	Dorchester	Dorchester Electric Motor Co. Inc.	79 Freeport 02122	617-265
Freeport	Precision Drive & Control	207 South Galena 61032	815-233-0000	Fairhaven	Delta Elec. Mtr. & Gen. Co.	379 Alden Rd 02719	617-997
	Midland Elec. Mtr. Work	937 Main Street 61461	309-342-4125	Fitchburg	Shepard & Parker Inc.	18 Lincoln St. 01420	508-343
				Framington	Walco Electric Co. of Mass.	10 Aaron St. 01702	508-872
				Hudson	Elect. Mtr. Serv.	74 Agapley St. 01749	508-562

Lenox, Dalt	Berkshire Electric Mfrs.	Crystal St. 01242	413-637-3255	Harrison	Belscher Electric Co.	217 Dair Avenue, 45030	413-367-9641
Lowell	Sun Electric Motor	389 Middlesex St. 01622	508-454-4572	Lima	Water Equipment Co.	1335 Bellefontaine Ave. 45804	419-228-697
Needham Ht	Williamson Electric Co.	43 Freemont St. 02194	781-444-6800	Piqua	Jenkins Pump & Elec.	815 E. Garby Rd. 45356	937-773-80
North Quincy	South Shore Electric Motor	93 Holmes Street 02171	617-847-1600	Rocky River	Hennings Quality Service	20800 Center Ridge Road 44116	216-941-945
Peabody	Peabody Electric Motor	98 Foster St. 01960	508-531-1409	Toledo	Lachmiller Elec. Mtr. & Serv.	5122 Lewis Ave. 43612	419-475-2121
Quincy	Hancock	231 Willard Street 02169	617-472-5789	Toledo	Leasco - Gurkin	2056 Canton Avenue 43620	419-242-4005
Saugnton	Kaiman Electric Motor Inc.	471 Page St. 02072	617-344-1050	Vermilion	Loran Armature & Mtr Repair	960 Sunnyside 44089	216-967-2620
MICHIGAN				Warren	Warren Elec. Co.	Niles Cortland Rd. SE 44484	216-856-6735
Auburn Hills	Smiley Elec.	3684 Auburn Road 48057	313-852-5135	Wooster	Hackworth Electric	4952 Cleveland Road 44691	330-345-6049
Brighton	Brighton Pump Rpr.	1012 West Main 48116	313-229-4429	OREGON			
Detroit	Howard Elec. Co.	4801 Bellevue 48207	313-923-0430	Eugene	Wheeler Elec. Mtr. Serv.	820 W. 1st Ave. 97402	503-687-2121
Detroit	Re-Nu Elec. Co.	20163 John R. 48203	313-923-0430	Portland	Conley Electric	1911 Southeast 7th. Ave. 97214	503-232-9392
Dexter	Turner Electric Motor Serv.	1022 Baker Road 48130	313-366-1570	Portland	DeTemple Co. Inc.	1551 Northwest Overton St. 97209	503-227-2641
Flint	Moore Brothers	2602 Leith St. 48506	313-662-4596	PENNSYLVANIA			
Gaylord	Graham Mtr. & Generator Serv.	975 N. Center, Old 27 49735	810-232-2148	Amore	MDT Plumbing & Heating	618 Kenilworth Rd. 19003	706-235-3003
Grand Rapids	Fix-All Elec.	737 Buttenworth S.W. 49503	517-732-5055	Aston	Crane Pump Repair	12 Crozerville Rd. 19014	610-358-4687
Holland	Holland Electric Motor	11269 E. Lakewood Blvd. 49424	616-392-1115	Bensalem	Economy Plumbing & Heating	520 State Ave. 19020	215-245-6868
Kalamazoo	Heco Inc.	3509 S. Burdick 49001	616-381-7200	Chambersburg	S & S Electric Motors	125 Felling Springs Rd. 17201	717-263-1919
Kalamazoo	Kalamazoo Electric Motor	658 East Vine Street 49001	616-345-7929	Clintonville	Interstate Pipe & Sply	Route 208 West 16372	614-385-6633
Jackson	Kent Motors	204 Homewild St. 42901	517-789-8131	Clintonville	Wolf Machine	2319 Longview Rd. 15148	724-981-8474
Lansing	Al's Elec. Mtr. Works	2108 N. East St. 48905	517-485-1647	Hermitage	Gander Dynamics	3152 Lebanon Rd. 17545	717-665-7747
Midland	R.W. Electric	510 Sixth Street 48640	517-835-1071	Manheim	Ampere Electric Co.	2200 E. Norris Street 19125	215-426-5356
Muskegon	Jones Electric Co.	1965 Sanford Street 49441	616-726-5001	Philadelphia	Snyder Electric Co.	1500-02 Chateau 15233	412-231-3100
Pigeon	Dietzel Electric	1716 Nitz St. 48755	517-453-2721	Pittsburgh	Kufen Elec. Mtrs. Inc.	27 N. York Rd. 18874	215-672-5250
Pontiac	Electric Motor Serv.	384 No. Saginaw 48342	810-334-3881	West Chester	Winding Specialties	1607 Nantux Rd. 19380	215-431-3859
Port Huron	Port Huron Elec. Motor	321 Court St. 48060	313-985-7197	Yeadon	Marc Elec. Co.	Penn St. & Church Lane 19050	215-284-1048
Riverside	Riverside Elec. Serv.	3864 Riverside Rd. 49084	616-849-1222	RHODE ISLAND			
Royal Oak	Coon Devisser Co.	1500 N. Stephenson 48068	248-398-6000	Providence	Walco Elec. Co.	303 Aliens Ave. 02905	401-467-6500
Saginaw	Lange & Leaman Elec. Co.	300 W. Bristol 48602	517-754-5266	SOUTH CAROLINA			
Ulica	Ulita Pump	7775 Auburn Road 48087	313-739-6733	Charleston	Rushton Motor Repair	1944 Belgrade Avenue 29407	843-571-3441
Ypsilanti	Current Electric Motor Supply	2010 N. Fourth St. 48197	612-522-3318	Clinton	Elect. Mtr. Serv. of Clinton	Highway 72 & 56 N. 29325	803-833-3593
MINNESOTA				Columbia	Electric Motor & Repair	125 Hucklebee Rd. 29169	803-791-9000
Janesville	Jemco	208 South Main 56078	507-234-5392	Conway	Todd Electric Mtr. Repair	110 Laurel St. 29525	803-248-5302
Minneapolis	Elec. Mtr. Rpr. Inc.	2010 N. 4th St. 55411	612-522-3318	Conway	Conway Elec. Mtr.	402 Lewis St. 29526	803-248-5302
North Mankato	Reliance Elec. Rpr.	1110 No. River Dr. Box 285 56001	507-345-4250	Greenville	Greenville Industrial Supply	100 Dixie Drive 29605	854-277-9400
MISSISSIPPI				Lake City	Lake City Elec. Mtr.	140 C. Adine St. 29560	803-394-5469
Columbus	Elec. Mtr. Sales & Serv.	232 Alabama Street 39702	601-327-1606	Lexington	A O Utilities Inc.	285 Zenker Rd. 29072	803-359-0245
Gulf Port	Power Source South	360 Tegarden Road 39507	601-896-9364	Myrtle Beach	Industrial Rewinding Inc.	1420 Cannon Rd. 29577	803-626-3536
Hattiesburg	Speed Electric Motor Co.	511 North Street 39403	601-583-0388	Ocala	Riverside Electric	Highway 301 North 29114	803-346-7777
Long Beach	Bay Motor Winding Inc.	125 N. Ocean Wave 39560	601-863-0666	Orangeburg	Leke Elec. Inc.	135 Market S.E. 29115	803-534-1022
Pascagoula	Gibson Elec. Mtr. Ser.	3320 Old Mobile 39567	601-762-4923	Spartanburg	Sellers Elec. Serv.	100 West Trayler St. 29304	803-583-8408
Smithville	Smithville Electric Mtr.	60014 Hwy. 23 38810	601-651-4635	Sumter	Industrial Elec. Rewinding	Mayesville Rd. 29150	803-773-9366
Tupelo	Blaylock Electric	584 Robert E. Lee Drive 38801	601-842-7803	West Columbia	Electric Motor & Repair	125 Hucklebee Rd. 29169	803-751-9000
MISSOURI				Windsboro	Collins Pump & Crt Serv.	Rt. #3 Box 98A Landis Rd. 29180	803-635-3100
St. Louis	Missouri Mach. & Eng. Co.	918 S. 4th St. 63102	314-231-9806	SOUTH DAKOTA			
MONTANA				Aberdeen	J.B. Center	710 S.W. 6th Ave. 57401	605-229-5284
Billings	Electric Mtr. & Pump Repair	2098 B. Hickory 59101	406-252-6081	Millbank	Roger's Electric Motor Service	205 East 22nd Ave. 57252	605-432-6990
NEBRASKA				Rapid City	Industrial Elec. & Sply	1130 W. Omaha 57701	605-342-1017
Grand Island	Motor Engineering Works	612 So. Webb Rd. 68802	308-384-2547	Watertown	Ron's Electric Mtr.	512 10th St., SE 57201	605-866-7893
Lincoln	Coln Elec. Mtr. Serv.	520 West "O" St. 68528	402-476-2121	TENNESSEE			
NEVADA				Chattanooga	Chattanooga Arm. Works	1209E. 23rd St. 37408	615-267-7
Henderson	Henderson Electric Motor	1414 Athol Street 89015	702-564-5575	Cincinnati	Clarksville Electric Motors	114 Kraft Street 37040	615-552-7
Reno	Comstock Elec. Mtr. Serv.	425 Eureka Ave. 89512	702-323-5982	Cleveland	Jerry Electric Motor Service	433 Broad Street 37320	423-472-5959
NEW HAMPSHIRE				Franklin	Colthem Elec. Mtr.	136 Reynolds Drive 37064	615-734-4312
Keene	G&R Elec. Mtr. Co.	453 Winchester Rd. 03431	603-352-3422	Gallatin	Max Electric Mtr.	124 W. Winchester St. 37066	615-412-2970
Laconia	New Hampshire Elec. Mtr.	Rt. 107 08246	603-524-3729	Kingsport	Kingsport Armature & Electric	323 E. Market 37660	615-247-7189
Manchester	Fay Electric Motors	48 Huse Rd. 03103	603-668-3811	Knoxville	Tenn. Armature & Elec.	208 W. Jackson Ave. 37902	615-524-3681
NEW JERSEY				Knoxville	Southern Armature Works	1721 Potter Ave. 37817	615-522-8638
Collingswood	Sern	714 Haddon Avenue 08108	609-854-4535	Memphis	American Electric Mtr.	3651 Cherry Rd. 38118	901-363-4558
East Brunswick	Quality Elec. Mtr. Serv.	396 Highway 18 08816	908-257-6655	Morristown	Morristown Electric Mtr. Serv.	3482 New Brights Park 37814	423-581-1126
Hawthorne	Industrial Elec. Serv. Co.	259-263 Goffle Rd. 07507	973-423-1212	Nashville	Allied Electric Mtr.	924 3rd Avenue S. 37210	615-259-3892
Keyport	Beacon Electric	145 3rd St. 07735	908-888-7888	Nashville	Tech. Industrial	115 A-2 Space Park South 37211	615-333-2181
Mid. Ephraim	A & N Electrical Motor Pump	505 West Kings Street 08059	609-931-7349	TEXAS			
Plainfield	Demo Elec. Co.	337 East 5th St. 07060	908-756-1395	Amarillo	G.E. Jones Elec. Co.	208-14 North Polk 79105	806-372-5505
Trenton	Electric Motor Repair	809 East State Street 08629	609-392-6122	Dallas	Pierce Pump Co.	3300 Dillio Rd. 75220	214-320-3604
Vineyard South	"D" Elec. Mtr. Sales	94 W. Sherman Ave. 08360	609-696-5959	Denton	Fry's Motor Shop	801 Woodrow Lane 75205	817-387-9911
Vineyard	Desiere Electric Motor Serv. Inc.	1338 Almond Road 08360	609-692-8442	Houston	Gulf Supply Co.	7721 Airline Dr. 77037	713-445-8077
NEW MEXICO				Houston	Hyro Dnye Electric	4301 Laura Koppe 77016	713-631-0770
Albuquerque	Teico Electric Inc.	2906 Fourth St. NW 87107	505-345-2426	Marshall	Bell Electric Motor Co.	207 W. Pinecrest Dr. 75670	903-935-5282
NEW YORK				Paris	City Elec. Mtr. Serv.	1480 NW 19th 75460	903-784-7671
Albany	Albany Burner Control	20 Colvin Ave. 12206	518-459-8855	Victoria	Horvath Elec. Serv.	1103 E. Rio Grande 77901	512-575-2921
Albany	Klarr Electric Co.	184 Central Ave. 12205	518-456-8510	UTAH			
Brewster	D & S Mtrs. Inc.	Sodom Rd. 10509	914-279-3785	Ogden	Johnson Elec. Mtr. Co.	2795 Industrial Dr. 84401	801-731-0832
Bronx	Star Elec. Mtr. Serv.	1854 Archer St. 10460	212-828-2820	Salt Lake City	Steve Regan Co.	4215 South 500 West 84123	801-268-4500
Buffalo	S-S Elec. Shop Inc.	2470 Seneca St. 14210	716-823-1232	VERMONT			
Larchmont	B & D Elec. Mtr. Rpr.	2412 Boston Post Rd. 10538	914-834-4841	Montpelier	Frank Allen-Montpelier Co.	141 River St. 05602	802-223-7721
Plainville	Wit-Craft Elec. Serv.	33 North Mall 11803	914-864-8151	S. Burlington	J & P Electric Mtr.	397 Palchen Road 05403	802-658-5564
Postdam	The Water Supply	7598 U.S. Hwy 11 13676	315-265-0003	St. Albans	Green Valley Repair	33 Swanton Rd. 05476	802-524-6213
Queensbury	Northwestern Electric Motors	442 Cornth Rd. 12804	518-793-5938	White River Jct.	T & L Electric	35 N. Main Street 05001	802-295-3114
Sanborn	Niagara Elec. Mtrs.	2894 Lockport Rd. 14132	716-731-5556	VIRGINIA			
Staten Island	Kerber & Son Sply.	451 Jewett Ave. 10302	718-720-5820	Fairfax	American Elect. Serv.	10890 Main St. 22030	703-273-4977
Waterford	G L L P Inc.	35 Washington Avenue 12188	818-238-1852	Red Ash	Cole Electric Inc.	Hwy. 460 24640	540-963-6067
NORTH CAROLINA				Richmond	MSC Equipment	1823 North Hamilton St. 23230	804-355-7491
Ahoshie	Electric Motor Service Co.	Hwy 13 South 27910	252-332-4364	Rocky Gap	Claude S. Morehead	Deer Run Estate 24366	703-928-1944
Albemarle	Hammond Elec. Mtr.	R. 3 Box 100 Concord Rd. 28001	704-983-3178	Staunton	Winchester Elec. Co.	26 South Jefferson St. 24401	540-866-4161
Concord	Pumper Central Rewind. Co. Inc.	865 Hwy. 29 No. 28025	704-786-3131	Winchester		120 Fort Collier Rd. 22603-5775	540-667-2040
Eden	TigerTek Industrial Services	602 Bridge Street 27288	919-623-1719	WASHINGTON			
Eden	Rox Electric	625 Irving Ave. 27288	919-623-2983	Centralia	C & R Electric Motor	820 North Tower 98531	206-736-2521
Greensboro	General Mtr. Repair	2206 Westbrook St. 27407	919-292-1715	Ferndale	Cannon Electric	6148 Portay Way 98248	206-384-3014
High Point	Piedmont Elec. Rpr. Co. Inc.	208 Lindsey 27261	919-889-0222	Lacey	Village Rental Center	4614 Lacey Blvd. S.E. 98503	206-491-9424
Horse Shoe	Pump Cnt & Specialties	19 Warrick Rd 28742	704-891-2244	Seattle	Popperton Electric & Machinery	969 So. Nebraska St. 98108	206-762-9160
Monroe	Randall Electric Motors	2409 Walkup Ave. 28110	704-289-6479	Spokane	Paragon Sales & Services	128 Stone 99202	509-534-4125
New Bern	Banks Electric	120 First Street 28563	919-637-2119	Tacoma	Center Elec. Inc.	1212 South 30th St. 98409	206-383-4416
New Bern	New Bern Electric	1102 Hwy. 70 West 28560	919-637-5522	WEST VIRGINIA			
Rocky Mount	Bowden Elec. Mtr. Serv.	1512 Raleigh Rd. 27801	919-446-4203	Accoville	B & T Recharge	Righthand Fork Buffalo 25606	304-583-8230
Salisbury	Delta Electric	725 Demco Drive, 28145	704-633-3709	Chapmanville	B & R Jack Repair	Benley Blanch Rd. 25508	304-855-3782
Shelby	Electric Motor Service	1143 Airport Rd. 28150	704-482-9979	Huntington	Lawter Elec. Mtr. Co.	202 Adams Ave. 25701	304-522-8297
Thomasville	Electric Drives Inc.	16 Carolina Avenue 27361	910-476-6751	Lavalette	Eastern States Pump & Equip.	4938 Route #152 25535	304-522-8297
Wake Forest	Electric Motor Shop	1225 N. White St. 27587	919-556-3229	Morgantown	West Electric & Machine	8 West Electric Drive 26508	304-26
NORTH DAKOTA				Mullens	Tranco	411 Black Eagle Rd. 25882	304-26
Fargo	S & W Elec. Mtr. Rpr.	12 N. 14th St. 58102	701-232-7141	Parkersburg	WWT Electric	641 Harris St. 26101	304-428-0424
Fargo	Stack Electric Mtr. & Cont.	101 S. 23rd St. 58103	701-298-0311	Princeton	MJ Electric	Sheller Road 24740	304-25-8887
Grand Forks	Acme Electric Motor Inc.	1705 13th Avenue North 58201	701-746-6481	WISCONSIN			
OHIO				Appleton	Crescent Elec. Mtr. Ser.	1727 N. Richmond 54911	414-733-6136
Akron	Tyler Electric Mtr. Rpr.	1888 Copley Rd. 44320	216-836-5537	Green Bay	Christianson Elec. Co. Inc.	1138 State St. 54304	414-435-6924
Canton	Ragon Elec.	1240 Duerbe Ave. S.W. 44706	216-453-0161	Hudson	Reliance Elec. Mtrs.	1621 Livingstone Rd. 54016	715-386-3633
Cincinnati	Frank's Elec. Mtr. Serv.	2640 Colerain Ave. 45214	513-542-0342	LaCrosse	Elect. Mtr. Rpr.	222 Vine St. 54601	608-784-6330
Cincinnati	Wheatley Elec. Serv.	2046 Ross Ave. 45212	513-631-4951	LaCrosse	Lackore Electric Motor Repair, Inc.	200 South 3rd. 54601	608-782-7635
Cleveland	Baumgardner & Sons	1380 East 170th St. 44110	216-631-2800	Madison	Elect. Mtrs. Unlimited	1000 Jonathan Dr. 53713	608-271-2311

Installation, Operation and Maintenance Instructions

Model NPE/ NPE-F

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. Important:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

CAUTION

Always disconnect electrical power when handling pump or controls.

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

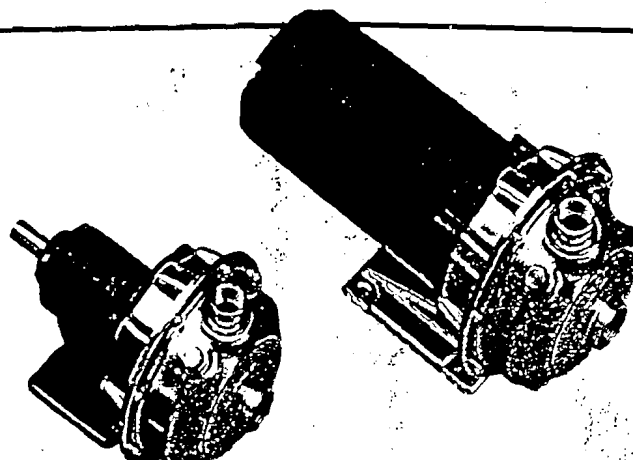
1.6. Maximum Operating Limits:

Liquid Temperature: 212° F (100° C) with standard seal
250° F (120° C) with optional high temp seal.

Pressure: 75 PSL

Starts Per Hour: 20, evenly distributed.

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.



2. Installation:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

CAUTION

Never draw piping into place by forcing the pump suction and discharge connections.

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units:

2.2.1. Units may be installed horizontally, inclined or vertically.

CAUTION

Do not install with motor below pump. Any leakage or condensation will affect the motor.

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units:

2.3.1. Bedplate must be grouted to a foundation with solid footing. Refer to Fig. 1.

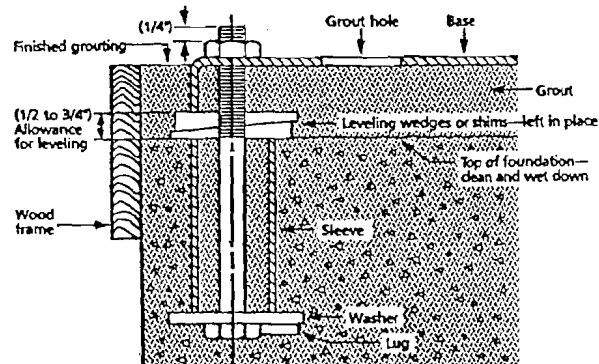
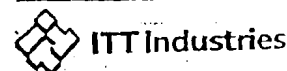


Figure 1

Goulds Pump



(two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. Suction Piping:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply:

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

CAUTION

Do not use suction isolation valve to throttle pump.

3.5. Installation with pump above source of supply:

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figs. 2-5

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

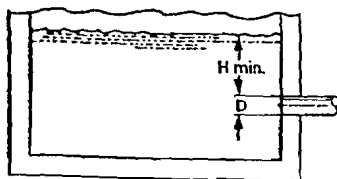


Figure 2

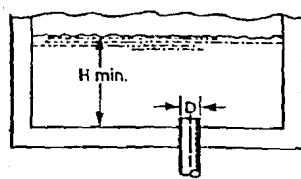


Figure 3

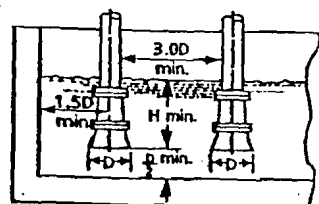


Figure 4

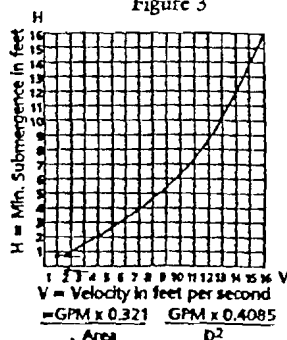


Figure 5

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. Motor-To-Pump Shaft Alignment:

5.1. Close-Coupled Units:

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units:

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Fig. 6.

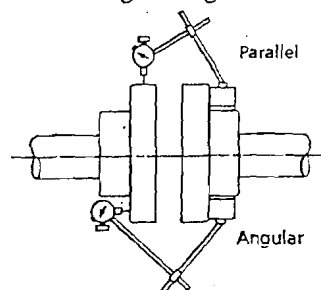


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

CAUTION

Always recheck both alignments after making any adjustment.

6. Rotation:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. Operation:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

CAUTION

Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. Maintenance:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units:

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. Disassembly:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End:

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

CAUTION

Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

CAUTION

Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame:

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 & 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 & 168).

10. Reassembly:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end:

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

CAUTION

Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. Trouble Shooting Chart:

MOTOR NOT RUNNING

(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:

(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:

(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:

(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

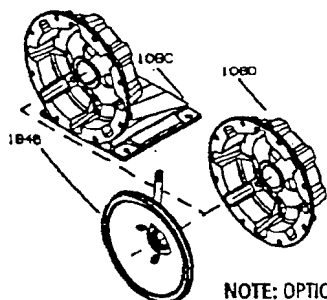
PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged.
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
Suction lift too high or suction losses excessive.
Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

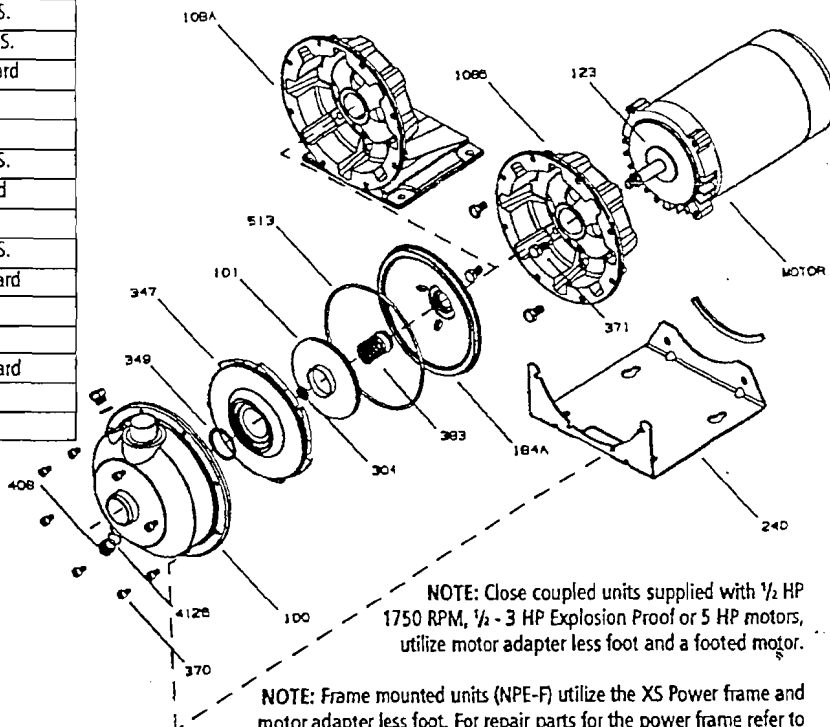
Standard Repair Parts List

Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	BUNA-N
123	Deflector	
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
304	Rubber channel	Rubber
347	Impeller locknut	AISI 316 S.S.
349	Guidevane	AISI 316L S.S.
370	Seal-Ring, guidevane	Viton Standard
371		EPR
371		BUNA
371		AISI 410 S.S.
383	Socket head screw, casing	Steel/plated
408	Bolts, motor	
408	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton, standard
412B		EPR
412B		BUNA
513	O-Ring, casing	Viton, standard
513		EPR
513		BUNA

Item 383 Mechanical Seal (1/4" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K35
Sil-Carbide		EPR		10K81
		Viton		10K62



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



NOTE: Close coupled units supplied with 1/2 HP 1750 RPM, 1/2 - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

- (a) Labor, transportation and related costs incurred by the dealer;
- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- (3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

Goulds Pumps and the ITT Engineered Blocks Symbol are registered trademarks and tradenames of ITT Industries.

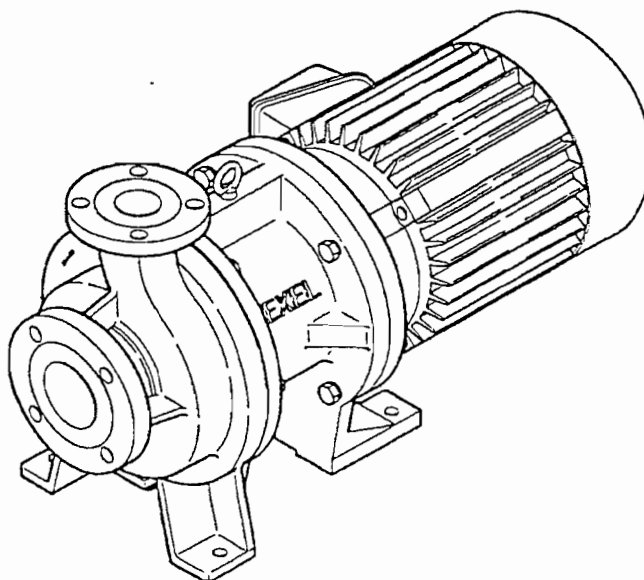
Visit us at www.goulds.com

INSTRUCTION MANUAL

TEXEL®

MAGNETIC DRIVE PUMP

MTA SERIES



Magnatex® Pumps, Inc., P.O. Box 770845, Houston, Texas 77215-0845
Phone (713) 972-8666 Fax (713) 972-8665

Thank you for purchasing Texel magnetic driven pump. This pump is not to be operated speeds, working pressures or temperatures higher than, nor used with liquids other than stated in the original order acknowledgement.

See the paragraph 2 "Safety Instruction" of this instruction manual.

Table of Contents

1. Checking Points on Arrival	2
2. Safety Introduction	2
1. Handling	2
2. Verification	2
3. Application	2
3. Storage	3
1. Storage for up to Three Months	3
2. Storage for more than Three Months	3
4. Installation and Piping	4
1. Installation	4
2. Piping	4
5. Precaution for Operation	6
1. Starting-Up	6
2. During Operation	6
3. Suspension of Operation	6
4. Shut-Down Operation	6
5. Other	6
6. Maintenance Check	7
1. Daily Check	7
2. Periodical Check	7
3. Boundary of Bearing Wear	7
7. Disassembly and Assembly	8
1. Disassembling Considerations	8
2. Preparation for Pump Disassembly	8
3. Disassembly	9
4. Assembly	10
5. Detachment/Attachment of Shaft	10
6. Replacement of the Bearing	10
7. Replacement of the Front/Rear Thrust Ring and Mouth Ring	10
8. Replacement of the Shaft Support	10
8. Structural Drawing and Part Names	11
1. MTA-1516/1518	11
2. MTA-0326	12
3. Part Name	13
4. Recommended Spare Parts List	13
9. Nozzle Loading Criteria	14
10. Accident and Cause	15/16

1. Checking Points on Arrival

Make sure of the following points right away when pump arrived.

1. Does the nameplate correspond to what you ordered?
2. Are all the accessories supplied?
3. Have any of the components been damaged in transit?
4. Are any of the bolts loose?
5. Can the motor be turned easily by hand? If heavy resistance is felt, or the motor does not turn at all, this means it has been damaged in shipping.

2. Safety Introduction

This magnetically drive pump, like high-speed or high-voltage equipment, has sufficient energy to cause severe personal injury and/or property damage if proper precautions are not taken. Special attention has to be taken when the pump is used in areas where corrosive or dangerous chemical substances are used. For safe operation and to prevent personal injury and/or damage to the equipment or other property, read and follow all "warning" described below.

1. Handling

The pump may be lifted by the eyebolt, however, additional support must be also be used on the motor. Suitable slings, chains or other lifting equipment should be used and appropriate safety procedures observed.



WARNING

The eyebolt or lifting lug on the motor are designed for the weight of the motor only. Never use this eyebolt or lifting lug alone to lift the entire pump system. When lifting the pump or pump system, always use adequate, auxiliary lifting support devices and do not rely on the pump eyebolt.

2. Verification

When conducting the operational tests after installation or maintenance, make sure that all drain bolts and casing bolts are tightly secured.

3. Application

This pump has been designed and constructed in accordance with the operating conditions and specifications stated in the contract. If the pump is not used for the above mentioned purpose, consult the supplier or Seikow Chemical Engineering & Machinery, Ltd. before installation or operation of the pump.

3. Storage

While in storage, perform maintenance and inspections by following the instructions shown below until pump startup.

1. Storage for up to Three Months:

1. Do not remove the seals from the suction and discharge flanges until the pump is installed in the piping.
2. Store the pump in a dry, adequately-vented room. The atmosphere must be free of rain, water and other sources of excess moisture.
3. Cover the opening through which wires enter the motor terminal box with gummed cloth tape or similar material to prevent entry of foreign matter, such as dust and dirt particles.
4. Avoid storing the pump in locations where an object may fall onto the pump or equipment being moved may contact the pump. If the pump cannot be moved, it must be fully protected.
5. Do not place heavy material on the pump.
6. Drain the liquid through the drain hole to prevent it from freezing.
7. When storing the pump after operating it, follow the steps below :
 - 1) Clean internals of the pump with fresh water.
 - 2) Seal the suction and discharge flanges to keep out foreign matter.
 - 3) When the total period of operation and storage exceeds one year before the pump is again operated, then an internal inspection of all rotating and wear parts, including gasket replacement, is required.

2. Storage for more than Three Months:

1. Follow steps 1 through 7 in paragraph 1 above.
2. The insulation resistance of the may degrade over time due to moisture absorption by the insulation. Therefore, measure and record the insulation resistance on delivery of the pump and check resistance periodically.
If resistance is reduced, dry the motor according to the manufacturer's recommended procedure and take action to avoid subsequent exposure to moisture. (Refer to the motor instruction manual.)



WARNING

Never operate the pump without previously checking the resistance of the motor insulation to avoid failures due to a short circuit, etc.

3. Remove the fan cover from the motor and rotate the fan by hand once per month.
4. When preparing to operate the pump after storage for more than one year, replace the gaskets before starting the pump.

4. Installation and Piping

1. Installation

1. Basically, the pump base should be installed on a concrete foundation. When this is not possible, install it on a steel or wooden frame, making sure that it is stable enough not to cause vibrations during operation.
2. Place the foundation bolts with nuts put on the top of bolts through the bolt hole on the baseplate, then embed in the foundation holes.
3. In case of a concrete foundation, adjust parallel alignment for baseplate by placing four sets of metal shims between concrete and base plate. (Fig.1)
4. Check this parallel alignment from all directions by placing a level on the pump discharge flange.
5. After checking parallel alignment for the baseplate, a high grade of non-shrinking grout should be poured between the baseplate and concrete foundation.

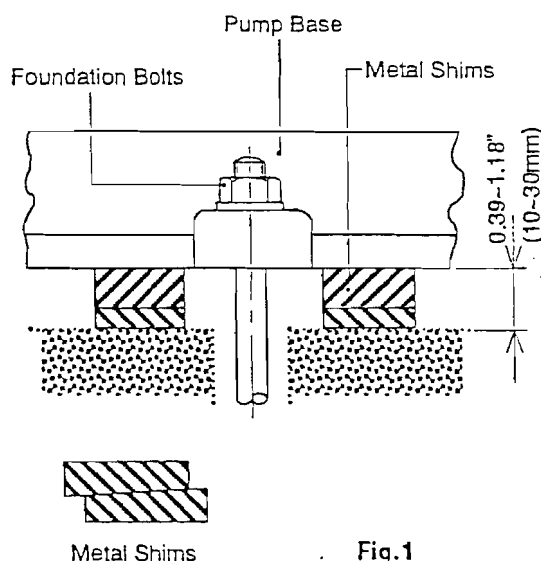


Fig.1

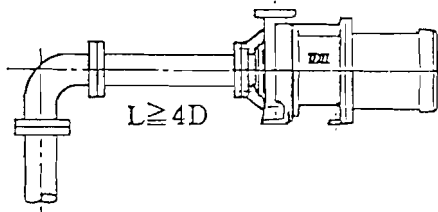
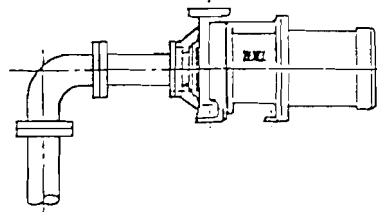
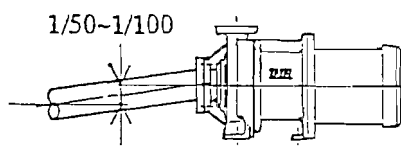
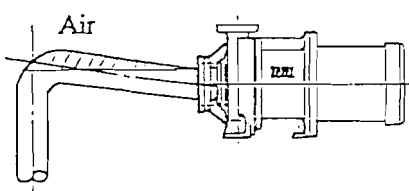
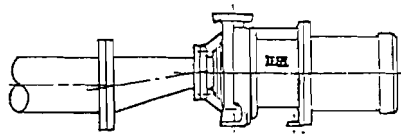
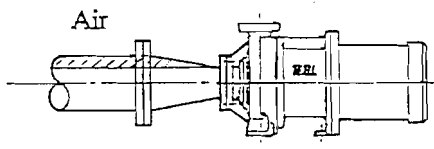
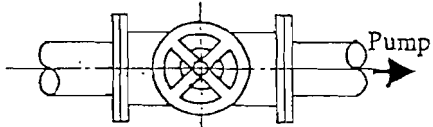
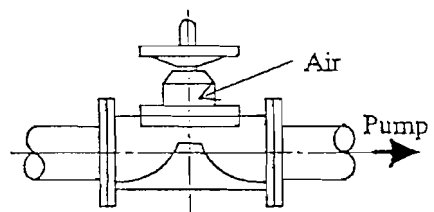
2. Piping

1. Piping the pump
 - 1) All piping connected with suction and discharge flanges on the pump must be supported independently to the pump.
 - 2) When, metallic material piping is involved, flexible connections are recommended on suction and discharge flanges.
 - 3) Piping force should not exceed the maximum allowable load as shown on page fourteen (14).

2. Suction piping (Fig.2)

- 1) The length of suction pipe from suction reservoir to pump inlet should be as short as possible.
- 2) Avoid all unnecessary elbows, bends and fittings as they increase friction losses in the piping. A valve and a short length pipe should be provided for disassembling the pump.
- 3) Consider sufficient available NPSH when designing the diameter and length of the suction pipe, and provide elbows/bends/fittings on the suction piping.
- 4) To avoid cavitation, incline the piping upward from the suction side toward the pump. However, when using pressurized piping, incline the piping down toward the pump.
- 5) Install a dust-proof screen on the suction tank. Clean out the tank before filling liquid.
- 6) Position the end of the suction pipe deep enough to be immersed even when the liquid level is low.
- 7) To prevent cavitation, the gate valve installed on the suction side should be positioned horizontally or facing downward. Be sure to keep the valve fully open except during inspection or when switching over.
- 8) Make the bends as gentle as possible, keep the number to a minimum, and do not install bends close to the pump suction port.
- 9) When using special or different sized pipes are used, an eccentric or special types of valves are recommended to prevent cavitation.
- 10) The suction piping of parallel operated pumps may cause an unbalance in suction pressure when connected to common main piping. Separate piping is recommended in this case.

Fig.2 Suction Piping

	Correct	Incorrect
Vertical Horizontal bend		
Inclined pipe		
Eccentric reducer		
Installation direction of gate valve		

5. Precaution for Operation

1. Starting-Up

1. Stickers on both inlet and outlet of the pump must be taken off before connecting pipes on to the pump.
2. Turn the motor manually to confirm that it rotates smoothly.
3. Clean inside of the suction piping. If dirt and scales, which entered the suction piping during installation, they may flow into the pump, causing critical malfunction.
4. Check the rotational direction of the motor.
(Direction indicated by arrow on the casing cover)



WARNING

Especially when the bearing material is SiC, check the motor rotation after priming or removing the motor. Running the pump without priming even for a very short time will result in damage to the pump.

5. Open the valve on the suction side pipe line completely.
6. In order to fill the pump completely, priming is required. To prime the pump, use the discharge side piping to discharge air. If difficulty is experienced in discharging air, rotate the motor fan in the reverse direction by hand three or four times and utilize the reaction.
7. Start operation with the discharge valve fully closed.
8. After confirming the rated speed and pressure and that the pressure has risen, gradually open the discharge valve to gain the specified discharge pressure.



WARNING

Do not run the pump dry or without priming as severe damage may result. Make sure to prime the pump completely. If the discharge pressure drops, stop the pump and locate the cause.
(inadequate priming, discharge pipe leak, etc.)

2. During Operation

1. Noise checking
Sucking of air or solid from the suction pipe line often causes abnormal noise and vibrations.
2. Vibration check
Take special care to avoid vibrations caused by cavitation. Adjustment of the discharge volume must be carried out by using the valve on the discharge side. Do not close the valve on the suction side.
3. Other
Special care should be taken to observe the discharge and suction pressure, discharge volume and electric current. When the discharge pressure fluctuates or falls abnormally, the cause can often be found in clogging of solids or in sucking air on the suction side.

3. Suspension of Operation

1. Normally, operation of the pump should be stopped only after fully closing the discharge valve. If the suction valve is closed first, cavitation and seizure may occur.
2. In case of flooded suction, close the suction valve after stopping operation.

4. Shut-Down Operation

In case of a long term shut-down, remove the liquids from the pump. If liquid is left inside the pump during the winter season, expansion of the liquid due to freezing may cause cracks and other damages.

5. Other

1. Do not leave a reserve or stand by pump unused for a long time. Operate it occasionally to confirm that it can be employed when necessary.
2. Avoid dry operation of the pump even for a short time. Dry operation may cause the sliding parts immersed in liquid to seize.
3. Use the pump within the specified flow rate and head. Do not use with an excessive flow.

6. Maintenance Check

1. Daily Check

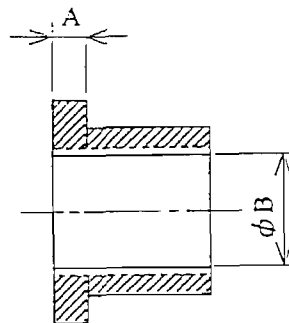
1. Check that the pump is operating without making any abnormal noise or vibrations.
2. Check the suction and discharge pressure as well as the liquid level of the suction tank.
3. Check that the electric current value of the motor does not exceed the rated current value and also check the bearing temperature.

2. Periodical Check

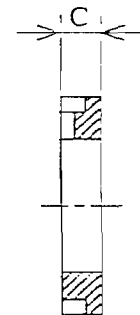
For smooth and safe operation of the pump, check each parts of the pump periodically in accordance with the instructions given below. Special care should be taken in case of the metal parts, since the outer and inner magnets feature strong magnet force. Also, special care should be taken when handling the sliding areas of the shaft, thrust rings and bearings.

3. Boundary limit of Bearing Wear

	[inch/mm]		
	A	ϕB	C
At Shipment	0.236/6.0	1.024/26	0.315/8.0
At Replacement	0.197/5.0	1.063/27	0.276/7.0



Bearing



Mouth Ring

Part Name	Check Points	Countermeasures
Casing	<ul style="list-style-type: none"> • Accumulation of dirt in the liquid contact parts • Presence of cracks • Wearing condition of Front Thrust Ring • Presence of sliding flaws or cracks 	<ul style="list-style-type: none"> • Cleaning • Confirm cause • Confirm cause • Confirm cause
Impeller	<ul style="list-style-type: none"> • Dirt between impeller blades or infiltration of foreign matter • Contact on inlet area • Wearing condition of Mouth Ring 	<ul style="list-style-type: none"> • Cleaning • Confirm cause • Confirm cause
Inner Magnet	<ul style="list-style-type: none"> • Sliding of the outer surface and Rear Casing • Presence of cracks on the end face • Accumulation of the dirt in the liquid contact parts • Wearing condition of Bearing • Clogging in cooling passage of Bearing 	<ul style="list-style-type: none"> • Confirm cause • Confirm cause • Cleaning • Confirm cause • Cleaning
Rear Casing	<ul style="list-style-type: none"> • Sliding of Rear Casing and Inner Magnet • Accumulation of dirt in the liquid contact area • Wearing condition of Rear Thrust Ring • Presence of sliding flaws or cracks 	<ul style="list-style-type: none"> • Confirm cause • Cleaning • Confirm cause • Confirm cause
Shaft	<ul style="list-style-type: none"> • Presence of cracks • Wearing condition of Bearing 	<ul style="list-style-type: none"> • Confirm cause • Confirm cause
Outer Magnet	<ul style="list-style-type: none"> • Sliding of the inner surface and Rear Casing • Setting position of motor shaft 	<ul style="list-style-type: none"> • Confirm cause • Confirm cause
Motor Bearing	<ul style="list-style-type: none"> • Presence of abnormal noise • Loosening of set screws 	<ul style="list-style-type: none"> • Two years • Retighten

7. Disassembly and Assembly

1. Disassembling Considerations

1. Always wear protective clothing and equipment, such as rubber/insulated gloves and safety glasses, when disassembling the pump.



WARNING

There is danger from chemical contact with skin during and after disassembling the pump.

2. After disassembling the pump, take the proper precautions when handling the shaft and bearing. They can be easily damaged.
3. The inner magnet and outer magnet can exert high magnetic forces. Do not let metal chips or metal materials come close to the magnets.



WARNING

Magnet strength results in strong magnetic forces that could cause physically damage to hands and fingers. Caution must be taken to keep fingers and hands from between Magnets.

2. Preparation for Pump Disassembly

1. Check the safety of the working environment, for example, provisions of proper scaffolding, etc.
2. Switch off the main power supply to avoid unintentional operation. Before disassembling the pump, be sure that the work area is appropriately defined with appropriated warning notices, on the notice board, lock-outs are in place, etc., to alert personnel that equipment is being serviced and to assure the pump or associated system components will not be operated.



WARNING

The pump is mechanical rotating device. If the pump is switched on with the rotating parts exposed while disassembled, severe injury to personnel may result.

3. Fully close the suction and discharge valves before removing the pump from the piping. The work area should be appropriately defined, etc. to alert personnel that the equipment is being serviced and the all valves to the pump must be kept closed.
4. Wear protective (rubber) gloves and safety glasses before loosening the flange bolts, then drain the liquid out of the pump and piping.



WARNING

If chemicals leak or are splashed out and contact the skin, severe injury may result.

5. If the pump is provided with a drain on casing, the following procedure and precautions should be taken for draining:
 - 1) Open a drain cap, or remove the drain bolts holding drain pan to the casing.
 - 2) Loosen four (4) flange bolts and nuts of the pump discharge nozzle equally little by little. Then, stop loosening the bolts when the liquid trapped in the pump and casing leaked from drain. And then, be properly positioned for the safety until the leakage stops completely.



WARNING

Do not loosen all four bolts that secure the pump flange of the discharge side at the same time. Liquid may leak or splash out, causing severe bodily harm. It is dangerous to work in front of the drain port while draining the fluid, so be properly positioned before and during the process of draining the pump.

- 3) Repeat this procedure mentioned in paragraph 2), then, remove four bolts and nuts from the discharge flange. Lift the discharge pipe up to drain the trapped liquid completely by placing a screw driver something like this.

3. Disassembly

The MTA Series is a back pull-out type pump. Disassemble in accordance with instructions (1) through (7) given below. Note : Disassembling start from the item (8) then back to the item (3) to (7) if back pull-out disassembling method is not provided.

1. Detach the bracket bolts.(104-17) (Photo 1)



Photo 1

2. Detach the casing bolts.(104-3) (Photo 2)

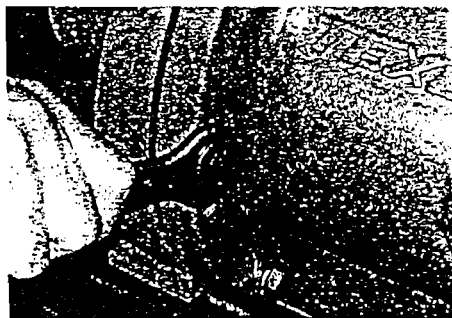


Photo 2

3. Leave them inserted in the tap holes on either side of the bracket by using disassembly/assembly bolts (104-58), and slide the motor toward the back. (photo 3)



Photo 3

4. Detach the rear casing bolts (104-54) and take out the rear casing by moving it backward. (Photo 4)

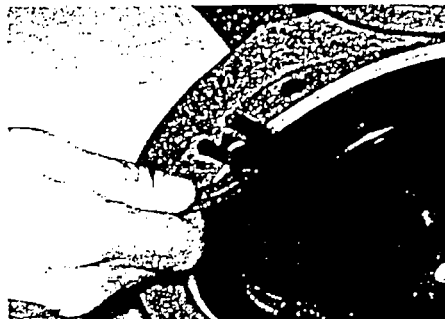


Photo 4

5. Detach the inner magnet (impeller). (Photo 5)

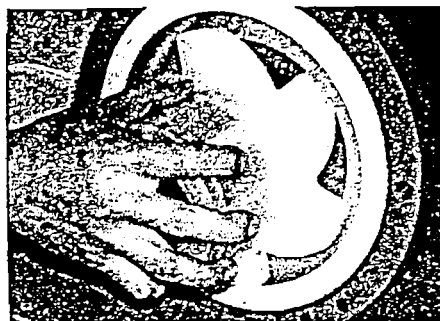


Photo 5

6. Detach the motor liner bolts (104-33) and pull out the motor. (Photo 6)

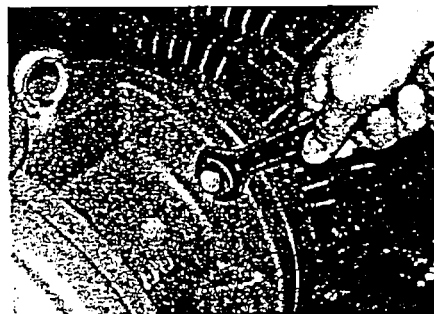


Photo 6

7. Loosen the outer magnet set screws (104-46) and detach the outer magnet. (Photo 7)



Photo 7

8. Detach the casing bolts, pull out the casing and remove it from the bracket. At this point, the rear casing will also come out. As mentioned in the item (3), the casing can be moved in front by tightening the jacking bolts on bracket. (Photo 8)

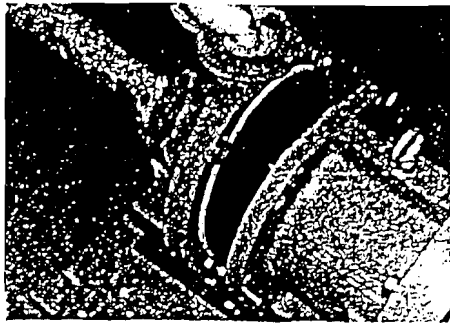


Photo 8

4. Assembly

For assembly, the procedure is the same as disassembly, but in the reverse order.

1. Set the outer magnet on the motor shaft and tighten the screws. The dimensions should be such that the surfaces of the outer magnet and motor shaft are in alignment, as shown in the diagram below (Fig. 3).

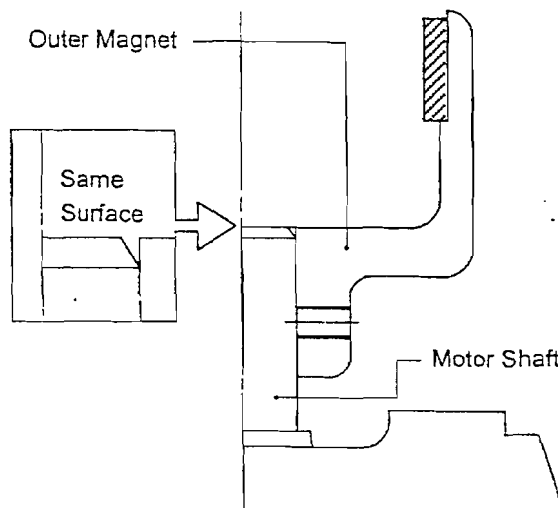


Fig.3

2. Set the motor on the bracket.
3. Place the inner magnet (impeller) on to the shaft.
4. Set the gasket on the casing and tighten to the rear casing with the insert bolts. (Tighten the rear casing bolts lightly by hand.)



WARNING

Since the inner and outer magnets attract each other, make sure not to insert fingers between them.

5. Move the bracket toward the front and set on the casing. Tighten the casing bolts in crisscross pattern to ensure even tightness.
6. Set the bracket bolts in place and tighten them.
7. At completion of assembly, check the motor if turns smoothly by rotating it with a screw driver, etc.

5. Detachment/Attachment of Shaft

When detaching the shaft, insert a plus driver through the hole of the shaft support and hammer the driver head gently with a resin mallet, and then detach. When attaching, align the notches on the shaft and shaft support, and then set in by hammering the rear part of the shaft with the mallet.

6. Replacement of the Bearing

When removing the bearing from the inner magnet, place a round stick behind the bearing (from the direction of the impeller) and hammer it with a resin mallet. When setting the bearing in position, align the notches on the opposite side of impeller, and using a piece of cloth to protect from damage, hammer it lightly into position with a resin mallet.

7. Replacement of the Front/Rear Thrust Ring and Mouth Ring

The front/rear thrust rings and mouth ring shall be shrink to fit with holding tabs in two or three places. When replacing the front/rear thrust rings and mouth ring, melt and detach these holding tabs using a hot air gun welder.

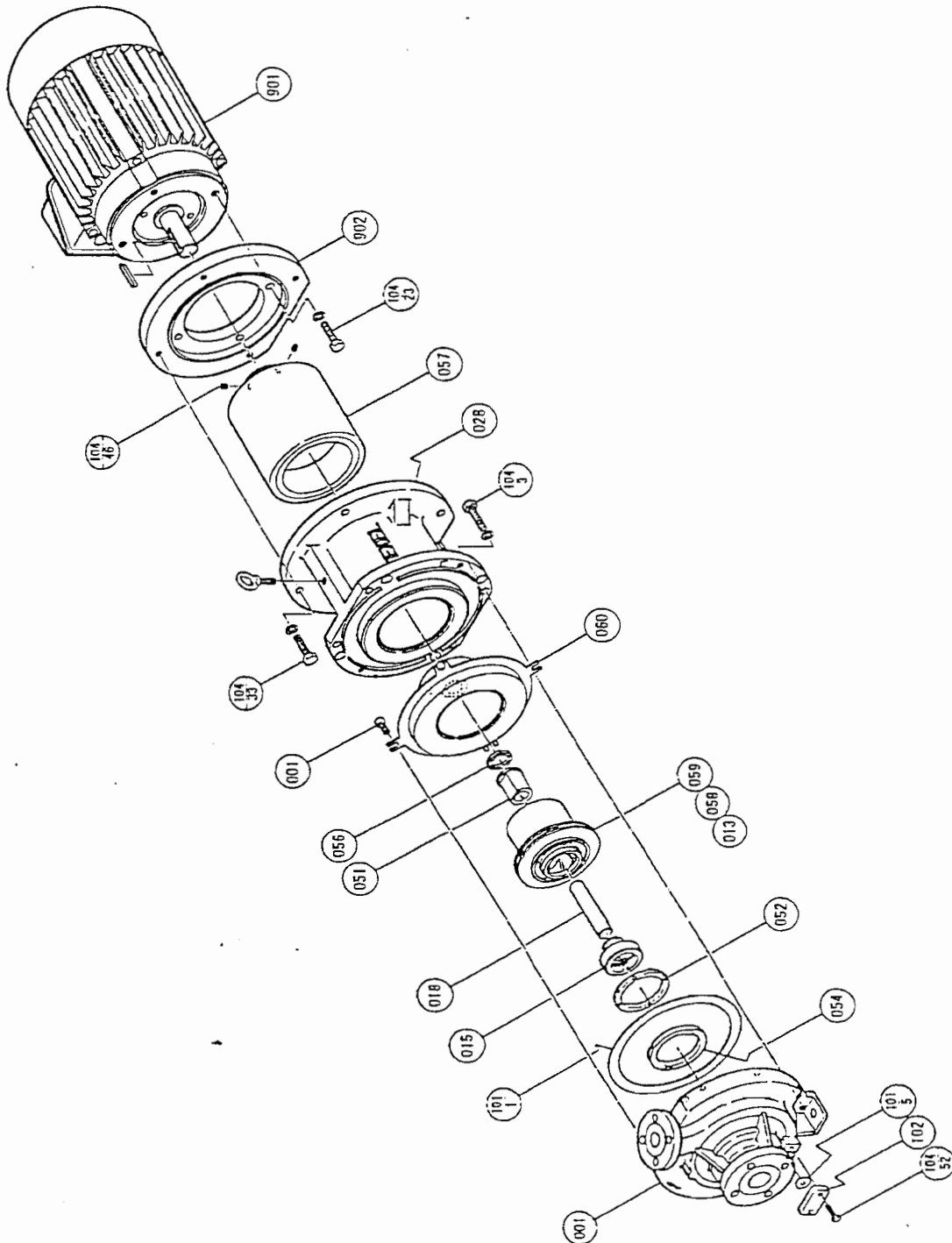
When installing the front/rear thrust rings and mouth ring, align the notches, solder the claws with the hot air gun welder and then flatten them using a round stick (approx. $\phi 0.16$ inch/ $\phi 4$ mm).

8. Replacement of the Shaft Support

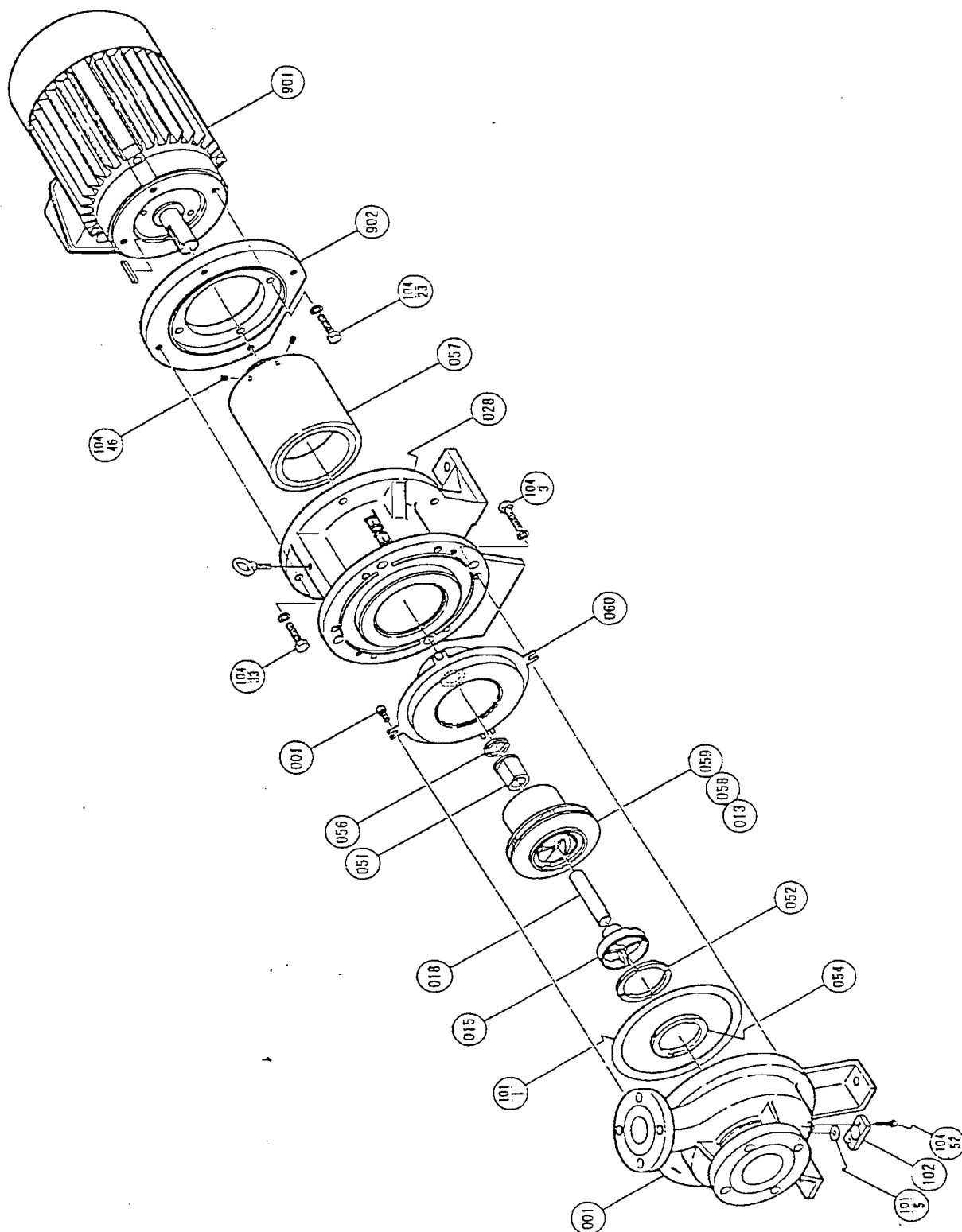
The shaft support is pressed in and welded on to the casing. When replacing the shaft support, remove the welded portion and detach it from the casing. When equipping the shaft support on to the casing PFA welding rod shall be used.

8. Structural Drawing and Part Names

1. MTA AA6 / AA8



2. MTA A10



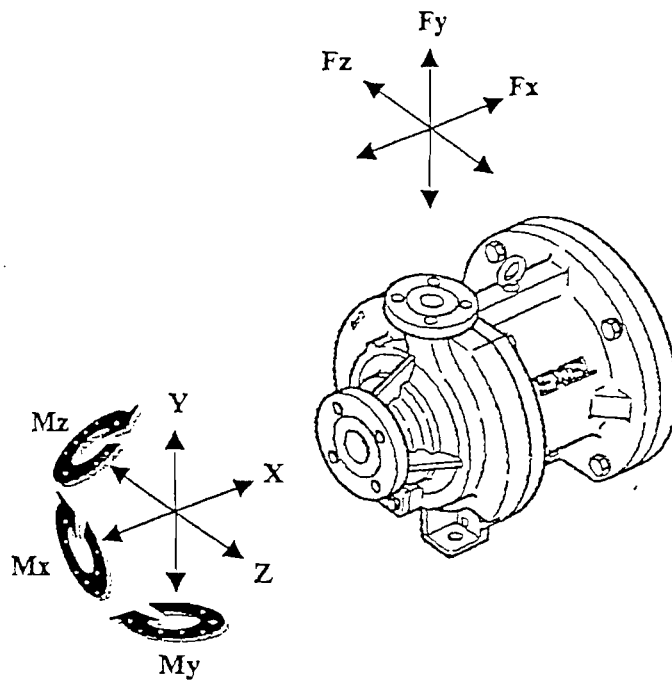
3. Part Name

No.	Part name	Material	Qty.	Remarks
001	Casing	PFA+FCD450	1	
013	Impeller	PFA	1	
015	Shaft Support	PFA	1	
018	Shaft	SiC Ceramic	1	
028	Bracket	FC200	1	
051	Bearing	C-PTFE/SiC Ceramic	1	
052	Mouth Ring	C-PTFE/SiC Ceramic	1	
054	Front Thrust Ring	SiC Ceramic	1	
056	Rear Thrust Ring	SiC Ceramic	1	
057	Outer Magnet	Rare Earth	1	
058	Inner Magnet	Rare Earth	1	Included in Impeller
059	Magnet Lining	PFA	1	Included in Impeller
060	Rear Casing	PFA+ENG. Plastic	1	
101-1	Casing Gasket	PTFE	1	Wrapping Gasket
101-5	Drain Gasket	PTFE	1	Wrapping Gasket
102	Drain Flange	FC200	1	
104-3	Casing Bolt	SUS304	6	
104-17	Bracket Bolt	SUS304	1 Set	
104-23	Motor Bolt	SUS304	4	
104-33	Motor Liner Bolt	SUS304	4	
104-46	Outer Magnet Set Screw	SNCM	2	
104-52	Drain Bolt	SUS304	2	
104-54	Rear Casing Bolt	SUS304	4	
104-58	Disassembly/Assembly Bolt	SUS304	2	
901	Motor		1	
902	Motor Liner	FCD450	1	

4. Recommended Spare Parts List

No.	Part name	Material	Qty.	Remarks
051	Bearing	C-PTFE/SiC Ceramic	1	
052	Mouth Ring	C-PTFE/SiC Ceramic	1	
054	Front Thrust Ring	SiC Ceramic	1	
056	Rear Thrust Ring	SiC Ceramic	1	
101-1	Casing Gasket	PTFE	1	Wrapping Gasket
101-5	Drain Gasket	PTFE	1	Wrapping Gasket

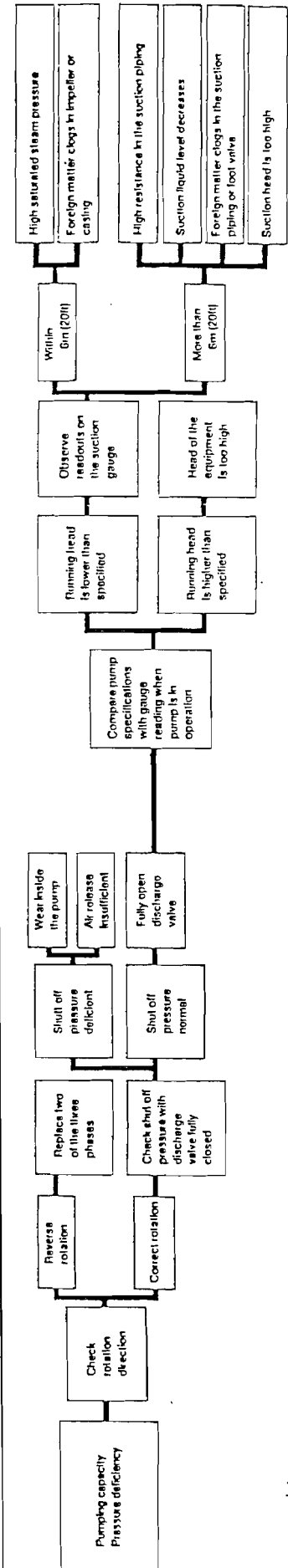
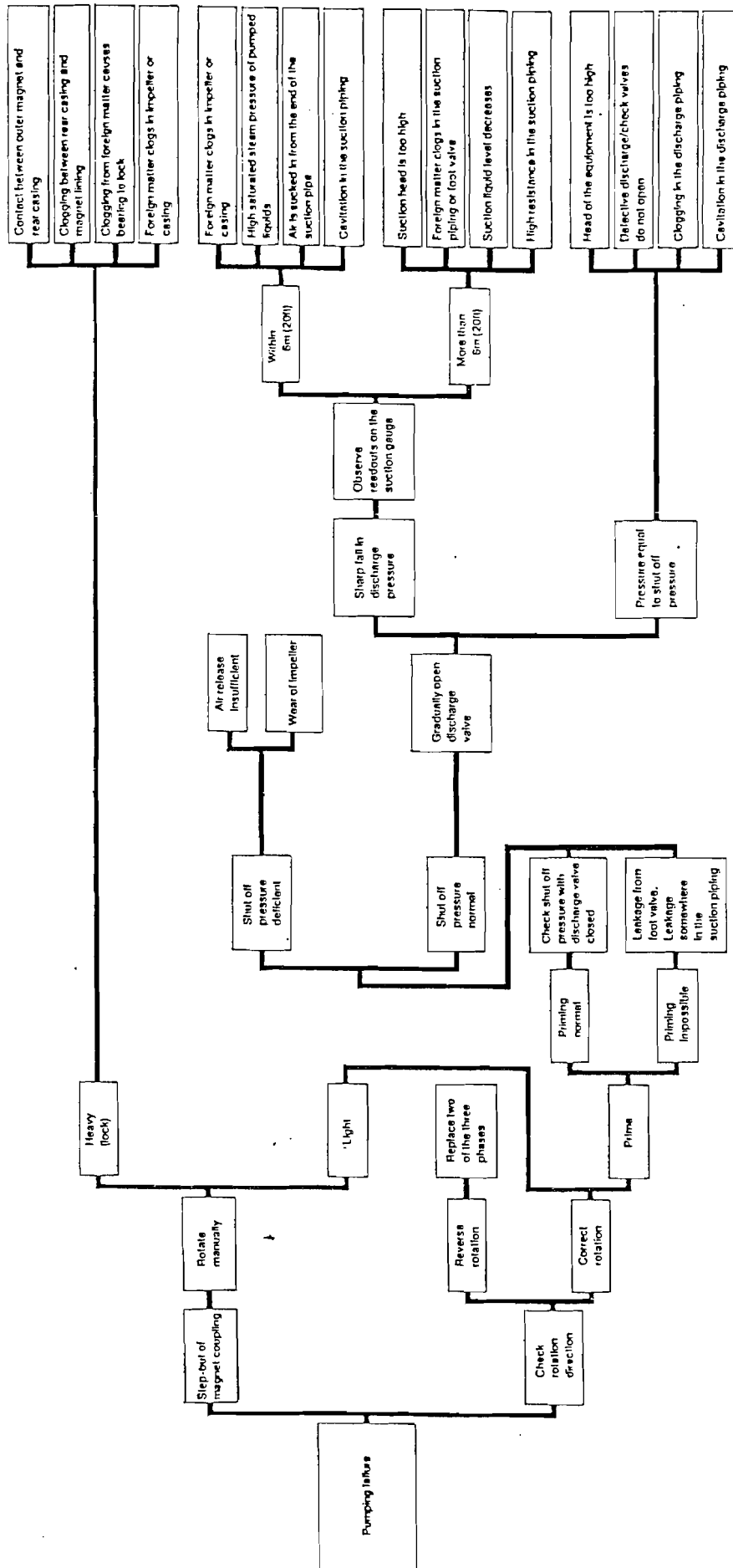
9. Nozzle Loading Criteria

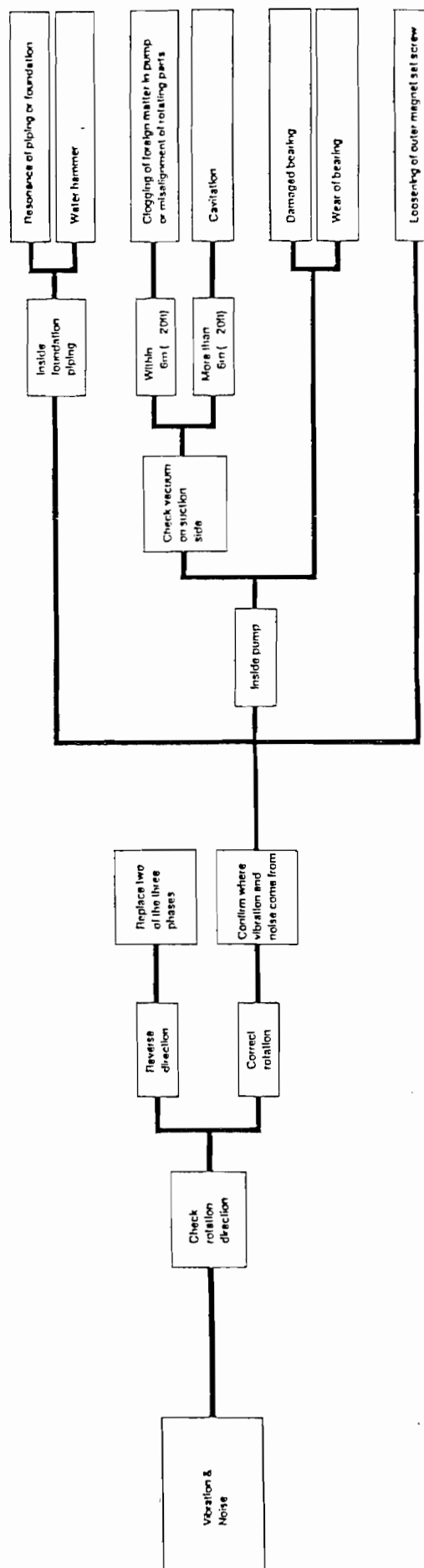
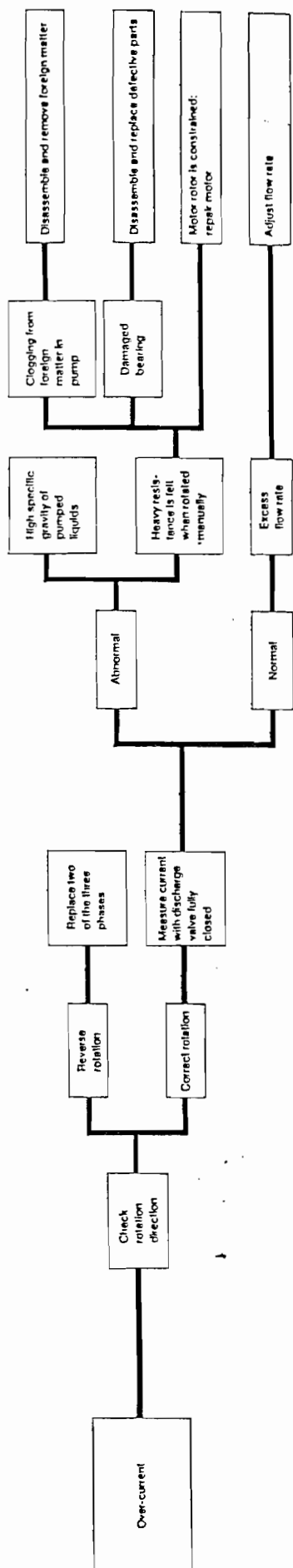


MODEL	SUCTION						DISCHAGE					
	FORCES (LBS)			MOMENTS (FT-LBS)			FORCES (LBS)			MOMENTS (FT-LBS)		
	FX	FY	FZ	MX	MY	MZ	FX	FY	FZ	MX	MY	MZ
MTA-1516/18	173.8	88.0	145.2	433.0	288.8	216.5	138.6	70.4	116.6	346.4	230.9	173.2
MTA-0326	356.4	178.2	297.0	887.6	591.7	447.4	286.0	1430	237.6	707.2	476.3	360.8

MODEL	SUCTION						DISCHAGE					
	FORCES (kgf)			MOMENTS (kgf-m)			FORCES (kgf)			MOMENTS (kgf-m)		
	FX	FY	FZ	MX	MY	MZ	FX	FY	FZ	MX	MY	MZ
MTA-1516/18	79	40	66	60	40	30	63	32	53	48	32	24
MTA-0326	162	81	135	123	82	62	130	65	108	98	66	50

10. Accident and Cause

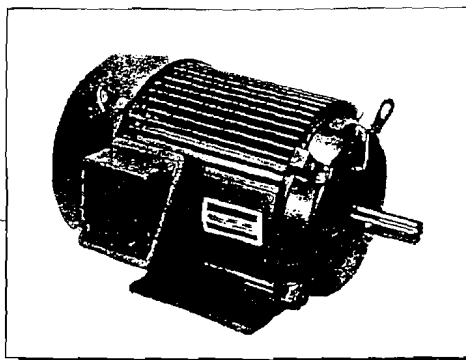




Magnatex® Pumps, Inc., P.O. Box 770845, Houston, Texas 77215-0845
Phone (713) 972-8666 Fax (713) 972-8665

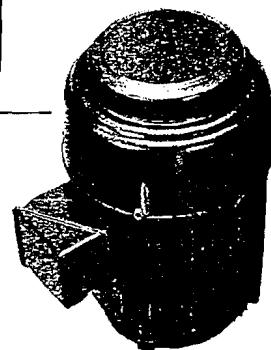


UNIMOUNT® 125
UNIMOUNT® HIGH EFFICIENCY
UNIMOUNT® PREMIUM EFFICIENCY
UNIMOUNT® MULTISPEED

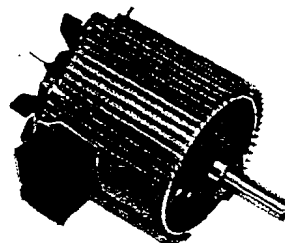


FOR
UNIVERSAL
MOUNTING

CANOPY CAP
MODULE

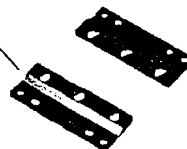
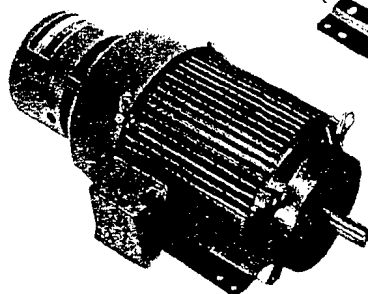


SHUR-STOP™
BRAKE MODULE



NEMA "C" FACE
MODULE

REMOVABLE
BASE/FOOT

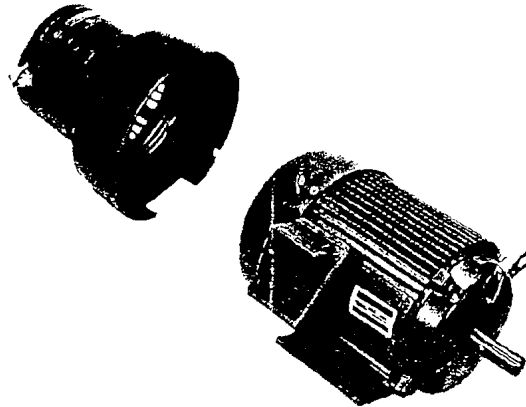


NEMA
"D" FLANGE
MODULE

MODULAR KIT INSTRUCTION MANUAL

FOR YOUR SAFETY, READ AND RETAIN THIS MANUAL

ELECTRIC BRAKE KIT



Brake Kit modules are available for 56, 140T, 180T and 210T frames. (4, 6 & 8 Pole).

Each kit is provided with its own specific installation instructions due to its detailed installation and electrical requirements.

Refer to your USEM Sales Office or local distributor for kit number, price and availability.



U.S. ELECTRICAL MOTORS

DIVISION OF EMERSON ELECTRIC CO.

8100 W. FLORISSANT AVE.

P.O. BOX 36912

ST. LOUIS, MO 63136



CANOPY CAP KIT INSTALLATION PROCEDURE — 180T-280T FRAME

DISASSEMBLY

1. Unscrew screws (item A-Qty. 4) and remove fan cover (item B).
2. Remove old lifting lugs (item R1-Qty. 2) by unscrewing overbolts and nuts (items C and D-Qty. 2 each). Item R1 not required for reassembly. NOTE: Loosen remaining overbolts to assure proper seating of bracket during reassembly.

180T FRAME

REASSEMBLY

3. Replace overbolts and nuts (items C and D-Qty. 2 each) and alternately tighten all 4 overbolts to a torque of 6 lb. ft.
4. Place square nut (item 1-Qty. 1) into recess inside fan cover.
5. Position spacer, canopy cap, lock washer and screw (items 2, 3, 4, and 5-Qty. 1 each) on fan cover as shown and tighten.
6. Replace fan cover (item B).
7. Place new lifting lugs (item 6-Qty. 2) across from each other, outside fan cover, and tighten screws (item A-Qty. 4) to 6 lb. ft.

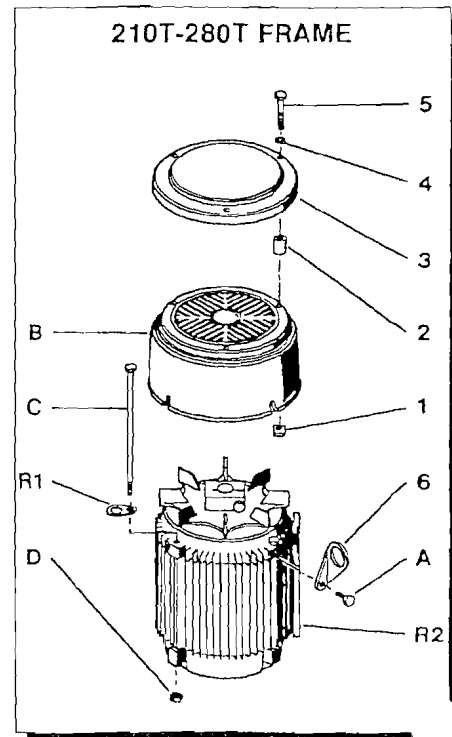
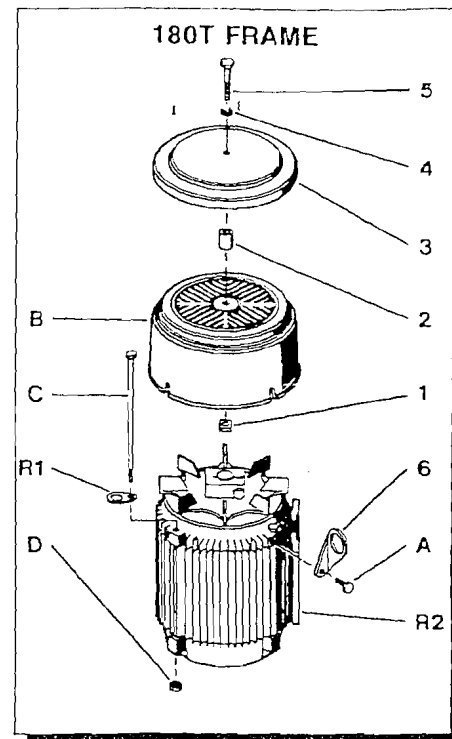
If feet (item R2) are not required for footless installation, refer to mounting foot removal/reposition procedure on page 2.

210T-280T FRAME

REASSEMBLY

3. Replace overbolts and nuts (items C and D-Qty. 2 each) and alternately tighten all 4 overbolts to a torque of 12 lb. ft.
4. Place square nuts (item 1-Qty. 3) into recesses inside fan cover.
5. Position spacers, canopy cap, lock washers and screws (items 2, 4, and 5-Qty. 3; item 3-Qty. 1) on fan cover as shown and tighten.
6. Replace fan cover. (item B).
7. Place new lifting lugs (item 6-Qty. 2) across from each other, outside fan cover, and tighten screws (item A-Qty. 4) to 12 lb. ft.

If feet (item R2) are not required for footless installation, refer to mounting foot removal/reposition procedure on page 3.



ATTENTION: Read carefully before attempting to install, operate, or service your motor.
Retain for future reference.

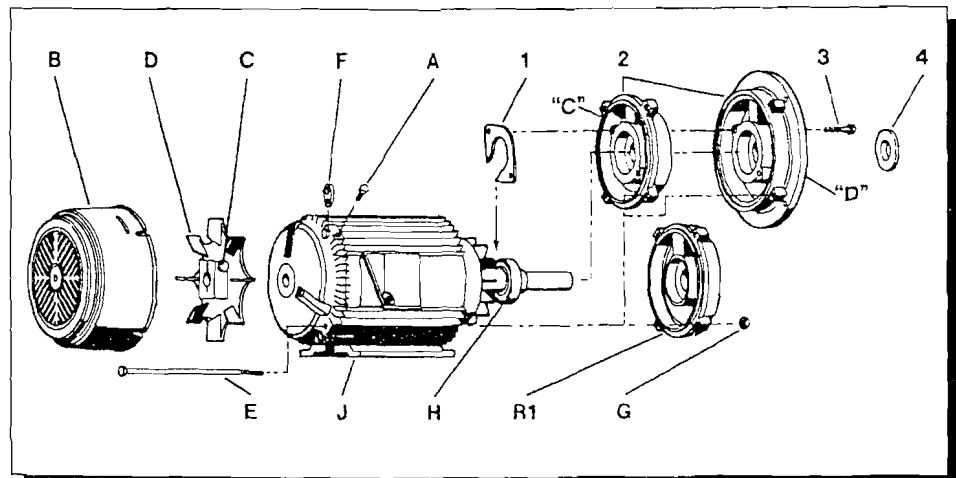
SAFETY FIRST, PROTECT YOURSELF AND YOUR EQUIPMENT

1. Be familiar with the equipment and read your manual thoroughly before you work on the equipment.
2. Always disconnect electrical power at the motor starter, fuse box, or circuit breaker before handling electrical connections. Double check to be sure power is off and that it cannot be turned on while you are working on the equipment.
3. Use proper electrical installation wiring and controls consistent with local and national electrical codes. Refer to "National Electrical Code Handbook" — NFPA No. 70. Employ qualified electricians.
4. Refer to motor nameplate for proper power supply requirements. Be sure connections are tight and adequately taped to prevent shorts and to assure maximum protection against moisture.
5. Be sure unit is electrically grounded and mounting bolts are secure.
6. Keep tools, clothing and hands away from rotating or moving parts while equipment is running.
7. Use safety glasses to protect your eyes when inspecting equipment while it is running.
8. * Observe good safety habits at all times and use care to avoid injury to yourself or damage to your equipment.

The above should not be considered as limiting in safety precautions to be followed. Local conditions, environments and prudent judgement in safety should be considered at all times.

NEMA "C" FACE IS STANDARD FOR 56-140T FRAME, ALL TYPES EXCEPT UT MULTISPEED, UTE AND UTN.

**NEMA "C" FACE KIT INSTALLATION PROCEDURE—180T-280T FRAME
& NEMA "D" FLANGE KIT INSTALLATION PROCEDURE—180T FRAME**



DISASSEMBLY

1. Unscrew screws (item A-Qty. 4) and remove fan cover (item B).
2. Loosen bolt(s) (item C) and remove fan (item D).
3. Remove nuts and overbolts (items G & E-Qty. 4 each) and lifting lugs (item F-Qty. 2) and note position for later reassembly.
4. Remove pulley end bracket, (item R1). Item R1 not required for reassembly.
5. Move rotor assembly, (item H) forward until front bearing is clearly visible as shown.

6. After disassembly (step 5) check to see if motor has snap ring out board of bearing. If not, install snap ring provided in this kit.

REASSEMBLY

7. Fill "C" ("D") bracket grease cavity $\frac{1}{2}$ full of grease (See operating instructions).
8. Insert new bearing clamp (item 1) behind bearing as indicated.
9. Position new "C" ("D") bracket (item 2) and align bearing clamp holes with corresponding "C" ("D") bracket holes.
10. Insert new bearing clamp screws (item 3-Qty. 2), and alternately tighten.
11. Position "C" ("D") bracket and rotor assembly (items 2 & H) with motor frame. Align bolt holes with those on short end bracket.
12. Reinstall lifting lugs (item F-Qty. 2) overbolts and nuts (items G & E-Qty. 4 each), and alternately tighten to torque value shown.

FRAME SIZE	TORQUE VALUE
180	6 lb. ft.
210 thru 280	12 lb. ft.

NOTE: 180 "C" bracket with 8- $\frac{1}{2}$ inch AK does not require reinstallation of nuts (item G) or lifting lug (item F) on pulley end.

13. Replace fan (item D) and tighten bolt(s) (item C).
14. Replace fan cover (item B) and secure with screws (item A-Qty. 4).
15. Place water deflector (item 4-Qty. 1) over shaft and press against bracket face.
16. Rotate shaft by hand several times to ensure free movement and proper reassembly.

If NEMA mounting dimensions are required, mounting base (item J) must be repositioned . . . refer to mounting feet removal/reposition procedure on pages 2 & 3.

MOUNTING BASE ON 56-140T FRAMES ARE WELDED AND CANNOT BE REMOVED.

MOUNTING FOOT REMOVAL/REPOSITION PROCEDURE (NEMA "C" FACE & "D" FLANGE) — 180T FRAME

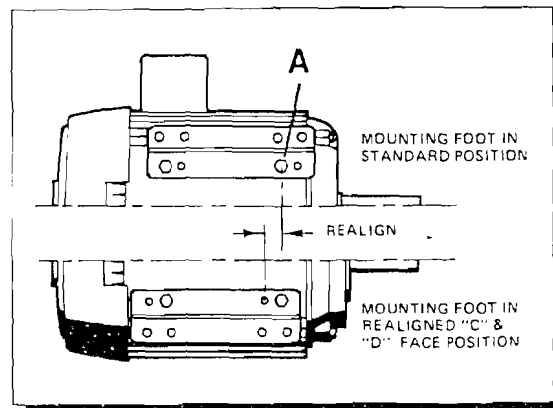
DISASSEMBLY/REMOVAL

1. Remove all screws, (item A-Qty. 4). Notice location of holes used in mounting feet, standard position.

NOTE: For footless installation, screws & mounting feet are not required.

REASSEMBLY

2. Move mounting feet toward rear of motor until the second set of holes in motor feet are aligned with holes in frame.
3. Replace and tighten all screws (item A-Qty. 4) securely to the torque value shown on mounting feet.



MOUNTING FOOT REMOVAL/REPOSITION PROCEDURE (NEMA "C" FACE) — 210T-280T FRAME

NOTE: 280 FRAME UNITS ALREADY MEET NEMA "C" FACE MOUNTING. BASE CANNOT BE REPOSITIONED.

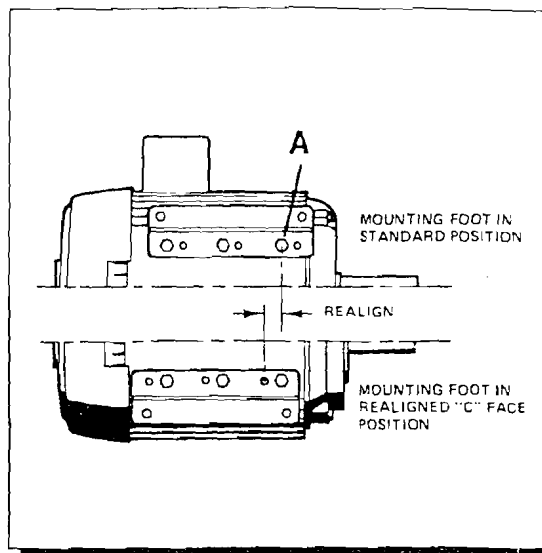
DISASSEMBLY

1. Remove all screws (item A-Qty. 6). Notice marking on bottom of feet, indicating position of feet with use of standard bracket.

NOTE: For Footless installation, screws & mounting feet are not required.

REASSEMBLY

2. Interchange mounting feet so that marking P.E. → C is closest to shaft. 250T Frame only.
3. Replace and tighten all screws (item A-Qty. 6) securely to the torque values indicated on mounting feet.



CANOPY CAP KIT INSTALLATION PROCEDURE — 56-140T FRAME

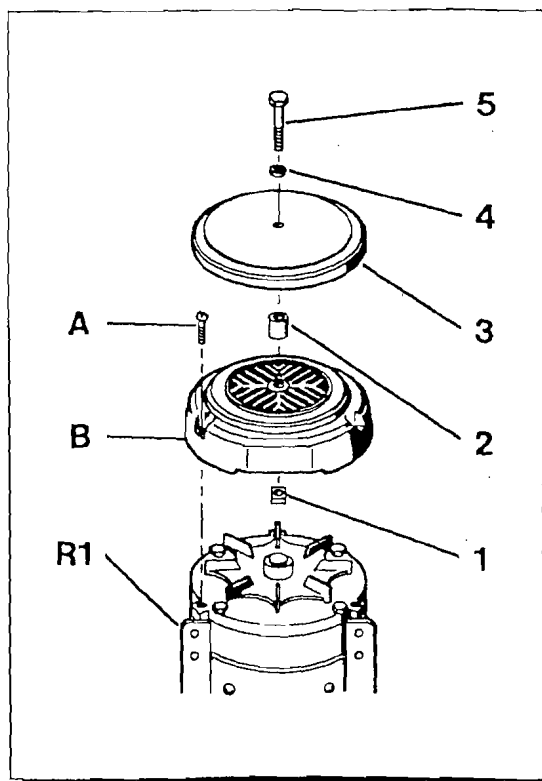
DISASSEMBLY

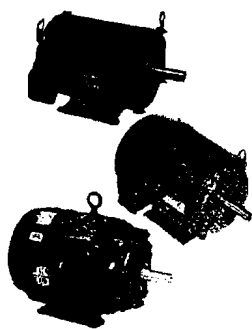
1. Unscrew screws (item A-Qty. 3) and remove fan cover (item B).

REASSEMBLY

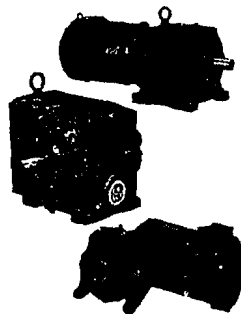
2. Place square nut (item 1) into recess inside fan cover.
3. Position spacer, canopy cap, lock washer and bolt (items 2, 3, 4, and 5) on fan cover (item B) as shown and tighten.
4. Reposition fan cover (item B) and secure with screws (item A-Qty. 3).

Mounting base is welded and cannot be removed.

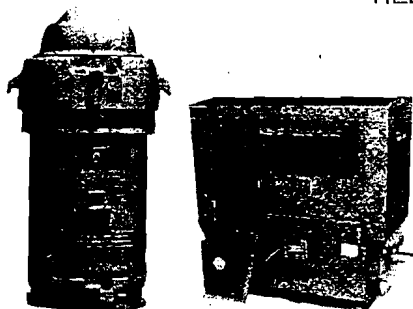




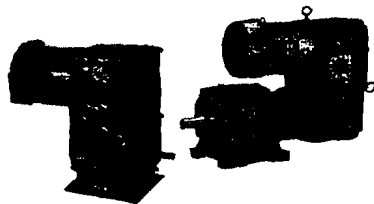
HORIZONTAL
MOTORS



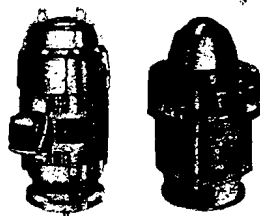
GEARMOTORS AND
REDUCERS



TITAN MOTORS



VARIABLE SPEED DRIVES



VERTICAL MOTORS

U.S. ELECTRICAL MOTORS

DIVISION OF EMERSON ELECTRIC CO.
ST. LOUIS, MO

Send for free brochure by product name.



WARRANTY

LIMITED WARRANTY

All U.S.E.M. products are warranted against defects in workmanship and materials for 12 months from date of installation, not to exceed 18 months from date of shipment from U.S.E.M. Some of U.S.E.M.'s products carry a warranty period longer than 12 months. Please refer to the current price catalog or to U.S.E.M. for details on specific products. This limited warranty does not apply to any product which has been subject to misuse, misapplication, neglect (including without limitation, inadequate maintenance), accident, improper installation, modification, adjustment, or repair. This constitutes U.S.E.M.'s only warranty in connection with this sale and is in lieu of all other warranties, expressed or implied, written or oral. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE THAT APPLY TO THIS SALE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of U.S.E.M. nor to assume for U.S.E.M. any other liability in connection with any of its products.

EXCLUSIVE REMEDY

U.S.E.M.'s liability shall be limited exclusively to repairing or replacing any product found by U.S.E.M. to be defective, or at U.S.E.M.'s option, to refund the purchase price of its product. Such product shall be returned, freight prepaid, to the nearest U.S.E.M. authorized service station or U.S.E.M. factory. It is agreed that such replacement, repair, or refund be the sole and exclusive remedies available from U.S.E.M.. U.S.E.M. shall not be liable for damages of any sort whatsoever beyond these exclusive remedies including incidental and consequential damages regardless of whether any claim is based upon contract, negligence, strict liability, tort, warranty, or other basis. The repair or replacement of the product, or the refund of the purchase price, at U.S.E.M.'s option, constitutes fulfillment of all liabilities of U.S.E.M. to the buyer for defective products.

RENEWAL PARTS AND WARRANTY SERVICE

When inquiring for renewal parts, call the nearest U.S. Electrical Motors Parts Stocking Distributor. For warranty service, call the nearest U.S. Electrical Motors Authorized Service Station. Give them complete Nameplate data, including identification number, etc.

Request installation and maintenance manuals by product name.

SALES REGION	PHONE	TOLL-FREE	FAX
ORANGE, CONNECTICUT	203 - 891 - 1080	800 - 243 - 2700	203 - 891 - 1077
CHICAGO, ILLINOIS	630 - 924 - 5200	800 - 523 - 5223	630 - 893 - 0182
MEMPHIS, TENNESSEE	901 - 794 - 5500	N/A	901 - 794 - 0741
DALLAS, TEXAS	972 - 644 - 0470	800 - 683 - 4126	972 - 644 - 0254
SANTA FE SPRINGS, CA	562 - 906 - 3945	800 - 854 - 3302	562 - 941 - 1858
INTERNATIONAL SALES	314 - 553 - 2196	N/A	314 - 553 - 2135
MONTREAL, QUEBEC/CAN.	514 - 332 - 1880	800 - 361 - 5509	514 - 332 - 5912
MARKHAM, ONTARIO/CAN.	905 - 475 - 4670	N/A	905 - 475 - 4672
MONTERREY, MEXICO	528 - 389 - 1300	N/A	528 - 389 - 1310
CARACAS, VENEZUELA	582 - 237 - 7522	N/A	582 - 232 - 9727
BOGOTA, COLOMBIA	571 - 439 - 5420	N/A	571 - 439 - 5417

FOR SERVICE CALL:

NEAREST U.S.E.M. AUTHORIZED SERVICE STATION OR U.S.E.M. PRODUCT SERVICE
ST. LOUIS, MO 314-553-2660.

VISIT OUR WEB SITE www.usmotors.com

For your safety, read and follow instructions.

GREASE LUBRICATION INSTRUCTIONS

Units are prelubricated at the factory and do not require initial lubrication. Relubricating interval depends upon speed, type of bearing and service. Refer to Table 1 for suggested regreasing intervals. Operating conditions may dictate more frequent lubrication. Motor must be at rest and electrical controls should be locked open to prevent energizing while motor is being serviced (refer to section on Safety). If motor is being taken out of storage, refer to storage procedures.

To relubricate bearings, remove the drain plug. Inspect grease drain and remove any blockage with a mechanical probe taking care not to damage bearing. CAUTION: Under no circumstances should a mechanical probe be used while the motor is in operation. Add new grease at the grease inlet, refer to Table 1 for replenishment quantities. New grease must be compatible with grease in the motor (See Caution Note). Run the motor for 15 to 30 minutes with the drain plug removed to allow purging of any excess grease. Shut off unit and replace the drain plug. Return motor to service.

CAUTION

Overgreasing can cause excessive bearing temperatures, premature lubricant breakdown and bearing failure. Care should be exercised against overgreasing.

Table 1
Recommended Grease Replenishment Quantities & Intervals
(For lubrication of units in service)

Bearing Number		Grease Fl. Oz.	Lubrication Interval		
62XX	63XX		3600 RPM	1800 RPM	1200 RPM
6203-6207	6303-6306	0.2	2 Years	3 Years	3 Years
6208-6212	6307-6309	0.4	1 Year	2 Years	2 Years
6213-6215	6310-6311	0.6	1 Year	2 Years	2 Years
6216-6220	6312-6315	1.0	6 Mos.	1 Year	2 Years
6221-6226	6316-6320	1.8	6 Mos.	1 Year	1 Year

For motors mounted vertically or in hostile environments, reduce intervals shown by 50 percent.

Refer to motor nameplate for bearings provided on a specific motor.

For bearings not listed in table above, the amount of grease required may be calculated by the formula:

$$G = 0.11 \times D \times B$$

Where;

G = Quantity of grease in fluid ounces.
D = Outside diameter of bearing in inches.
B = Width of bearing in inches.

Table 2
RECOMMENDED GREASES

THE FOLLOWING GREASES ARE INTERCHANGEABLE WITH THE GREASE AS PROVIDED IN UNITS SUPPLIED FROM FACTORY (UNLESS STATED OTHERWISE ON A LUBRICATION NAMEPLATE PROVIDED ON MOTOR).

MANUFACTURER	GREASE (NLGI No. 2)
CHEVRON U.S.A. INC.	SRI No. 2
SHELL OIL CO.	DOLIUM-R

CAUTION

Greases of different bases (lithium, polyurea, clay, etc.) may not be compatible when mixed. Mixing such greases can result in reduced lubricant life and premature bearing failure. When necessary, prevent such intermixing by disassembling the motor, removing all old grease from bearings and housings (including all grease fill and drain holes). Inspect and replace damaged bearings. Fill bearing housings and bearing approximately 30% full of new grease. Remove any excess grease extending beyond the edges of the bearing races and retainers. Refer to Table 2 for recommended greases.

INSTALLATION 0

SAFETY FIRST

High voltage and rotating parts can cause serious or fatal injury. Safe installation, operation and maintenance must be performed by qualified personnel. Familiarization with, and adherence to, NEMA MG2, the National Electrical Code (NEC), and local codes is required. It is important to observe safety precautions to protect personnel from possible injury. Personnel should be instructed to:

1. Be familiar with the equipment and read all instructions thoroughly before installing or working on equipment.
2. Avoid contact with energized circuits or rotating parts.
3. Disconnect all power sources before initiating any maintenance or repair.
4. Act with care in accordance with prescribed procedures in handling and lifting this equipment.
5. Be sure unit is electrically grounded in accordance with code requirements.
6. Be sure equipment is properly enclosed or protected to prevent access by children or other unauthorized personnel to prevent possible accidents.
7. Be sure shaft key is fully captive before unit is energized.
8. Avoid contact with capacitors until safe discharge procedures have been completed.
9. Provide proper guarding for personnel against rotating parts and applications involving high inertia loads which can cause overspeed.
10. Avoid extended exposure to equipment with high noise levels.

INSPECTION AND HANDLING

Inspect unit to make sure no damage has occurred during shipment. Check nameplate for correct speed, horsepower, voltage, Hertz and phase for conformance with power supply and equipment. **WARNING:** Units should be lifted using all eyebolts or lugs if provided. These eyebolts or lugs are provided for lifting this unit only and must not be used to lift any additional weight. Lifting angle, from shank of eyebolt, must not exceed 30 degrees for machines with single and 45 degrees for machines with multiple lifting means. Replacement eyebolts must be per ASTM A489 or equivalent. All eyebolts must be securely tightened. Be careful not to touch overhead power lines with lifting equipment. Failure to observe this warning may result in serious personal injury.

STORAGE

Units should be stored indoors, in a clean, dry location & winding should be protected from excessive moisture absorption. **NOTE:** If motors are to be stored for over one year, refer to U.S. Electrical Motors. If gear and belt transmission units are to be stored for over six months, refer to U.S. Electrical Motors.

LOCATION

WARNING: Use only UL Listed Hazardous Location Motors for service in Hazardous Locations as defined in Article 500 of the NEC. Units should be located in a clean, well-ventilated area. **WARNING:** Units should be located in a suitable enclosure or protected to prevent access by children or other unauthorized personnel to prevent possible accidents.

INSTALLATION / MOUNTING

Mount unit on a firm, flat surface sufficiently rigid to prevent vibration. Drive belts and chains should be tensioned in accordance with supplier recommendations. Couplings

OPERATION & MAINTENANCE

should be properly aligned and balanced. For belt, chain and gear drive selection refer to the drive or equipment manufacturer. For application of drive equipment refer to applicable information in NEMA MG1.

Motors have been dynamically balanced using a half key the same length as the full key shipped with the motor. If pulley length keyway is less than this length, rework long key by removing one-half of excess length, between pulley and end of key to maintain balance.

Do not restrict motor ventilation. Unless otherwise specified on nameplate, motor is designed for operation in accordance with NEMA MG1 "Usual Service Conditions" which states an ambient temperature range of -15°C to 40°C (5°F to 104°F). Standard grease lubricated units are suitable for operation within this temperature range, special lubricants may be required for ambient temperatures outside of this range. Note: Motors operating under rated load and allowable ambient conditions may feel hot when touched; this is normal and should not be cause for concern. When in doubt, measure frame surface temperature and confer with nearest office. Enclosed motors normally have condensation drain openings. Insure that drain openings are properly located and open (plugs removed) for the motor mounting position. Drain openings should be at lowest point of end brackets, frame housing and terminal housing when the motor is installed. This may require modification of motor to accomplish. If unit appears wet, and/or has been stored in a damp location, dry out thoroughly and check for adequate insulation resistance to ground before operating.

WARNING: Guards should be provided for all exposed rotating parts to prevent possible personal injury. Keep fingers and foreign objects away from ventilation and other openings. Applications involving *high inertia loads* may damage this equipment due to motor overspeed during coast shutdown. Such applications should be referred to U.S. Electrical Motors.

CAUTION: Do not force drive coupling or other equipment onto shaft, as bearing damage may result.

POWER SUPPLY AND CONNECTIONS

The power supply must agree with values on nameplate. Terminal voltage should not vary more than $\pm 10\%$ of nameplate voltage at rated frequency. Unbalanced line voltage, greater than one percent, can cause overheating. Do not exceed the rated load amperes on the nameplate. Starting controls and overload protection should be properly sized in accordance with the NEC and the control manufacturer's recommendations.

Motor connections should be made by following instructions on connection diagram. Determine direction of rotation before connecting driven equipment. If direction of rotation label is supplied, operate only in specified direction. Rotation may be reversed on three phase motors by interchanging any two line connections. On single phase motors interchange leads per connection diagram on motor. Wiring of units, controls and grounding shall be in accordance with local and NEC requirements. **WARNING:** Failure to properly ground unit may cause serious injury to personnel. Where unexpected starting could be hazardous to personnel, do not use automatic reset starting devices.

USE OF VARIABLE FREQUENCY DRIVES

Electric motors can be detrimentally affected when applied with variable frequency drives (VFD's). The non-sinusoidal waveforms of VFD's have harmonic content which causes additional motor heating; and high voltage peaks and short rise times, which result in increased insulation stress, especially when long power cable lengths are used.

E INSTRUCTIONS

Other effects of VFD's on motor performance include reduced efficiency, increased load current, vibration and noise. Standard motors utilized with VFD's must be limited to those application considerations defined in NEMA MG-1 Part 30.

NEMA MG-1 Part 31 defines performance and application considerations for Definite-Purpose Inverter Fed Motors. To insure satisfactory performance and reliability, U.S. Electrical Motors offers and recommends nameplated inverter duty motor products which meet the requirements of NEMA MG-1 Part 31. The use of non-inverter duty motors may result in unsatisfactory performance or premature failure, which may not be warrantable under the Terms and Conditions of Sale. Contact your U.S. Electrical Motors Field Sales Engineer for technical assistance for motor selection, application and warranty details.

OIL LUBRICATION

Most oil lubricated units are shipped without oil. Refer to Instruction Manual with unit for specific type and grade of oil to be used, change interval and level. If lubrication instructions specify synthetic oil, do not substitute. **WARNING:** For applications in the food and drug industry (including animal food), consult the petroleum supplier for lubricants that are acceptable to the Food and Drug Administration and other governing bodies.

MAINTENANCE

Inspect units at regular intervals. Keep units clean and ventilation openings clear of dust, dirt or other debris. Lubricate units per this operating instruction folder and instruction plate on unit. Excessive lubrication may damage the unit. Do not overgrease. **WARNING:** Disconnect all power sources to the unit and discharge all parts which may retain an electrical charge before attempting any maintenance or repair. Screen and covers must be maintained in place when unit is in operation. Failure to observe this warning may result in personal injury.

U.L. listed Motors For Use in Hazardous Locations: Repair of these motors must be made by the manufacturer or manufacturer's authorized service station approved to repair U.L. Listed Motors. The U.L. listing applies to the electric motor only and not to the belt or gear transmissions or other devices that may be connected to the motor.

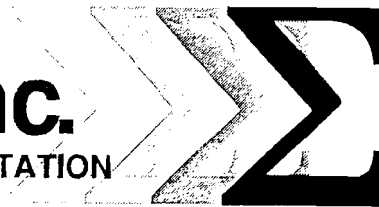
VARIDRIVE UNITS

Do not turn speed control hand wheel while unit is not operating; this may cause damage to the unit. Handwheel position is a relative speed indication only. Use direct speed sensing accessory for precise speed indication. Units equipped with electric remote speed indicator accessory are not calibrated at the factory and must be calibrated at site. Refer to calibration instructions with the unit.

VARIDRIVES equipped with ENDOLUBE construction do not require lubrication of the sliding Varidisc. Operate VARIDRIVE through its entire speed range weekly. **WARNING:** Do not force control wheel beyond speed limits shown on the nameplate. The mechanism and belt are designed for the rated speed and horsepower shown on the nameplate. Operation beyond these limits may result in damage to the belt and mechanism and possible injury to personnel. The covers on the frame case must not be removed or left off while unit is in operation. Do not attempt to disassemble or repair the driven pulley discs because high spring tension may be released causing injury to personnel. Refer to authorized Service Center. Refer to VARIDRIVE Installation and Maintenance Manual for complete belt changing instructions. For additional detailed information, request specific product installation and maintenance manual.

13300-01-A
PROCESS INSTRUMENTATION AND CONTROLS

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134



SUBMITTAL
FOR
CAMERON GREAT LAKES
FOR
REMEDATION CONTROLS
ACTIVE INDUSTRIAL UNIFORM SITE

NOTE – The motor for pump P1 was changed from a 7-1/2 hp to a 15 hp motor after this submittal package was prepared. *The drawings at the back of the submittal have been updated to reflect this change.* The reader is requested to change remaining text references for P1 to read “15 hp.” All references to the motor for P1 will be changed to read “15 hp” in the final “as built” version of this submittal.

BY:

Cameron Great Lakes SO # 77977
Blue Water Env'tal PO # 02370-109
Law Project # 22000-0-0019 Ph. 300
Active Industrial Site - NYSDEC

SIGMA CONTROLS, INC.
SYSTEMS DIVISION
LES SOUTER
JUNE 19, 2001

CONTENTS

SECTION 1)	CONTROL OVERVIEW
SECTION 2)	MAIN CONTROL PANEL & APPURTENANCES
SECTION 3)	MAGNETIC FLOWMETERS
SECTION 4)	PRESSURE SWITCHES
SECTION 5)	LEVEL SWITCHES
SECTION 6)	PRESSURE GAUGE
SECTION 7)	TEMPERATURE GAUGE
SECTION 8)	FLOW SWITCH
SECTION 9)	WIRING & LAYOUT DRAWINGS AND BOM

CONTROL DESCRIPTIONS

1. Well Sites RW-1, RW-2 and RW-SP (Spare):

Well Pumps:

Monitoring and Control:

The two ground water well pumps will run continuously. The blower will start when any recovery well pump hand switch is turned to 'Auto.' The pumps start-up will be delayed by 1 minute (Operator settable) to allow the blower to reach the design air flow rate. A current monitoring pump controller will prevent the pump from running dry. The flow will be monitored and totalized for each well. The low flow alarm will be generated when the totalized daily flow is outside the operator's deadband (hi/lo limits). Low flow will not shut off the pump since the pump will be controlled locally by the current monitoring well pump controller.

Well Pump will stop if one of the following occurs:

1. Air stripper 1 or 2 sump Level Alarm Hi-Hi (LAHH). A float switch will also be used as backup to the calculated hi-hi level transducer output.
2. Building sump Level Alarm Hi-Hi (LAHH)
3. Blower low air flow (FSL)
4. Blower not in 'Auto'

On a hi-hi level in the building sump, or a low blower air flow the whole treatment system will be shut down. The system must be reset manually after these conditions have been corrected.

Note: RW-SP (spare) controls will be inactivated at start-up to prevent false alarms. The spare well controls will be provided to facilitate future well installation.

2. Air Stripper Blower Operation:

The air stripper blower starts when the blower (B-1) is in 'Auto' and RW-1, RW-2, RW-Spare or Transfer Pump 1 (P-1) starts. B-1 stops 5 minutes (operator settable) after the last of RW-1, RW-2, RW-SP and P-1 stops. The blower will not operate during acid

recirculation (P-3 in 'Auto').

Emergency Stop: The Blower will stop following shutdown of the recovery wells for other alarms.

3. Transfer Pumps (P-1, P-2, P-3, P-4):

Monitoring and Control:

The following monitoring and control description is based on a variable speed transfer pump. The flow can also be controlled by a motorized valve on the discharge of the transfer pump (a motorized valve will require the addition of a high pressure shut down alarm).

Transfer pump 1 (P-1):

P-1 starts when the air stripper 1 sump level is at or above high level setpoint (Operator settable). The pump speeds shall be varied to keep the air stripper sump at a constant level setpoint (Operator settable). P-1 will be limited to a maximum flow rate (operator settable). P-1 shall stop when air stripper 1 sump level is at or below low level setpoint or an emergency stop alarm condition exists.

Emergency Stop. P-1 will stop for the following conditions:

1. Air stripper 2 sump Level Alarm Hi-Hi (LAHH)
2. Air Stripper 1 or 2 differential air Pressure Alarm Hi (PAH)
3. Cartridge filter system Pressure Alarm Hi (PAH)
4. Air flow Switch Low (FSL)
5. Building sump Level Alarm Hi-Hi (LAHH)

Transfer pump 2 (P-2):

P-2 starts when the air stripper 2 sump level is at or above high level setpoint (Operator settable). The pump speeds shall be varied to keep the air stripper sump at a constant level setpoint (Operator settable). Transfer pump 2 (P-2) shall stop when air stripper 2 sump level is at or below low level setpoint or an alarm condition exists.

Emergency Stop. P-2 will stop for the following conditions:

1. Acid storage tank Level Alarm Hi-Hi (LAHH)
2. Cartridge filter system Pressure Alarm Hi (PAH)
3. Air flow Switch Low (FSL)
4. Building sump Level Alarm Hi-Hi (LAHH)

Transfer Pump 3 (P-3):

P-3 will operate from a 'Hand - Off - Auto' hand switch on the control panel.

When P-3 is in 'Auto', the pump will stop for low level in the acid storage tank

reaches and start when the tank is at or above high level.

Emergency Stop. P-3 will stop for the following conditions:

1. Air Stripper 1 sump Level Alarm Hi-Hi (LAHH)
2. Air Stripper 1 or 2 differential air Pressure Alarm Hi (PAH)
3. Building sump Level Alarm Hi-Hi (LAHH)
4. Secondary containment Level Alarm Hi-Hi (LAHH)

Moisture Separator Pump (P-4):

P-4 will operate from a 'Hand - Off - Auto' hand switch on the control panel. When P-4 is in 'Auto', the pump will turn on for high level in the moisture separator and turn off at low level. An alarm will be generated for Hi-Hi level in the moisture separator.

Emergency Stop: P-4 must be stopped if one of the following occurs:

1. Air stripper 1 or 2 sump Level Alarm Hi-Hi (LAHH)
2. Air flow Switch Low (FSL)
3. Building sump Level Alarm Hi-Hi (LAHH)

The transfer pumps must be reset from the panel or PLC for an auto start after an emergency stop.

4. Building Sump Pump:

Monitoring:

The building sump pump (P-5) is controlled locally by a level switch. The pump run status is monitored and level high alarms generated.

Emergency Stop: P-5 must be stopped if one of the following occurs:

1. Air stripper 1 or 2 sump Level Alarm Hi-Hi (LAHH)
2. Air flow Switch Low (FSL)
3. Building sump Level Alarm Hi-Hi (LAHH)

The pump will operate automatically after the emergency stop condition is corrected when in the 'Auto' mode.

5. Chemical Transfer Pump/Acid Recirculation system:

The acid recirculation system is a manned operation with only minimal controls (P-3) above). All valves must be modified manually. An alarm is generated if the acid storage tank reaches Level Alarm Hi-Hi (LAHH). The chemical transfer pump (P-6) is a manual operation. Do not fill tank if at high level.

Surge Protection

SECTION 2

MAIN CONTROL PANEL

- A) ENCLOSURE
- B) DISCONNECT SWITCH
- C) CONTROL TRANSFORMER
- D) MOTOR STARTERS & OVERLOADS
- E) VARIABLE SPEED DRIVES
- F) OPERATOR LIGHTS & SWITCHES
- G) WELL PUMP MONITOR
- H) PROGRAMMABLE LOGIC CONTROLLER
- I) OPERATOR INTERFACE
- J) ALARM ANNUNCIATOR

SECTION 2-A

ENCLOSURE

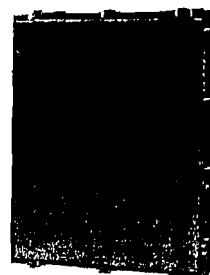
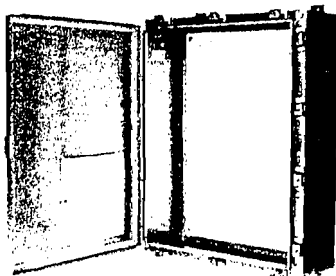
NEMA 4X SS, SINGLE DOOR ENCLOSURE 72 X 30 X 12

CONTROL ENGINEERING # 4WMSS-072-030-012SD



NEMA 4X STAINLESS STEEL SINGLE DOOR WALL MOUNT ENCLOSURES

NEMA 4



APPLICATIONS - Designed to house electrical controls, instruments, and terminals in wet and corrosive environments. Applications may include: food processing, sewage, packing and chemical plants, as well as breweries, dairies, and outdoor locations.

CONSTRUCTION - Fabricated from 14 gauge Type 304 stainless steel with continuously welded seams, without holes or knockouts. An adhesive backed, oil-resistant gasket applied to the door provides a tight seal in conjunction with the rolled lip flange around the opening on the enclosure. External feet are provided for wall or machinery mounting. Doors have a continuous hinge with removable hinge pins, and are secured with clamps. All hardware is stainless steel. These enclosures feature a print pocket, padlocking provisions, and on larger sizes

door and body stiffeners are added for extra rigidity. 12 gauge mild steel sub-panels mounted on collar studs are included.

FINISH - Polished on five sides. The mild steel sub-panel has a white polyester powder coat finish.

CUSTOM BUILD - C.E.C. will custom design enclosures according to your specifications. Special finishes, holes, hubs, cutouts, louvers, sizes, materials, and many more options are available. Quotations made upon request.

MODIFICATIONS - C.E.C. will modify standard stock enclosures to customer specifications. Quotations made upon request.

UL LISTED - Listed by Underwriters Laboratories, Inc.

STANDARD SIZES

Catalog Number	Part Number	Enclosure Size H x W x D	Panel Size
4WMSS-012-024-006-SD	37600	12 x 24 x 6	9 x 21
4WMSS-016-012-006-SD	37601	16 x 12 x 6	13 x 9
4WMSS-016-020-006-SD	37602	16 x 20 x 6	13 x 17
4WMSS-020-016-006-SD	37603	20 x 16 x 6	17 x 13
4WMSS-020-020-006-SD	37604	20 x 20 x 6	17 x 17
4WMSS-020-024-006-SD	37605	20 x 24 x 6	17 x 21
4WMSS-024-012-006-SD	37606	24 x 12 x 6	21 x 9
4WMSS-024-020-006-SD	37607	24 x 20 x 6	21 x 17
4WMSS-024-024-006-SD	37608	24 x 24 x 6	21 x 21
4WMSS-030-020-006-SD	37609	30 x 20 x 6	27 x 17
4WMSS-030-024-006-SD	37610	30 x 24 x 6	27 x 21
4WMSS-036-024-006-SD	37611	36 x 24 x 6	33 x 21
4WMSS-036-030-006-SD	37612	36 x 30 x 6	33 x 27
4WMSS-012-024-008-SD	37613	12 x 24 x 8	9 x 21
4WMSS-016-012-008-SD	37614	16 x 12 x 8	13 x 9
4WMSS-016-020-008-SD	37615	16 x 20 x 8	13 x 17
4WMSS-020-016-008-SD	37616	20 x 16 x 8	17 x 13
4WMSS-020-020-008-SD	37617	20 x 20 x 8	17 x 17
4WMSS-020-024-008-SD	37618	20 x 24 x 8	17 x 21
4WMSS-024-012-008-SD	37619	24 x 12 x 8	21 x 9
4WMSS-024-020-008-SD	37620	24 x 20 x 8	21 x 17
4WMSS-024-024-008-SD	37621	24 x 24 x 8	21 x 21

STANDARD SIZES

Catalog Number	Part Number	Enclosure Size H x W x D	Panel Size
4WMSS-030-020-008-SD	37623	30 x 20 x 8	27 x 17
4WMSS-030-024-008-SD	37624	30 x 24 x 8	27 x 21
4WMSS-030-036-008-SD	37625	30 x 36 x 8	27 x 33
4WMSS-036-024-008-SD	37626	36 x 24 x 8	33 x 21
4WMSS-036-030-008-SD	37627	36 x 30 x 8	33 x 27
4WMSS-042-024-008-SD	37628	42 x 24 x 8	39 x 21
4WMSS-042-030-008-SD	37629	42 x 30 x 8	39 x 27
4WMSS-042-036-008-SD	37630	42 x 36 x 8	39 x 33
4WMSS-048-024-008-SD	37631	48 x 24 x 8	45 x 21
4WMSS-048-030-008-SD	37632	48 x 30 x 8	45 x 27
4WMSS-048-036-008-SD	37633	48 x 36 x 8	45 x 33
4WMSS-060-036-008-SD	37634	60 x 36 x 8	57 x 33
4WMSS-016-012-010-SD	37635	16 x 12 x 10	13 x 9
4WMSS-020-016-010-SD	37636	20 x 16 x 10	17 x 13
4WMSS-024-020-010-SD	37639	24 x 20 x 10	21 x 17
4WMSS-024-024-010-SD	37640	24 x 24 x 10	21 x 21
4WMSS-030-020-010-SD	37641	30 x 20 x 10	27 x 17
4WMSS-030-024-010-SD	37642	30 x 24 x 10	27 x 21
4WMSS-036-024-010-SD	37643	36 x 24 x 10	33 x 21
4WMSS-036-030-010-SD	37644	36 x 30 x 10	33 x 27
4WMSS-042-030-010-SD	37645	42 x 30 x 10	39 x 27
4WMSS-042-036-010-SD	37646	42 x 36 x 10	39 x 33

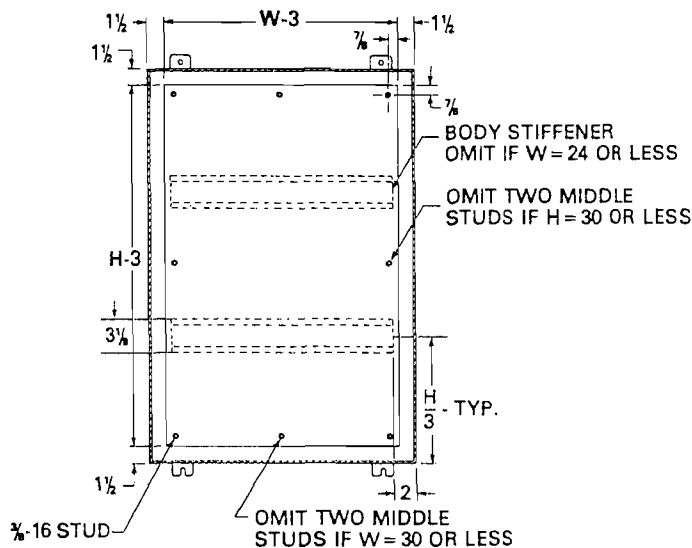
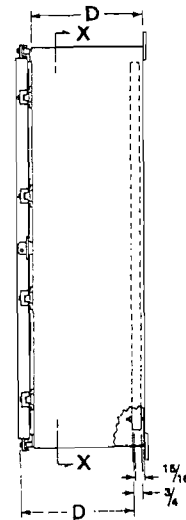
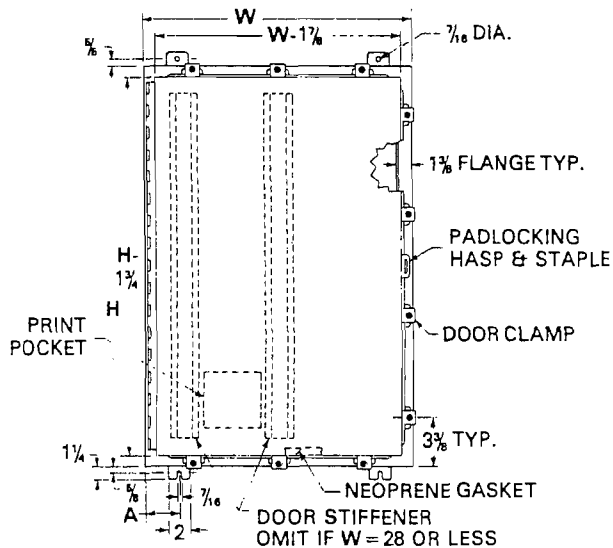
NEMA 4X STAINLESS STEEL SINGLE DOOR WALL MOUNT ENCLOSURES

STANDARD SIZES

Catalog Number	Part Number	Enclosure Size H x W x D	Panel Size
4WMSS-048-030-010-SD	37647	48 x 30 x 10	45 x 27
4WMSS-048-036-010-SD	37648	48 x 36 x 10	45 x 33
4WMSS-060-036-010-SD	37649	60 x 36 x 10	57 x 33
4WMSS-020-016-012-SD	37650	20 x 16 x 12	17 x 13
4WMSS-024-020-012-SD	37651	24 x 20 x 12	21 x 17
4WMSS-024-024-012-SD	37652	24 x 24 x 12	21 x 21
4WMSS-030-024-012-SD	37653	30 x 24 x 12	27 x 21
4WMSS-036-030-012-SD	37654	36 x 30 x 12	33 x 27

STANDARD SIZES

Catalog Number	Part Number	Enclosure Size H x W x D	Panel Size
4WMSS-048-036-012-SD	37655	48 x 36 x 12	45 x 33
4WMSS-060-036-012-SD	37656	60 x 36 x 12	57 x 33
4WMSS-072-030-012-SD	37657	72 x 30 x 12	69 x 27
4WMSS-024-024-016-SD	37658	24 x 24 x 16	27 x 17
4WMSS-030-024-016-SD	37659	30 x 24 x 16	27 x 21
4WMSS-036-030-016-SD	37660	36 x 30 x 16	33 x 27
4WMSS-048-036-016-SD	37661	48 x 36 x 16	45 x 33
4WMSS-060-036-016-SD	37662	60 x 36 x 16	57 x 33



SECTION X-X

NOTE:

1. Print pocket - 6x6, when $H \times W$ is 30x20 or more, pocket is 10x10.
2. Panel flanged on 4 sides when size exceeds 17x17.
3. Clamps located along 3 sides of door as required by enclosure size.
4. $A = 3"$, when $W = 16"$ or more, $A = 1\frac{1}{4}"$ when $W =$ less than 16".



SECTION 2-B

DISCONNECT SWITCH

DOOR INTERLOCKED, 3 POLE DISCONNECT SWITCH, 200 AMPS

CUTLER HAMMER # C362N200	SWITCH
CUTLER HAMMER # C362H25	HANDLE
CUTLER HAMMER # C362S24	SHAFT



MOTOR CONTROL PANEL DISCONNECT SWITCHES

600-Volt, 3- and 4-Pole, Non-Fused

WHEN ORDERING SPECIFY

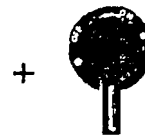
- Catalog Number of Switch
- Catalog Number of Switch Operator
- Catalog Number of Shaft required
- Catalog Number of Auxiliary Contacts and/or Accessories, if required — see next page



Basic Switch



Shaft



Operator

DESCRIPTION

- Use with your choice of fuse blocks to minimize panel space.
- Switch units and operators mount with 2 screws, 40 and 80 ampere switches also suited for DIN rail mounting.
- Captive box lug screws on 40 and 80 ampere switches.
- Variable depth — Cut shaft for shallower enclosure depths.
- Handle type or selector operators for thru-the-door operation. Toggle type for internal panel mounting.
- Operator engages with switch in On position to interlock door. Interlocking may be defeated on NEMA 12 handle type operator for inspection with switch On.
- Operators may be locked with up to 3 padlocks to prevent unauthorized entry.
- UL listed as manual motor controllers under UL File E12455(N), Guide No. NLRV2. Suitable for equipment or machinery as motor disconnects or industrial control panel disconnects. CSA certified.

SWITCHES — 3 POLE

Ampere Size	Horsepower				Rotary Operated		Toggle Operated	
	200 V	230 V	480 V	575 V	Catalog Number	Price	Catalog Number	Price
40	10	10	20	30	C362N40	\$ 60.	C362T40	\$ 60.
80	15	20	40	50	N80	90.	T80	90.
120	20	25	50	60	N100	120.	T100	120.
200	30	40	75	75	N175	425.		
400	60	75	150	200	N200	472.		
600	100	125	250	350	N400	870.		
800	150	200	400	500	N600	1575.		
1200	200	250	500	600	N800	2650.		
					N1200	4100.		

SWITCHES — 4 POLE

Description	Price
40 Ampere Rotary Operated Switch — ratings same as 3 Pole listed above	\$90.

SWITCH OPERATORS

Style	NEMA Type	Color	Marking	Defeatable	Catalog Number	Price
40-100 Ampere Sizes						
Selector	1, 3R, 12	Black	Off/On	No	C362H1	\$ 23.
Selector	1, 3R, 12	Red/Yellow	O/I	No	H2	23.
Selector	1, 3R, 12	Red/Yellow	Off/On	No	H4	23.
Pistol	1, 3R, 12	Black	Off/On	Yes	H5	60.
Pistol	1, 3R, 12	Red/Yellow	O/I	Yes	H7	60.
Pistol	1, 3R, 4, 4X, 12	Black	Off/On	No	H8	90.
Pistol	1, 3R, 4, 4X, 12	Red/Yellow	O/I	No	H10	90.
175-200 Ampere Sizes						
Pistol	1, 12	Black	Off/On	Yes	C362H25	60.
Pistol	1, 12	Red/Yellow	O/I	Yes	H27	60.
Pistol	1, 3R, 4, 4X, 12	Black	Off/On	No	H26	102.
Pistol	1, 3R, 4, 4X, 12	Red/Yellow	O/I	No	H28	102.
400-1200 Ampere Sizes						
Pistol	1, 3R, 12	Black	Off/On	Yes	C362H17	\$ 90.
Pistol	1, 3R, 12	Red/Yellow	O/I	Yes	H19	90.
Pistol	1, 3R, 4, 4X, 12	Black	Off/On	No	H20	110.
Pistol	1, 3R, 4, 4X, 12	Red/Yellow	O/I	No	H22	110.
Metallic	1, 3R, 4, 4X, 12	Black	Off/On	No	H23	140.

TERMINAL WIRE SIZES

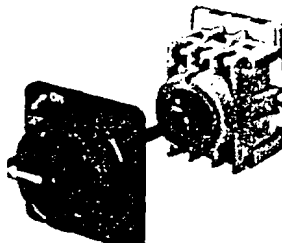
Switch Size Amperes	Wire Size (AWG)
40	#14 - #8 Copper Only
80	#14 - #2 Copper Only
100	#14 - #1 Copper Only
175	#6 - 300 MCM (AL Cu)
200	#6 - 300 MCM (AL Cu)
400	#2-600 MCM (AL Cu)
600	(2) #2-600 MCM (AL Cu)
800	(2) #2-600 MCM (AL Cu)
1200	(4) #2-600 MCM (AL Cu)

MOTOR CONTROL PANEL DISCONNECT SWITCHES

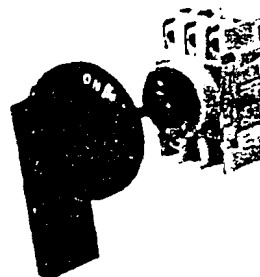
600-Volt, 3- and 4-Pole, Non-Fused



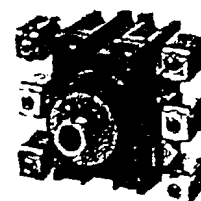
Toggle Type
40 A Switch



Selector Type
40 A Switch



Handle Type
80 A Switch



100 A Switch

SHAFTS

Operator Type	Shaft Length (L) ❶	Mounting Depth (H) ❷	Catalog Number	Price
40-100 AMPERE SIZES				
Pistol	5.90 in. [150 mm]	6.85- 7.47 in. [174-190 mm]	C362S1	\$ 9.
	10.43 in. [265 mm]	11.41-12.00 in. [290-305 mm]	C362S2	15.
	15.75 in. [400 mm]	16.73-17.32 in. [425-440 mm]	C362S3	24.
Selector	7.90 in. [180 mm]	8.07- 9.25 in. [205-235 mm]	C362S4	9.
	12.00 in. [305 mm]	13.00-14.17 in. [330-360 mm]	C362S5	21.
175-200 AMPERE SIZES				
Pistol	5.50 in. [140 mm]	4.72- 8.66 in. [120-220 mm]	C362S22	9.
	9.44 in. [240 mm]	8.66-12.59 in. [220-320 mm]	C362S25	16.
	13.39 in. [340 mm]	12.61-16.55 in. [320-420 mm]	C362S24	26.
400-1200 AMPERE SIZES				
Pistol	7.28 in. [185 mm]	7.87-11.61 in. [200-295 mm]	C362S13	20.
	11.00 in. [279 mm]	11.59-15.33 in. [294-389 mm]	C362S10	26.
	18.31 in. [465 mm]	18.90-22.64 in. [480-575 mm]	C362S18	32.

AUXILIARY CONTACT KITS

Description	Application	Catalog Number	Price
40 - 100 Ampere Sizes			
1 NO & 1 NC ❸	C362N40	C362AC1	\$27.
1 NO & 1 NC ❸	N80	AC3	27.
1 NO & 1 NC ❸	N100	AC5	27.
175 and 200 Ampere Sizes			
1 NO & 1 NC ❸	C362N175 N200	C362AC13	102.
2 NO & 2 NC ❸		AC14	102.
4 NO & 4 NC ❸		AC15	205.
400-1200 Ampere Sizes			
1 NO & 1 NC ❸	C362N400 thru C362N1200	C362AC11	110.
2 NO & 2 NC ❸		AC12	145.

ACCESSORIES

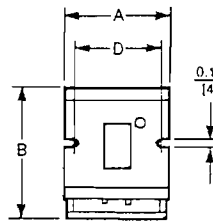
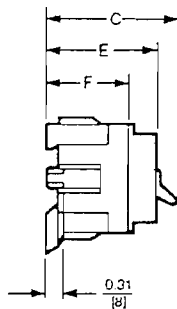
Description	Application	Catalog Number	Price
Terminal Shroud	For C362N100	C362ATS1	\$ 11.
Terminal Shroud	For C362N175 & N200	C362ATS12	19.
Terminal Shroud	For C362N400	C362ATS4	40.
Terminal Shroud	For C362N600	ATS5	60.
Terminal Shroud	For C362N800	ATS6	90.
Terminal Shroud	For C362N1200	ATS7	110.
Door Mtg. Kit ❹	For C362N40	ADM1	36.
Door Mtg. Kit ❹	For C362N100	ADM2	54.
Door Mtg. Kit ❹	For C362T40 & T80	ADM3	36.
Door Mtg. Kit ❹	For C362T100	ADM4	54.
Extended Shaft Support Kit ❺	For C362N40, N80 & N100	SS1	12.

- ❶ 0.203 in. square steel bar is easily cut to suit different depths.
- ❷ Mounting depth is the distance from the outside surface of the door to the switch mounting surface.
- ❸ Single pole, double throw, single break snap action contacts rated at 6 A, 250 V maximum.
- ❹ 10 Amp rating, 600V maximum.
- ❺ For optional enclosure door mounting of switch. Includes bracket and hardware for mounting to rear surface of door.
- ❻ Recommended when shaft length exceeds 7.09 in.

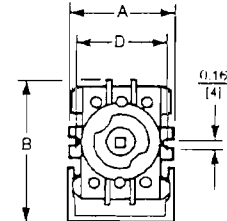
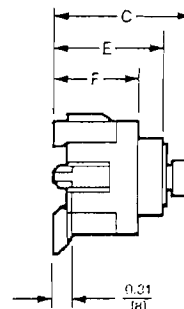


MOTOR CONTROL PANEL DISCONNECT SWITCHES 600-Volt, 3- and 4-Pole, Non-Fused

APPROXIMATE DIMENSIONS — Inches [mm]

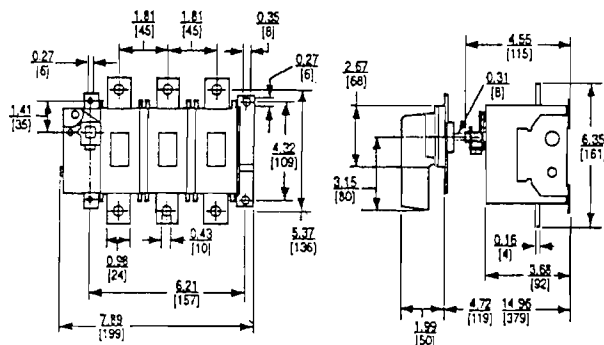


Rotary Operator — 40-100 Ampere Sizes

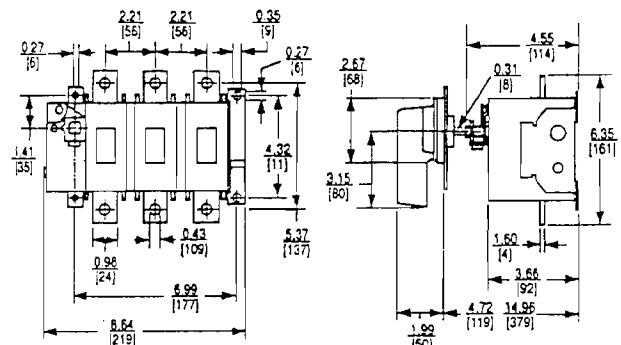


Toggle Operator — 40-100 Ampere Sizes

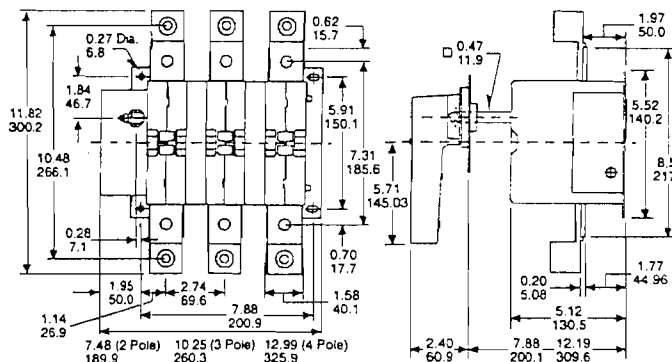
Lever Style	Ampere Size	Dimensions in inches [mm]					
		A	B	C	D	E	F
Rotary	40 A	2.00 [51]	2.72 [69]	2.72 [69]	1.78 [45]	2.16 [55]	1.67 [42]
	80 A	2.08 [53]	3.32 [84]	2.92 [74]	1.97 [50]	2.29 [58]	1.69 [43]
	100 A	3.06 [78]	3.94 [100]	3.13 [80]	2.75 [70]	2.44 [62]	1.81 [46]
Toggle	40 A	2.09 [53]	2.72 [69]	2.63 [67]	1.78 [45]	2.22 [56]	1.67 [42]
	80 A	2.08 [53]	3.32 [84]	2.75 [70]	1.97 [50]	2.34 [59]	1.72 [44]
	100 A	3.06 [78]	3.94 [100]	3.06 [78]	2.75 [70]	2.34 [59]	1.81 [46]



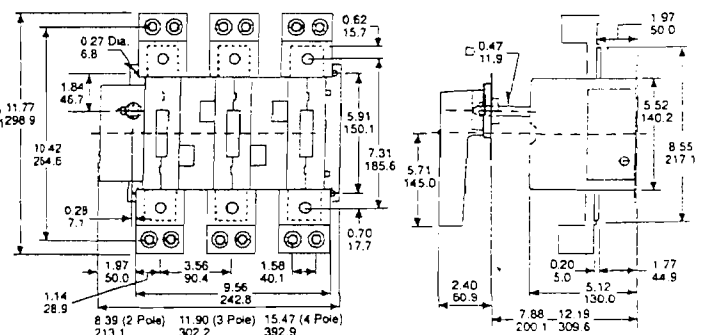
175A Non-fusible Disconnect Switch



200A Non-fusible Disconnect Switch



400A Non-fusible Disconnect Switch



600A Non-fusible Disconnect Switch

CC DISCONNECT SWITCHES



SECTION 2-C

CONTROL TRANSFORMER

230/3/60 TO 110/1/60 CONTROL TRANSFORMER, FUSED, 1KVA

CUTLER HAMMER # 1F0900FB



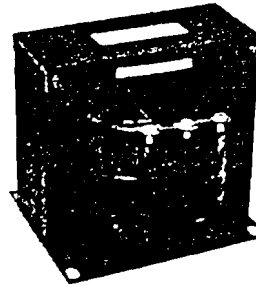
WESTINGHOUSE TRANSFORMERS

Machine Tool and Control Types MTC, AP

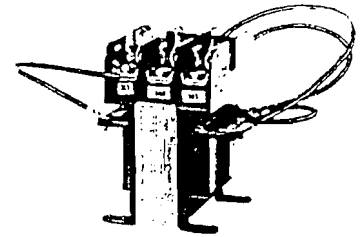
TYPE MTC

Features • Specifications

- Designed specifically for loads requiring extremely good regulation - 10% to 200% better regulation than Type MTA
- U.L. listed through 1000 VA
- Provides step-down voltages to machine tool control devices
- Isolates control circuits from power and lighting circuits
- Electrical performance exceeds requirements of ANSI/NEMA ST-1
- 100% tested; each unit must pass rigid tests for turns ratio, insulation, continuity, over potential
- All ratings normally stock
- Type MTC with "FB" suffix contains an integrally mounted 30A, 600V class fuse block. Fuses are not included.



Type MTC



MTC with Fuse Block

List Prices and Catalog Numbers

VA	Style Number	List Price	UIC Item 78-6680-	Dimensions (In.) ^①			Weight (Lbs.)	Frame	Wiring ^② Diagram	VA	Style Number	List Price	UIC Item 78-6680-	Dimensions (In.) ^①			Weight (Lbs.)	Frame	Wiring ^② Diagram
				Height	Width	Depth								Height	Width	Depth			
240/480 Volts to 120 Volts, 60 Hz 230/460 Volts to 115 Volts, 50/60 Hz 220/440 Volts to 110 Volts, 50/60 Hz										240/480 Volts to 120 Volts, 60 Hz 230/460 Volts to 115 Volts, 50/60 Hz 220/440 Volts to 110 Volts, 50/60 Hz With 3-Pole Fuse Block									
50 ^⑤	1F0890	\$ 44	08900	2 1/2	3	3 1/4	2	1310	1	50 ^⑤	1F0890FB	\$ 58	18900	3 1/4	3	3 1/4	2 1/4	1310	1
75 ^⑤	1F0891	54	08910	2 1/2	3	3 1/4	3	1314	1	75 ^⑤	1F0891FB	67	18910	3 1/4	3	3 1/4	3 1/4	1314	1
100 ^⑤	1F0892	58	08920	2 1/2	3 3/4	4	3	1413	1	100 ^⑤	1F0892FB	71	18920	4 1/2	3 3/4	4	3 1/4	1413	1
150 ^⑤	1F0893	68	08930	3 3/4	3 3/4	4 1/4	6	1517	1	150 ^⑤	1F0893FB	82	18930	4 1/2	3 3/4	4 1/4	6 1/4	1517	1
200 ^⑤	1F0894	80	08940	3 3/4	4 1/2	4 1/2	7	1714	1	200 ^⑤	1F0894FB	95	18940	5 1/2	4 1/2	4 1/2	7 1/4	1714	1
250 ^⑤	1F0895	100	08950	3 1/2	4 1/2	5	8	1717	1	250 ^⑤	1F0895FB	114	18950	5 1/2	4 1/2	5	8 1/4	1717	1
300 ^⑤	1F0896	107	08960	3 1/2	4 1/2	5 1/2	10	1722	1	300 ^⑤	1F0896FB	121	18960	5 1/2	4 1/2	5 1/2	10 1/4	1722	1
350 ^⑤	1F0897	118	08970	3 1/2	4 1/2	6	11	1726	1	350 ^⑤	1F0897FB	131	18970	5 1/2	4 1/2	6	11 1/4	1726	1
500 ^⑤	1F0898	144	08980	4 1/2	5 1/4	6 1/2	20	1931	1	500 ^⑤	1F0898FB	158	18980	5 1/2	5 1/4	6 1/2	20 1/4	1931	1
750 ^⑤	1F0899	191	08990	4 1/2	5 1/4	7 1/4	28	1943	1	750 ^⑤	1F0899FB	205	18990	5 1/2	5 1/4	7 1/4	28 1/4	1943	1
1000 ^⑤	1F0900	233	09000	5 1/4	6 1/2	7 1/2	34	2236	1	1000 ^⑤	1F0900FB	238	19000	6 1/2	6 1/2	7 1/2	34 1/4	2236	1
1500 ^⑤	1F0901	392	09010	6 1/2	6 1/2	8 1/4	35	C822	1	1500 ^⑤	1F0901FB	406	19010	7 1/2	6 1/2	8 1/4	35 1/4	C822	1
2000 ^⑤	1F0902	468	09020	6	6 1/2	8 1/2	38	C823	1	2000 ^⑤	1F0902FB	482	19020	7 1/2	6 1/2	8 1/2	38 1/4	C823	1
3000 ^⑤	1F0903	652	09030	7 1/2	8 1/4	8 1/4	53	C824	1										
5000 ^⑤	1F0904	1013	09040	7 1/2	8 1/4	11	82	C825	1										

DISCOUNT SYMBOL DT-2

TYPE AP

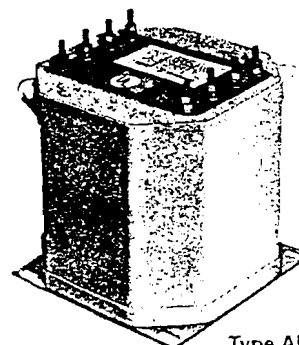
Features • Specifications

- U.L. listed and labeled
- Resin encapsulated
- Convenient screw-type terminal board
- Bottom or side/wall mounting designs
- Performance meets/exceeds ANSI/NEMA ST-1 requirements
- Regulation exceeds ANSI/NEMA requirements for all ratings

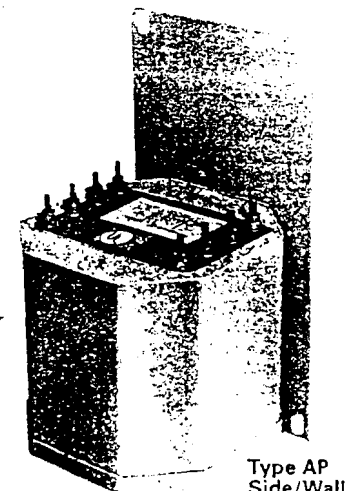
List Prices and Catalog Numbers

VA	Style No.	List Price	UIC Item 78-6680-	Mounting	Dimensions (In.) ^①			Wt. (Lbs.)	Frame	Wiring Diagram ^②
					Height	Width	Depth			
240/480 Volts to 120/240 Volts, 60 Hz										
3	6F495	\$ 429	18495	Bottom	8 1/2	9 1/2	8 1/2	65	133	6
5	6F201	536	18201	Bottom	10 1/4	10 1/4	8 1/2	104	99	5
7.5	6F202	737	18202	Bottom	10 1/4	10 1/4	10 1/4	129	100	5
10	6F203	923	18203	Bottom	10 1/4	10 1/4	11 1/4	148	101	5
15	6F496	1250	18496	Bottom	12	13 1/4	10 1/4	197	134	6
3	6F320	429	18320	Side/Wall	9 1/2	8 1/2	9 1/2	65	283	6
5	6F321	536	18321	Side/Wall	11 1/2	8 1/2	10 1/4	104	256	6
7.5	6F322	737	18322	Side/Wall	11 1/2	10 1/4	10 1/4	129	257	6
10	6F323	923	18323	Side/Wall	11 1/2	11 1/4	10 1/4	148	258	6
15	6F324	1250	18324	Side/Wall	12 1/2	10 1/4	13 1/4	197	259	6

DISCOUNT SYMBOL DT-3



Type AP
Bottom Mount



Type AP
Side/Wall Mount

- ① Not for construction. Refer to TCS 47-820 by frame number for certification. Height over terminals.
- ② For wiring diagram, refer to TCS 47-830 by diagram number.
- ③ Height over terminals.
- ④ Normally stock.

NOTE: Refer to Cutler-Hammer for availability of custom designs.

I.E.C. RATED AC CONTACTORS

Freedom Series, 600 Volt Maximum



DESCRIPTION

Contactors are most commonly used to switch motor loads in applications where running over current protection is either not required or is provided separately. Contactors consist of a magnetically actuated switch which can be remotely operated by a pushbutton station or pilot device such as a proximity switch, limit switch, float switch, auxiliary contacts, etc.

I.E.C. CONTACTORS — FEATURES

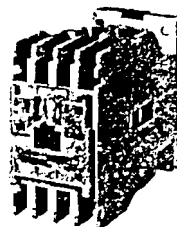
- **EN60947-4-1 I.E.C. 947-4-1** compliance — new International Standard for low voltage switchgear and control devices.
- UL listed and CSA certified.
- Highest horsepower rating in a compact, space-saving design. 45 mm frame rated maximum 20 hp at 460V, 65 mm frame rated maximum 50 hp, 90 mm frame rated 100 hp, 180 mm frame rated 200 hp, 220 mm frame rated 350 hp, and 280 mm frame rated 400 hp.
- Long life twin break, silver cadmium oxide contacts — provide excellent conductivity and superior resistance to welding and arc erosion.
- 45 mm open contactors, sizes A through F, have DIN rail or universal base mounting, 65 mm open contactors have molded feet for panel mounting, and 90 mm to 280 mm have steel mounting plates (optional on smaller sizes).
- DIN rail release mechanism conveniently located on line side of contactor.
- Designed to 2,000,000 electrical and 20,000,000 mechanical operations at maximum hp ratings through 20 hp at 460V. Adequate for most general duty control applications.
- IP20 finger protection shields available.
- Contactor and terminal markings conform to CENELEC EN50011.
- Holding circuit contact(s) supplied as standard:
 - Sizes A – N have a NO auxiliary contact block mounted on right hand side (on sizes A – C, contact occupies 4th power pole position — no increase in width).
 - Sizes P – S have a NO/NC contact block mounted on the left hand side.
 - Sizes T – V have 2NO/2NC contact block mounted on the top left between arc-chutes.
- Lugs supplied standard on sizes A – S. On sizes T – V, lugs must be ordered separately.

MAGNET COILS — AC and DC

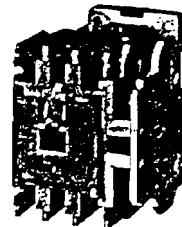
Contactors listed in this section also have a 50 hertz rating as shown in adjacent table. For other than listed volts and hertz, select required contactor by catalog number and replace the magnet coil alpha designation in the catalog number with the proper code suffix from adjacent table.

For Sizes A-F, the magnet coil alpha designation will be the second-to-the-last digit of the listed Catalog Number. **EXAMPLE:** For a 380V, 50 Hz coil, change CE15AN4BB to CE15AN4LB. For all other sizes, the magnet coil alpha designation will be the last alpha.

For DC MAGNET COILS, see ACCESSORIES, Page C-47.



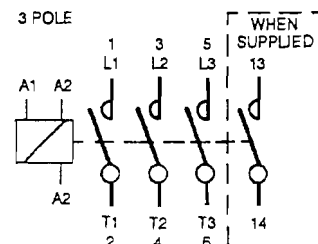
I.E.C. Size B
Cat. No. CE15BNS3AB



I.E.C. Size E
Cat. No. CE15ENS3AB

CONTACTOR TERMINAL MARKINGS

Contactors are identified by a two digit number in accordance with International Standards approved by CENELEC (European Committee for Electrotechnical Standardization). This distinctive number is marked on the top nameplate and designates the type and quantity of built-in auxiliary contacts. The first digit indicates the quantity of NO and the second digit indicates the quantity of NC contacts. Example: 10E indicates a contactor with 1 NO and no NC auxiliary contacts factory supplied. In addition, all terminals conform to both CENELEC and NEMA requirements. Auxiliary contact terminals use the first digit to indicate location and the second digit to indicate status (1-2 means NC and 3-4 means NO). Example: 13-14 indicates the first auxiliary contact and it's a NO. See example below.



Coil Volts and Hertz	Code Suffix	Coil Volts and Hertz	Code Suffix
120/60 or 110/50	A	380-415/50	L
240/60 or 220/50	B	550/50	N
480/60 or 440/50	C	24/60, 24/50 ①	T
600/60 or 550/50	D	24/50	U
208/60	E	32/50	V
277/60	H		
208-240/60 ②	J	48/60	W
240/50	K	48/50	Y

① On IEC Sizes A-F, a non-encapsulated coil is standard. To order a contactor with an encapsulated coil, change the last digit of the listed Catalog Number to 3B and add \$ 4. to price. **EXAMPLE:** CE15AN3A3B.

② Encapsulated coil for I.E.C. Sizes A - F only.

③ I.E.C. Sizes A - F only. Sizes G - V are 24/60 only.

SECTION 2-D

MOTOR STARTERS & OVERLOADS

3 POLE, MAGNETIC MOTOR STARTERS WITH THERMAL OVERLOADS,
208/3/60, 110 VAC COIL

15HP	CUTLER HAMMER # CE15JNS3AB
O/L	CUTLER HAMMER # C316KNA3F

10HP	CUTLER HAMMER # CE15HNS3AB
O/L	CUTLER HAMMER # C316KNA3B

5HP	CUTLER HAMMER # CE15DNS3AB
O/L	CUTLER HAMMER # C316FNA3R

1HP	CUTLER HAMMER # CE15ANS3AB
O/L	CUTLER HAMMER # C316FNA3L

.5HP	CUTLER HAMMER # CE15ANS3AB
O/L	CUTLER HAMMER # C316FNA3H



I.E.C. RATED AC CONTACTORS

Freedom Series, 600 Volt Maximum

2 and 3 Pole

TYPE CE15 I.E.C. CONTACTORS — 2 POLE (1 Phase) or 3 POLE (3 Phase)

SIZE	Max. UL Ampere Rating 600V ac ⑥	I.E.C. 947 AC1 Thermal Current 600V ①	MAXIMUM UL HORSEPOWER *			MAXIMUM KW RATING (AC-2, AC-3) ①			Magnet Coil Voltage 50/60 Hz	2 POLE (1 Phase)		3 POLE (3 Phase)	
			Motor Voltage 60 Hz	1 Phase	3 Phase	Motor Voltage 50 Hz	1 Phase	3 Phase		OPEN TYPE		OPEN TYPE	
										Catalog Number	Price	Catalog Number	Price
WITH 1 NO AUXILIARY CONTACT ②													
A	7	20	115	1/4	---	110	0.18	---	110/120	CE15ANS2AB	\$ 78.	CE15ANS3AB	\$ 84.
			200	---	1-1/2	---	---	---	208 ⑥	ANS2EB		ANS3EB	
			230	1/2	1-1/2	220	0.37	1.1	220/240	ANS2BB		ANS3BB	
			---	---	---	380	---	2.2	380/415 ④	ANS2LB		ANS3LB	
			460	---	3	415/440	---	2.2	440/480	ANS2CB		ANS3CB	
			575	---	5	500/550	---	4.0	550/600	ANS2DB		ANS3DB	
45 mm			---	---	---	660	---	1.5	---	ANS2_B ⑤	ANS3_B ⑤		
B	10	20	115	1/2	---	110	0.37	---	110/120	CE15BNS2AB	80.	CE15BNS3AB	86.
			200	---	2	---	---	---	208 ⑥	BNS2EB		BNS3EB	
			230	1	2	220	0.75	1.5	220/240	BNS2BB		BNS3BB	
			---	---	---	380	---	4.0	380/415 ④	BNS2LB		BNS3LB	
			460	---	5	415/440	---	4.0	440/480	BNS2CB		BNS3CB	
			575	---	7-1/2	500/550	---	5.5	550/600	BNS2DB		BNS3DB	
45 mm			---	---	---	660	---	2.2	---	BNS2_B ⑤	BNS3_B ⑤		
C	12	20	115	1/2	---	110	0.37	---	110/120	CE15CNS2AB	103.	CE15CNS3AB	109.
			200	---	3	---	---	---	208 ⑥	CNS2EB		CNS3EB	
			230	2	3	220	1.5	2.2	220/240	CNS2BB		CNS3BB	
			---	---	---	380	---	5.5	380/415 ④	CNS2LB		CNS3LB	
			460	---	7-1/2	415/440	---	5.5	440/480	CNS2CB		CNS3CB	
			575	---	10	500/550	---	7.5	550/600	CNS2DB		CNS3DB	
45 mm			---	---	---	660	---	4.0	---	CNS2_B ⑤	CNS3_B ⑤		
D	18	32	115	1	---	110	0.75	---	110/120	CE15DNS2AB	118.	CE15DNS3AB	124.
			200	---	5	---	---	---	208 ⑥	DNS2EB		DNS3EB	
			230	3	5	220	2.2	4.0	220/240	DNS2BB		DNS3BB	
			---	---	---	380	---	7.5	380/415 ④	DNS2LB		DNS3LB	
			460	---	10	415/440	---	7.5	440/480	DNS2CB		DNS3CB	
			575	---	15	500/550	---	11.0	550/600	DNS2DB		DNS3DB	
45 mm			---	---	---	660	---	5.5	---	DNS2_B ⑤	DNS3_B ⑤		
E	25	32	115	2	---	110	1.5	---	110/120	CE15ENS2AB	132.	CE15ENS3AB	138.
			200	---	5	---	---	---	208 ⑥	ENS2EB		ENS3EB	
			230	3	7-1/2	220	2.2	5.5	220/240	ENS2BB		ENS3BB	
			---	---	---	380	---	11.0	380/415 ④	ENS2LB		ENS3LB	
			460	---	15	415/440	---	11.0	440/480	ENS2CB		ENS3CB	
			575	---	20	500/550	---	15.0	550/600	ENS2DB		ENS3DB	
45 mm			---	---	---	660	---	7.5	---	ENS2_B ⑤	ENS3_B ⑤		
F	32	32	115	2	---	110	1.5	---	110/120	CE15FNS2AB	151.	CE15FNS3AB	157.
			200	---	7-1/2	---	---	---	208 ⑥	FNS2EB		FNS3EB	
			230	5	10	220	4.0	7.5	220/240	FNS2BB		FNS3BB	
			---	---	---	380	---	15.0	380/415 ④	FNS2LB		FNS3LB	
			460	---	20	415/440	---	15.0	440/480	FNS2CB		FNS3CB	
			575	---	25	500/550	---	18.5	550/600	FNS2DB		FNS3DB	
45 mm			---	---	---	660	---	10.0	---	FNS2_B ⑤	FNS3_B ⑤		
G	37	50	115	3	---	110	2.2	---	110/120	CE15GNS2AB	179.	CE15GNS3AB	185.
			200	---	7-1/2	---	---	---	208 ⑥	GNS2EB		GNS3EB	
			230	5	10	220	4.0	---	220/240	GNS2BB		GNS3BB	
			---	---	---	380	---	18.5	380/415 ④	GNS2LB		GNS3LB	
			460	---	25	415/440	---	18.5	440/480	GNS2CB		GNS3CB	
			575	---	30	500/550	---	22.0	550/600	GNS2DB		GNS3DB	
65 mm			---	---	---	660	---	11.0	---	GNS2_B ⑤	GNS3_B ⑤		
H	44	60	115	3	---	110	2.2	---	110/120	CE15HNS2AB	194.	CE15HNS3AB	200.
			200	---	10	---	---	---	208 ⑥	HNS2EB		HNS3EB	
			230	7-1/2	15	220	5.5	11.0	220/240	HNS2BB		HNS3BB	
			---	---	---	380	---	22.0	380/415 ④	HNS2LB		HNS3LB	
			460	---	30	415/440	---	22.0	440/480	HNS2CB		HNS3CB	
			575	---	40	500/550	---	30.0	550/600	HNS2DB		HNS3DB	
65 mm			---	---	---	660	---	15.0	---	HNS2_B ⑤	HNS3_B ⑤		

① For definitions of AC-1, AC-2 and AC-3 ratings, see Page C-7.

② I.E.C. sizes A - N are supplied with a NO side mounted auxiliary contact. On I.E.C. sizes A - C, the 4th power pole position is used as the side mounted contact and adds no additional width. Open type sizes A - K can be ordered with a top mounted auxiliary contact instead of a side mounted contact. To order, change the 7th digit of the listed catalog number from "S" to "T". Example: CE15ANT3AB. On open type sizes A - K, if the NO auxiliary contact

is not required, drop the "S" from the listed catalog number and deduct \$16. from price. Example: CE15AN3AB, \$ 66.

④ 60 Hz only.

⑤ 50 Hz only.

⑥ Available for separate control only. Specify coil voltage required.

⑦ UL General purpose rating.

I.E.C. RATED AC CONTACTORS **Freedom Series, 600 Volt Maximum** **2 and 3 Pole**



TYPE CE15 I.E.C. CONTACTORS — 2 POLE (1 Phase) or 3 POLE (3 Phase)

SIZE Frame Width	Max. UL Ampere Rating 600V ac ⑥	I.E.C. 947 AC1 Thermal Current 600V ①	MAXIMUM UL HORSEPOWER			MAXIMUM KW RATING (AC-2, AC-3) ①			Magnet Coil Voltage 50/60 Hz	2 POLE (1 Phase)		3 POLE (3 Phase)	
			Motor Voltage 60 Hz	1 Phase		Motor Voltage 50 Hz	1 Phase			OPEN TYPE		OPEN TYPE	
				3 Phase	3 Phase		3 Phase	3 Phase		Catalog Number	Price	Catalog Number	Price
AUXILIARY CONTACTS: SIZES J – N HAVE 1NO, AND SIZES P – S HAVE 1NO/1NC ②													
J 65 mm	60	75	115 200 230 460 575 ---	5 --- 10 --- --- ---	15 20 20 40 40 ---	110 --- 220 380 415/440 500/550 660	4.0 --- 7.5 --- --- ---	15.0 30.0 30.0 30.0 18.5	110/120 208 ③ 220/240 380/415 ④ 440/480 550/600 ---	CE15JNS2AB JNS2EB JNS2BB JNS2LB JNS2CB JNS2DB JNS2_B ⑤	\$ 208.	CE15JNS3AB JNS3EB JNS3BB JNS3LB JNS3CB JNS3DB JNS3_B ⑤	\$ 214.
K 65 mm	73	80	115 200 230 460 575 ---	5 --- 10 --- --- ---	20 25 50 50 ---	110 --- 220 380 415/440 500/550 660	3.7 --- 7.5 --- --- ---	18.5 37.0 37.0 37.0 22.0	110/120 208 ③ 220/240 380/415 ④ 440/480 550/600 ---	CE15KNS2AB KNS2EB KNS2BB KNS2LB KNS2CB KNS2DB KNS2_B ⑤	289.	CE15KNS3AB KNS3EB KNS3BB KNS3LB KNS3CB KNS3DB KNS3_B ⑤	295.
L 90 mm	85	100	115 200 230 460 575 ---	7.5 --- 10 --- --- ---	25 30 60 75 ---	110 --- 220 380 415/440 500/550 660	5.5 --- 7.5 --- --- ---	45.0 45.0 55.0 37.0	110/120 208 ③ 220/240 380/415 ④ 440/480 550/600 ---	CE15LN2A LN2E LN2B LN2L LN2C LN2D LN2 ⑤	327.	CE15LN3A LN3E LN3B LN3L LN3C LN3D LN3 ⑤	333.
M 90 mm	105	135	115 200 230 460 575 ---	10 --- 10 --- --- ---	30 40 75 100 ---	110 --- 220 380 415/440 500/550 660	7.5 --- 7.5 --- 7.5 ---	55.0 55.0 55.0 75.0 45.0	110/120 208 ③ 220/240 380/415 ④ 440/480 550/600 ---	CE15MN2A MN2E MN2B MN2L MN2C MN2D MN2 ⑤	469.	CE15MN3A MN3E MN3B MN3L MN3C MN3D MN3 ⑤	475.
N 90 mm	140	175	115 200 230 460 575 ---	10 --- 10 --- --- ---	40 50 100 125 ---	110 --- 220 380 415/440 500/550 660	7.5 --- 7.5 --- 7.5 ---	37.0 75.0 75.0 90.0 45.0	110/120 208 ③ 220/240 380/415 ④ 440/480 550/600 ---	CE15NN2A NN2E NN2B NN2L NN2C NN2D NN2 ⑤	754.	CE15NN3A NN3E NN3B NN3L NN3C NN3D NN3 ⑤	760.
P 180 mm	170	185	115 200 230 460 575 ---	--- --- 60 --- 125 125 ---	50 60 380 415/440 500/550 660	110 --- 220 380 415/440 500/550 660	--- --- 45.0 90.0 90.0 45.0	110/120 208 ③ 220/240 380 ④ 440/480 550/600 ---	Use 3-Pole Device	CE15PN3A PN3E PN3B PN3L PN3C PN3D PN3 ⑤	1068.		
R 180 mm	200	220	115 200 230 460 575 ---	--- --- 75 --- 150 150 ---	60 75 380 415/440 500/550 660	110 --- 220 380 415/440 500/550 660	--- --- 55.0 110.0 110.0 55.0	110/120 208 ③ 220/240 380 ④ 440/480 550/600 ---	Use 3-Pole Device	CE15RN3A RN3E RN3B RN3L RN3C RN3D RN3 ⑤	1200.		
S 180 mm	300	315	115 200 230 460 575 ---	--- --- 100 --- 200 200 ---	75 100 380 415/440 500/550 660	110 --- 220 380 415/440 500/550 660	--- --- 90.0 160.0 160.0 75.0	110/120 208 ③ 220/240 380 ④ 440/480 550/600 ---	Use 3-Pole Device	CE15SN3A SN3E SN3B SN3L SN3C SN3D SN3 ⑤	1625.		

① For definitions of AC-1, AC-2 and AC-3 ratings, see Page C-7.

I.E.C. sizes A - N are supplied with a NO side mounted auxiliary contact. Open type sizes A - K can be ordered with a top mounted auxiliary contact instead of a side mounted contact. To order, change the 7th digit of the listed catalog number from "S" to "T". Example: CE15ANT3AB. On open type sizes A - K,

If the NO auxiliary contact is not required, drop the "S" from the listed catalog number and deduct \$18. from price. Example: CE15AN3AB, \$66.

- ③ 60 Hz only.
- ④ 50 Hz only.
- ⑤ Available for separate control only. Specify coil voltage required.
- ⑥ UL General purpose rating.



I.E.C. RATED AC CONTACTORS

Free

TYPE CE15 I.E.C. CONTACTORS - 2 POLE (1 Phase) or 3

I.E.C. Size	Frame Width	Max. UL Ampere Rating 600V ac ②	I.E.C. 947 AC1 Thermal Current 600V ①	Maximum UL Horsepower			Maximum Kw Rating (AC-2, AC-3) ①			Magnet Coil Voltage 50/60 Hz	Open Type		Open Type	
				Motor Voltage 60 Hz	1 Phase	3 Phase	Motor Voltage 50 Hz	1 Phase	3 Phase		Catalog Number	Price	Catalog Number	Price
AUXILIARY CONTACTS: SIZES T – X HAVE 2NO/2NC, SIZE Z HAS 2NO/1NC. SIZES T – Z ARE SUPPLIED WITHOUT LUGS – ORDER APPROPRIATE LUG KITS FROM TABLE BELOW														
T	220 mm	420	600	--- 200 230 --- 460 575	--- --- --- --- ---	--- 125 125 --- 250 250	--- --- 220 380 500 660	--- --- --- --- ---	--- --- 129 220 300 300	110/120 208 220/240 380/415 440/480 550/600	Use 3-Pole Device		CE15TN3A80 TN3E80 TN3B80 TN3L80 TN3C80 TN3D80	\$1800
U	220 mm	520	760	--- 200 230 --- 460 575	--- --- --- --- ---	--- 150 150 --- 350 350	--- --- 220 380 500 660	--- --- --- --- ---	--- --- 160 280 375 375	110/120 208 220/240 380/415 440/480 550/600			CE15UN3A80 UN3E80 UN3B80 UN3L80 UN3C80 UN3D80	2800.
V	280 mm	550	1000	--- 200 230 --- 460 575	--- --- --- --- ---	--- 150 200 --- 400 400	--- --- 220 380 500 660	--- --- --- --- ---	--- --- 220 375 500 500	110/120 208 220/240 380/415 440/480 550/600			CE15VN3A80 VN3E80 VN3B80 VN3L80 VN3C80 VN3D80	4000.
W	280 mm	700	1000	--- 200 230 --- 460 575	--- --- --- --- ---	--- 200 250 --- 500 500	--- --- 220 380 500 660	--- --- --- --- ---	--- --- 220 375 500 500	110/120 208 220/240 380/415 440/480 550/600	Use 3-Pole Device		CE15WN3A80 WN3E80 WN3B80 WN3L80 WN3C80 WN3D80	5200.
X	280 mm	810	1100	--- 200 230 --- 460 575	--- --- --- --- ---	--- 250 300 --- 600 600	--- --- 220 380 500 660	--- --- --- --- ---	--- --- 270 475 600 600	110/120 208 220/240 380/415 440/480 550/600			CE15XN3A80 XN3E80 XN3B80 XN3L80 XN3C80 XN3D80	6400.
Z	334 mm	1215	1350	--- 200 230 --- 460 575	--- --- --- --- ---	--- 450 450 --- 900 900	--- --- 220 380 500 660	--- --- --- --- ---	--- --- 380 650 840 840	110/120 208 220/240 380/415 440/480 550/600			CE15ZN3A80 ZN3E80 ZN3B80 ZN3L80 ZN3C80 ZN3D80	7200.

- ① For definitions of AC-1, AC-2 and AC-3 ratings, see Page C-7.
② UL General purpose rating.

LINE/LOAD LUG KITS - I.E.C. Sizes T - Z Only

Lugs come standard on all contactors except sizes T - Z. If lugs are required, order separately from below. Each kit consists of three line and three load side lugs and hardware.

Contactors Size	Cable Range	Catalog Number	Price
T	(2) #2/0 - 600 kcmil	C325KAL15	\$ 50.
U	(2) #2/0 - 600 kcmil	KAL16	50.
V - W	(2) 750 kcmil - #3/0	KAL17	60.
X	(3) 750 kcmil - #3/0	KAL18	70.
Z	(4) 750 kcmil - #1/0	KAL19	75.

Contact Kits		
Contactors	2-Pole	3-Pole
T	---	6-621
U	---	6-622
V	6-601-2	6-601
W, X	---	6-613
Z	---	6-571
Publications		
I.E.C. Size	Publication Number	
T	22275	
U	22276	
V & W	22586	
X	24932	
Z	22588	

TECHNICAL DATA, Pages C-11 - C-15
DIMENSIONS, Page C-40 - C-49

DISCOUNT SCHEDULE 1CD-1

October 1997

EATON
C-5

I.E.C. RATED AC CONTACTORS
NON-REVERSING CONTACTORS

I.E.C. RATED OVERLOAD RELAYS

Fixed Heater

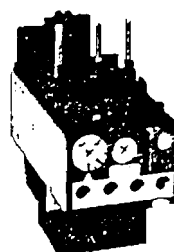
Manual or Automatic Reset



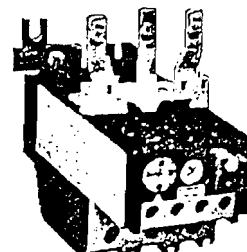
DESCRIPTION

Cutler-Hammer Integral Overload Relays are for use with Freedom Series contactors. They are designed and manufactured to meet IEC (International Electrotechnical Commission) recommendations and other international standards necessary for acceptance in many countries around the world. Features include:

- EN60947-4-1 I.E.C. 947-4-1 Compliance — the new International Standard for low voltage switchgear and control devices.
- Direct heated bimetal elements
- Class 10 trip characteristics through 200 amperes and Class 30 on 400 and 850 ampere relays
- Single phase and phase unbalance sensitive
- Ambient temperature compensated
- Adjustable trip current, overload trip indication
- NO/NC Electrically isolated contacts, contact test lever
- Manual / Automatic reset
- DIN rail and panel mounting adapter
- UL listed — File E130332
- CSA certified — File LR15332M94



Frame Size F Overload Relay
Cat. No. C316FNA3



Frame Size K Overload Relay
Cat. No. C316KNA3

ACCESSORIES

Description	Application	Catalog Number	Price
Din Rail And Panel Mounting Adapters — for separate mounting of overload relays	Frame Size C316F Frame Size C316K	C306T81 C316T81	\$ 9. 30.
Contactor Link Set — For direct coupling of C316PNA3 overload relay to I.E.C. contactors	Contactor Sizes L - N P - S	C316MCL C316PCL1	36. 36.

FREEDOM SERIES INTEGRAL OVERLOAD RELAYS — Bimetal Class 10

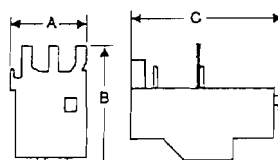
Trip Class	Motor F.L.A.	Manual/Automatic Reset, NO - NC Electrically Separated	Price	Trip Class	Motor F.L.A.	Manual/Automatic Reset, NO - NC Electrically Separated	Price
Catalog No.				Catalog No.			
FOR I.E.C. CONTACTOR SIZES A - F				FOR I.E.C. CONT. SIZES L - S			
10	0.25 - 0.40	C316FNA3C	\$ 58.	10	65 - 90	C316PNA3A	\$ 185.
	0.40 - 0.63	FNA3D			80 - 100	PNA3B	300.
	0.63 - 1.00	FNA3E			100 - 135	PNA3C	300.
	1.00 - 1.40	FNA3F			110 - 150	PNA3D	300.
	1.30 - 1.80	FNA3G			130 - 175	PNA3E	300.
10	1.70 - 2.40	C316FNA3H	58.	10	150 - 200	C316PNA3F	300.
	2.20 - 3.10	FNA3J					
	2.80 - 4.00	FNA3K					
	3.50 - 5.00	FNA3L					
	4.50 - 6.50	FNA3M					
5HP	6.00 - 8.50	C316FNA3N	60.	FOR I.E.C. CONT. SIZES M - V SEPARATELY MOUNTED CT STYLE			
	7.50 - 11.0	FNA3P	60.	30	130 - 185	C316SNA3A	400.
	10.0 - 14.0	FNA3Q	60.		165 - 235	SNA3B	400.
	13.0 - 19.0	FNA3R	60.		220 - 310	SNA3C	400.
	18.0 - 24.0	FNA3S	65.		285 - 400	SNA3D	675.
24.0 - 32.0	FNA3T	70.					
FOR I.E.C. CONTACTOR SIZES G - K				FOR I.E.C. CONT. SIZES M - V SEPARATELY MOUNTED CT STYLE			
10HP	18.0 - 25.0	C316KNA3A	90.	30	355 - 500	C316UNA3A	950.
	22.0 - 32.0	KNA3B	90.		465 - 650	UNA3B	
	29.0 - 42.0	KNA3C	95.		610 - 850	UNA3C	
	36.0 - 52.0	KNA3D	103.				
	45.0 - 63.0	KNA3E	103.				
60.0 - 80.0	KNA3F	123.					

① Must use Contactor Link Set when direct coupling to contactor. Hardware (bolts and nuts) provided for cable connection.

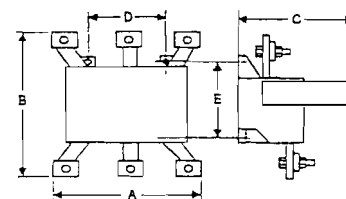
CONTACT RATINGS (35% Power Factor)

Rating	Volts	Make	Break
Insulation Voltage.....	120	30.0 A	3.0 A
660V ac (IEC).....	230	15.0 A	1.5 A
600V ac (UL & CSA).....	480	7.5 A	0.75 A
Thermal Rating 10 A.....	600	6.0 A	0.6 A

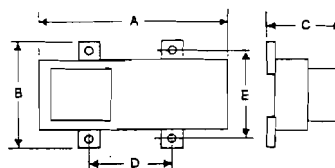
APPROXIMATE DIMENSIONS



Frame Sizes F and K



Frame Size P



Separately Mounted Frame Sizes S and U

Frame Size	Dimensions in Inches [mm]					Ship. Wt. Lbs.
	Wide A	High B	Deep C	Mounting		
				D	E	
F	1.71 [43.5]	2.62 [66.5]	3.66 [93]	---	---	0.37
K	2.13 [54]	3.70 [94]	4.41 [112]	---	---	0.71
P	4.09 [104]	5.51 [140]	4.88 [124]	2.65 [67.3]	1.46 [37]	2.01
S	7.60 [193]	2.63 [67]	6.61 [168]	2.99 [76]	2.17 [55]	3.31
U	3.65 [94]	3.94 [100]	8.27 [210]	3.23 [82]	3.15 [80]	6.61

DISCOUNT SCHEDULE 1CD-1

August 1997

SECTION 2-E

VARIABLE SPEED DRIVES

MICROPROCESSOR BASED, 3 PHASE, 208 VAC WITH DISPLAY/KEYPAD
OPERATOR INTERFACE

15HP SAFTRONICS # FP5-2011(2 EACH)

FP5 ... finally, an inverter designed exclusively for the Fan and Pump markets!

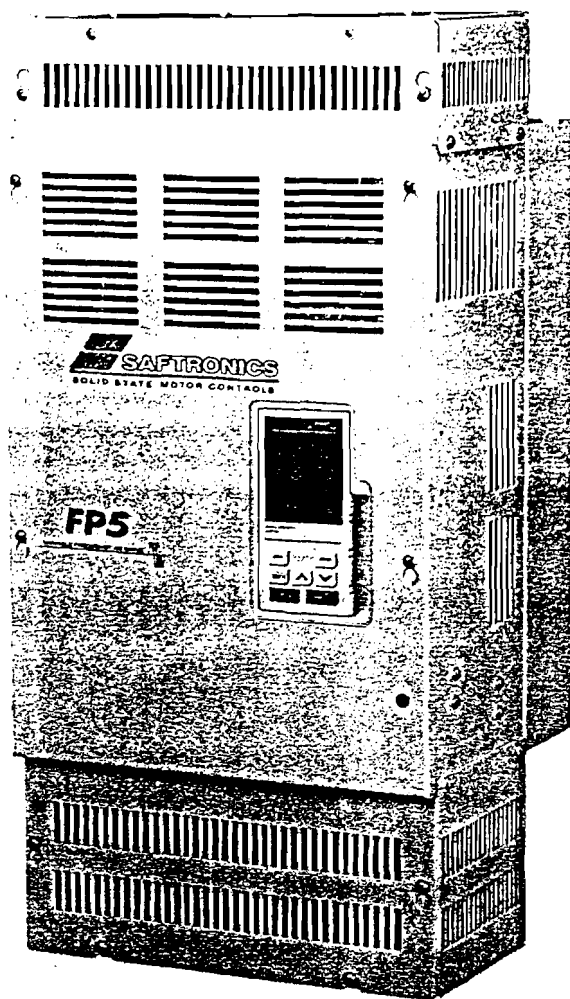
Why continue buying general purpose inverters for fan and pump applications when you can specify a unit designed specifically with your market in mind?

SAFTRONICS has responded to your requests for a variable torque product. The FP5 is the result of those requests. We have thoroughly evaluated our general purpose products and kept only those features you need. We've eliminated the costly, yet unnecessary hardware that normally comes bundled with the general purpose inverters. Instead, we have added those features you really need:

- ♦ Innovative Energy Saving Function
- ♦ Integral PID Loop
- ♦ Harmonic Suppression
 - ♦ 12-pulse Input*
 - ♦ DC Link Choke*
- ♦ User Friendly Operator Interface

If you combine our pre-engineered bypass package, the FPC5000, with the FP5 inverter, you can be assured of a simple turnkey installation... every time!

* Standard for 30 to 250 HP. DC Link Choke is optional for 5 - 25HP.



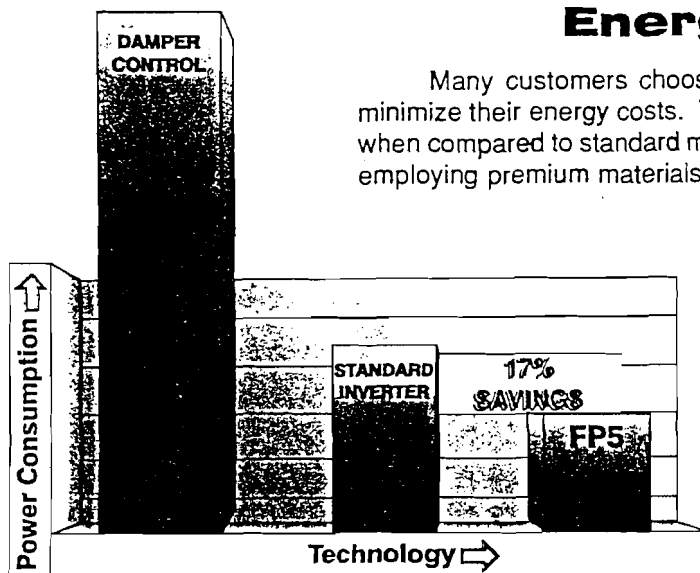
Energy Saving Function

Many customers choose to upgrade to premium efficiency motors to minimize their energy costs. These motors can save several efficiency points when compared to standard motors. Unfortunately, this savings is achieved by employing premium materials in the motor - at a significant cost adder!

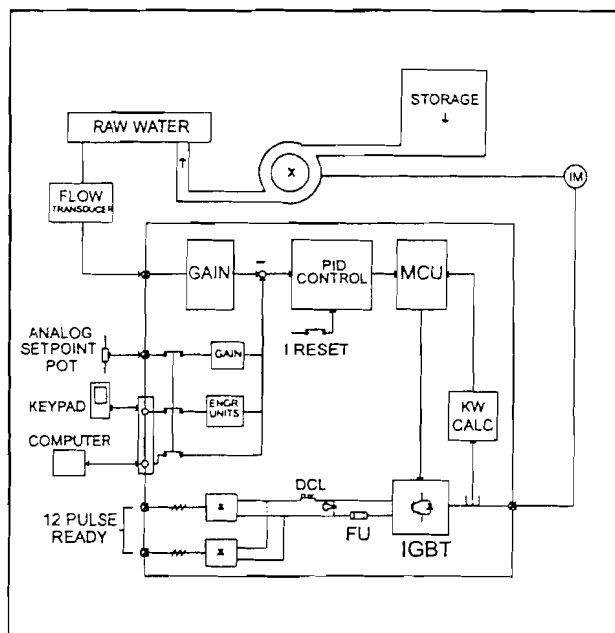
The FP5 inverter includes an innovative new control algorithm that can yield much greater energy savings. Our data shows savings of 17% compared to standard inverters.

This reduction in your operating costs is achieved by a real-time tuning of the inverter output. The inverter continuously optimizes the motor operation, even with load variations, long after the start-up is completed.

Remember, these savings can be achieved with your existing motor!



Typical Energy Savings



Typical Process Control

Integral PID Loop

Most variable torque controls require an external process controller. This device varies the motor speed to maintain the precise temperature, pressure or level desired by the customer.

These controllers are typically third party devices that increase the up-front cost of the system and can complicate its commissioning.

Saftronics' built-in PID control yields the following benefits:

- Lower up front system cost
- Compatibility with the inverter assured
- One source for the start-up
- No additional panel space
- No additional power supplies

Harmonic Suppression

(DC Link Choke and 12 Pulse Input)

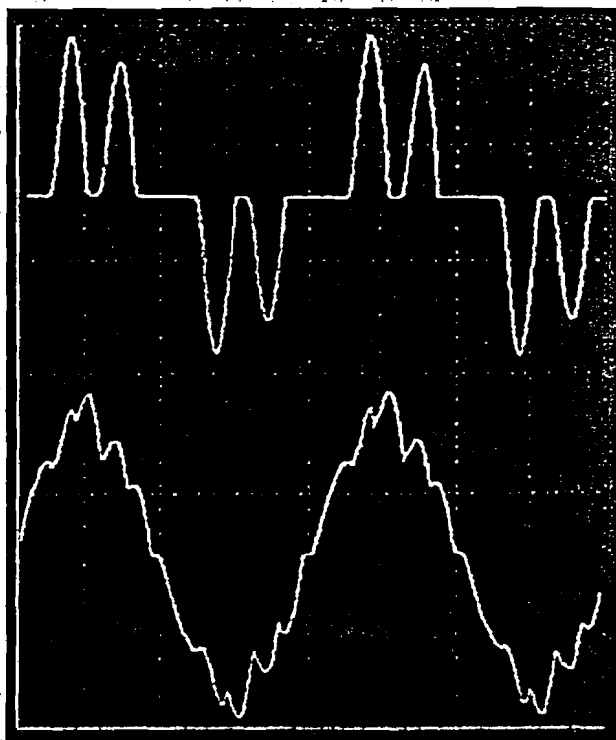
The proliferation of non-linear loads, including computers, switched mode power supplies, electronic ballasts and solid state ac / dc drives has given rise to concerns of the effects of these devices on the incoming power supply. These devices all result in non-sinusoidal, or harmonic, current flow in the power distribution network.

The **FP5** inverters, 30 to 250 HP, include two effective countermeasures against these harmonic problems; a 12-pulse converter assembly*, and an integral dc link reactor (optional dc link reactor available on 5 to 25 HP units). One or both of these approaches can be used to meet the ever increasing demands of such standards as IEEE-519-1992.

The DC link choke effectively smooths the input current waveform. This component eliminates the need for ac input line reactors which are options with most inverters.

The 12-pulse input section can be used with an external phase-shifting transformer to effectively eliminate the 5th and 7th harmonics. These are the highest individual contributors to the harmonic problem.

The two approaches offered by the **FP5** yield today's only cost effective measures against harmonic distortion. Why take chances with any other inverter?



Input Current Waveforms

*Available only on 30 to 250 HP inverters.

User Friendly Keypad

Customers are demanding simpler keypad interfaces. What good does it do to have all of the sophisticated features in the world if nobody can use them?

Our approach to this request has been the quick start keypad. You navigate among the most commonly used parameters and monitor functions simply by depressing the Display (DSPL) key.

This "one touch" approach allows you to access the following:

- Frequency command
- Actual output frequency
- Output current
- Output power
- Accel time
- Decel time
- V/f pattern
- Motor rated current
- PID enable
- Energy saving enable

Other Standard Features

Please contact your local SAFTRONICS representative for more information on the following functions:

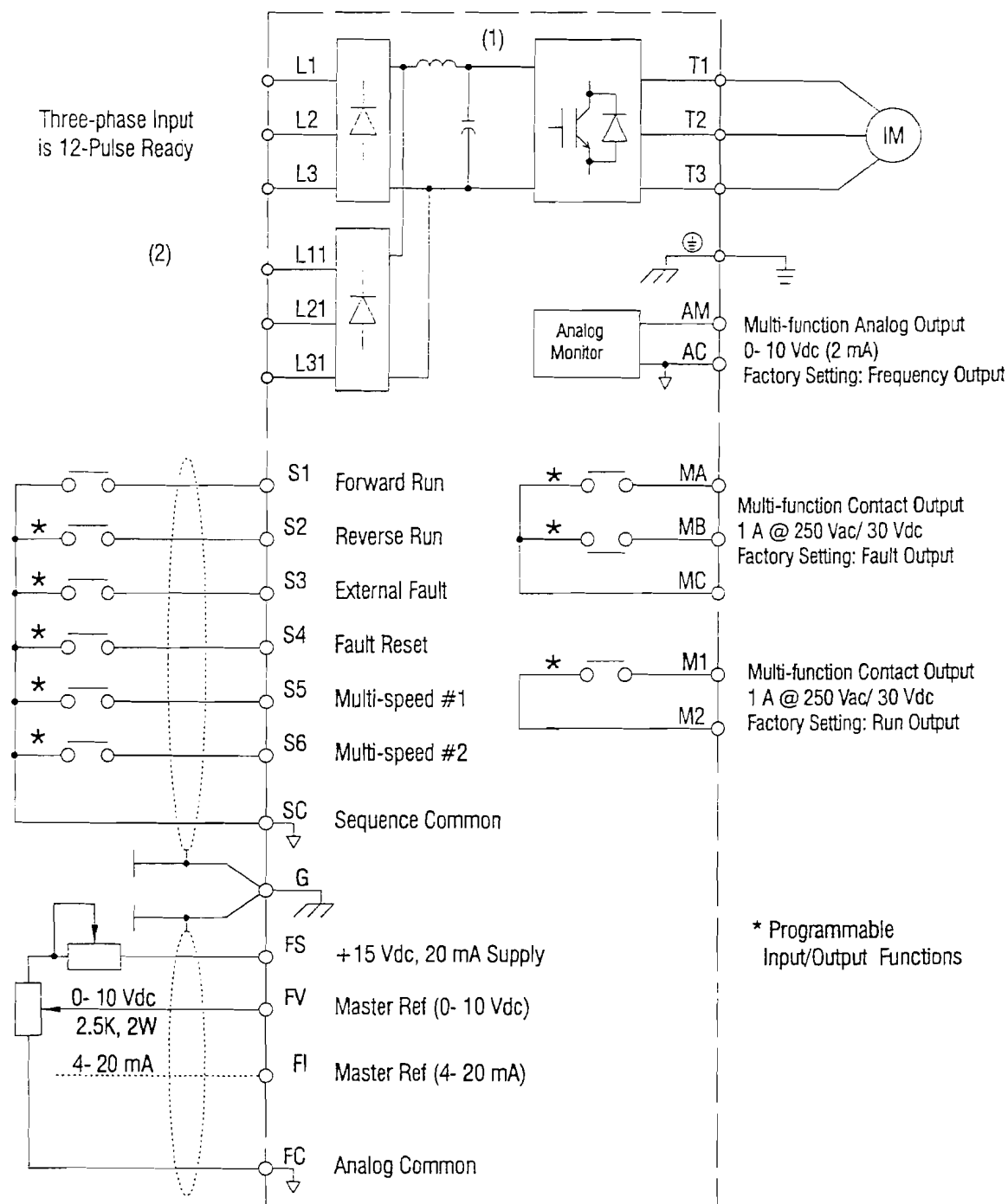
- Speed search (to start into a spinning motor).
- UL recognized motor thermal overload.
- Thermistor based heatsink temperature detection.
to allow an overheat alarm before a fault trip.
- 2 second control power ride-thru.
- Built-in RS-232 Modbus™ communications port.
RS-422/485 with addition of optional SI-K2/P card.
- Enhanced fault diagnostics now also include:
 - input phase loss
 - output phase loss
 - output short circuit
- 0-10 Vdc or 4-20 mA inputs.
- Programmable I/O.
- 5 programmable contact inputs
- 2 programmable digital outputs
- 1 programmable analog output
- On-delay/ off-delay timer function.
- Overtorque detection.
- Elapsed time meter (hours).
- Motorized pot (with or without memory).
- Prohibited frequency points.
- Low audible motor noise.

FP5 Specifications

Output Characteristics	Inverter Model FP5										23P7	25P5	27P5	2011	2015	2018	2022	2030	2037	2045	2055	2075	
	Nominal Motor Output (HP)										5	7.5	10	15/20	25	30	40	50	60	75	100	125	
	Rated Output Current (A)										17.5	27	36	54	68	80	104	130	160	192	248	312	
	Capacity (kVA)										6.9	11	14	22	27	32	41	52	64	76	99	124	
	Maximum Voltage										3-Phase, 200/208/220/230V (Proportional to input voltage) *												
	Rated Output Frequency										0.1 to 400 Hz												
	Overload Capacity										120% rated output current for 1 minute												
Power Supply	Input Current (A)										21	33	44	65	82	88	119	143	176	212	270	344	
	Rated Voltage & Frequency										3-phase, 200 to 230V, 50/60 Hz												
	Voltage Fluctuation										+10%, -15%												
	Frequency Fluctuation										±5%												
Output Characteristics	Inverter Model FP5		43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075	4110	4160	4185	4220	4300			
	Nominal Motor Output (HP)		5	7.5	10	15	20	25	30	40	50	60	75	100	150	200	250	300	400	500			
	Rated Output Current (A)		8	11	14	21	27	34	41	52	65	80	96	128	180	240	302	380	506	675			
	Capacity (kVA)		6.4	8.8	11	17	22	27	33	41	52	64	76	102	143	191	241	303	403	538			
	Maximum Voltage		3-Phase, 380/400/415/440/460V (Proportional to input voltage) *																				
	Rated Output Frequency		0.1 to 400 Hz																				
	Overload Capacity		120% rated output current for 1 minute																				
Power Supply	Input Current (A)		9.6	13.2	16.8	26	33	40	46	58	72	88	106	141	198	264	330	456	608	810			
	Rated Voltage & Frequency		3-phase, 380 to 460V, 50/60 Hz																				
	Voltage Fluctuation		+10%, -15%																				
	Frequency Fluctuation		±5%																				
Control Characteristics	Control Method		Sine wave PWM with full-range, automatic torque boost																				
	Frequency Control Range		0.1 to 400 Hz																				
	Frequency Accuracy		Digital command: 0.01%, Analog command: 0.1%																				
	Frequency Setting Resolution		Digital Operator Reference: 0.1Hz, Analog Reference: 0.06Hz (@ 60Hz)																				
	Output Frequency Resolution		0.01Hz																				
	Frequency Setting		0 to +10 VDC (20kΩ), 4-20mA (250Ω)																				
	Accel/Decel Time		0.1 to 3600.0 seconds (Accel/Decel time setting independently: 0.1 sec.)																				
	Braking Torque		Approximately 20% Standard																				
	Number of V/f Patterns		15 preset V/f patterns and 1 custom																				
Protective Functions	Motor Overload Protection		Electronic thermal overload relay (I²T)																				
	Instantaneous Overcurrent		Motor coasts to a stop at approximately 180% of rated output current																				
	Fuse Protection		Motor coast to a stop at blown fuse																				
	Overload		Motor coasts to a stop after 1 minute at 150% of rated output current																				
	Overvoltage		Motor coasts to a stop if converter output voltage exceeds 410VDC (820VDC at 460V input)																				
	Undervoltage		Motor coasts to a stop if converter output voltage drops below user adjustable value																				
	Momentary Power Loss		Immediate stop after 15ms or longer power loss (continuous system operation during power loss less than 2 seconds is equipped as standard)																				
	Heatsink Overheat		Thermistor - OH1, OH2																				
	Stall Prevention		Stall prevention at acceleration/deceleration and constant speed operation																				
	Ground Fault		Provided by electronic circuit																				
	Power Charge Indication		Charge LED stays on until voltage drops below 50VDC																				
	Environmental Conditions	Input Phase Loss		Single-phase protection																			
Location		Indoor (protected from corrosive gases and dust)																					
Ambient Temperature		+14 to 104°F (-10 to 40°C) for NEMA1 not frozen, +14 to 113°F (-10 to 45°C) for open chassis																					
Storage Temperature		-4 to 140°F (-20 to 60°C)																					
Humidity		95%RH (non-condensing)																					
Vibration		9.8m/s (1G) less than 20 Hz, up to 1.96m/s (0.2G) at 20 to 50 Hz																					

* Consult factory for 200V, 208V, and 380V ratings

FP5 Interconnect

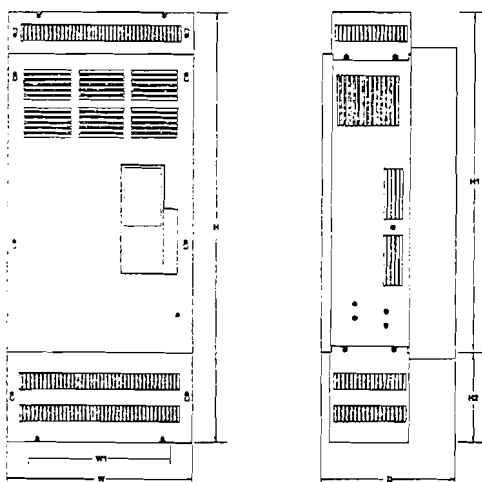


(1) Input DC Link Reactor is standard on 2018 - 2075 and 4018 - 4160 (30HP through 250HP). It is available as an option on 23P7 - 2015 and 43P7 - 4015 (5 - 25 HP).

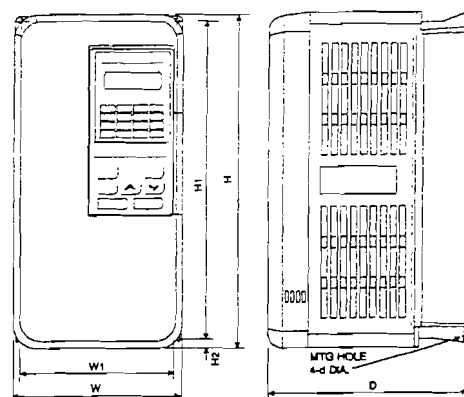
(2) 12 Pulse Input is standard on 2018 - 2075 and 4018 - 4160 (30HP through 250HP). Shipped with jumpers as shown.

FP5 Dimensions

Voltage	Model FP5	Part # E7001-	Enclosed Wall-mounted Type (IP20, NEMA1) inches/mm							Weight lbs./kg
			W	H	D	W1	H1	H2	d	
230V	23P7	05F	5.5/140	11.0/280	7.1/180	5.0/126	10.5/266	0.3/7	M5	10/4.5
	25P5	06F	7.9/200	11.8/300	8.1/205	7.3/186	11.2/285	0.3/8	M6	12/5.5
	27P5	07F								13/6
	2011	08F	9.8/250	15.0/380	8.9/225	9.3/236	14.4/365	0.3/7.5 1.08/27.5	M6	24/11
	2015	09F		15.6/400						
460V	43P7 44P0	26F 25F	5.5/140	11.0/280	7.1/180	5.0/126	10.5/266	0.3/7	M5	10/4.5
	45P5 47P5	27F 28F	7.9/200	11.8/300	8.1/205	7.3/186	11.2/285	0.3/8	M6	13/6
	4011 4015	29F 30F	9.8/250	15.0/380	8.9/225	9.3/236	14.4/365	0.3/7.5	M6	24/11



Models 2018 - 2075
and 4018 - 4300



Models 23P7 - 2015
and 43P7 - 4015

Voltage	Model FP5	Part # E7001-	Open Chassis Type (IP00) inches/mm						Weight lbs./kg	Part # E7001-	Enclosed Wall-mounted Type (IP20, NEMA1) inches/mm						Weight lbs./kg
			W	H	D	W1	H1	H2			W	H	D	W1	H1	H2	
230V	2018	-	-	-	-	-	-	-	-	10F	13/330	24.6/10	11.2/285	10.8/275	17.1/435	3.4/87.5	71/32
	2022	-	-	-	-	-	-	-	11F	26.6/675		5/152.5					
	2030	13F	16.7/425	26.6/675	13.8/350	12.6/320	25.6/650	0.5/12.5	134/61	12F	16.9/430	38.8/985	13.8/350	12.6/320	25.6/650	8.4/212.5	148/67
	2037	15F							137/62	14F							150/68
	2045	17F	18.7/475	31.5/800	13.8/350	14.6/370	30.5/775	0.5/12.5	176/80	16F	18.9/480	43.7/1110	13.8/350	14.6/370	30.5/775	8.4/212.5	192/87
	2055	19F								18F							
	2075	21F	22.6/575	36.4/925	15.8/400	17.5/445	35.2/895	.6/15	298/135	20F	22.8/580	50.8/1290	15.8/400	17.5/445	35.2/895	10.6/270	320/145
460V	4018	-	-	-	-	-	-	-	-	31F	13.0/330	24.0/610	11.2/285	10.8/275	17.1/435	3.4/87.5	68/31
	4022	-	-	-	-	-	-	-	32F								
	4030	-	-	-	-	-	-	-	-	33F	13.0/330	30.9/785	11.2/285	10.8/275	24.0/610	3.4/87.5	106/48
	4037	-	-	-	-	-	-	-	34F								
	4045	-	-	-	-	-	-	-	-	35F		33.5/850			6.0/152.5		
	4055	38F	17.9/455	32.3/820	13.8/350	13.8/350	31.3/795	0.5/12.5	174/79	37F	18.1/460	44.5/1130	13.8/350	13.8/350	31.3/795	8.4/212.5	187/85
	4075	40F							176/80	39F							
	4110	42F	22.6/575	36.4/925	14.8/375	17.5/445	35.2/895	0.6/15	298/135	41F	22.8/580	50.8/1290	14.8/375	17.5/445	35.2/895	10.6/270	320/145
	4160	44F			15.8/400					320/145			43F				15.8/400
	4185	46F	37.4/950	57.1/1450	17.1/435	29.5/750	55.1/1400	1.0/25	794/360	-							
	4220	48F															
4300	50F	37.8/960	63.0/1600	18.0/455	29.5/750	61.0/1550	1.0/25	826/420	-								

SECTION 2-F

OPERATOR LIGHTS & SWITCHES

PANEL MOUNT, NEMA 4X

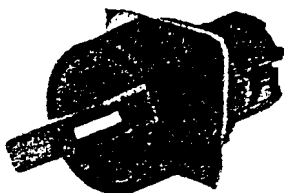
HAND OFF AUTO (SPRING RETURN)	ALLEN BRADLEY # 800EP-SL32
RUN LIGHT (GREEN)	ALLEN BRADLEY # 800EP-PL3
FAULT LIGHT (YELLOW)	ALLEN BRADLEY # 800EP-PL5
ALARM (RED)	ALLEN BRADLEY # 800EP-PL4
RESET PUSHBUTTON	ALLEN BRADLEY # 800EP-F2

Bulletin 800E

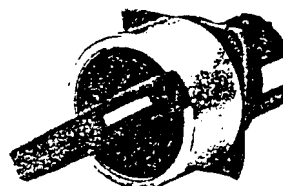
22.5 mm Push Buttons

IP66, Type 4/4X/13 (Plastic) — IP66, Type 4/13 (Metal)

3-Position Selector Switch Operators, Non-Illuminated

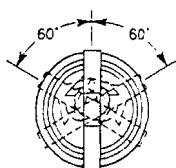


Standard Knob
Cat. No. 800EP-SM33



Knob Lever
Cat. No. 800EM-HM33

Switching Angles



Target Table and Operator Position (60° Switching Angle)				
Contact Type	Position on Mounting Latch			
N.O.	Left	X	O	O
N.O.	Right	O	O	X
N.C.	Left	O	X	X
N.C.	Right	X	X	O

Note: X = Closed/O = Open

Color	Operator Type M = Maintained S = Spring Return	Standard Knob — Round		Knob Lever — Round	
		Plastic	Metal	Plastic	Metal
		Cat. No.	Cat. No.	Cat. No.	Cat. No.
Black knob with white insert		800EP-SM32	800EM-SM32	800EP-HM32	800EM-HM32
		800EP-SR32	800EM-SR32	800EP-HR32	800EM-HR32
		800EP-SL32	800EM-SL32	800EP-HL32	800EM-HL32
		800EP-SB32	800EM-SB32	800EP-HB32	800EM-HB32

Back-of-Panel Components, Non-Illuminated Operators

Mounting Latch

	Contact	2-Across Mounting	3-Across Mounting
		Cat. No.	Cat. No.
 2-Across	 3-Across	800E-A2L	800E-A3L

Contact Block

	Type	Contact	2-Across Mounting	3-Across Mounting
			Cat. No.	Cat. No.
 2-Across	Standard	1 N.O.	800E-2X10	800E-3X10
		1 N.C.	800E-2X01	800E-3X01
	PenTUFF (low voltage) ❶	1 N.O.	800E-2X10V	800E-3X10V
		1 N.C.	800E-2X01V	800E-3X01V

Mounting Latch and Contact Blocks ❷

	Type	Contact	2-Across Mounting	3-Across Mounting
			Cat. No.	Cat. No.
 2-Across	Standard	1 N.O.	800E-2LX10	800E-3LX10
		1 N.C.	800E-2LX01	800E-3LX01
		1 N.O. - 1 N.C.	800E-2LX11	800E-3LX11
		2 N.O.	800E-2LX20	800E-3LX20
	PenTUFF (low voltage) ❶	2 N.C.	800E-2LX02	800E-3LX02
		1 N.O.	800E-2LX10V	800E-3LX10V
		1 N.C.	800E-2LX01V	800E-3LX01V
		1 N.O. - 1 N.C.	800E-2LX11V	800E-3LX11V

❶ Patented PenTUFF contacts supplied only with 2-across mounting, gold-plated contacts supplied only with 3-across mounting.

❷ 2-across mounting latch and contact block combinations are factory assembled. When one contact block is specified, it is mounted in position 2 (right side/viewed from back). When 1 N.O. and 1 N.C. contacts are specified, the N.O. is mounted in position 2, and the N.C. is mounted in position 1 (left side/viewed from the back).

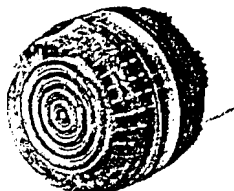
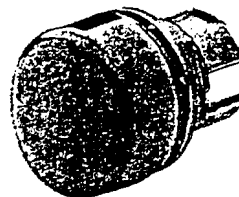
Accessories — Page 10-233

Legend Plates — Page 10-248

Approximate Dimensions — Page 10-256

22.5 mm Push Buttons

IP66, Type 4/4X/13 (Plastic) — IP66, Type 4/13 (Metal)

Pilot Light Operators — Optically Enhanced and Diffuser StyleOptically Enhanced Pilot Light
Cat. No. 800EP-PL5Diffuser Style Pilot Light
Cat. No. 800EM-P4

Color	Optically Enhanced — Round		Diffuser Style — Round	
	Plastic	Metal	Plastic	Metal
	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Green	800EP-PL3	800EM-PL3	800EP-P3	800EM-P3
Red	800EP-PL4	800EM-PL4	800EP-P4	800EM-P4
Amber	800EP-PL5	800EM-PL5	800EP-P5	800EM-P5
No lens	800EP-P9	800EM-P9	800EP-P9	800EM-P9

Back-of-Panel Components, Illuminated Operators**Full Voltage Power Module with Latch**

	Type	Volts	2-Across Mounting	3-Across Mounting
			Cat. No.	Cat. No.
	No lamp ❶	—	800E-2DL0	800E-3DL0
	Incandescent	24 AC/DC	800E-2DL3	800E-3DL3
		120 AC/DC	800E-2DL5	800E-3DL5
	LED ❷ (red)	24 AC/DC	800E-2DL3R	800E-3DL3R
		120 AC	800E-2DL5R	800E-3DL5R
	LED ❷ (green)	24 AC/DC	800E-2DL3G	800E-3DL3G
		120 AC	800E-2DL5G	800E-3DL5G
	LED ❷ (amber)	24 AC/DC	800E-2DL3A	800E-3DL3A
		120 AC	800E-2DL5A	800E-3DL5A

Transformer Power Module with Latch

	Type	Volts	2-Across Mounting	3-Across Mounting
			Cat. No.	Cat. No.
	Incandescent	110/120 AC	800E-2TL5	800E-3TL5
		220/240 AC	800E-2TL7	800E-3TL7
	LED ❷ (red)	110/120 AC	800E-2TL5R	800E-3TL5R
		220/240 AC	800E-2TL7R	800E-3TL7R
	LED ❷ (green)	110/120 AC	800E-2TL5G	800E-3TL5G
		220/240 AC	800E-2TL7G	800E-3TL7G
	LED ❷ (amber)	110/120 AC	800E-2TL5A	800E-3TL5A
		220/240 AC	800E-2TL7A	800E-3TL7A

❶ Lamp must match line voltage. See replacement lamps table on page 10-247.

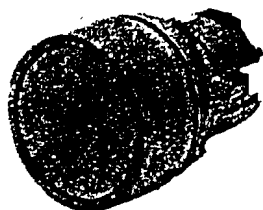
❷ LEDs are available in red, green, blue, amber, and white; color cap must match LED color.

Bulletin 800E

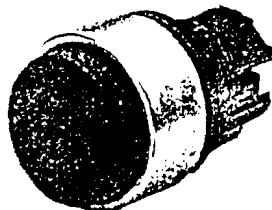
22.5 mm Push Buttons

IP66, Type 4/4X/13 (Plastic) — IP66, Type 4/13 (Metal)

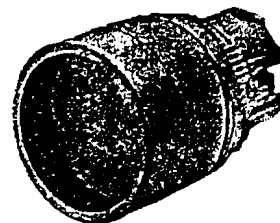
Momentary Contact Push Button Operators, Non-Illuminated — Flush, Extended, Guarded



Flush Operator
Cat. No. 800EP-F3



Extended Operator
Cat. No. 800EM-E4





Guarded Operator
Cat. No. 800EP-G3

Color	Flush — Round		Extended — Round		Guarded — Round	
	Plastic	Metal	Plastic	Metal	Plastic	Metal
	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Black	800EP-F2	800EM-F2	800EP-E2	800EM-E2	800EP-G2	800EM-G2
Green	800EP-F3	800EM-F3	800EP-E3	800EM-E3	800EP-G3	800EM-G3
Red	800EP-F4	800EM-F4	800EP-E4	800EM-E4	800EP-G4	800EM-G4
No cap	800EP-F9	800EM-F9	800EP-F9	800EM-F9	800EP-G9	800EM-G9

Back-of-Panel Components, Non-Illuminated Operators

Mounting Latch

		Contact	2-Across Mounting	3-Across Mounting
			Cat. No.	Cat. No.
2-Across	3-Across	Mounting latch	800E-A2L	800E-A3L
				

Contact Block

		Type	Contact	2-Across Mounting	3-Across Mounting
				Cat. No.	Cat. No.
2-Across	3-Across	Standard	1 N.O.	800E-2X10	800E-3X10
			1 N.C.	800E-2X01	800E-3X01
		Pen TUFF (low voltage) ①	1 N.O.	800E-2X10V	800E-3X10V
			1 N.C.	800E-2X01V	800E-3X01V

Mounting Latch and Contact Blocks

		Type	Contact	2-Across Mounting	3-Across Mounting
				Cat. No.	Cat. No.
2-Across	3-Across	Standard	1 N.O.	800E-2LX10	800E-3LX10
			1 N.C.	800E-2LX01	800E-3LX01
			1 N.O. - 1 N.C.	800E-2LX11	800E-3LX11
			2 N.O.	800E-2LX20	800E-3LX20
			2 N.C.	800E-2LX02	800E-3LX02
		Pen TUFF (low voltage) ①	1 N.O.	800E-2LX10V	800E-3LX10V
			1 N.C.	800E-2LX01V	800E-3LX01V
			1 N.O. - 1 N.C.	800E-2LX11V	800E-3LX11V

① Patented Pen TUFF contacts supplied only with 2-across mounting, gold-plated contacts supplied only with 3-across mounting.

SECTION 2-G

WELL PUMP MONITOR

THREE PHASE MONITOR, ADJUSTABLE SET POINTS, INDICATOR LIGHTS

COYOTE # 3PH208V	1 EACH
COYOTE # 3PH460V	1 EACH

COYOTE

PROTECTS THREE PHASE PUMPS and MOTORS
from

PHASE

phase loss
phase reversal

VOLTAGE

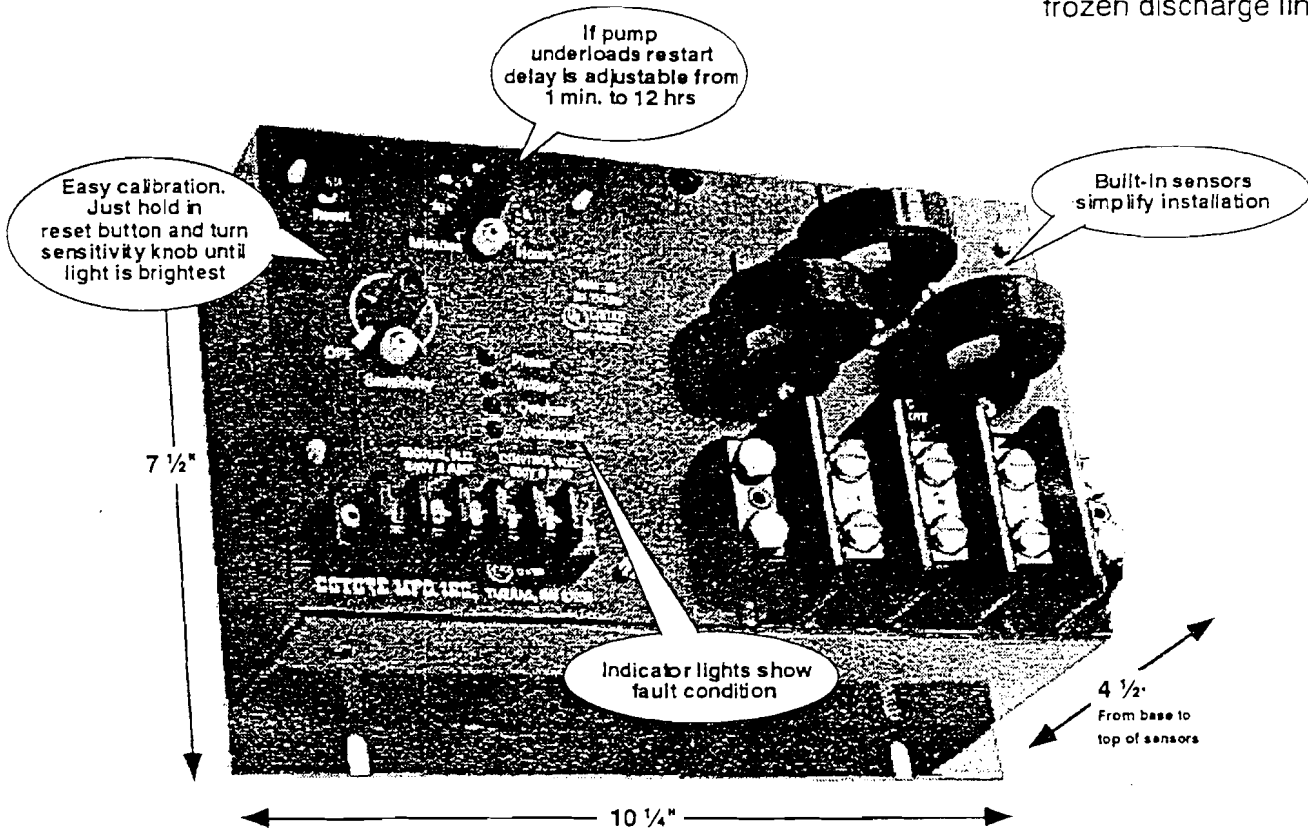
high voltage
low voltage
voltage imbalance

OVERLOAD

excessive current draw
sand locking
broken wire to motor
rapid cycling

UNDERLOAD

running dry
gas locking
air locking
clogged inlet
frozen discharge line



NO PLUMBING • NO PROBES • FULLY AUTOMATIC

FIVE MODELS

U.L. HORSEPOWER RATINGS

3PH208V	50 Hz or 60 Hz	1/3 - 60 HP
3PH230V	50 Hz or 60 Hz	1/3 - 75 HP
3PH380V	50 Hz or 60 Hz	1/3 - 125 HP
3PH460V	50 Hz or 60 Hz	1/3 - 150 HP
3PH575V	50 Hz or 60 Hz	1/3 - 200 HP



COYOTE
MANUFACTURING, INC.

7120 WEST 117 AVE UNIT B 4
BROOMFIELD, CO 80452

800-468-1177

FAX 303-635-0135

No need to specify horsepower when ordering.
Each voltage model will operate any horsepower
motor in its range.

THREE PHASE COYOTE TECHNICAL DATA

OPERATING RANGE

-20° TO + 70° C temperature
0% to 95% humidity noncondensing

RANDOM START

When energizing Coyote by turning on power at circuit breaker or fused disconnect there is a delay of 4 to 10 seconds before Coyote turns on the pump. This "random start" feature is designed to prevent many pumps served by a single power source from all restarting at the same instant when power is restored after a power outage.

VOLTAGE FAULT

	low voltage		high voltage	
model	trip	reset	reset	trip
3PH208V	172V	181V	235V	244V
3PH230V	190V	200V	260V	270V
3PH380V	320V	330V	430V	440V
3PH460V	380V	400V	520V	540V
3PH575V	475V	500V	650V	675V
	trip delay		reset delay	
	2 seconds		60 seconds	

PHASE LOSS OR REVERSAL

trip delay	reset delay
1 second	60 seconds

OVERLOAD

trip amps	trip delay	reset delay
120% of normal	1/4 second	60 seconds

Tries two times to restart 60 seconds apart. If unsuccessful, Coyote locks out pump and overload light blinks.

UNDERLOAD OR LACK OF FLUID

trip delay	reset delay
1 second	adjustable
	1 minute - 12 hours

SIGNAL

Normally open dry contact closes to activate alarm on any fault condition.

ALL ABOUT THREE PHASE COYOTES

What does it do?

Coyote shuts off the pump:

- If the pump fails to pump fluid because there is no fluid available to it, or because it is gas locked or air locked, or because the inlet is clogged;
- If the power supplied to the pump is improper, e.g., phase reversed or missing, voltage too high or too low, etc.;
- If the motor draws excessive current or if there is a broken wire to the motor.

For how long does it shut off?

- If the pump runs out of fluid, Coyote restarts it after waiting the interval you choose on the timer.
- If the incoming power goes bad, Coyote restarts the pump one minute after proper power is restored.
- If the motor draws excessive current, Coyote will try two times to restart it. If the overcurrent condition is not cured, Coyote locks out the pump to prevent motor winding burn out, and the overcurrent light blinks.

What if there is not enough fluid to pump when the pump restarts?

Coyote will let it run just one second, shut it off, wait the time dialed on the timer and try again, wait the time dialed on the timer and try again, until there is enough to pump.

What if I want to turn on the pump before the timer has run its cycle?

Just push the RESET button or turn the power off and then on again at the circuit breaker and the pump will restart.

How does it work?

Coyote monitors the incoming power and the electrical characteristics of the motor. When the pump quits pumping fluid, those characteristics change, and Coyote shuts it off.

Will it operate on power supplied by generators and phase converters?

Yes.

On what kinds of pumps does it work?

Submersibles, centrifugals, jets, and sumps.

In what kinds of applications?

Water wells, oil wells, booster and lift stations, chemicals transfer, mine dewatering, sewage treatment, solution mining, food processing, construction dewatering, and clean-up of aquifers contaminated by hydrocarbons are the most common.

What about protection from the environment?

The insides of Coyote are sealed in plastic to keep out moisture, insects and blowing sand and dust.

What about power outages?

When the power is out, the pump won't run. When it comes back on, Coyote automatically resets itself. There is no need to touch anything.

What about lightning induced power surges?

Rugged and effective protection for the electronics of Coyote is built-in.

How is it installed?

Coyote is installed between the circuit breaker and magnetic contactor in minutes with a standard screwdriver.

What if I need something a little different from the standard unit?

Please call us. Options too numerous to detail here are available.

LIMITED WARRANTY

Coyote products are warranted against faulty materials or workmanship for one year from date of manufacture. Coyote's liability under this warranty is limited to repairing, replacing, or at its option issuing credit for any product returned during this period, and provided that any such defect has not been caused by misuse, neglect, improper installation, repair, or alteration. Coyote will not be liable and specifically disclaims responsibility to any party for loss, direct or indirect, for costs, expenses, or for consequential damage of any nature.

SECTION 2-H

PROGRAMMABLE LOGIC CONTROLLER

MODULAR STYLE PROGRAMMABLE CONTROLLER

CPU	PLC DIRECT # D2-250	
RACK	PLC DIRECT # D2-09B	
DIGITAL INPUT	PLC DIRECT # D2-16NA	
DIGITAL OUTPUT	PLC DIRECT # D2-12TR	
ANALOG INPUT	PLC DIRECT # F2-08AD-1	
ANALOG OUTPUT	PLC DIRECT # F2-02DA-1L	(2 EA.)

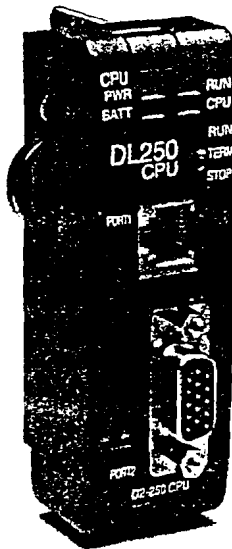


D2-250 Key Features

D2-250

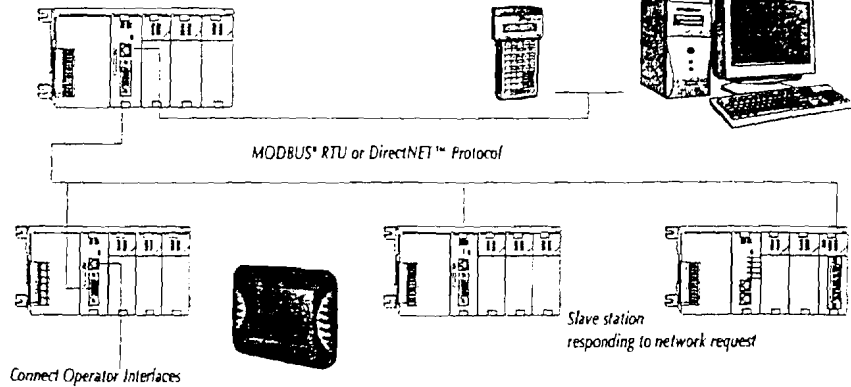
The D2-250 provides all the capabilities of our D2-230 and D2-240 CPUs, plus several additional features rarely found in a PLC of this size. With such an incredible array of features, you may be able to replace PLCs costing hundreds (or thousands) more.

Release 2.1 or higher of **DirectSOFT™** will be required to program the D2-250. If you're using a handheld programmer, version 1.8 of handheld programmer firmware will also be required. Here are a few key features about the D2-250 CPU:



Master station issuing network requests

Easily connect programming devices



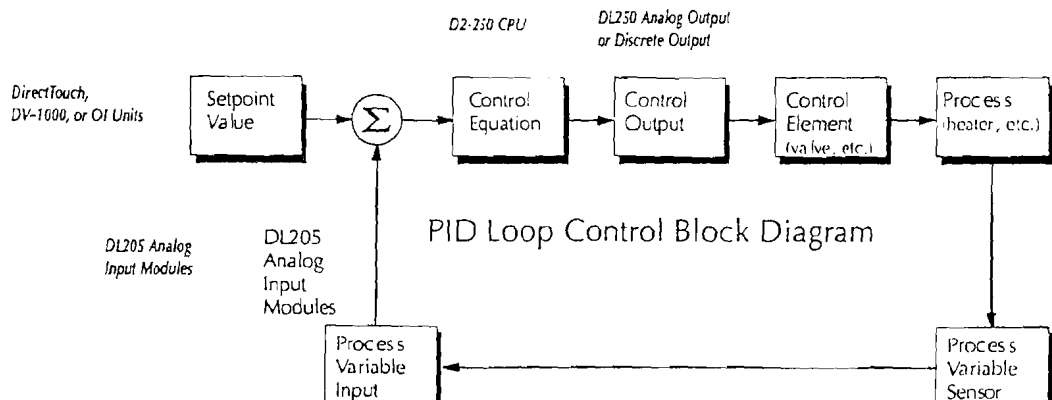
Powerful communications

The D2-250 offers 2 communication ports that provide a vast array of communication possibilities. The top RS232C port is for programming, connection to a DV-1000, EZText/EZTouch operator interface panels, or a **DirectNET** slave. The 15-pin bottom port supports RS232C or RS422. This port offers several different protocol options, such as K-sequence, **DirectNET** Master/Slave, MODBUS RTU Master/Slave, and even a direct connection to a remote I/O network. The D2-250 also supports the Data Communication Module and the Ethernet Communication module.

Four PID loops and auto tuning!

The D2-250 CPU can process up to 4 PID loops directly in the CPU. You can select from various control modes including automatic, manual, and cascade control. There are a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The loop operation parameters (Process Variable, Setpoint, Setpoint Limits, etc.) are stored in V-memory, which allows easy access from operator interfaces or HMIs. Setup is accomplished with easy-to-use setup menus and monitoring views in **DirectSOFT** programming.

The auto tuning feature is easy to use and can reduce setup and maintenance time. Basically, the CPU uses the auto tuning feature to automatically determine near optimum loop settings.



Serial networking as Master or Slave

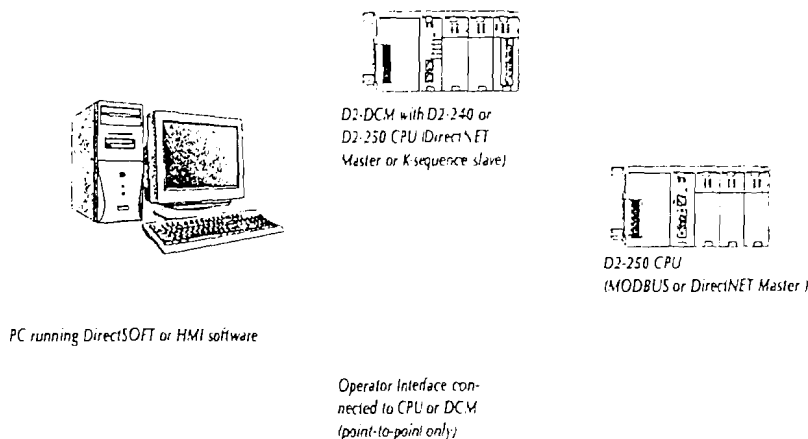
A D2-250 CPU can serve as a network master or slave for either **DirectNET** or MODBUS RTU. The bottom port of the D2-240 can be used as a **DirectNET** slave. The D2-230 cannot be used for networking but does offer K-sequence protocol for programming or for connecting an operator interface. The Data Communication Module (D2-DCM) can act as a **DirectNET** master, **DirectNET** peer, or a MODBUS[®] RTU slave. It requires a D2-240 or D2-250 CPU. Check the slot placement requirements, set the DIP switches, and plug in the D2-DCM. Adding an additional communication port is that simple. You can also program the CPU through the DCM if you have a PC master running **DirectSOFT** Programming Software. If you need an RS422 network for multidrop capability, use the F2-UNICON RS232C to RS422 adapter.

Ethernet networking

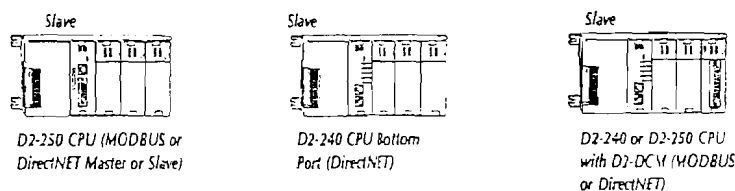
The D2-240 and D2-250 CPU both support the new H2-ECOM modules which make Ethernet networking a snap. The H2-ECOM module supports industry standard 10BaseT networking with an RJ45 port. The H2-ECOM-F has ST-style bayonet connectors for 10BaseFL fiber optic connections. The ECOM modules use standard cables, hubs, and repeaters which are available from a large number of suppliers. A virtually unlimited number of PLCs can be connected to an Ethernet network using ECOM modules.

This is the fastest data transfer rate we offer for HMI or other Windows-based software. Use **DirectSOFT** to program any PLC on the network. When monitoring

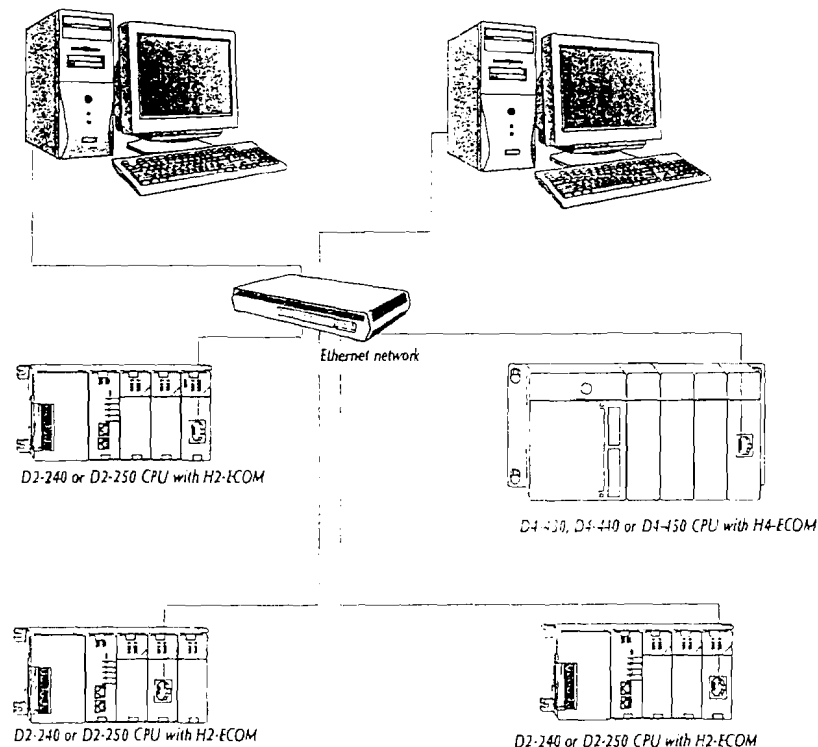
One Master per network for DirectNET or MODBUS



DirectNET or MODBUS RTU Slaves



PCs running **DirectSOFT** Programming Software, HMI Software, or other Windows-based programs



your operating PLC, you will see much faster updates using Ethernet and the ECOM module.



Communications

What are the communication requirements for your control system? Do you only need a programming port? Could you use an extra port to connect an operator interface or HMI? Would you like to connect to a network of other Automationdirect.com products, or a MODBUS RTU or Ethernet network? The DL205 family provides "Valued Technology" solutions for all of these needs.

Protocols supported

The DL205 family supports the following protocols through the CPU, a Data Communications Module, or an Ethernet Communication Module:

K-sequence—our point-to-point proprietary protocol, used by our handheld programmers, **DirectSOFT**, **EZTouch/EZText** Panels, DV-1000, or other Operator Interface panels.

DirectNET—our serial master/slave network protocol: connects up to 90 stations in a network. Transfer V-memory, I/O status, etc.

MODBUS RTU—an industry standard network protocol, developed by MODICON, but available for use by many vendors.

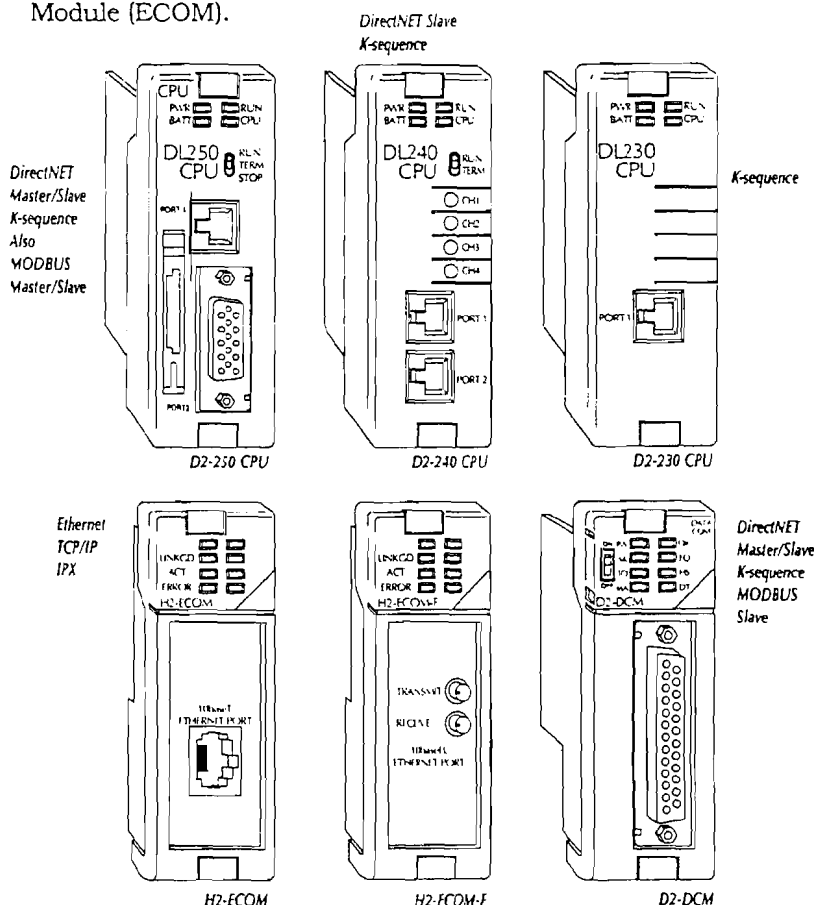
Ethernet TCP/IP and IPX—extremely fast data transfer for HMIs, **DirectSOFT**, or PLC-to-PLC communications.

D2-250

The D2-250 offers two built-in ports. The top port is an RS232C port that is primarily used for programming connections to our handheld programmer or a personal computer running **DirectSOFT**. It can also be used to connect EZTouch/EZText panels, a DV-1000 or other operator interface. The 15-pin bottom port uses either RS232C or RS422. It can be used in the same manner as the phone jack, plus it can be a **DirectNET**™ master/slave port, or a MODBUS RTU master/slave port. The bottom port can also be used as an ASCII output port for connections to printers or other devices that can take ASCII input. The D2-250 also supports the Data Communications Module (DCM) and the Ethernet Communication Module (ECOM).

D2-230 and D2-240

The D2-240 CPU offers 2 built-in RS232C communication ports. The D2-230 CPU offers one RS232C port. Operator interfaces, such as the EZTouch/EZText Panels, DV-1000 and **DirectSOFT** can be connected to any of these ports. The handheld programmer can be attached to any DL205 CPU. Port 2 on the D2-240 supports **DirectNET** (slave mode). The D2-240 also supports the DCM and ECOM.



D2-250 Key Features

Full array of instructions

Imagine if someone asked you to use only 50 different words to write a book. It would be difficult to do. The same is true for writing a PLC program. The right instruction can greatly simplify your programming task and can save hours of programming time.

The D2-250 supports over 160 powerful instructions.

- Four types of drum sequencers
- Leading and trailing edge triggered one-shots
- Bit of word manipulation
- Floating point conversions
- Print instruction to send ASCII data through the bottom port

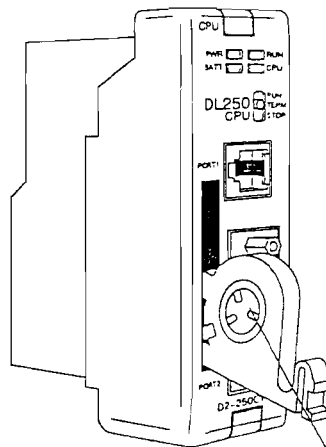
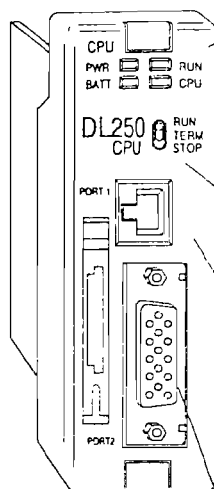
For a complete list of instructions supported by all DL205 CPUs, see the end of this section.

On-board flash memory

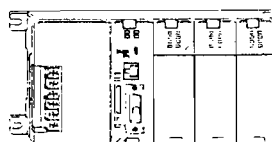
The D2-250 has 7.6K of flash memory on board. With flash memory, you don't have to worry about losing the program due to a bad battery. If you have critical data stored in V-memory, simply purchase the optional lithium battery to maintain these parameters as well.

Built-in remote I/O connection

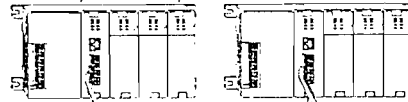
In addition to providing outstanding communications capabilities, the bottom port on the D2-250 can also be used as a master for remote I/O networks. If you need extra I/O at a remote distance from the CPU, you can use this port to add up to 7 of our remote slave stations. (See the D2-RSSS for additional information.)



Built-in Remote I/O Master feature...



...allows you to connect up to seven remote slaves!



CPU Status Indicators

RUN	ON	CPU is in RUN mode
	OFF	CPU is in Program mode
BATT	ON	Battery backup voltage is low
	OFF	Battery backup voltage is OK or disabled
CPU	ON	CPU internal diagnostics has detected an error
	OFF	CPU is OK
PWR	ON	CPU power good
	OFF	CPU power failure

Mode Switch

RUN	CPU into Run Mode
TERM	Allows peripherals (HPP, DirectSOFT) to select the mode of operation
STOP	Forces CPU out of RUN mode

Port 1

Protocols	K-sequence slave, DirectNET™ slave
Devices	Can connect w/HPP, DirectSOFT, DirectTouch, DV-1000, Oper. Inter. Panels, or any DirectNET master
Specs.	6P6C phone jack connector RS232C 9,600 Baud Odd parity only 8 data bits one start, one stop Asynchronous, Half-duplex, DTE

Port 2

Protocols	K-sequence slave, DirectNET Master/Slave, MODBUS RTU Master/Slave
Devices	Can connect w/many devices, such as PCs running DirectSOFT, DDE Server, HMI packages, EZText/EZTouch, DV-1000, Oper. Inter. Panels, or any DirectNET or MODBUS RTU master or slave.
Specs.	HD15 connector RS232C/RS422 300/1200/4800/9600 19.2K/38.4K Baud Odd, even, or no parity Selectable address (1-90, HEX 1 - 5A) 8 data bits, one start, one stop Asynchronous, Half-duplex, DTE Remote I/O

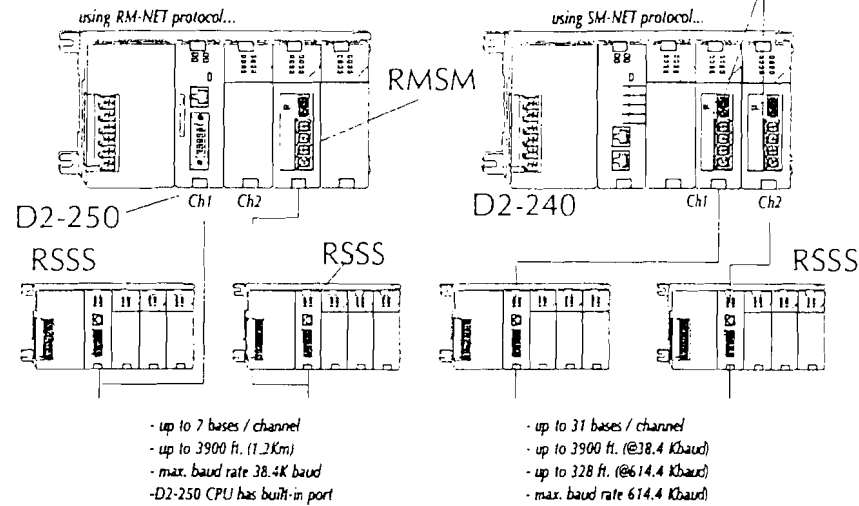
Battery (Optional)

D2-BAT-1	Coin type, 3.0V Lithium battery, 560mA, battery number CR2354
----------	---

Note: Batteries are not needed for program backup. However, you should order a battery if you have parameters in V-memory that must be maintained in case of a power outage.

D2205

Remote I/O

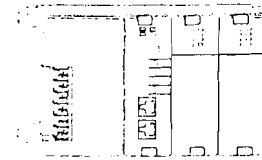


Remote Master - One master for each channel. Can be a D2-RMSM, or the bottom port on a D2-250 CPU. (The D2-250 CPU only supports RM-NET.)

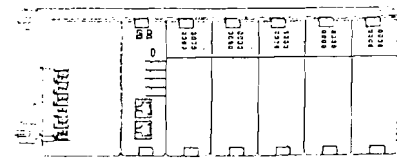
Remote Slave - Must have a D2-RSSS and base for each slave. The remote I/O points are updated asynchronously to the CPU scan. For this reason, remote I/O applications should be limited to those that do not require the I/O points to be updated on every scan.

Base Configurations

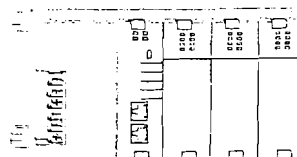
3-slot base. 64pts max.



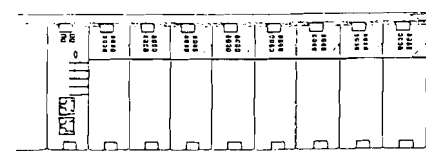
6-slot base. 160pts max.



4-slot base. 96pts max.



9-slot base. 256pts max.



Specification	AC Powered Bases	24VDC Powered Bases	125VDC Powered Bases
Part numbers	D2-03B, D2-04B, D2-06B, D2-09B	D2-03BDC-1, D2-04BDC-1, D2-06BDC-1, D2-09BDC-1	D2-03BDC-2, D2-04BDC-2, D2-06BDC-2, D2-09BDC-2
Voltage withstand (dielectric)	1 minute @ 1,500 VAC between primary, secondary, field ground, and run relay		
Insulation resistance	> 10M @ 500 VDC		
Input voltage range	85-132 VAC (110 range) 170-264 VAC (220 range) 47-63Hz	10.2 - 28.8VDC (24VDC) with less than 10% ripple	90-264VDC (125 VDC) with less than 10% ripple 115-264 VDC (9-slot base)
Auxiliary 24 VDC output	200mA max. 300mA max. (9-slot base)	none	200mA max. 300mA max. (9-slot base)
Maximum inrush current	30A	20A < 1ms	20A
Maximum power	50 VA 80 VA (9-slot base)	15W 25W (9-slot base)	30VV

DL205



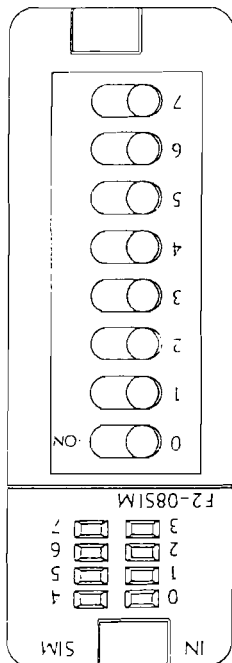
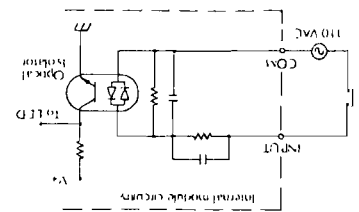
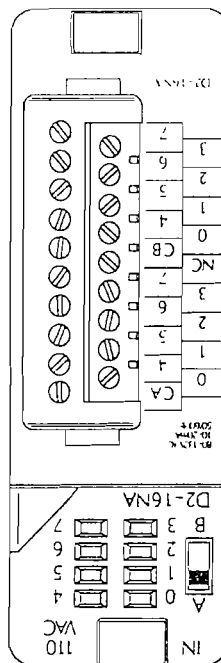
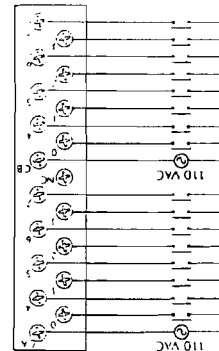
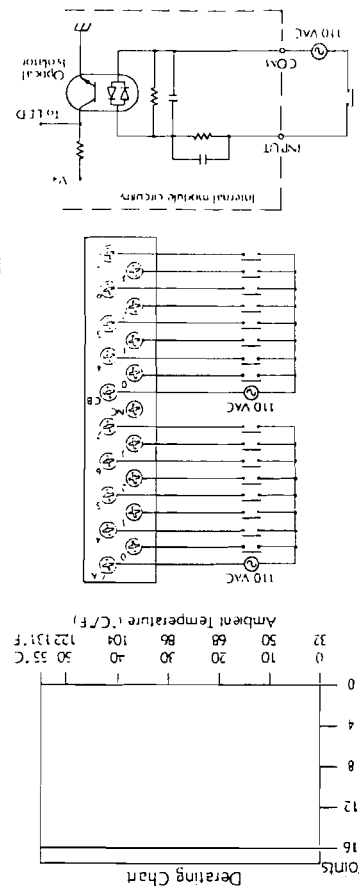
I/O Modules

F2-08SIM Input Simulator

Inputs per module	8
Base power required	50mA max
Terminal Type	None
Status Indicator	Switch side
Weight	2.65oz (75g)

Inputs per module	16
Commons per module	2 (isolated)
Input voltage range	80-132VAC
Peak voltage	132VAC
AC frequency	47-63Hz
ON voltage level	70VAC minimum
OFF voltage level	20VAC maximum
Input impedance	12K Ω @ 60Hz
Input current	11mA @ 100VAC, 50Hz 13mA @ 100VAC, 60Hz 15mA @ 132VAC, 60Hz
Minimum ON current	5mA
Maximum OFF current	2mA
Base power required	100mA max
OFF to ON response	5 to 30ms
ON to OFF response	10 to 50ms
Terminal Type	Removable
Status Indicator	Logic side
Weight	2.4oz (68g)

D2-16NA AC Input



I/O Modules



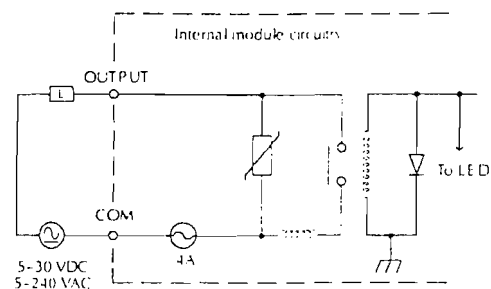
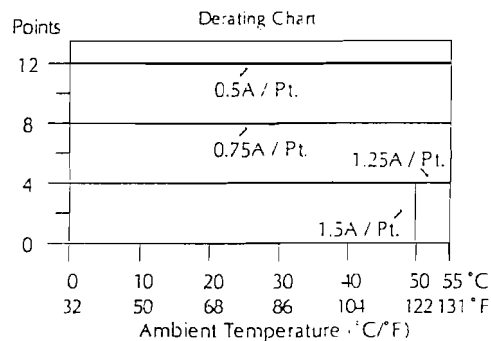
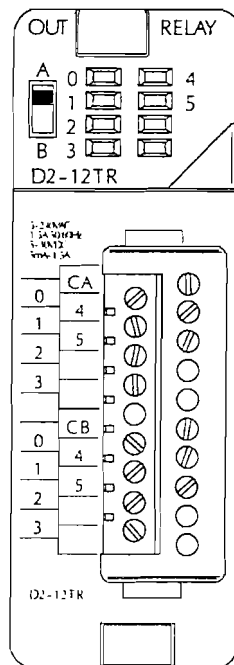
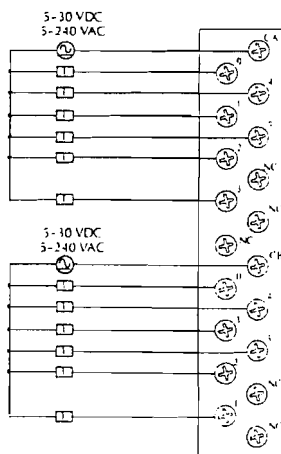
D2-12TR Relay Output	
Outputs per module	12
Outputs Consumed	16 (4 unused, see chart below)
Commons per module	2 (6pts. per common)
Operating voltage	5-30VDC/5-240VAC
Output type	Relay, form A (SPST)
Peak voltage	30VDC, 264VAC
AC frequency	47 to 60Hz
ON voltage drop	N/A
Max current (resistive)	1.5A/point 3A/common
Max leakage current	0.1mA @ 265 VAC

Typical Relay Life (Operations)		
Voltage/Load	Current	Closures
24VDC Resistive	1A	500K
24VDC Solenoid	1A	100K
110VAC Resistive	1A	500K
110VAC Solenoid	1A	200K
220VAC Resistive	1A	350K
220VAC Solenoid	1A	100K

Max inrush current	Output: 3A for 10ms Common: 10A for 10ms
Minimum load	5mA @ 5VDC
Base power required	450mA Max
OFF to ON response	10ms
ON to OFF response	10ms
Terminal type	Removable
Status Indicators	Logic Side
Weight	4.6oz. (130g)
Fuses	2 4A slow blow, replaceable Order D2-FUSE-4 (5 per pack)

Addresses Used			
Points	Used?	Points	Used?
Yn+0	Yes	Yn+10	Yes
Yn+1	Yes	Yn+11	Yes
Yn+2	Yes	Yn+12	Yes
Yn+3	Yes	Yn+13	Yes
Yn+4	Yes	Yn+14	Yes
Yn+5	Yes	Yn+15	Yes
Yn+6	No	Yn+16	No
Yn+7	No	Yn+17	No

n is the starting address



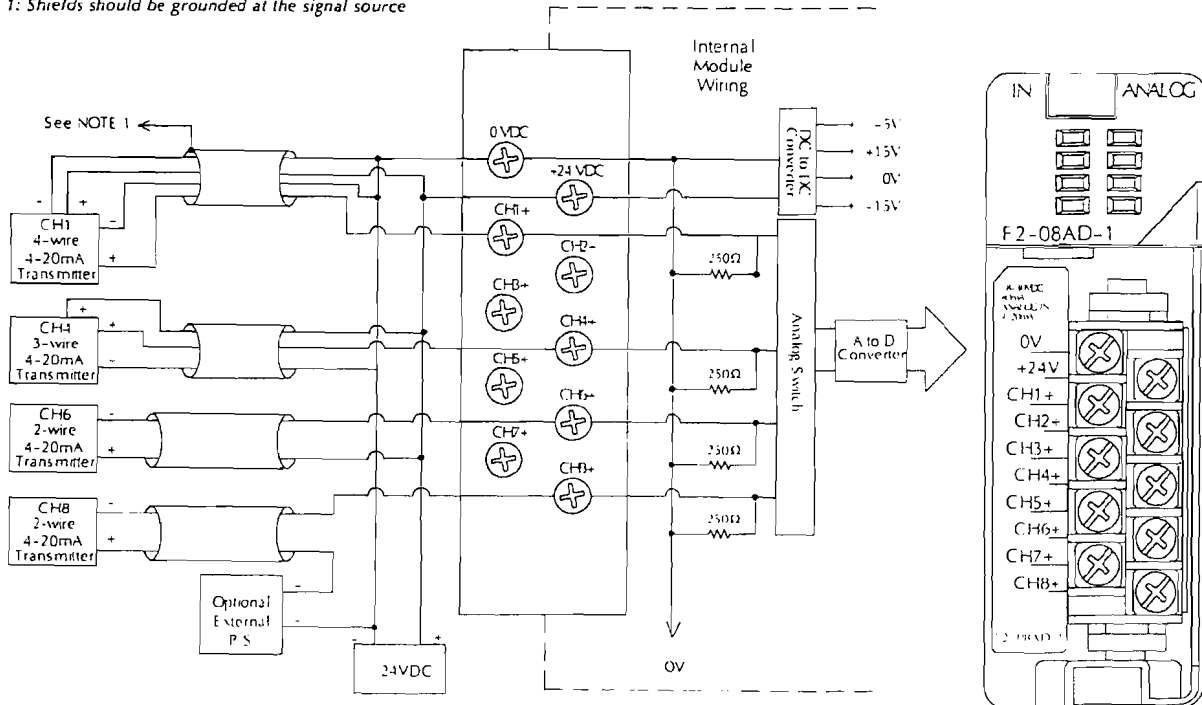
DL205

F2-08AD-1 8 Channel 4-20mA Analog Input	
Number of Channels	8, single ended (1 common)
Input Ranges	4 to 20mA current
Resolution	12 bit (1 in 4096)
Low-pass Filtering	-3dB at 200Hz, -6dB per octave
Input Impedance	250Ω ±0.1%, 1/2W current input
Absolute Maximum Ratings	-45mA to +45mA
Converter type	Successive approximation
Conversion Time (PLC update rate)	(D2-230 CPU) 1 channel per scan maximum (D2-240 or D2-250 CPU) 8 channels per scan maximum
Linearity Error (End to End)	±1 count (0.025% of full scale; maximum)
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±5 counts max., @ 20mA current input
Offset Calibration Error	±2 counts max., @ 4mA current input
Step Response	7ms to 95% of F.S. change

Maximum inaccuracy	±1% @ 77°F (25°C) ±25% 32° to 140°F (0° to 60°C)
Accuracy vs Temperature	±50ppm/°C maximum full scale (including max. offset change of two counts)
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Digital Inputs Input points required	16 I/O input points 12 binary data bits, 3 channel ID bits, 1 broken transmitter bit
Power Budget Requirement	50mA maximum, 5VDC (supplied by base)
External Power Supply	80mA maximum, +18 to +30VDC
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 883C 514.2
Shock	MIL STD 883C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source



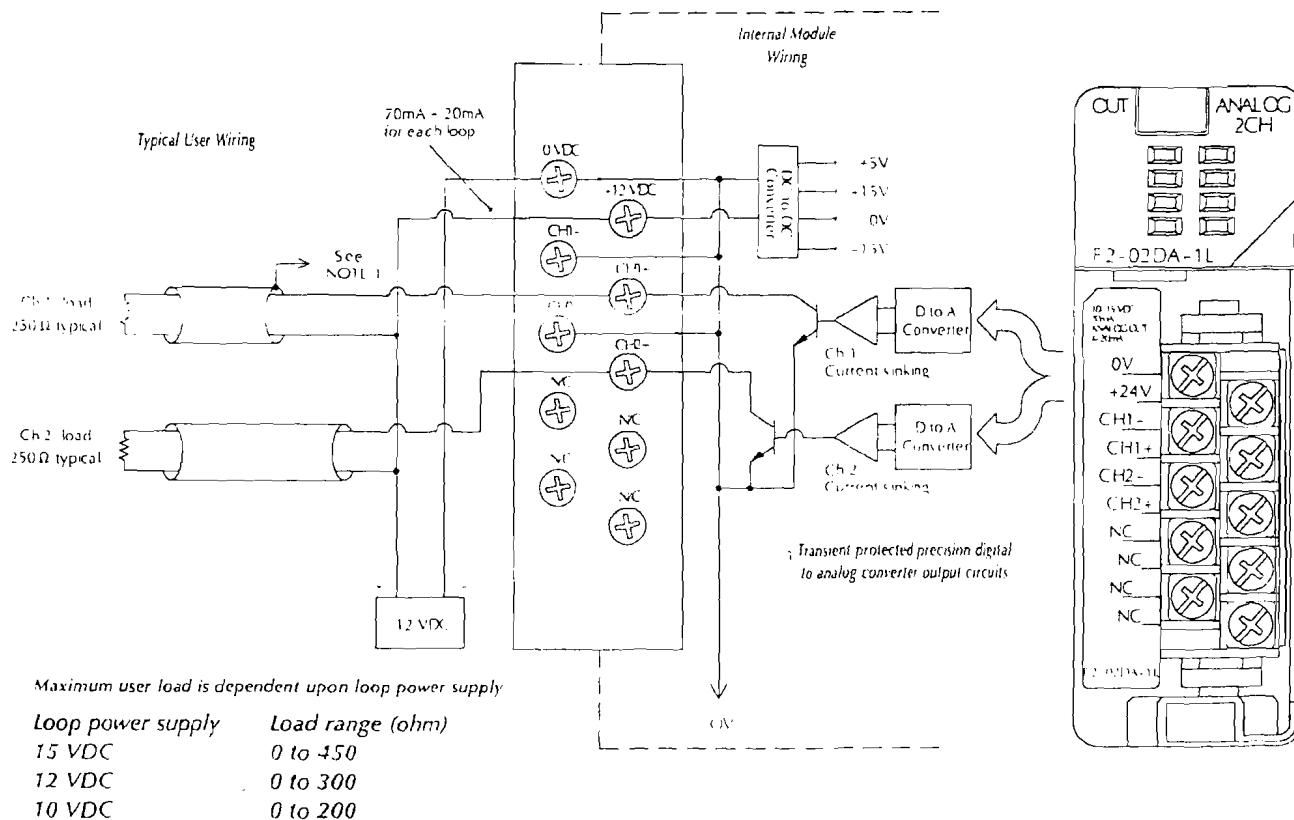
More than one external power supply can be used provided all the power supply commons are connected. A Series 217, 0.032A, fast-acting fuse is recommended for 4-20mA current loops. If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20mA transmitter types are:

- 2 or 3 wire: Isolation between Input signal and power supply.
- 4 wire: Isolation between Input signal, power supply, and 4-20mA output

Number of Channels	2
Output Ranges	4 to 20mA
Resolution	12 bit (in 4,096)
Output Type	Single ended, 1 common
Peak output voltage	40VDC (clamped by transient voltage suppressor)
Load Impedance	0Ω minimum
Maximum Load/ Power Supply	620Ω/18V, 910Ω/24V, 1200Ω/30V
PLC update rate	1 channel per scan maximum (D2-230 CPU) 2 channels per scan maximum (D2-240 or D2-250 CPU)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Conversion Settling time	100μs maximum (full scale change)
Full Scale Calibration Error (offset error included)	±5 counts max., 20mA @ 77°F (25°C)
Offset Calibration Error	±3 counts max., 4mA @ 77°F (25°C)

Accuracy vs Temperature	±50ppm/°C (full scale calibration change (including maximum offset change of 2 counts))
Maximum inaccuracy	+0.1% @ 77°F (25°C) ±0.3% @ 32 to 140 F (0 to 60°C)
Digital outputs Output points required	16(Y) output points 12 binary data bits, 2 channel ID bits
Power Budget Requirement	40mA @ 5VDC (supplied by base)
External Power Supply	10 to 15VDC, 70 mA (add 20 mA for each current loop used)
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

NOTE 2: Unused current outputs should remain open (no connections) for minimum power consumption.



SECTION 2-I

OPERATOR INTERFACE

TWO LINE, 40 CHARACTER, ALPHANUMERIC OPERATOR
DISPLAY/KEYPAD, PLAIN ENGLISH TEXT

MAPLE SYSTEMS 3160A

OIT Family

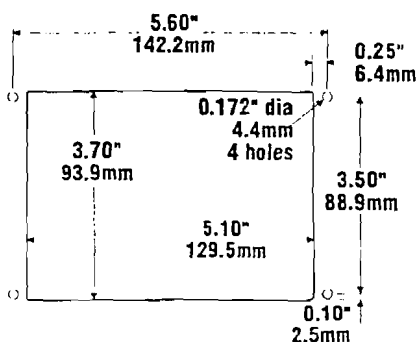
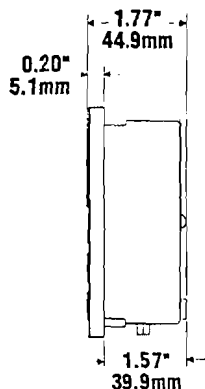
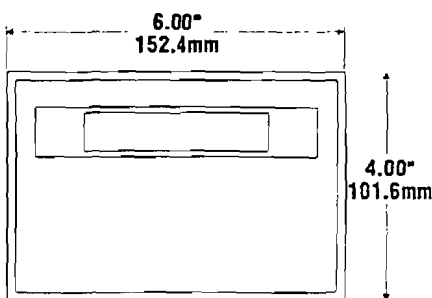
OIT3160A

Specifications

Certifications



Dimensions



PANEL CUTOUT



Mechanical

Material aluminum sealed to NEMA 4/12 when panel mounted
 Mounting panel
 Weight 1 pound [0.45 kg]

Display

Type backlit LCD; 5 x 7 dot matrix with cursor
 Size 2 lines of 20 characters
 Character Height 0.2 inches [5 mm]
 Viewing Angle approximately 90 degrees

Environment

Operating Temperature 32 to 122° F; 0 to 50° C
 Storage Temperature -4 to 158° F; -20 to 70° C

Power Requirements

Input Voltage 12 to 30 VDC
 Power Usage 2.5 watts typical

Communication

- One RS-232/RS-422/RS-485 serial port for OIT configuration from a personal computer and for communication with the PLC/host
- Baud rates from 300 to 19200
- Point-to-point serial communications (network support with ASCII protocols)

Keypad

- Membrane with tactile feedback
- Up to 3 million operations
- 6 function keys configurable as momentary, push on/push off, latch, message display, or disabled
- Function keys have 4 level password protection
- Numeric keypad
- Alarm Ack key to acknowledge the current alarm
- Arrow keys to move the cursor in the screen
- Clear key to clear the current register monitor's contents and activate data entry mode
- Del key to perform a destructive backspace at the cursor's current position in the screen
- Delta+ and Delta- keys to increment or decrement the value in the current register monitor by the programmed amount
- Enter key to accept the data entered by the operator and update the current register
- Help key to display customized help screens
- Page Down key to display the next message in a message chain
- Toggle key to immediately change the value in a binary read/write register

OLT Family

OLT3160A

Specifications

(continued)

Screens

- Up to 500 configurable as message, recipe, alarm, menu, or help
- Any message, recipe, or menu screen can be the startup screen
- Any screen can display text and characters from the extended character set

Message Screens

- Beep on display
- Chain to other message screens
- Display up to 25 register monitors
- Display blinking characters
- Display one line of scrolling text up to 128 characters long
- Display for a preset length of time from 1 to 255 seconds

Recipe Screens

- Beep on display
- Display up to 25 register monitors
- Include up to 20 preset registers
- Display blinking characters
- Display one line of scrolling text up to 128 characters long
- Display for a preset length of time from 1 to 255 seconds

Alarm Screens

- 4 priority levels
- 9 audible alert types
- Display up to 25 register monitors
- Display blinking characters
- Display one line of scrolling text up to 128 characters long

Menu Screens

- Beep on display
- Branch to a maximum of 9 message, recipe, or menu screens
- Display blinking characters
- Display one line of scrolling text up to 128 characters long
- Display for a preset length of time from 1 to 255 seconds

Help Screens

- Display blinking characters
- Display from any message, recipe, or menu screens

Register Monitors

- Adjustable field width
- Fully programmable linear scaling on decimal, signed, and long formats
- Left/right justification
- Optional comma insertion
- Optional 'Hide Data' format for secure data entry
- Optional leading zeros
- Programmable decimal point
- Read only or read/write

Register Monitor Formats

- Signed
- Decimal
- Long
- 4-digit BCD
- 8-digit BCD
- Binary-1/0 coil
- Binary-on/off coil
- Binary-bank 8
- Binary-bank 16
- ASCII string
- ASCII character

Other Operating Features

- Windows-based OITware-200 configuration software
- Downloadable operational and protocol software
- Up to 16 set points that monitor the value in a register and display a screen if the low limit or high limit is exceeded
- Screen saver
- Message Request Register
- Current Message Register
- Status Bit and Key coils

OIT Family

Features

Serial Communication

The OIT3160, OIT3200, OIT3600, OIT4160, and OIT4400 have one serial communication port that is used to connect to the PLC/host and to configure the OIT. It uses a standard subminiature 9-pin, D-style connector (except the OIT3600 which has a terminal block connection) and supports both RS-232 and RS-422/485 point-to-point communication at baud rates from 300 to 19200.

The OIT3250, OIT4450, and OIT5400 have two serial communication ports. One supports both RS-232 and RS-422/485 point-to-point communication and is used to connect to the PLC/host. The other supports RS-232 point-to-point communication and is used to configure the OIT, to connect the OIT to a serial printer, and for external alarm and buzzer outputs. Both ports use a standard subminiature 9-pin, D-style connector and support baud rates from 300 to 19200.

Display

There are several display options available including 2-line by 20-character VFD and backlit LCD, 2-line by 40-character VFD and backlit LCD, and 8-line by 40-character backlit LCD.

Stored Screens

The OIT Family Operator Interface Terminals can store up to 500 pre-programmed screens (250 on the OIT5400). There are five different screen types: message, recipe, alarm, menu, and help. All screen types can display text and characters from the extended character set. In addition, each screen type has unique features described below. Screens are created for:

- providing instructions to the OIT operator
- notifying the OIT operator of alarm conditions
- displaying and changing the operating parameters of the control system.

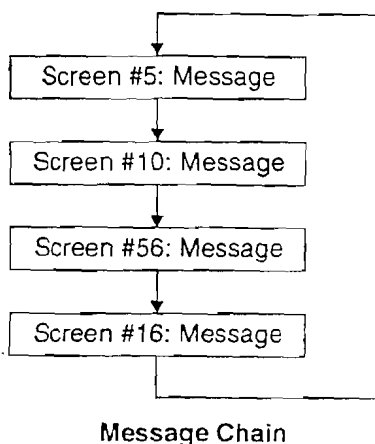
One message, recipe, or menu screen can be designated as the "startup" screen. The startup screen is displayed whenever the OIT reinitializes or powers up.

Message Screens

Message screens are the simplest and most often used type of screen. They were designed to convey information to the OIT operator and to provide the OIT operator with a means of changing the operating parameters of the control system. A message screen can be displayed and optionally sent to the printer (OIT3250, OIT4450, and OIT5400 only) in several ways: by a request from the PLC/host, by pressing one of the function keys on the OIT, from a menu selection, or by another message screen chaining to it.

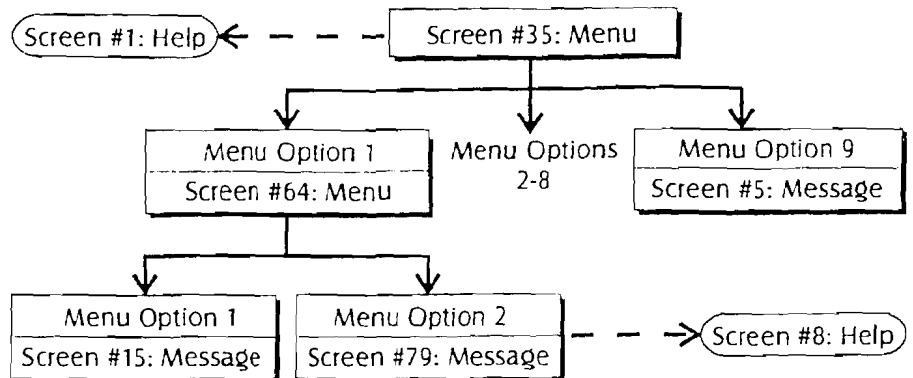
Message screens can be chained or linked together to form multiple screen messages. This allows one request from the PLC/host to display a set of screens. For example, Message #5 may be chained to Message #10, and Message #10 may be chained to Message #56, etc. A message loop can be created by chaining the last message in the chain to the first message in the chain. The ability to chain message screens in any order provides maximum flexibility and speed when setting up the OIT for your application. The configuration process is simple and adjustments can easily be made later, since you only need to change the order of the message screens instead of changing the message screens themselves.

Each message screen can display up to 25 register monitors as read only or read/write. Message screens can also display date and time information from the OIT's real time clock (OIT3250, OIT3600, OIT4450, and OIT5400 only).



Help Screens

A help screen is simply additional text that appears when the operator presses and holds the Help key on the OIT. The help screen remains on the display until the operator releases the Help key. Each help screen can be attached to any number of message, recipe, and/or menu screens.



Screen Attributes

The following screen attributes are available for certain screen types:

Horizontal Scrolling

Each message, recipe, alarm, or menu screen can have a single line of up to 128 characters that scrolls horizontally. This line can be used to get the operator's attention, or for displaying a message that is too long to fit onto the screen.

Blinking Characters

Each character in a stored screen (including words, register monitors, etc.) can have the blink attribute enabled or disabled. If the blink attribute is enabled, the character will blink once per second for as long as the screen is displayed.

Timed Display

Normally, each screen stays on the display until another screen is displayed or the screen is cleared. However, the timed display attribute allows a message, recipe, or menu screen to be configured so that it displays for a set amount of time, 1 to 255 seconds, after which the prior screen is displayed. If the screens in a message chain are configured for timed display, each screen in the chain displays for the specified time and then the next screen in the chain is automatically displayed.

Beep on Display

Each message, recipe, or menu screen can be configured to beep for two seconds whenever it is initially displayed.

Timer Events

The OIT3250, OIT4450, and OIT5400 can be configured to display a screen and/or set a coil at a particular time during a particular day of the week or daily. For example, you could configure the OIT to display Screen #10 and set coil 100 every day at 8:00 a.m. Up to 16 of these timer events can be programmed in the OIT. Timer events are checked by the OIT once every minute.

Recipe Screens

Recipe screens are used to set up a batch process that utilizes a predetermined number of ingredients. Applications might include mixing paint or other ingredients. A recipe screen can be displayed and optionally sent to the printer in several ways: by a request from the PLC/host, by pressing one of the function keys on the OIT, or from a menu selection.

Each recipe screen can store up to 20 preset registers. For security, none of the preset registers are displayed on the screen. Once the operator selects Y at the "Start process?" prompt, the preset register values are downloaded to the PLC/host.

Each recipe screen can display up to 25 read only or read/write register monitors. The operator can change the values in read/write registers prior to starting the process which facilitates changes to the recipe such as quantity or size of run.

For example, a plastics factory makes three kinds of polyethylene bags. Each kind of bag has unique characteristics that never change. A recipe screen could be created that stores each unique characteristic in a separate preset register and includes one read/write register monitor for the quantity of bags. When the plant operator is ready to start a run, they only need to display the recipe on the OIT and enter the quantity of bags to manufacture in the read/write register monitor.

BAG C PROCESSING SCREEN
Quantity: 500 Start: N

Recipe Screen

Alert Types

1	second beep
5	second beep
30	second beep
60	second beep
3	beeps @ 1Hz
5	beeps @ 2Hz
	continuous 1Hz beeps
	continuous 2Hz beeps
	continuous sound

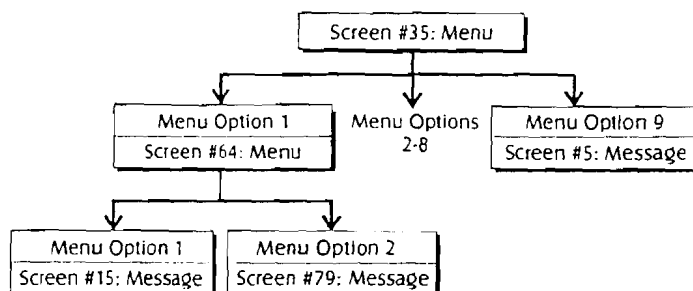
Alarm Screens

Each alarm screen can display up to 25 read only or read/write register monitors and the current time and/or date from the OIT's real time clock (OIT3250, OIT3600, OIT4450, and OIT5400 only). Alarm screens have 4 priority levels and 9 audible alert types. The priority level determines the order in which the alarm screen is placed into the alarm stack. The alarm stack holds up to 10 alarm screens and continuously reorders new alarm screens by placing the highest priority alarm screens at the top of the alarm stack. Alarm screens are placed in the alarm stack when the OIT receives a request from the PLC/host.

The screen at the top of the alarm stack is displayed and the selected audible alert type is sounded. On the OIT3250, OIT4450, and OIT5400 the alarm LED is turned on and the screen is optionally sent to the printer. The screen remains on the display until the operator acknowledges it by pressing the Alarm Acknowledge key or until the PLC cancels the alarm.

Menu Screens

Menu screens were designed to allow the operator to branch off to one of up to nine screens. When the operator presses one of the numeric keys, the associated message, recipe, or menu screen is displayed. A menu screen can be displayed and optionally sent to the printer in several ways: by a request from the PLC/host, by pressing one of the function keys on the OIT, or from a menu selection.



Special Keys

The **Alarm Ack** key clears any alarm which is currently in progress.

The **Arrow** keys move the cursor from one read/write register monitor to another.

The **Clear** key clears the current register monitor's contents and activates data entry mode.

The **Delete** key performs a destructive backspace at the cursor's current position in the screen.

The **Delta+** and **Delta-** keys increment or decrement the value in the current register monitor by the programmed amount, stopping at the preset high and low limits.

The **Enter** key accepts the data entered by the operator and updates the current register.

The **Help** key displays the help screen attached to the message, recipe, or menu screen currently being displayed.

The **Last Message** and **Next Message** keys (not available on the OIT3160 and OIT4160) allow the operator to review the screens that were previously displayed on the OIT and then return to the most recent screen.

The **Page Up** and **Page Down** keys (only Page Down is available on the OIT3160 and OIT4160) allow the operator to move through a group of chained messages.

The **Setup** key places the OIT into setup mode. On the OIT3160 and OIT4160 setup mode is entered by holding down the Clear key when the OIT is being powered up or pressing Enter three times during operation.

The **Toggle** key immediately changes the value in a binary read/write register.

Function Keys

Each global or screen dependent function key can be programmed as:

Momentary

When the function key is pressed, the function key coil is set. The coil remains activated for as long as the function key is held down.

Push On/Push Off

When the function key is pressed, the function key coil is set; when the function key is pressed again, the coil is cleared.

Latch

When the function key is pressed, the function key coil is set. Only the PLC/host can clear the coil.

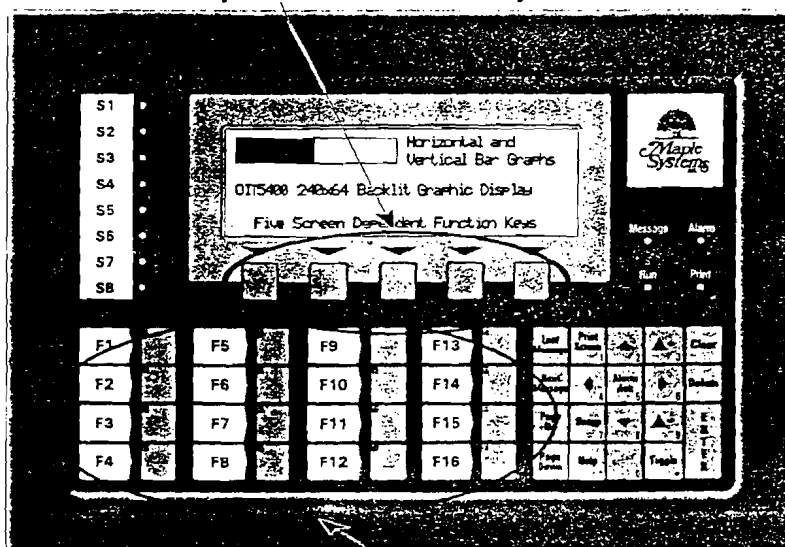
Message Display

When the function key is pressed, the assigned message, recipe, or menu screen is displayed.

Disabled

The function key is completely disabled; pressing it produces no action.

Screen Dependent Function Keys



Global Function Keys

Global Function Keys

Each OIT Family Operator Interface Terminal has either 6, 12, or 16 global function keys. Each global function key can be programmed to perform one function.

Screen Dependent Function Keys

The OIT5400B has five screen dependent function keys. Each screen dependent function key can be programmed to perform a different function in each of the OIT5400B's 250 pre-programmed screens.

Security Passwords

Any function key programmed to display a screen can have a password associated with it. When the function key is pressed, the operator must successfully enter the password prior to advancing to the selected screen. If an incorrect password is entered, the OIT returns to the previous screen.

SECTION 2-J

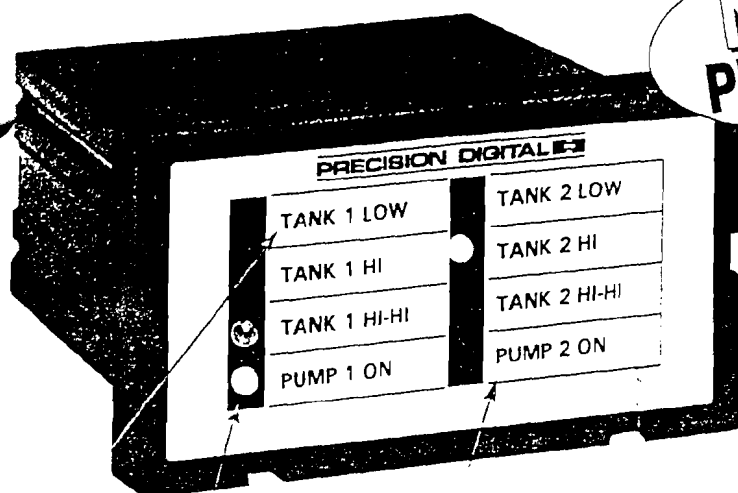
ALARM ANNUNCIATOR

PANEL MOUNT, NEMA 4X, 8 POINT ALARM ANNUNCIATOR, LED DISPLAY

PRECISION DIGITAL # PD-128

NEW!
PD128-NI

Model PD128 PLC Annunciator



Displays up to
8 messages
at once

FREE custom
message labels

Built-in horn

Interchangeable LED colors
(Red, Yellow, Green)

- Low-cost – Less than Half the Price of a Message Center
- Powered From PLC
- No Programming
- Accepts Common High or Common Low Input Signals
- Simple Installation

**Get FREE
labels from us
to make your
panel look**

Specifications

NUMBER OF INPUTS: 8 visual per unit + 1 audio

TYPE OF INPUTS:

1. Logic Levels: Low = 0 to .8VDC; High = 4.7 to 24VDC @ 12 mA
 - a. Common Low Input - activates when input goes high.
 - b. Common High Input - activates when input goes low.
2. NO Switches: External power required to power switch.
3. Open Collector Transistor: (common low only) transistor must be turned off to detect an alarm. Transistor ON under normal conditions.

MAX INPUT SUPPLY: 24 VDC @ 12 mA per channel.

OUTPUTS:

1. Audible: Built-in horn
2. Visual: Red LED next to alarm message. May be replaced with yellow or green.

ALARM MESSAGES: FREE Custom printed, 1 line per message at 14 characters per line. Factory or field printable.

APPROVAL: PD128-NI, Non-Incendive:

CSA Certified and FM Approved as Non-Incendive for use in Class I, Division 2, Groups A, B, C & D; T-code: T6.

ENVIRONMENTAL:

Operating temperature range: -20 to 70°C

Storage temperature range: -40 to 55°C

Relative humidity: 0 to 90% non-condensing

ENCLOSURE: 1/8 DIN, high impact plastic, UL 94V-0.

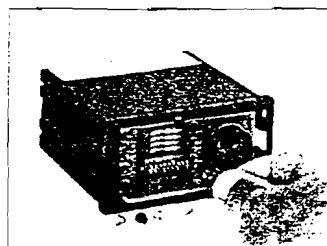
FRONT PANEL: NEMA 4X[®], panel gasket provided.

CONNECTIONS: Removable screw terminal block (provided).

*PD128-NI is not approved as NEMA 4X by FM and CSA.

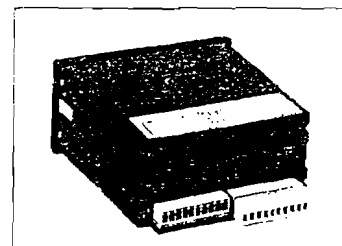
When it comes to low-cost, high efficiency and ease of use, the PD128 beats message centers and pilot lights hands down. The PD128 is a low-cost easy-to-use PLC annunciator that displays up to 8 messages at once, and features a built-in horn. Interchangeable LEDs (Red, Yellow, Green) allow for customized alarm messages. Powered directly from the PLC, the PD128 accepts standard digital output signals, requires no programming and can be connected in minutes. Precision Digital also prints custom message labels free of charge.

CHANGING LED COLOR



Changing LED color is a simple matter of removing the existing one from its socket and replacing with the desired color.

SIGNAL CONNECTIONS



Common Low inputs are connected to J1 header on the right (pictured). Common High inputs would be connected to header J2 on the left.

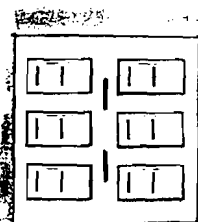
Ordering Information

Model:	Description:
*PD128	PLC Annunciator
PD128-6	6-pack of PD128s
PD128-NI	Non-Incendive PLC Annunciator
PD128-NI-6*	6-pack of PD128-NIs
PDX128G	Green LEDs (10)
PDX128Y	Yellow LEDs (10)

*Six-pack not for individual re-sale.

***Quick Shipment Item, shipped within 2 working days.**

SIX-PACK BOX



**Buy
a 6-Pack
and
Save 20%!**

**PRECISION
DIGITAL**

PHONE (800) 451-1111

www.precision.com

SECTION 3

MAGNETIC FLOWMETER

IN-LINE, MAGNETIC FLOWMETER, FLANGED BODY, ALLOY 'C'
ELECTRODES, NEMA 4X ELECTRONIC ENCLOSURE, HARD RUBBER
LINER, 4/20MA OUTPUT

BADGER METER # MAGNETO FLOW/3"
BADGER METER # MAGNETO FLOW/4"

Magnetoflow® Mag Meter

Model Magnetoflow® Flanged

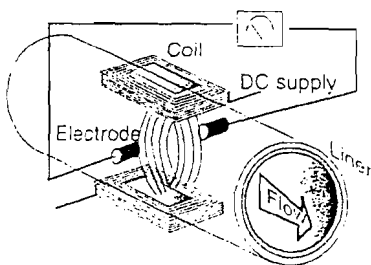
Technical Brief

GENERAL

Badger's Magnetoflow line is the result of 35 years of research and field use in electromagnetic flow meters. Based on Faraday's law of induction, these meters can measure almost any liquid, slurry or paste that has a minimum of electrical conductivity. Designed, developed and manufactured under the strictest quality standards, the Magnetoflow meter ranks among the best in the market. It's sophisticated, processor based signal conversion represents the state of the art in the industry with accuracies of 0.25% or better. The wide selection of liner and electrode materials insures maximum compatibility and minimum maintenance over a long operating period.

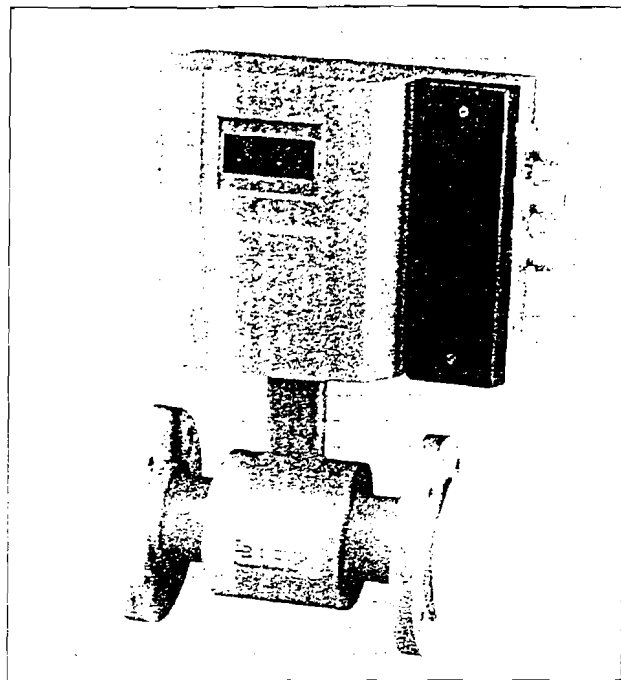
OPERATION

The flow meter is basically a stainless steel tube lined with a nonconductive material. Outside the tube two DC powered electromagnetic coils are positioned diametrically opposing each other. Perpendicular to these coils, two electrodes are inserted into the flow tube. When the coils are energized, a magnetic field is created across the whole diameter of the pipe. When a conductive fluid flows through this magnetic field, a voltage is induced across the electrodes. This voltage is directly proportional to the average flow velocity of the fluid and is picked up by the two electrodes. This induced voltage is then amplified and processed digitally by the converter to produce a very accurate analog or digital signal. The signal can then be used to indicate flow rate, totalization or to communicate to remote sensors and controllers. The main advantages of this technology are that with no parts in the flow stream, there is no pressure loss, the accuracy is not affected by temperature, pressure, viscosity, density or flow profile and with no moving parts there is practically no maintenance required.



APPLICATION

Because of its inherent advantages over other more conventional technologies, this meter can be used in the majority of industrial flow applications. Whether the fluid is water or something highly corrosive, very viscous, contains



Magnetoflow Flanged

solids or requires special handling, this meter will be able to accurately measure it. Today Magnetoflow meters are successfully being used in most industries including food and beverage, pharmaceutical, water and waste water, chemical, pulp and paper, and mining.

FEATURES

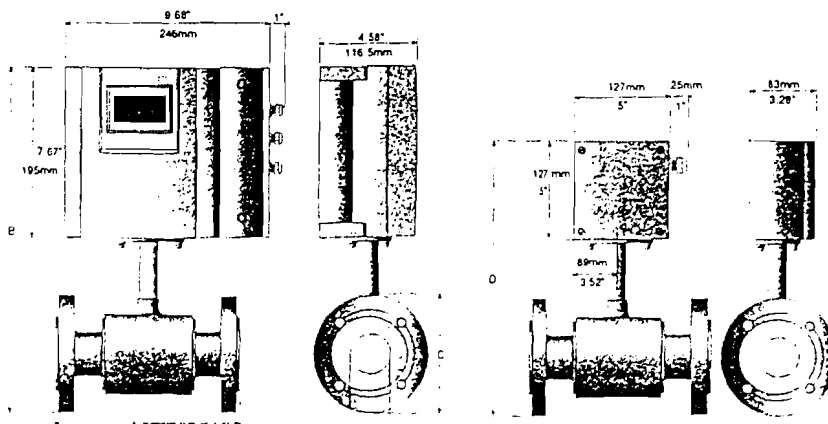
- 0.25% accuracy independent of fluid viscosity, density and temperature
- Unaffected by fluids containing solids
- Pulsed DC magnetic field for zero point stability
- No pressure loss for low operational costs
- Long life corrosion resistant liners
- Calibrated in state of the art facilities
- Integral and remote signal converter availability
- Optional grounding electrode
- Measurement largely independent of flow profile
- Measures fluids with as low as 0.5 micromhos/cm conductivity



BadgerMeter, Inc.

Bulletin No. ITB-106-01

Ver. 12-79



Meter with Primo® converter

Meter with junction box for remote Primo® converter

Size		A		B		C		D		Est. Weight with Primo		Flow Range			
												GPM		LPM	
Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Lbs	Kg	Min	Max	Min	Max
1/4	6	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.015	5	0.06	19
5/16	8	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.023	7.9	0.1	30
3/8	10	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.034	11.4	0.13	43
1/2	15	6.7	170	14.0	356	3.5	89	11.4	288	12	5.5	0.06	20	0.23	76
3/4	20	6.7	170	14.2	361	3.9	99	11.5	293	15	6.5	0.13	45.4	0.52	171
1	25	8.9	225	14.4	366	4.3	108	11.7	298	20	9.0	0.24	80	0.92	305
1 1/4	32	8.9	225	15.2	386	4.6	117	12.5	318	22	10.0	0.4	126	1.45	477
1 1/2	40	8.9	225	15.4	390	5.0	127	12.7	322	23	10.5	0.6	181	2.1	687
2	50	8.9	225	15.9	403	6.0	152	13.2	335	28	12.5	1.0	323	3.7	1223
2 1/2	65	11.0	279	17.1	434	7.0	178	14.4	366	54	24.5	1.5	504	5.8	1910
3	80	11.0	279	17.3	440	7.5	191	14.7	372	56	25.5	2.2	727	8.3	2751
4	100	11.0	279	18.4	466	9.0	229	15.7	398	58	26.5	4.0	1292	14.8	4892
5	125	15.8	400	19.6	498	10.0	254	16.9	430	60	27.0	6.0	2019	23.2	7643
6	150	15.8	400	20.6	524	11.0	279	17.9	456	62	28.0	9.0	2908	33.4	11000
8	200	15.8	400	22.5	572	13.5	343	20.4	518	88	40.0	16	5170	59.3	19568
10	250	19.7	500	26.8	681	16.0	406	24.1	613	180	82.0	25.0	8078	92.6	30500
12	300	19.7	500	28.9	734	19.0	483	26.2	666	209	95.0	35.0	11632	133	44000
14	350	23.6	600	30.8	782	21.0	533	28.2	716	260	118	48	15834	182	59927
16	400	23.6	600	33.7	856	23.5	597	31.0	788	308	140	63.0	20680	237	78272
18	450	23.6	600	35.0	890	25.0	635	32.4	822	287	130	76.0	25200	288	95392
20	500	23.6	600	38.2	969	27.5	699	35.5	901	495	225	98.0	32313	370	122300
22	550	23.6	600	39.6	1005	29.5	749	36.9	937	441	200	115	37660	435	142558
24	600	23.6	600	42.2	1071	32.0	813	39.5	1003	554	252	141	46531	533	176100
28	700	23.6	600	46.2	1173	36.5	927	44.0	1118	650	295	192	63334	726	239708
30	750	31.5	800	48.3	1228	38.0	965	45.7	1161	704	320	240	70000	908	265000
32	800	31.5	800	52.2	1325	41.4	1015	49.5	1257	770	350	250	82722	948	313000
36	900	31.5	800	55.3	1405	46.0	1168	54.1	1374	850	386	317	104696	1200	396253
40	1000	31.5	800	60.0	1525	50.2	1230	57.4	1457	924	420	391	129254	1482	489000
42	1050	36.0	915	66.0	1675	53.0	1346	63.4	1610	1100	500	431	142241	1631	538382
48	1200	39.4	1000	69.9	1775	59.4	1455	67.2	1707	1210	550	564	186126	2134	704000
54	1400	39.4	1000	78.5	1995	68.4	1675	75.9	1927	1364	620	767	253338	2905	958835

SPECIFICATIONS

Flow Range: 0.1 - 33 fps (0.03-10 m/s)

Sizes: 1/4" to 54" (15 to 1400 mm)

Min. Conductivity: ≥ 0.5 micromhos/cm

Accuracy:

$\pm 0.25\%$ accuracy of rate from 1-33 fps.

$\pm 0.5\%$ accuracy of rate from .1-1 fps.

Electrode Materials: Standard: Alloy C

Optional: 316 Stainless Steel,
Gold/Platinum Plated, Tantalum,
Platinum/Rhodium

Liner Material: PTFE up to 24",

Soft and Hard Rubber from 1" to 54",

Halar from 1" to 40"

Fluid Temperature:

With Remote Converter:

PTFE & Halar 311°F, (155°C)

Rubber 178°F, (80°C)

With Meter Mounted Converter:

PTFE & Halar 212°F, (100°C)

Rubber 178°F, (80°C)

Pressure Limits: 150 psi (10Bar)

optional 300psi (20Bar)

Coil Power: Pulsed DC

Ambient Temperature: -4°F to 122°F,

(-20°C to 50°C)

Pipe Spool Material : 316 Stainless Steel

Meter Housing Material: Carbon Steel
welded

Flanges: Carbon Steel - Standard (ANSI
B16.5 Class 150 RF)

316 Stainless Steel - Optional

Meter Enclosure Classification: Nema 4

Junction Box Enclosure Protection:

(For Remote Converter Option)

Powder coated die-cast aluminum, Nema 4

Cable Entries: 1/2" NPT Cord Grip



BadgerMeter, Inc.

P.O. Box 245036 Milwaukee, WI 53224-9536

Telephone: (414) 355-0400

Fax: (414) 355-7499

Due to continuous research, product improvements and
enhancements, Badger Meter reserves the right to change product
or system specifications without notice, except to the extent that
an outstanding bid obligation exists.

Copyright© 2000 Badger Meter, Inc.

All rights reserved.

SECTION 4

PRESSURE SWITCHES

PRESSURE SWITCH

NEMA 4 HOUSING, 12A SWITCHING ELEMENT, 316SS CONNECTION,
1/4" NPT, ADJ. RANGE 10-70 PSI

MERCOID # 1004W-A-1-D

DIFFERENTIAL PRESSURE SWITCH

NEMA 4 HOUSING, BRASS BODY, SPDT, 5A SWITCHING ELEMENT,
ADJ. RANGE 5-15 PSID

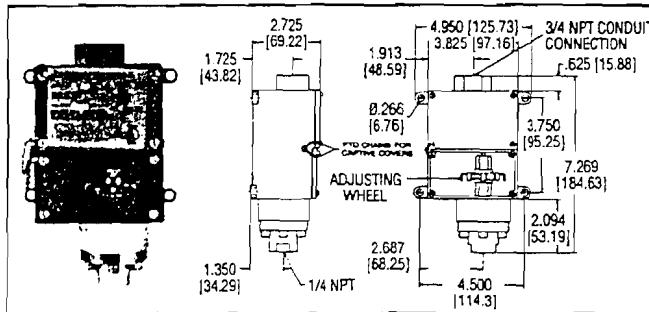
W. E. ANDERSON # H3B-2SL



Series
1000

Diaphragm Operated Pressure Switches

Visible setpoint, fixed deadband, pressure ranges to 1400 PSI.



STOCKED MODELS in bold

Aluminum Press. Chamber Polyimide Diaph. Model Number	316 Stainless Steel Pressure Chamber Teflon Diaphragm Model Number	Adjustable Operating Range PSIG	Approx.* Deadband (Fixed) PSIG	Max. System Pressure without Bursting
1003W-A1-D	1003W-B3-D	7-40	2	3000 psig
1004W-A1-D	1004W-B3-D	10-70	4	3000 psig
1005W-A1-D	1005W-B3-D	25-200	8	3000 psig
1005W-A1-D	1005W-B3-D	50-350	15	3000 psig
1007W-A1-D	1007W-B3-D	75-550	30	3000 psig
1008W-A1-D	1008W-B3-D	100-900	50	3000 psig
1009W-A1-D	1009W-B3-D	200-1400	75	3000 psig

*Deadband 10-15% larger when using 316SS diaphragm. Change A1 to B2 for 316 stainless steel diaphragm and pressure chamber e.g. 1003W-B2-D. Values shown are for mid-scale.

PHYSICAL DATA

Maximum Temperature: 170°F (76°C)

Pressure Connection: 1/4" NPT(F)

Electrical Rating: 1/4 HP, 12A @ 125 VAC resistive; 1/4 HP, 12A @ 250 VAC resistive; 0.5A @ 125 VDC resistive

Wiring Connections: 3 Screw type; N.O., N.C. and Common

Setpoint Adjustment: Internal thumbwheel with visible scale

Housing: Die cast copper free aluminum — weatherproof

Diaphragm: Polyimide, Teflon* or 316 stainless steel

Calibration Spring: Plated Steel

Mounting: 4 holes to accept 1/4" bolts

Weight: 3 lbs. (1.4 kg)

Installation: Any position

PRICES

With alum. pressure chamber, polyimide diaphragm\$173.50

With 316 SS pressure chamber, Teflon* diaphragm200.50

Extremely rugged construction provides excellent reliability in chemical, petroleum and industrial plants. Bellville spring movement permits mounting of control in any position and helps prevent contact chatter. New design also provides high over-pressure protection. Weather-proof housing is standard.

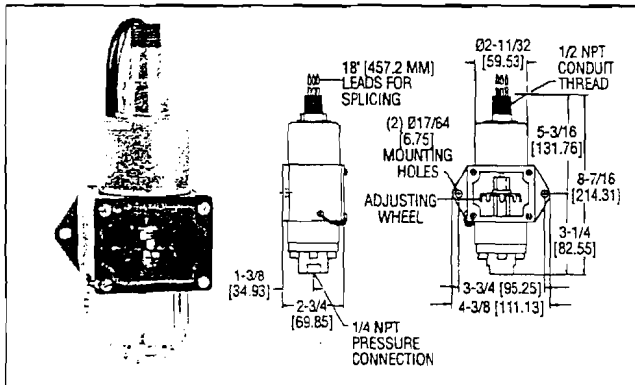
Suggested Specification:

Pressure switches shall be diaphragm operated with fully adjustable set point. Switch shall have visible set point indicator protected by clear polycarbonate window. Electrical terminals shall be isolated from set point adjustment. Units shall be Mercoïd Model 100 () W().

Series
1000E

Explosion-Proof Diaphragm Operated Pressure Switches

Visible setpoint, fixed deadband, pressure ranges to 1400 PSI.



STOCKED MODELS in bold

Aluminum Press. Chamber Polyimide Diaph. Model Number	316 Stainless Steel Pressure Chamber Teflon Diaphragm Model Number	Adjustable Operating Range PSIG	Approx.* Deadband (Fixed) PSIG	Max. System Pressure without Bursting
1003E-A1-J	1003E-B3-J	7-40	2.5	3000 psig
1004E-A1-J	1004E-B3-J	10-70	5	3000 psig
1005E-A1-J	1005E-B3-J	25-200	10	3000 psig
1006E-A1-J	1006E-B3-J	50-350	18	3000 psig
1007E-A1-J	1007E-B3-J	75-550	36	3000 psig
1008E-A1-J	1008E-B3-J	100-900	60	3000 psig
1009E-A1-J	1009E-B3-J	200-1400	90	3000 psig

*Deadband 10-15% larger when using 316SS diaphragm. Change A1 to B2 for 316 stainless steel diaphragm and pressure chamber e.g. 1003E-B2-J. Values shown are for mid-scale.

PHYSICAL DATA

Maximum Temperature: 170°F (76°C)

Pressure Connection: 1/2" NPT(F)

Electrical Ratings: 1/4 HP, 12A @ 125 VAC resistive; 1/4 HP, 12A @ 250 VAC resistive; 0.5 @ 125 VDC resistive

Wiring Connection: (3) 18" color coded leads: N.O., N.C. and Com.

Setpoint Adjustment: Internal thumbwheel with visible scale

Housing: Die cast, copper free aluminum — both weatherproof and explosion-proof

Diaphragm: polyimide, Teflon* or 316 stainless steel

Calibration Spring: Plated Steel

Mounting: 2 holes to accept 1/2" bolts

Weight: 2 lbs. (.91 kg)

Installation: Any position

PRICES

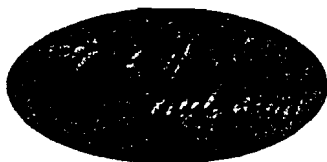
With alum. pressure chamber, polyimide diaphragm\$279.50

With 316 SS pressure chamber, Teflon* diaphragm 307.00

Same rugged construction as used in Model 1000W plus explosion-proof design are combined in this new unit. UL listed for Class I, Groups A, B, C & D; Class II, Groups E, F & G. Bellville Spring Movement permits mounting of control in any position and helps prevent contact chatter. High over-pressure protection and vibration resistance are also featured.

Suggested Specification:

Pressure switches shall be diaphragm operated with fully adjustable set point. They shall be weatherproof and explosion-proof. Switches shall have visible set point indicator protected by clear polycarbonate window. Switch shall have 18" leads to be field connected and sealed. Units shall be Mercoïd Model 100() E().



Series
H3

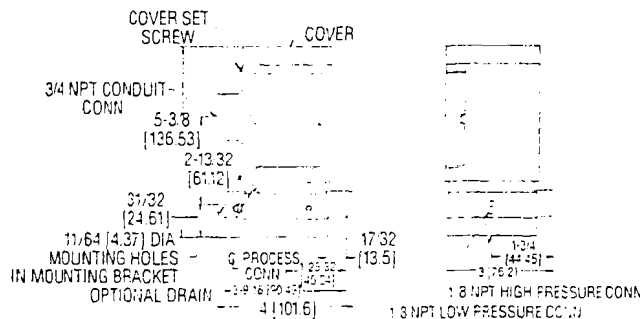
Explosion-Proof Differential Pressure Switches

Compact and weatherproof.

Setpoints from 10" w.c. to 200 PSID.

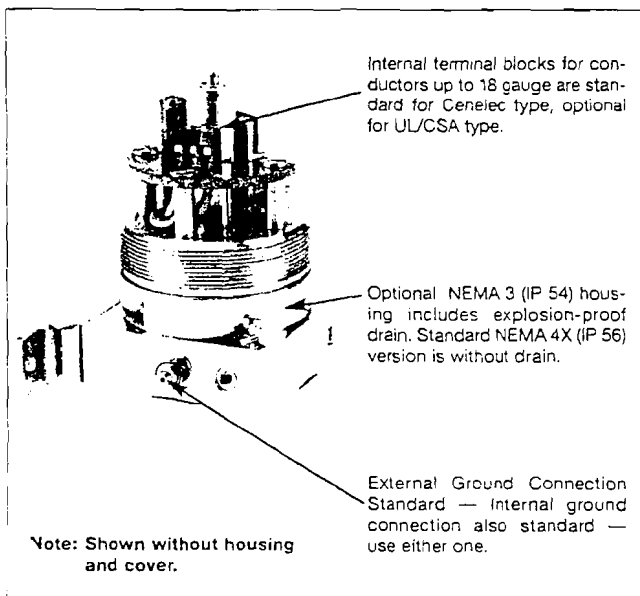


Patent No. 4,827,095



Explosion-proof, heavy duty, industrial unit has patented and unique new design which provides sensitivity to differential pressures as low as 10 inches of water, yet handles total pressure of 1500 psi. Unit yields deadbands approximately 5% of range, with zero setpoint shift due to variation in working pressures. Friction is minimized and repeatability increased by allowing range spring to act directly on diaphragm plate. Rolling diaphragm design maintains constant effective area to further reduce friction. Diaphragm is allowed to "seat" following application of full rated pressure, up to 1500 psi, on either high or low pressure port, without damage. Special overtravel feature prevents overtightening of range adjust screw.

Compact explosion-proof, weatherproof housing meets NEMA 4 standards; is UL/CSA listed and CENELEC certified to IP 56. Optional construction adds drain to meet NEMA 3 and IP 54. Both versions are suitable for hazardous locations: Class I, Groups B, C & D; Class II, Groups E, F & G or CENELEC Exd IIC T6 (T amb = 75°C). Set screw on housing locks threaded cover in place to discourage tampering. Both internal and external ground screws are included for installation flexibility. Optional internal terminal block can be supplied to eliminate need for external junction box.



PHYSICAL DATA

Maximum Temperature: 220°F

Maximum Pressure: 1500 PSI

Pressure Connection: 1/8" FNPT

Electrical Rating: SPDT or optional DPDT contact rated 5A @ 125/250 VAC, 5A @ 30 VDC. MV (gold contact) option for dry circuits rated 1A @ 125 VAC, 1A res. or 0.5A ind. @ 30 VDC

Wiring Connections: 18 AWG x 18" leads. Internal terminal blocks optional

Conduit Connection: 3/4" NPT
Set Point Adjustment: Screw type, field adjustable

Housing: Aluminum

Body: Aluminum, Brass or 316 SS

Diaphragm: Nitrile or Viton

Weight: 4 lbs., 2 oz.

STOCKED MODELS in bold

Aluminum body, Nitrile Diaphragm		
Model Number	Range, English	Range, Metric
H3A-1SL	10 to 180 in. w.c.	2.48 to 44.78 kPa
H3A-2SL	5 to 15 psid	3.44 to 103 kPa
H3A-3SL	5 to 70 psid	34.4 to 482 kPa
H3A-4SL	10 to 200 psid	68.9 to 1379 kPa
Brass body, Nitrile Diaphragm		
Model Number	Range, English	Range, Metric
H3B-1SL	10 to 180 in. w.c.	2.48 to 44.78 kPa
H3B-2SL	5 to 15 psid	3.44 to 103 kPa
H3B-3SL	5 to 70 psid	34.4 to 482 kPa
H3B-4SL	10 to 200 psid	68.9 to 1379 kPa
316 Stainless Steel body, Viton Diaphragm		
Model Number	Range, English	Range, Metric
H3S-1SL	10 to 180 in. w.c.	2.48 to 44.78 kPa
H3S-2SL	5 to 15 psid	3.44 to 103 kPa
H3S-3SL	5 to 70 psid	34.4 to 482 kPa
H3S-4SL	10 to 200 psid	68.9 to 1379 kPa

DPDT Contacts — Change S to D. (H3A-1 DL)

UL/CSA Terminal Block — Change L to C. (H3A-1 SC)

Cenelec Certified — Change L to CN. (H3A-1 SCN)

NEMA 3 Housing with Explosion-Proof drain — Add DR suffix (H3A-1SL-DR)

Gold Contacts — For dry circuits. Add MV suffix (H3A-1SL-MV)

A-610 Pipe Mounting Kit — For 1/2" to 2" pipe

Suggested Specification:

Pressure switches shall be (UL/CSA) (CENELEC) listed and diaphragm operated with (Viton) (Nitrile) diaphragm and seals. Body shall be (type 316 stainless steel) (aluminum) with type 316 stainless steel trim. Switch shall withstand without damage 1500 psi applied to either process port. Switch shall exhibit zero setpoint shift due to variation in working pressure. Electrical connections shall be (internal screw type terminal blocks) (18" leads). Contacts shall be (SPDT) (DPDT) rated 5A @ 125/250 VAC. Housing shall be weatherproof and explosion-proof. Class I, Groups B, C & D, Class II, Groups E, F & G, (Cenelec Exd IIC T6 (T amb = 75°C).

Switch shall be W.E. Anderson model H3.

SECTION 5

LEVEL SWITCHES

SIDE MOUNT

BRASS BODY, 1" NPT CONNECTION, POLY FLOAT, 5A SPDT ELEMENT

W. E. ANDERSON # L6EPB-B-S-3-O

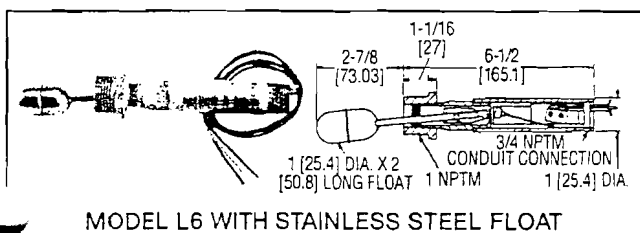
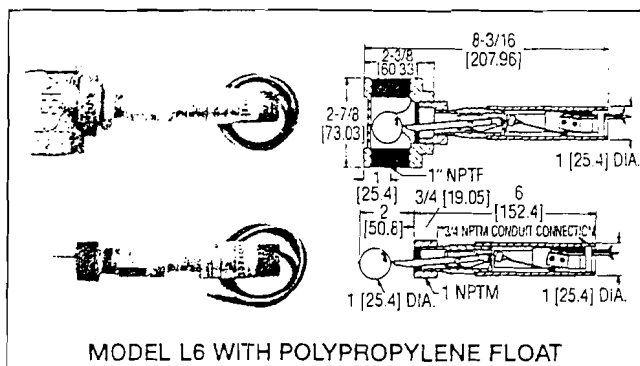
TOP MOUNT

- A) 3 STAGE, BUNA FLOAT, SS SHAFT, NEMA 4 HOUSING
SIGMA CONTROLS # 1503B
- B) 1 STAGE, BUNA FLOAT, SS SHAFT, NEMA 4 HOUSING
SIGMA CONTROLS # 1501B



Model L6 **FLOTECT** Liquid Level Switch

Easy in-wall or external installation, up to 2000 PSIG.



Explosion-Proof; U.L. and C.S.A. Listed —
 Class I, Groups A†, B, C, D
 Class II, Groups E, F, G.
 CENELEC: EExd IIC T6 (T amb = 75°C)
 (†Group A, stainless steel body only).

PHYSICAL DATA

Temperature limits: 220°F (105°C) max.
Operating Pressure: (Polypropylene float) to 2000 PSIG (140kg/cm²) (304SS float) to 350 PSIG (25kg/cm²).
Electrical Rating: U.L.: 5A @ 125/250 VAC. C.S.A. and CENELEC: 5A @ 125/250 VAC, 5A resistive, 3A inductive @ 30 VDC. Optional ratings: **MV** option, (gold contacts for dry circuits) 0.1A @ 125 VAC. **MT** option (temperatures to 400°F, 205°C), 5A @ 125/250 VAC. Not UL or CSA listed.

Wiring Connections: 18" (460mm) leads, 18 gauge.

Minimum Specific Gravity: (Polypropylene float) 0.9 S.G. (round SS float) 0.7 S.G. (cylindrical SS float) 0.5 S.G.

Wetted Materials: Style B-S-3-O, Brass, 301 SS, Polypropylene, Ceramic. Style B-S-3-A, Style B-S-3-C; Brass, 301SS, 304SS, Ceramic. Style S-S-3-O 303SS, 301SS. Polypropylene, Ceramic. Style S-S-3-A, S-S-3-C; 303SS, 301SS, 304SS, Ceramic.

Switch Body: Brass 3/4" NPT(M) conduit conn. For S.S. switch housing change model number to L6EPS.

Piping Connection: 1" NPT(M).

Installation: Horizontal w/index arrow pointing down.

Weight: Approx. 1 lb. (.5kg); approx. 1 1/2 lb. (.8kg) w/external chamber.

STOCKED MODELS

Model No.	Body	Installation	Float Material	Max. Pressure psig(kg/cm ²)	Min. Sp. Gr.	Price
L6-EPB-B-S-3-O	Brass	Side Wall Mounting	Solid Polypropylene	1000 (70)	0.9	\$101.00
L6-EPB-B-S-3-A	Brass	Side Wall Mounting	Stainless Steel, Cylindrical	200 (14)	0.5	116.50
L6-EPB-B-S-3-C	Brass	Side Wall Mounting	Stainless Steel, Spherical	350 (25)	0.7	116.00
L6-EPB-B-S-3-B	Brass	With External Float Chamber	Solid Polypropylene	250 (18)	0.9	122.00
L6-EPB-B-S-3-H	Brass	With External Float Chamber	Stainless Steel, Spherical	250 (18)	0.7	125.00
L6-EPB-S-S-3-O	Stainless Steel	Side Wall Mounting	Solid Polypropylene	2000 (140)	0.9	142.00
L6-EPB-S-S-3-A	Stainless Steel	Side Wall Mounting	Stainless Steel, Cylindrical	200 (14)	0.5	128.00
L6-EPB-S-S-3-C	Stainless Steel	Side Wall Mounting	Stainless Steel, Spherical	350 (25)	0.7	148.00
L6-EPB-S-S-3-S	Stainless Steel	With External Float Chamber	Solid Polypropylene	2000 (140)	0.9	186.50
L6-EPB-S-S-3-L	Stainless Steel	With External Float Chamber	Stainless Steel, Spherical	350 (25)	0.7	205.00

Options for L6 Switches Above

CSA/CENELEC certified switch with junction box. Add suffix -CN. CENELEC models only. stainless steel floats only. add \$35.00

DPDT Contacts — Change seventh character in model number to D. Example: L6EPB-B-S-3-D add \$20.00

MT Option — For higher temperature applications to 400°F (205°C). Available on all models with stainless steel floats. Add suffix -MT. add \$20.00

MV Option — Gold plated contacts. 0.1A @ 125 VAC. Add suffix -MV. add \$5.00

The compact Flotect Model L6 Level Switch is designed and built for years of trouble-free service in a wide variety of process liquid level applications. Machined from brass or stainless steel bar stock, the body is leak proof, eliminating the possibility of the process media entering the switch housing. The float lever pivoted within the body moves when the process liquid displaces the solid polypropylene or stainless steel float. A magnet on the opposite end of the float lever controls a second magnet on the switch actuating lever located in the switch housing. Maintenance is easy since the electrical assembly can be removed for inspection or replacement without removing the entire switch. The stainless steel float lever arm and the polypropylene or stainless steel float are compatible with most process fluids.

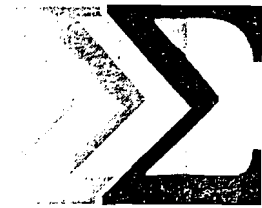
The Flotect Model L6 is sensitive to level changes of less than 1/8" (12mm) and is U.L./C.S.A. Listed for explosion-proof service — Class I, Groups A†, B, C & D and Class II, Groups E, F & G. CSA and CENELEC models furnished with optional junction box.
 (†Group A, stainless steel body only).

Suggested Specification:

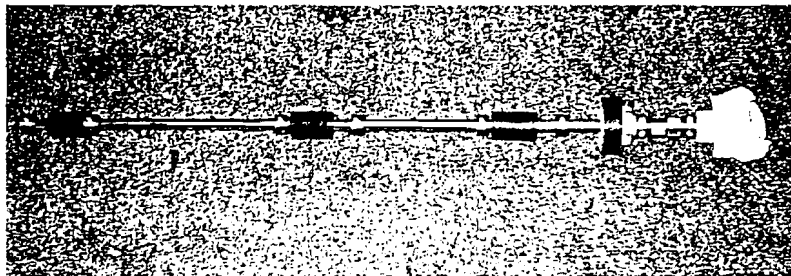
Automatic explosion-proof level switches shall be operated by a (solid polypropylene) (stainless steel) float actuating (one) (two) single pole, double throw switch(es) rated at 5 amps, 125/250 VAC. Motion of the float shall actuate switch by action of a magnet which controls the switch inside the one-piece switch body. Switches shall be W.E. Anderson Model No. L6 ____.

Sigma Controls, Inc.

PROCESS CONTROLS AND INSTRUMENTATION



SERIES 1500 MULTI FLOAT SWITCH



FEATURES

- 316SS Central Shaft
- 316SS or Buna Floats
- Positive Float Stops
- 1.5" or 2" NPT Process Connection
- Adjustable Connection Location
- Weather Proof Terminal Head
- 1, 2, 3, or 4 Float System
- 1 AMP @ 250 VDC Switching Element

DESCRIPTION

Sigma Series 1500 Float Level Switches are specifically designed to meet the harsh conditions found in industrial, municipal, environmental and machine level control applications.

Available with up to four (4) level stages, the Series 1500 utilizes hermetically sealed reed switches actuated by a magnetic embedded in the float. Floats are restricted in their movement by positive float stops.

A non-metallic weatherproof head contains a screw terminal barrier strip for field connections.

Floats are provided as standard in 316SS or Buna N, however, many other non-metallic materials are available as special order.

1-1/2" or 2" NPT process connections facilitate ease of installation in tanks, drums or sight glass.

Multiple stage independent switches permit both pump control and alarm functions to be carried out by a single switch assembly, easily installed through a tank top mounted fitting.

VISIT OUR WEBSITE SIGMACONTROLS.COM

127-1500p1

514 West Walnut Street • Perkasi, PA 18944 • (215) 257-3412 • FAX: (215) 257-3416

SERIES 1500 MULTI FLOAT SWITCH

SPECIFICATIONS

Switching Element:

Hermatically Sealed Reed Switch
Rated @ 1A @ 250VDC

Construction:

316SS Shaft, Brass Unions, (SS Optional)
C.S. Process Connection, Ryton Terminal
Weatherproof Head

Float Construction:

316SS, Buna 'N'

Electrical Connections:

Screw Terminal Barrier Strip in Ryton Head,
1/2" Conduit Connection

Pressure Rating:

150 PSI Max.

Temperature Rating:

150° F

ORDERING INFORMATION

Model	No. of Floats	Float Mat'l
1501S	1	316SS
1502S	2	316SS
1503S	3	316SS
1504S	4	316SS
1501B	1	BUNA 'N'
1502B	2	BUNA 'N'
1503B	3	BUNA 'N'
1504B	4	BUNA 'N'

APPLICATIONS

Tank Level Alarms

Pump Control

Cooling Tower Basins

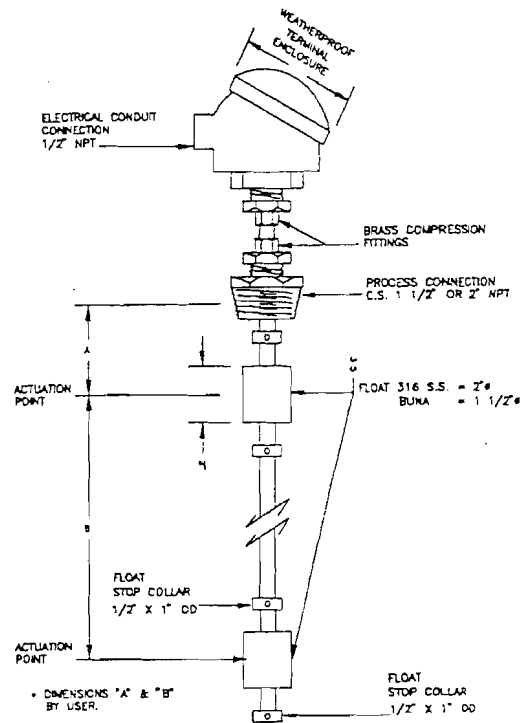
Effluent & Holding Tanks

Condensate Tanks

Sump Alarm and Control

Drum Level Alarm

DIMENSIONS



#21500P2.041200

Sigma Controls, Inc.

PROCESS CONTROLS AND INSTRUMENTATION

514 WEST WALNUT STREET, PERKASIE, PA 18944
PH: 215-257-3412 FAX: 215-257-3416

VISIT OUR WEBSITE SIGMACONTROLS.COM

SECTION 6

PRESSURE GAUGE

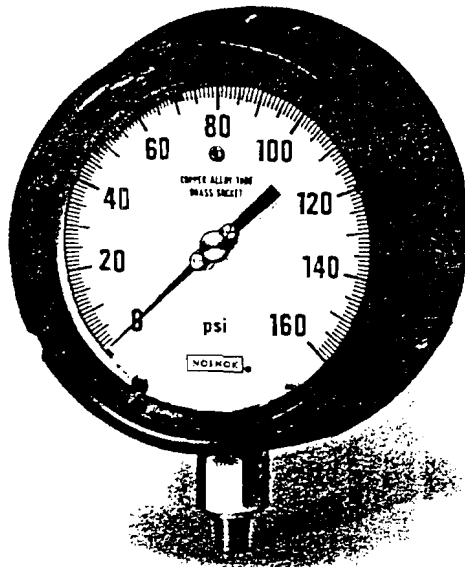
4 ½" DIAL, ¼ LM, BASS T & S, SAFETY FRONT

NOSHOK # 45-660-XXX

(RANGES TO BE DEFINED)

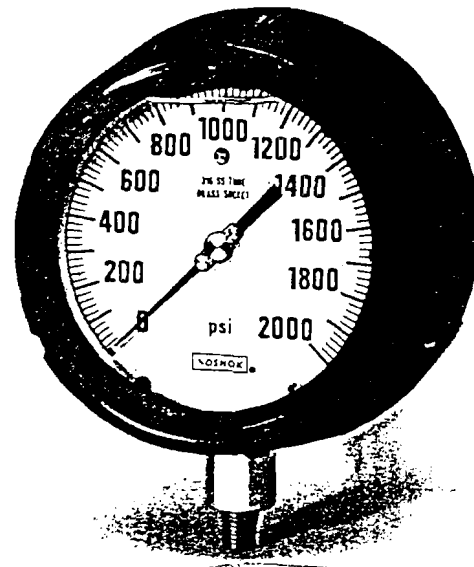
4 1/2 INCH PROCESS GAUGES

600/700 S E R I E S



45.640

4 1/2 INCH
PHENOLIC CASE
COPPER ALLOY INTERNALS
DRY
1/4" NPT
BOTTOM CONNECTION



45.660

4 1/2 INCH
PHENOLIC CASE
COPPER ALLOY INTERNALS
GLYCERINE FILLED
1/4" NPT
BOTTOM CONNECTION

SPECIFICATIONS	
Case	Turret Style Black Phenolic. Solid Front. Safety Case with Blow-out Back
Bayonet Ring	Threaded Black Phenolic
Lens	Acrylic, Laminated Safety Glass is Available.
Bourdon Tube	Beryllium Copper 'C' Tube for Pressures up to 600 PSI 316SS Coiled Safety Tube Above 600 PSI
Connection	1/4" NPT
Safety Protection	Blow-out Back on the Rear of Case.
Movement	Brass and Nickel Silver with Highly Polished Bearing Surfaces. An internal zero stop is standard.
Accuracy	± 1/2% Full Scale. ANSI Grade 2A.
Pointer	Balanced Micro-Adjustable Aluminum, Black Finish
Dial	Aluminum, White Background with Black Markings. Single Scale, PSI is Standard. PSI/kPa or PSI/Kg-cm² Dual Scale is Available as a Stock Option. On Dual Scale Dials, the Outer Scale is PSI in Black and the Inner Metric Scale is Red. UV Resistant.
Fill Liquid	(Model 45.660) Glycerine and Water. Silicone or Halocarbon are Available as Options.

STANDARD DIAL CONFIGURATIONS					
DIAL RANGE	FIGURE INTERVAL	GRADUATION INTERVAL	DIAL RANGE	FIGURE INTERVAL	GRADUATION INTERVAL
30" Hg Vacuum	5" Hg	0.2" Hg	0-200 PSI	20 PSI	2 PSI
30" Hg/15 PSI	5" Hg-3 PSI	0.5" Hg-0.2 PSI	0-300 PSI	50 PSI	2 PSI
30" Hg/30 PSI	10" Hg-5 PSI	1" Hg-0.5 PSI	0-400 PSI	50 PSI	5 PSI
30" Hg/60 PSI	10" Hg-10 PSI	1" Hg-0.5 PSI	0-600 PSI	50 PSI	5 PSI
30" Hg/100 PSI	30" Hg-10 PSI	2" Hg-1 PSI	0-800 PSI	100 PSI	5 PSI
30" Hg/160 PSI	30" Hg-20 PSI	2" Hg-1 PSI	0-1000 PSI	100 PSI	10 PSI
30" Hg/200 PSI	30" Hg-20 PSI	5" Hg-2 PSI	0-1500 PSI	200 PSI	10 PSI
30" Hg/300 PSI	30" Hg-50 PSI	5" Hg-2 PSI	0-2000 PSI	200 PSI	20 PSI
0-15 PSI	2 PSI	0.1 PSI	0-3000 PSI	500 PSI	20 PSI
0-30 PSI	5 PSI	0.2 PSI	0-5000 PSI	500 PSI	50 PSI
0-60 PSI	5 PSI	0.5 PSI	0-6000 PSI	1000 PSI	50 PSI
0-100 PSI	10 PSI	1 PSI	0-10,000 PSI	1000 PSI	100 PSI
0-160 PSI	20 PSI	1 PSI	0-15,000 PSI	2000 PSI	100 PSI

Consult factory for availability of specific models, ranges and options.

600/700

4 1/2 INCH PROCESS GAUGES

S E R I E S

GENERAL INFORMATION

Noshok 4 1/2 Inch 600 (Brass) and 700 (316SS) Series Process Gauges are specifically designed for demanding applications in the chemical and petroleum processing industries, as well as many industrial applications.

The turret style cases are constructed of a rugged, corrosion resistant phenolic material. The solid front, safety case design with a blow-out back isolates the gauge face from the pressure measuring system and assures operator protection if ever needed. The standard lenses are a shatter resistant acrylic and safety glass lenses are available.

The heavy-wall bourdon tubes and connections are made of copper alloy and brass (600 series) or all 316 stainless steel (700 series). "C" tubes are used on pressure ranges through 600 PSI and coiled safety tubes are used on pressure ranges above 600 PSI. These bourdon tubes are then

matched with precision movements of similar materials; brass movements in the 600 Series and stainless steel movements in the 700 Series. The pointers are balanced and micro-adjustable.

Liquid filled models are also available to further enhance gauge life and incorporate a unique breathing diaphragm that limits the effect of calibration changes due to ambient pressure and temperature changes.

Applications for Noshok 4 1/2 Inch 600 and 700 Series Process Gauges include service in chemical, petroleum and petrochemical refineries and pumping stations, food processing plants, power generating stations, water treatment plants and pulp and paper plants. They are widely used throughout industry where accuracy, readability, safety and reliability are important.

OPERATING SPECIFICATIONS

1. Working Pressure Limitations

a. Dynamic Pressure

The working pressure should be limited to 60% of the dial range.

b. Static Pressure

The working pressure, where no sharp fluctuations occur, should be limited to 90% of the dial range.

2. Ambient Temperature

a. 640 and 740 (dry)

-40°F to 160°F (-40°C to 71°C)

b. 660 and 760 (liquid filled)

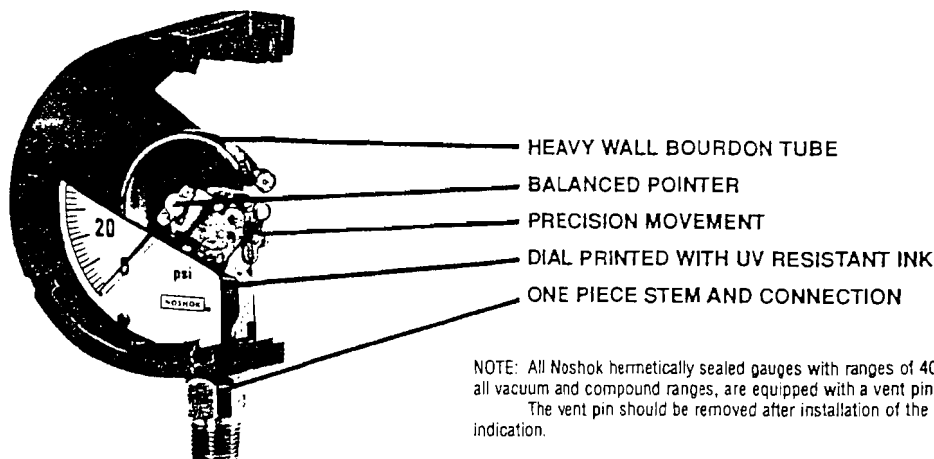
0°F to 140°F (-18°C to 60°C)

Lower operating temperatures are available to -40°F (-40°C) by using a special glycerine mixture or low temperature silicone. Please contact us for assistance in selecting the best fill liquid for your application.

ORDERING INFORMATION

45.740 • 100 PSI • 1/2" NPT • 316SS Orifice

1. Select size and model number.....
2. Select pressure range.....
3. Select NPT connection size (if more than one is offered).....
4. Select any required accessory or option



NOTE: All Noshok hermetically sealed gauges with ranges of 400PSI and below, including all vacuum and compound ranges, are equipped with a vent pin in the relief disc. The vent pin should be removed after installation of the gauge to insure accurate indication.

SECTION 7

TEMPERATURE GAUGE

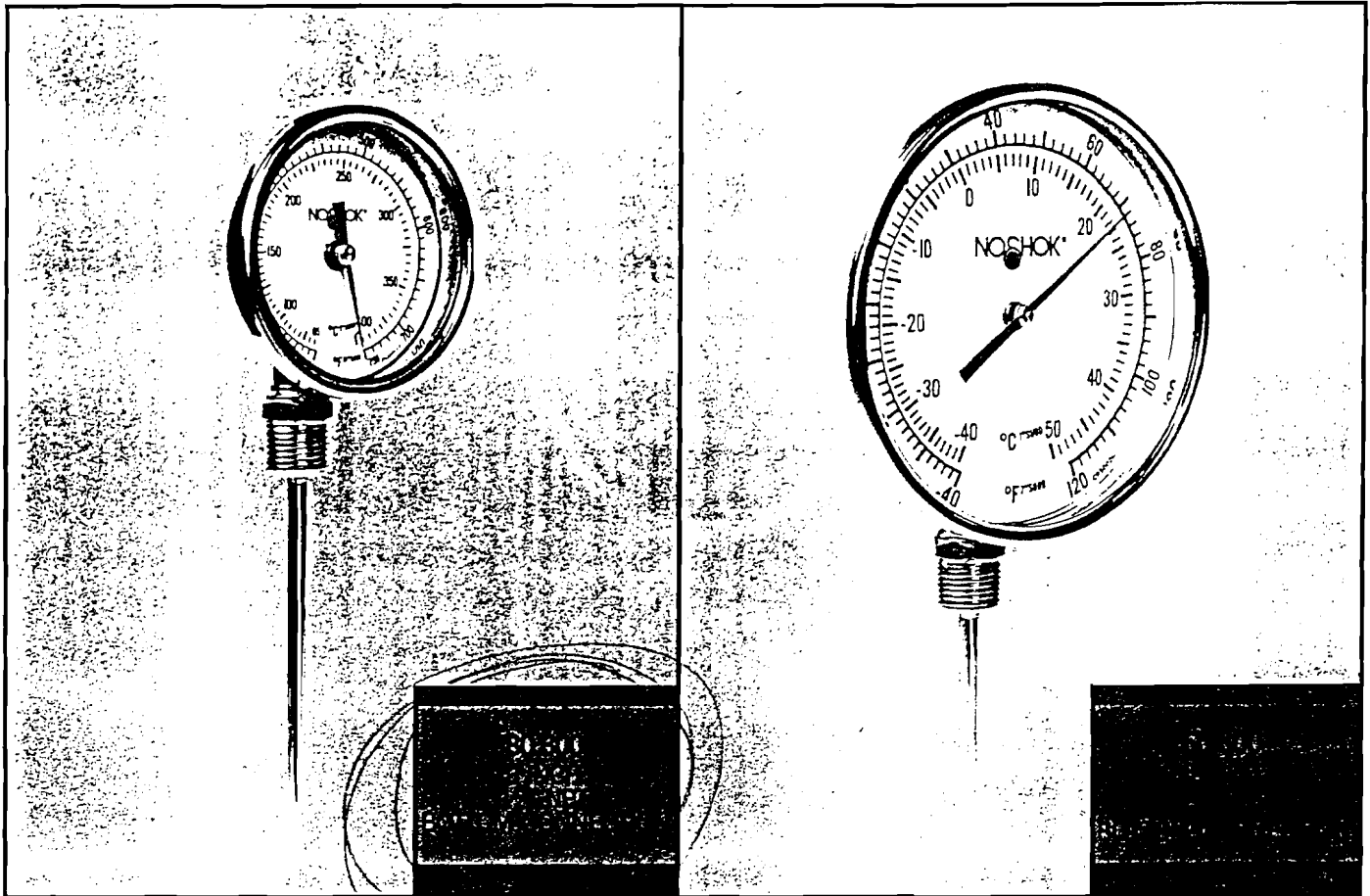
DIRECT MOUNT, BIMETAL THERMOMETER, WITH THERMOWELL, 0-200° F

NOSHOK # 30.300.060.0/200 F

6" STEM, ½" NPT

THERMOWELL, 4 ½" U. DIM, .260" BORE, ¾" NPT

NOSHOK # 75.060.304SS



SPECIFICATIONS

Case	304 Stainless Steel
Bezel	304 Stainless Steel Electroless Polished
Crystal	Instrument Glass
Pointer	Black Finished Aluminum
Stem	304 Series Stainless Steel
Accuracy	±1% Full Scale
Dial	Aluminum White Background Dual Scale, Black Celsius Scale and Black Fahrenheit Scale
Recalibrator	External Reset

Thermowells are recommended for pressure, corrosive fluids and high velocity applications

STANDARD RANGES—DUAL SCALE

RANGE Fahrenheit, Outer Scale	FIG. INT.	DIV.	RANGE Celsius	FIG. INT.	DIV.
0 to 50	20	2°	0 to 10	10	1°
0 to 120	20	2°	0 to 20	10	1°
0 to 250	10	1°	0 to 50	5	1/2°
0 to 300	10	1°	0 to 60	5	1/2°
0 to 400	20	2°	0 to 80	10	1°
0 to 500	20	2°	0 to 100	10	1°
0 to 600	20	2°	0 to 120	10	1°
0 to 700	20	2°	0 to 150	10	1°
0 to 800	20	2°	0 to 200	20	2°
0 to 900	100	10°	0 to 250	50	5°
0 to 1000	100	10°	0 to 300	50	5°

STANDARD STEM LENGTHS

INCHES	63.5	101.6	152.4	228.6	304.8	381.0	451.2	690.6
MILLIMETERS	2 1/2	4	6	9	12	15	18	24
ORDERING CODE	0025	0040	0060	0090	0120	0150	0180	0240

Longer stems are available on special order up to 120"

GENERAL INFORMATION

NOSHOK THERMOWELLS are recommended whenever the process being measured may be under pressure. They are also recommended as protection to the operator and/or observer. The correct thermowell will reduce the possibility of damage to the temperature instrument which may be caused by pressure, corrosion, or the flow of abrasive or viscous media. In addition, an instrument may be removed and replaced without shutting down and possibly draining the process.

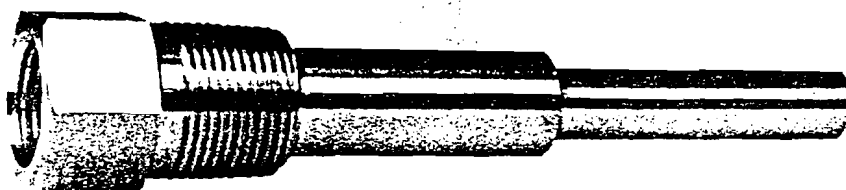
NOSHOK STANDARD THERMOWELLS are supplied with 1/2" NPSM instrument connection. The female thread will match the standard 1/2" NPT male thread without seizing or galling. Lagging, welded, flange type etc. wells are available upon request.

For an instrument to indicate within its specified accuracy, the sensitive portion must be immersed into the media. This immersion length varies and is specified by the instrument manufacturer. These factors must be considered when specifying the "U" dimension on any thermowell.

ORDERING INFORMATION

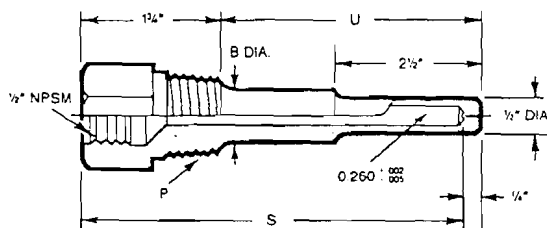
1. Select model no. _____
2. Select bore depth _____
3. Select material _____

75 • 040 • 304SS



75
STEPPED SHANK
NOMINAL BORE

DIMENSIONS



LEGEND

- U - Shank Length Under Threads
- P - Process Connection NPT
- S - Bore Depth = Instrument Element Length including Threads.
- B - Shank Base Diameter

MATERIAL—PLEASE SPECIFY

BRASS
304SS
316SS
OTHER—PLEASE SPECIFY

Other materials are available upon request

BORE SIZE	PROCESS CONNECTION	MAXIMUM INSERTION DIAM.
.260 inch (6.35mm)	3/4" NPT	3/4 inch (19.05mm)

STANDARD LENGTHS

INSERTION "U"	mm	41.3	63.5	114.3	190.5	266.7	342.9	419.1	571.5
	inch	1 5/8"	2 1/2"	4 1/2"	7 1/2"	10 1/2"	13 1/2"	16 1/2"	22 1/2"
BORE DEPTH "S"	mm	63.5	101.6	152.4	228.6	304.8	381.0	457.2	558.8
	inch	2 1/2	4	6	9	12	15	18	24
ORDERING CODE		025	040	060	090	120	150	180	240

Remote thermometers are available upon request

SECTION 8

FLOW SWITCH

AIR ACTUATED, VANE STYLE, 8" LINE, BRASS BODY, NEMA 4 HOUSING

W. E. ANDERSON # V4-2-U



Series
V4

Flotect Vane Operated Flow Switch

Field adjustable — 1½ to 20 inch pipe. Leak proof body.

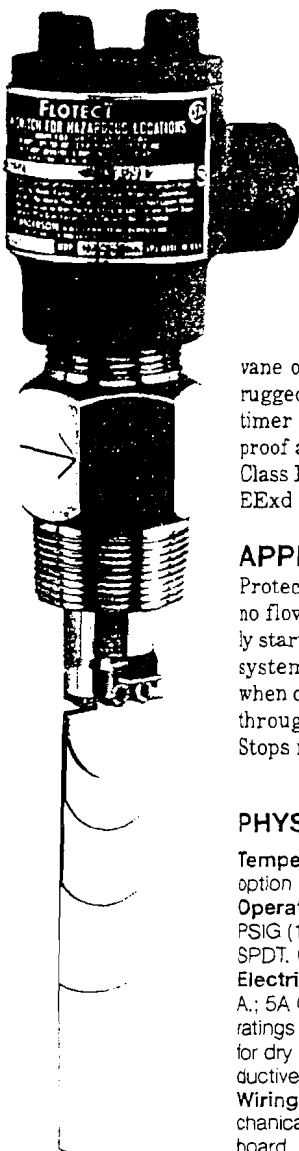


Dependable protection against flow variation or stopping in pipelines for fluids, gases and flowing solids.

Supplied with custom or universal multilayer vanes for field installation in pipes from 1½". Designed to meet NEMA-4 watertight construction.

Compact and reliable, the Flotect® V4 Flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. Installed in thousands of pipelines and processing plants around the world, this unique magnetically actuated switching design gives superior performance. Universal multi-layer vane accommodates pipe sizes from 1½" up. Custom vanes are available with factory calibration. There are no bellows, springs, or seals to fail. Instead, the free-swinging vane attracts a magnet within the solid metal switch body above, actuating a snap switch by means of a simple lever arm.

Features include: Simplicity of design and a leak-proof switch body, machined from bar stock for pressures to 2000 PSIG, (140kg/cm²), it eliminates the possibility of process fluid entering the switch compartment. The threaded conduit enclosure cover permits easy inspection or replacement of electrical assembly without shutting down the process, or removing electrical conduit. Power must be disconnected. The unit fits directly into pipeline with tee, thredolet or flange for easy installation. Pendulum-like vane action responds accurately to fluid flow rate. The custom



Explosion-Proof; U.L. and C.S.A. listed - Class I, Groups C, D; Class II, Groups E, F, G. CENELEC: EExd IIB T6. (T amb. = 75°C) SAA: Exd IIB T6. (T amb. = 75°C) IP66 CII, Zone I; also FM approved.

vane or multi-layer vane is sensitive to low velocity flows, yet it is rugged enough to withstand high flow surges. If desired, a delay timer can be wired into the installation. All units are explosion-proof and listed with U.L. and C.S.A. for Class I, Groups C and D, Class II, Groups E, F, and G or are flame-proof to CENELEC/SAA EExd IIB T6 (T amb = 75°C); also FM approved.

APPLICATIONS

Protects motors, pumps and other equipment against low flow and no flow. Controls sequential operation of pumps, etc. Automatically starts auxiliary pumps and engines or actuates alarm and signal systems. Stops water cooled engines, machines and processes when coolant flow is interrupted. Shuts down burner when air flow through heating coil fails. Controls dampers according to flow. Stops machines if cooling oil flow ceases.

PHYSICAL DATA

Temperature Limits: Standard 275°F (135°C) High temperature option (not U.L. C.S.A or CENELEC/SAA), 400°F (205°C) max.

Operating Pressure: Brass 1000 PSIG (70kg/cm²), 316SS 2000 PSIG (140kg/cm²). Ratings to 5000 PSIG (350kg/cm²) available only SPDT. Only SS body.

Electrical Rating: UL AND CENELEC/SAA 10A @ 125/250 VAC C.S. A.; 5A @ 125/250 VAC, 5A resistive, 3A inductive @ 30 VDC. Optional ratings (not U.L., C.S.A or CENELEC/SAA); **MV** option: Gold Contacts for dry circuits. Rated 1 amp @ 125 VAC, 1 amp resistive, ½ amp inductive @ 30 VDC. **MT** option: 400°F (205°C) 5 amp @ 125/250 VAC. **Wiring:** U.L./C.S.A. unit; 16 gauge copper wire, 6" (152mm) long, mechanically and solder bonded to switch. CENELEC/SAA unit: Terminal board.

Switch body: One piece milled and bored Brass or 316SS. Other materials on request.

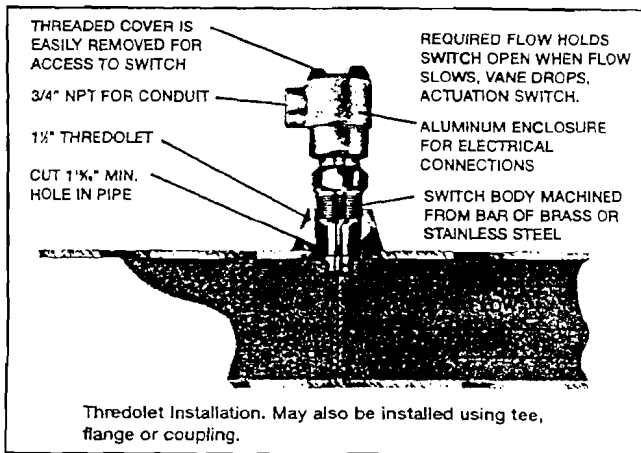
Vane: 316SS 1½" (40mm) wide. Std. trim includes 430SS. Other materials on request.

Piping Connection: 1½" NPT std for mounting in 1½" thredolet. For other mounting see next page. Thredolet fittings available.

Installation: within 5° of vertical for proper operation. Units for horizontal installation (vertical pipes) on request.

Weight: 4 lb. 5 oz. (1.96kg).

Options: All 316SS wetted parts. Nickel alloy magnet keeper. DPDT circuits. Cartridge heater to melt paraffin, etc. Time delay relay



Suggested Specification:

Automatic explosion-proof flow switches shall be vane operated to actuate one or two single pole double throw snap switches. Motion of the vane shall actuate switch by action of a magnet linked to switch inside the single piece sealed switch body. Switches shall. W.E. Anderson Model No. V 4 _____.

STOCKED MODELS in bold

Model	Description	Price
V4-2-U	Brass body, universal vane	\$189.00
V4-SS-2-U	316SS* body, universal vane	278.00
V4	Brass body, custom vane	228.00
V4-SS	316SS* body, custom vane	315.00

6SS body with 430SS magnet keeper. For 316SS magnet keeper, specify: with all 316SS parts.....add \$32.00

Options for Series V4 Flotect® Flow Switches

Add suffixes to model numbers

-D DPDT contacts.....add \$20.00

-MT High temperature construction (400°F, 204°C)

Available only on all stainless steel models.

Not UL, CSA or CENELEC listed.....add \$20.00

-TR Time delay relay with 2 SPDT contact sets, adjustable from 0-1 to 0-31 minutes.

Not UL, CSA or CENELEC listed.....add \$247.00

-CN CENELEC approved.....add \$34.00

-NI Nickel alloy magnet keeper.....add \$12.00

Fittings for use with Series V4 Flotect® Flow Switches

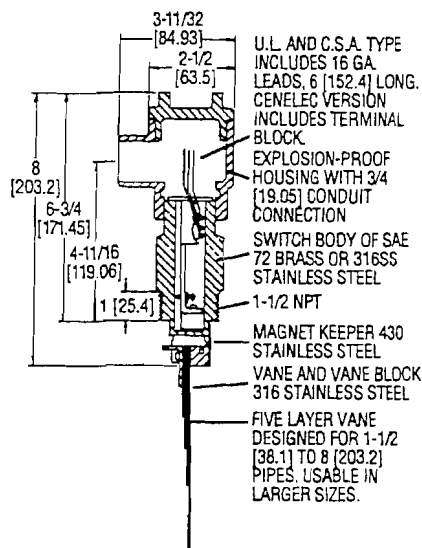
1½" Thredolet Specify pipe size.....\$23.00*

2½" Bushing Carbon steel, required with wide vane V4's.....\$84.00*

2" Flange 150# Carbon steel raised face connection.

Custom vane required.....\$120.00*

*These prices for carbon steel fittings. Other materials available at additional cost.



APPROXIMATE ACTUATION/DEACTUATION FLOW RATES FOR COLD WATER. UPPER FIGURES IN GPM. LOWER FIGURES IN M³/HR												
VANE LAYERS	1.5" PIPE	2" PIPE	3" PIPE	4" PIPE	6" PIPE	8" PIPE	10" PIPE	12" PIPE	14" PIPE	16" PIPE	18" PIPE	20" PIPE
1	7-3 1.6-0.7	15-8 3.4-1.8	45-22 10-5	95-40 22-9	210-120 48-27	375-175 85-40	600-300 136-68	900-450 204-102	1200-600 273-136	1400-800 318-182	2000-1000 454-227	2400-1200 545-273
1&2		7-4 1.6-0.9	23-14 5.2-3.2	50-35 11.4-7.9	130-90 30-20	230-150 52-34	450-250 102-57	650-350 148-79	900-500 204-114	1200-650 273-148	1450-800 329-182	1800-1000 409-227
1,2,&3			11-7 2.5-1.6	27-19 6.1-4.3	80-60 18-14	160-115 36-26	300-180 68-41	450-275 102-62	600-350 136-79	750-450 165-125	1000-600 227-136	1200-700 273-159
1,2,3,&4				17-12 3.9-2.7	60-45 14-10	120-90 27-20	230-150 52-34	310-200 70-45	430-280 98-64	550-360 125-82	700-450 159-102	850-550 193-125
1,2,3,4,&5					40-30 9.1-6.8	80-65 18-15	135-100 31-23	200-140 45-32	290-200 66-45	360-250 82-57	460-325 104-74	575-400 131-91

Actuation rates are based on cold water at a specific gravity of 1.0. For fluids of different specific gravity, actuation rates may be approximated by dividing the rate shown by the square root of the specific gravity.

Values shown in both charts are nominal. If normal flows exceed actuation rates by less than 10%, custom vanes are recommended. Figures are based on standard vertical installation in a 1½" thredolet in a horizontal run of pipe.

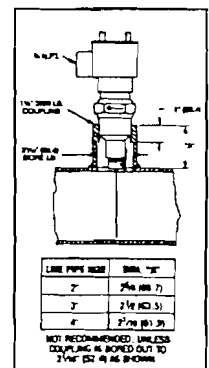
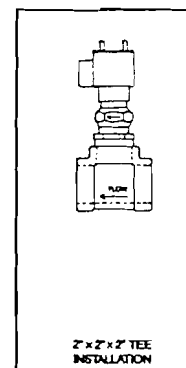
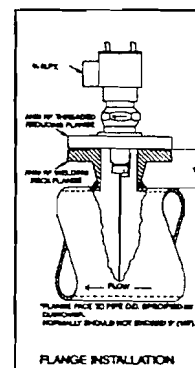
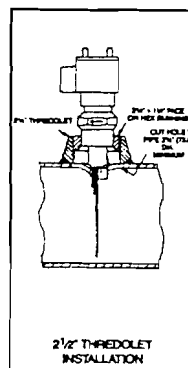
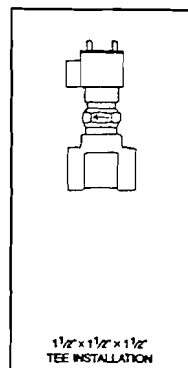
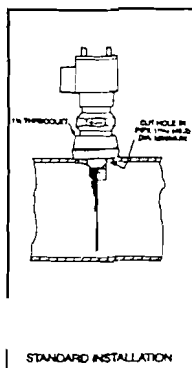
APPROXIMATE ACTUATION/DEACTUATION FLOW RATES FOR AIR. UPPER FIGURES IN SCFM. LOWER FIGURES IN M³/MS												
VANE LAYERS	1.5" PIPE	2" PIPE	3" PIPE	4" PIPE	6" PIPE	8" PIPE	10" PIPE	12" PIPE	14" PIPE	16" PIPE	18" PIPE	20" PIPE
1	32-17 .02-.008	65-32 .03-.02	210-105 .10-.05	400-200 .19-.09	950-475 .45-.22	1550-850 .73-.40	2400-1300 1.1-0.6	3450-1900 1.6-0.9	4700-2600 2.2-1.2	6400-3500 3.0-1.7	8000-4400 3.8-2.1	10000-5500 4.7-2.6
1&2		23-13 .01-.006	120-70 .06-.03	195-140 .09-.07	550-375 .26-.18	1100-700 .52-.33	1850-1200 .87-.57	2700-1750 1.3-0.8	3400-2200 1.6-1.0	4800-3100 2.3-1.5	6000-3900 2.8-1.8	7400-4800 3.5-2.3
1,2,&3			60-48 .03-.02	135-100 .06-.05	375-265 .18-.13	725-500 .34-.24	1200-850 .57-.40	1850-1300 .87-.61	2600-1800 1.2-0.8	3350-2350 1.7-1.1	4300-3000 2.0-1.4	5300-3700 2.5-1.7
1,2,3,&4				65-50 .03-.02	260-200 .12-.09	500-400 .24-.19	875-700 .41-.33	1250-1000 .59-.47	1900-1500 .90-.71	2500-2000 1.2-0.9	3100-2500 1.5-1.2	3900-3100 1.8-1.5
1,2,3,4,&5					130-100 .06-.05	310-250 .15-.12	650-525 .31-.25	1000-800 .47-.38	1600-1250 .76-.59	2200-1750 1.04-0.83	2800-2250 1.3-1.1	3550-2850 1.7-1.3

Actuation rates are based on air at standard conditions. For gases at other pressures, temperatures, or specific gravities, consult factory for equivalent flow approximations.

For custom vane models, please supply factory with following information: pipe size, flow direction (horizontal, up, down), mounting, pressure, temperature, specific gravity, flow rates (maximum normal, actuation/deactuation*), etc.

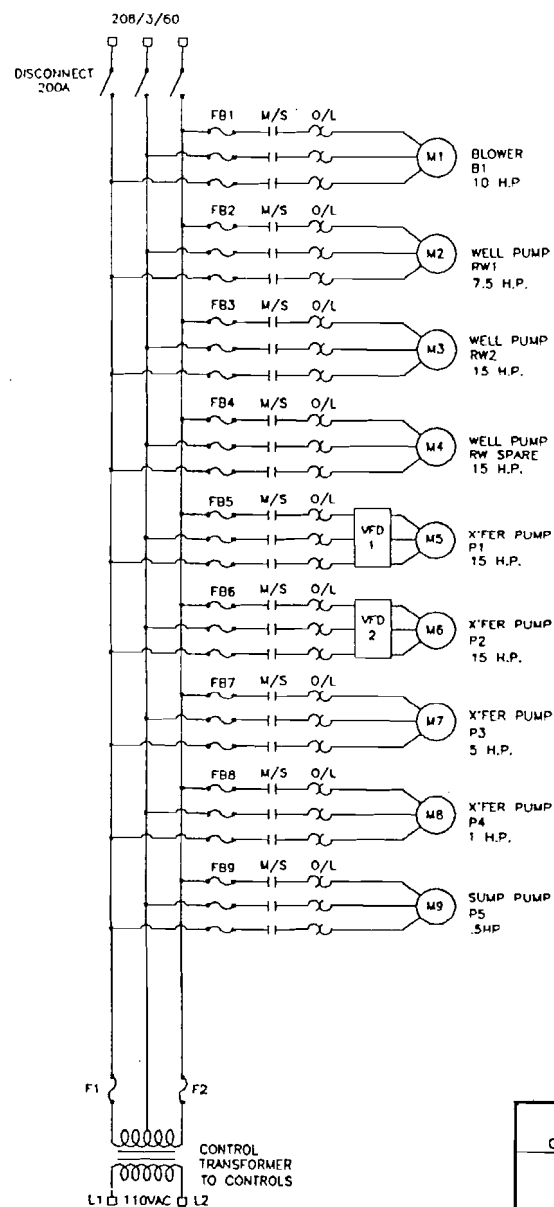
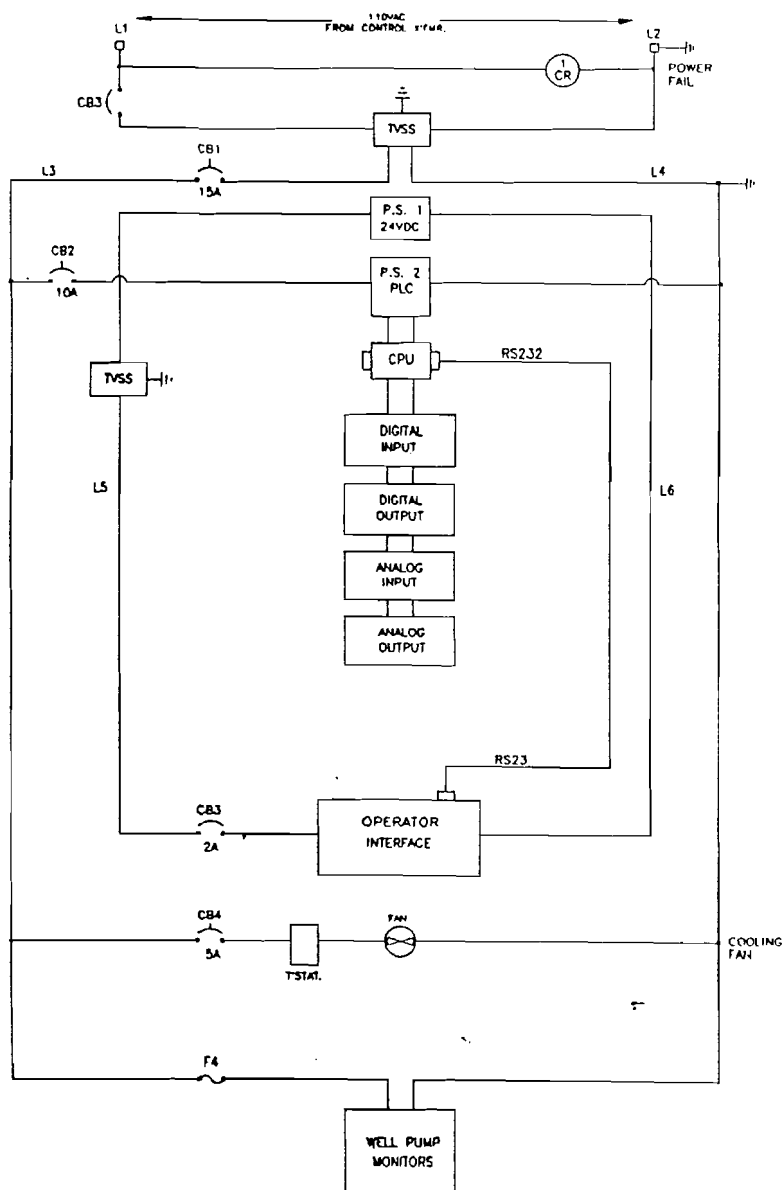
*When both values are supplied, note which is critical.

APPLICATION DRAWINGS FOR FLOTECT® AUTOMATIC FLOW SWITCHES

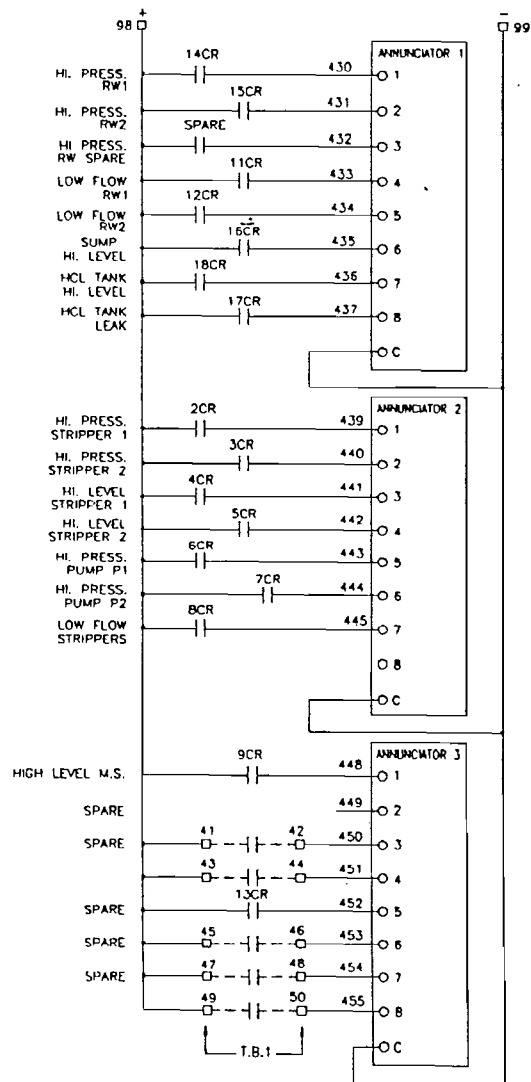
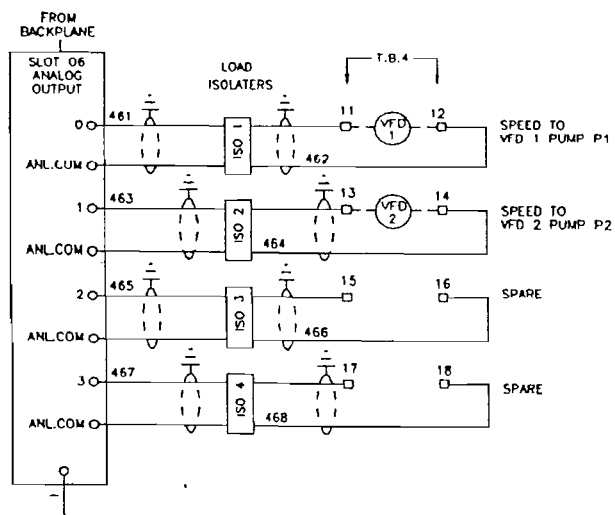
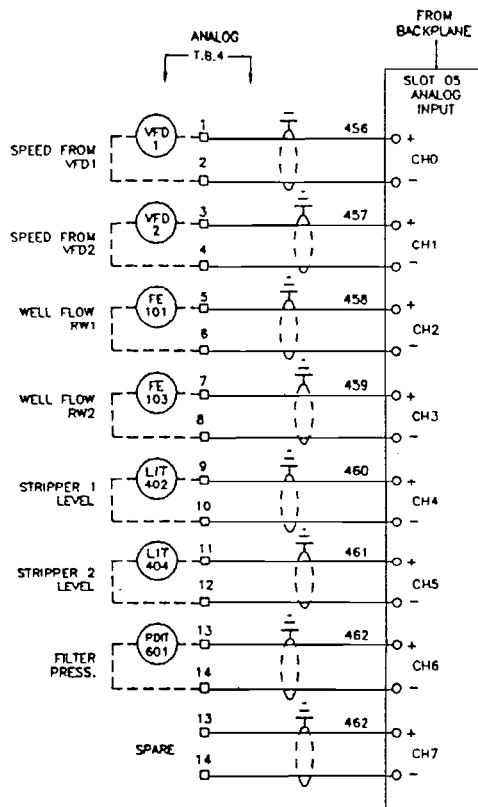


SECTION 9

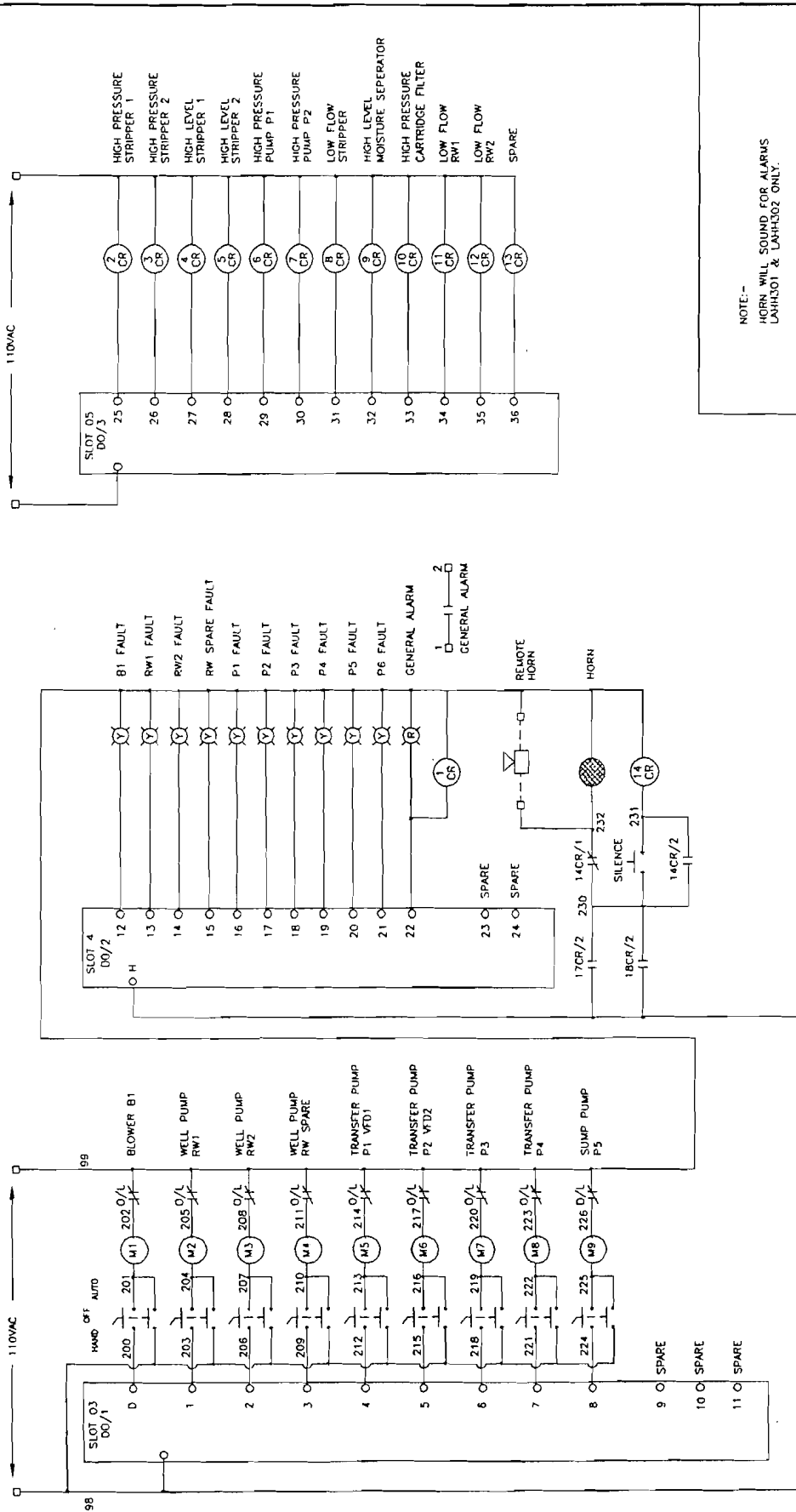
WIRING & LAYOUT DRAWINGS AND BOM



SIGMA CONTROLS, INC.		514 W. Walnut Street, Parkton, Pa. 18944 Phone: (215) 257-3412 Fax: (215) 257-3418	
REMEDIATION CONTROL PANEL BLOCK WIRING DIAGRAM			
Client: CAMERON GREAT LAKES			
Dwg. No.: 01-81-1	Date: 6-26-01	Rev: "C" 7-24-01 (MISC.)	
Sheet 1 of 3	Scale: N.T.S.		

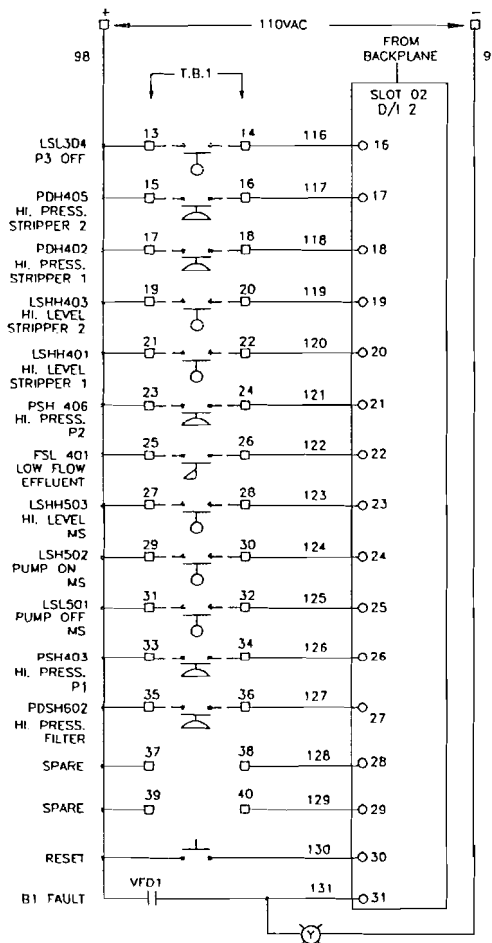
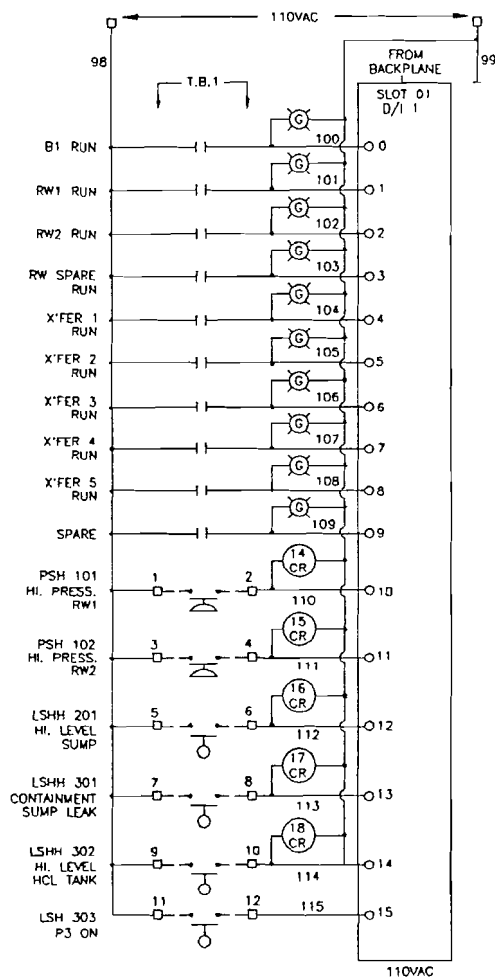


SIGMA CONTROLS, INC.		514 W. Walnut Street, Parkside, Pa. 18944 Phone: (215) 257-3412 Fax: (215) 257-3418	
REMEDIATION CONTROL PANEL ANALOG INPUT/OUTPUT			
Client: CAMERON GREAT LAKES			
Dwg. No.: 01-81-2		Date: 6-26-01	
Sheet 2 of 3		Scale: N.T.S.	
Rev: 'C' 7-24-01 (MISC)			



NOTE:-
HORN WILL SOUND FOR ALARMS
UNLESSOT & LAHMOZ ONLY.

SIGMA CONTROLS, INC.		514 W Walnut Street, Perkasie, Pa. 18944 Phone: (215) 257-3412 Fax: (215) 257-3416	
REMIATION CONTROL PANEL DIGITAL OUTPUT DETAIL			
Client:		CAMERON GREAT LAKES	
Dwg. No. 01-81-3	Date: 6-27-01	Rev: "C" B-3-01 (MISC.)	
Sheet 3 of 5	Scale: N.T.S.		



NOTE:-
SYSTEM WILL SHUT DOWN IF THE FOLLOWING ALARM
CONDITIONS OCCUR:-

LAHH 503,
PAH 402,
PAH 403,
PAH 405,
PAH 406
MF-B1
MF-P1,
MF-P2,
MW-P4

SIGMA
CONTROLS, INC.

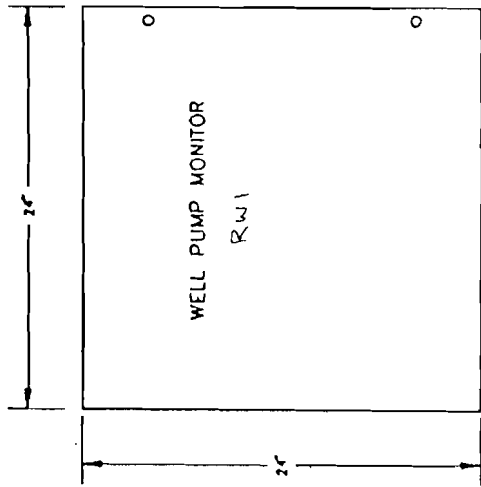
514 W. Walnut Street, Perkasie, Pa. 18944
Phone: (215) 257-3412 Fax: (215) 257-3416

REMEDIATION CONTROL PANEL DIGITAL INPUT DETAIL

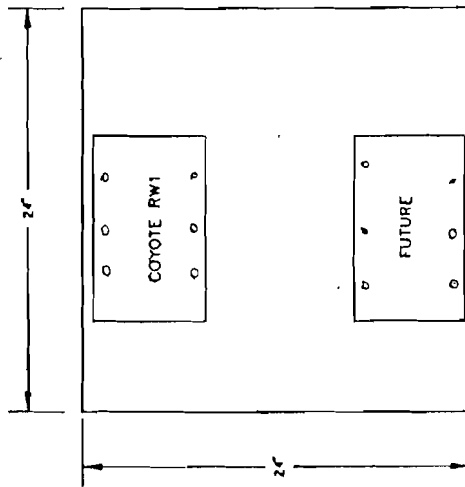
Client: CAMERON GREAT LAKES

Dwg. No.: 01-B1-4 Date: 6-26-01 Rev: "B" 7-24-01 (MISC.)

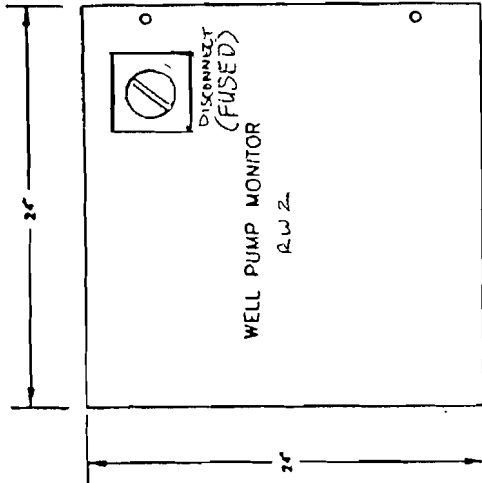
Sheet 4 of 5 Scale: N.T.S.



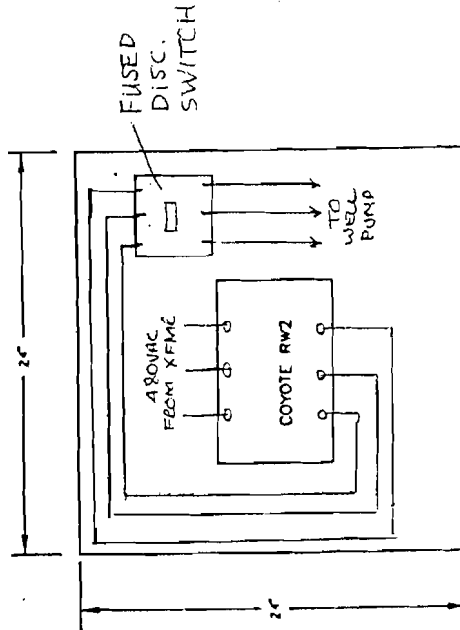
FRONT PANEL LAYOUT
(NEMA 4 P'GLASS.)



BACK PANEL LAYOUT



FRONT PANEL LAYOUT
(NEMA 4 P'GLASS.)



BACK PANEL LAYOUT

SIGMA
CONTROLS, INC.

Dwg. 01-81-6

Date :

Scale :

Revision:

WELL MONITOR PANELS
LAYOUT & WIRING.

514 West Walnut street, Perkasio, Pa. 18944 --- (215) 257-3412

Sigma Controls, Inc.

PROCESS CONTROLS AND INSTRUMENTATION



CUSTOMER:	CAMERON GREAT LAKES	PROJECT NAME:	ACTIVE IND. UNIFORM SITE
TYPE PANEL:	REMEDATION CONTROLS	DRAWING NO.:	01-81

BILL OF MATERIALS

ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	ENCLOSURE, NEMA 4X, SS	CONTROL ENGINEERING	4WMSS072030012SD	1
2	DISCONNECT SWITCH, 200 AMPS	CUTLER HAMMER	C362N200	1
3	HANDLE	CUTLER HAMMER	C362H25	1
4	SHAFT	CUTLER HAMMER	C362S24	1
5	CONTROL TRANSFORMER, 230/110	CUTLER HAMMER	1B0900FB	1
6	MOTOR STARTER, 15HP	CUTLER HAMMER	CE15JNS3AB	2
7	OVERLOAD	CUTLER HAMMER	C316KNA3F	2
8	MOTOR STARTER, 10HP	CUTLER HAMMER	CE15HNS3AB	1
9	OVERLOAD	CUTLER HAMMER	C316KNA3B	1
10	MOTOR STARTER, 5HP	CUTLER HAMMER	CE15DNS3AB	1
11	OVERLOAD	CUTLER HAMMER	C316FNA3R	1
12	MOTOR STARTER, 1HP	CUTLER HAMMER	CE15ANS3AB	3
13	OVERLOAD	CUTLER HAMMER	C316FNA3L	3
14	MOTOR STARTER, .5HP	CUTLER HAMMER	CE15ANS3AB	1
15	OVERLOAD	CUTLER HAMMER	C316FNA3H	1
16	VARIABLE SPEED DRIVE, 15HP	SAFTRONICS	FP5-2011	2
17	HAND OFF AUTO SELECTOR, N4X	ALLEN BRADLEY	800EP-SL32	10
18	RUN LIGHT, GREEN, N4X	ALLEN BRADLEY	800EP-PL3	10
19	FAULT LIGHT, YELLOW, N4X	ALLEN BRADLEY	800EP-PL5	10
20	ALARM LIGHT, RED, N4X	ALLEN BRADLEY	800EP-PL4	1
21	RESET PUSHBUTTON, N4X	ALLEN BRADLEY	800EP-F2	1
22	WELL PUMP MONITOR, 3 PHASE	COYOTE	3PH208V	2
23	CPU	PLC DIRECT	D2-250	1
24	RACK	PLC DIRECT	D2-09B	1
25	DIGITAL INPUT	PLC DIRECT	D2-16NA	2
26	DIGITAL OUTPUT	PLC DIRECT	D2-12TR	2
27	ANALOG INPUT	PLC DIRECT	F2-08AD-1	1
28	ANALOG OUTPUT	PLC DIRECT	F2-02DA1L	1
29	OPERATOR INTERFACE	MAPLE SYSTEMS	3160A	1
30	ALARM ANNUNCIATOR	PRECISION DIGITAL	PD-128	3
31	MAGNETIC FLOWMETER 3"	BADGER METER	MAGNETO FLOW/3"	1
32	MAGNETIC FLOWMETER 4"	BADGER METER	MAGNETO FLOW/4"	1
33	PRESSURE SWITCH, 10-70 PSI	MERCOLD	1004W-A-1-D	1
34	DIFF. PRESS. SWITCH, 5-15 PSID	W. E. ANDERSON	H3B-2SL	1
35	LEVEL SWITCH, SIDE MOUNT	W. E. ANDERSON	L6EPB-B-S-3-0	1
36	LEVEL SWITCH, TOP MOUNT, 3/STG	SIGMA CONTROLS	1503B	1
37	LEVEL SWITCH, TOP MOUNT, 1/STG	SIGMA CONTROLS	1501B	1
38	PRESSURE GAUGE	NOSHOK	45-660-XXX	2
39	TEMPERATURE GAUGE, 0-200 F	NOSHOK	30.300.060.0/200 F	2
40	THERMOWELL	NOSHOK	75.060.304SS	2
41	FLOW SWITCH, VANE STYLE	W. E. ANDERSON	V4-2-U	1

BOMCGLAUSITE.DOC

02-A

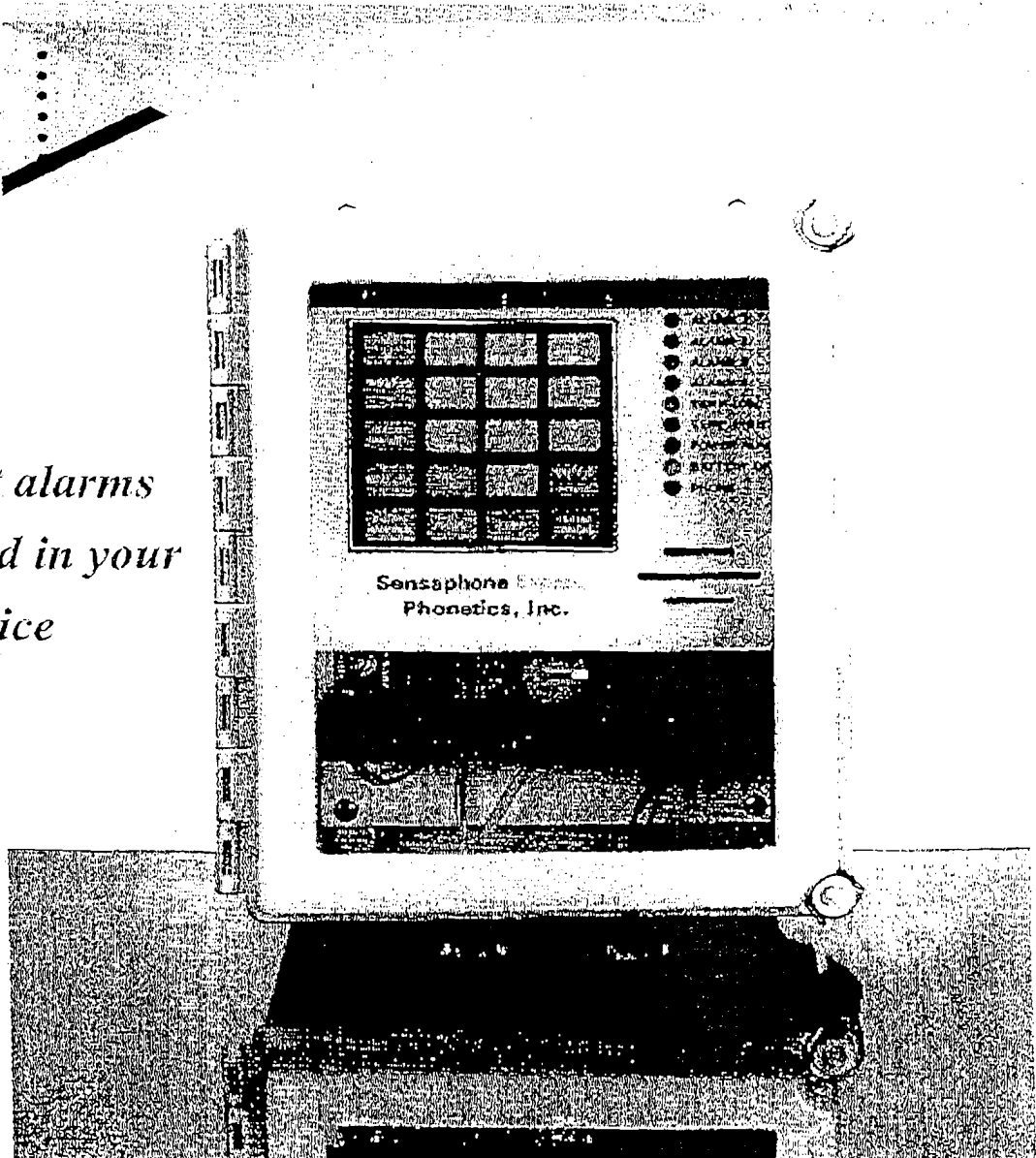
13300-01-B

AUTODIALER - PROCESS INSTRUMENTATION AND CONTROLS

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

Sensaphone[®] Express

*Dialout alarms
expressed in your
voice*



Phonetics, Inc.

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

APPLICATIONS



For monitoring of remote or unattended locations, Sensaphone® *Express* is ideal. Typical applications for *Express* include:

- Boilers
- Chemical Plants & Refineries
- Computer Rooms & Peripherals
- Electric Power Substations
- Frozen Food Storage
- Greenhouses
- Hatcheries, Fish & Poultry
- HVAC Systems & Equipment
- Pipelines & Compressor Stations
- Remote Pump Stations
- Security
- Switchgear & Telephone Huts
- Water & Waste Treatment Plants

SPECIFICATIONS



General:

Monitoring Capacity:	4 dry contact inputs (configured Normally Open or Normally Closed)
	Power failure
	Temperature: -60° to 175° F or -50° to 80° C
Speech Technology:	ADPCM 24 kb/s
Message Length:	8 seconds for alarms / 10.5 seconds for ID
Message Types:	4 alarm messages / 1 ID message
Telephone Numbers:	8 phone numbers, up to 32 digits
Dialing Format:	Touch-Tone™ or pulse
Phone Connector:	RJ11C
Output Type:	SPDT Form C 5A 125 VAC

Electrical:

Power Requirements:	120 VAC 10 Watts Max
Internal Battery Backup:	12 hour Gel Cell with built-in charger

Environmental:

Operating Temperatures:	32° - 120° F
Operating Humidity:	0 - 90%, non-condensing
Storage Temperatures:	10° - 130° F

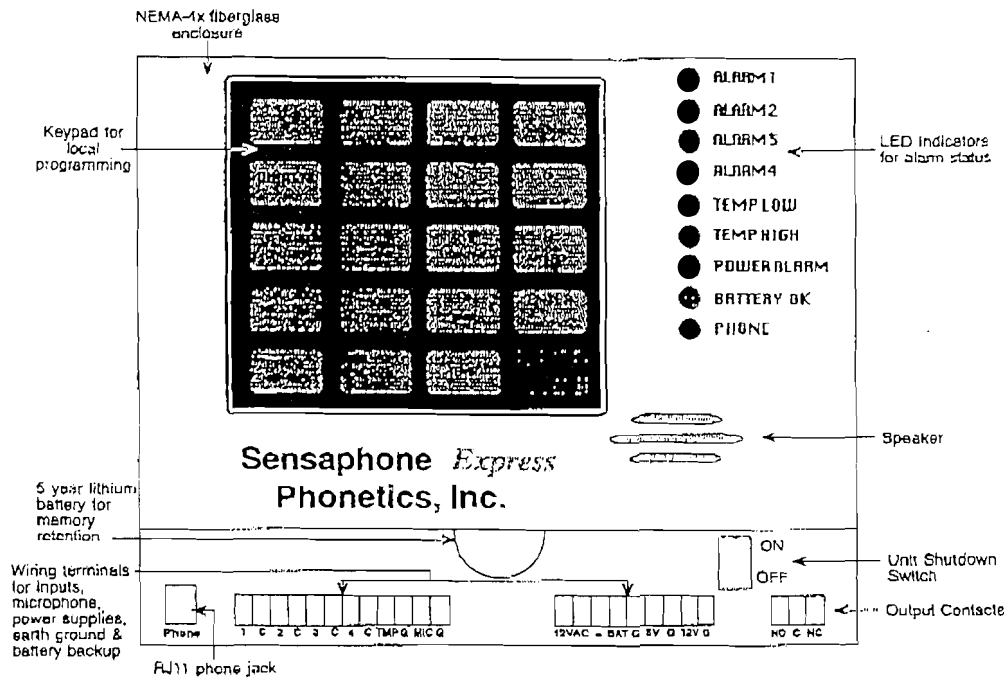
Physical:

Dimensions:	10.5" x 8.5" x 6.25"
Weight:	9 lbs. 4 oz.
Enclosure:	NEMA 4
Construction:	High-impact, fiberglass with hinged, latched clear cover

© 1996 Phonetics, Inc. Sensaphone® is a registered trademark of Phonetics, Inc.
Touch-Tone™ trademark of AT&T. Specifications subject to change without notice.



Phonetics, Inc.



*Easy
access to
program-
ming,
status
information
and wiring
terminals.*

FEATURES

- Digitally records user's voice for ID message and alarm messages for 4 dry contact inputs. Can be recorded locally or remotely
- Monitors 4 dry contact inputs (configured N.O./N.C.), temperature and AC power
- Stores up to 8 32-digit phone numbers
- Front panel LED's indicate input alarm status, power alarm status, low battery condition, and phone status
- 12-hour rechargeable internal battery backup with built-in charger
- Call progress detects busy signal or no answer
- Output relay for automatic or manual switching
- Housed in a dust-tight, high-impact, corrosion-resistant fiberglass NEMA 4 enclosure
- Can share a phone line with other devices
- Non-volatile memory for voice and programming storage
- Ability to call and listen to on-site sounds

PROGRAMMABILITY

Express's voice-guidance makes programming easy. Parameters such as the temperature limits, alarm recognition time, intercall delay, rings until answer, power-out to alarm time, password, message repetitions, phone numbers and voice recording can be easily programmed via the local keypad. Alarm messages can even be changed remotely. A user-defined 4-digit password prevents access to the information. Programming is stored in non-volatile memory to prevent loss of data during power failure or storage.

ALARM NOTIFICATION

When an alarm condition occurs, *Express* automatically dials up to 8 32-digit phone numbers. *Express* recites the user-recorded ID message followed by the recorded alarm message. *Express* monitors call progress to detect busy signals or no answers. These features ensure that the right people get the alarm message without wasted time.

Alarm dial-out stops when *Express* is acknowledged. Alarms can be acknowledged by either pressing Touch-Tones™ on your phone or by calling your *Express* unit back.

Even when there is no alarm situation, you can keep track of your monitored conditions. You can call *Express* from any telephone to obtain a comprehensive status report on all conditions monitored by the system. *Express* also has a built-in microphone so you can listen in to sounds at the site. You can also review and change alarm messages.

affordable monitoring, 24 hours a day.

Sensaphone® Express by *Phonetics, Inc.*

is an advanced environmental monitoring system combined with digital speech recording technology for alarm message clarity. *Express* will warn you quickly and automatically with your own voice message when any of the monitored conditions change. *Express* is a comprehensive alarm system that is easy to use and effective to prevent disaster in your remote and unattended facilities.

SPEECH TECHNOLOGY

With *Express*, Phonetics introduces digital speech recording to its family of industrial/environmental monitors. This unique feature of *Express* allows you to record your own voice for the dial-out alarm messages. This means that when *Express* calls you during an alarm, you will receive your personalized voice message telling you exactly what the alarm condition is. Now, you can hear: "The computer room is flooding! Water level has exceeded one inch."

You can record a separate message for each of the four inputs and an ID message. You can record the voice message locally with *Express's* built-in microphone, or remotely by telephone. The voice messages are stored in non-volatile memory so there is no loss of information if a power failure occurs.

OUTPUT

The output is a SPDT Form C contact capable of switching up to 5 Amps. The output can be automatically controlled when an alarm occurs, or you can call *Express* with a Touch-Tone™ phone and change the output manually.

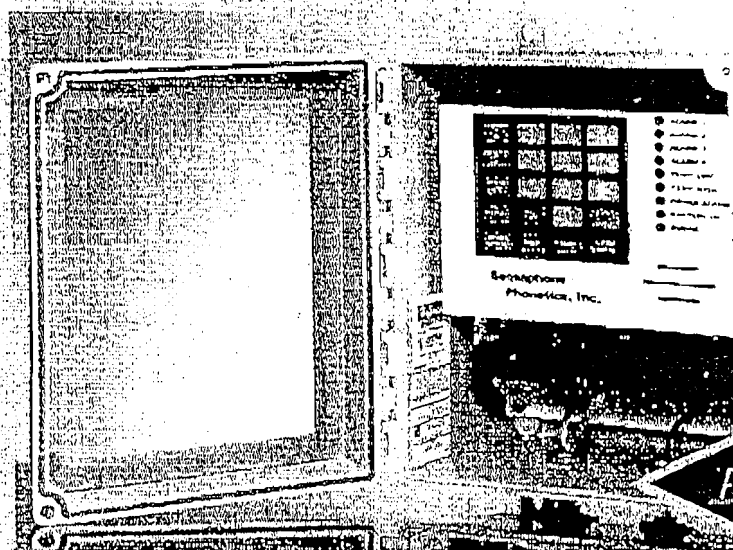
MONITORING CAPACITY

Express monitors up to four dry contacts. These can be configured as either normally open or normally closed. The alarm disabling feature allows you to enable or disable the dial-out for an input during an alarm. *Express* also monitors power failure with its built-in power out detection. *Sensaphone® Express* has a built-in temperature sensor with a 20 ft. cable to monitor in either degrees Fahrenheit or degrees Celsius. Front panel LED's indicate to on-site personnel the status of each input (ALARM/OK) for additional on-site warning. Other LED's indicate the power alarm status, battery condition, and phone status. *Express's* built-in microphone allows you to call and listen to noises at the remote site.

RELIABILITY

Express is equipped with a 12-hour Gel Cell rechargeable backup battery to ensure continued monitoring through power failures. Microcontroller operation is insured by two watchdog circuits. Dry contact inputs are optically isolated. Non-volatile memory for voice and programming storage also prevents loss.

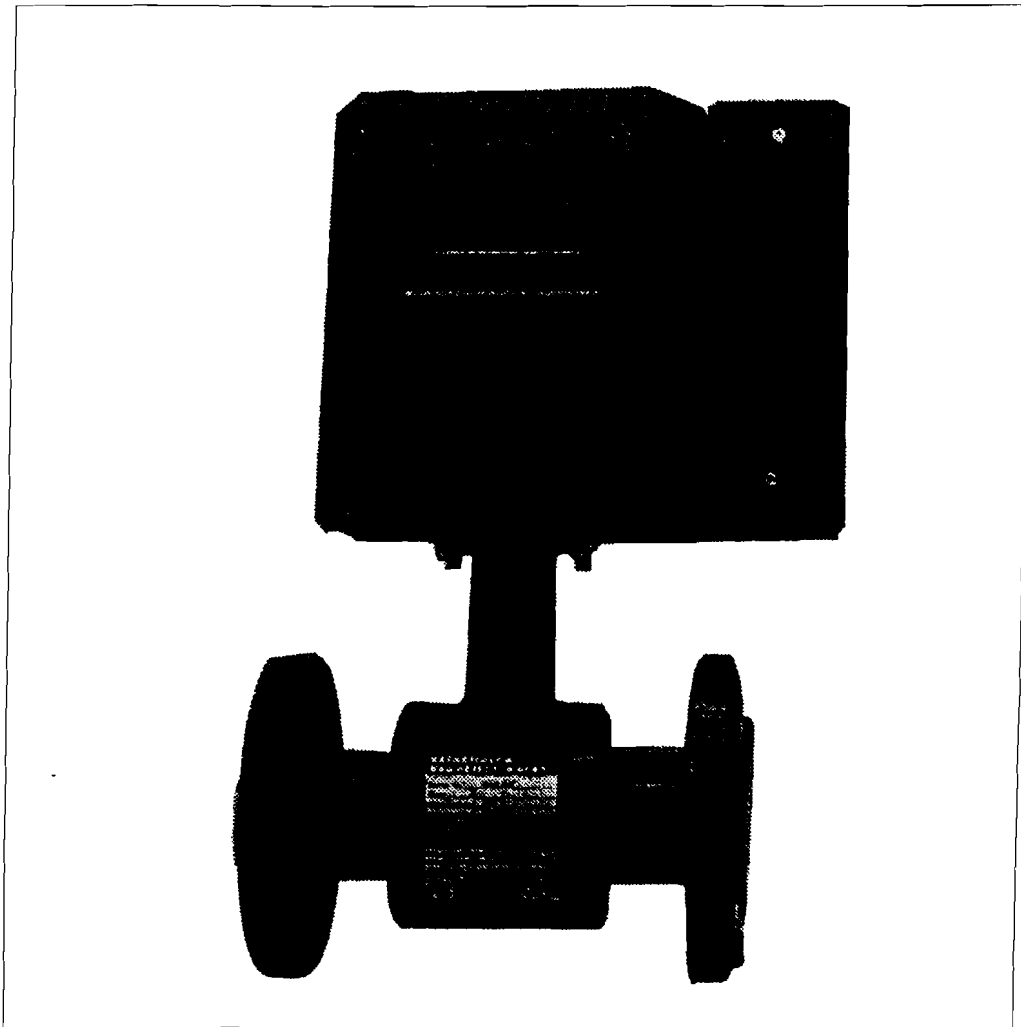
Express is housed in a high-impact, dust-tight NEMA 4 fiberglass enclosure. Its latched, clear cover allows you to lock the unit for security while still providing easy visual access to the front panel.



Effective

Magnetoflow®
Electromagnetic Flow meters
Sizes 1/4" through 54"

Installation & Operation Manual



***IMPORTANT !!!! Read this manual before
attempting any installation, wiring or operation.***



BadgerMeter, Inc.

Bulletin No. IOM-074-02
Part No. 53400-074

May 2000

SCOPE OF THIS MANUAL

This manual contains information concerning the installation, operation and maintenance of Badger's Magnetoflow Electromagnetic flow meters. To ensure proper performance of the meters covered, the instructions given in this manual should be thoroughly understood. Retain the manual in a readily accessible location for future reference.

DESCRIPTION

Badger's electromagnetic meters are intended for use in fluid metering applications involving water, chemical solutions and food ingredients. The meters are available in a variety of sizes and configurations that cover a wide range of flow rates and special applications.

The basic components of an electromagnetic flow meter (see Figure 1-1) consists of a stainless steel tube internally lined with an isolating material. Two (2) electrodes are mounted flush with the liner walls. The entire meter is sealed and therefore cannot be serviced other than the occasional cleaning of the electrodes. This manual focuses on the installation of the meter, the wiring, and programming procedures.

OPERATION

The operation of the magmeter is fairly simple. As fluid flows through the meter, the electrodes pick up a voltage directly proportional to the velocity of the fluid. This is made possible by creating a magnetic field inside of the tube with two electromagnets that are placed on the outside of the tube. This voltage is then amplified, filtered from other internal and external electrical noise and converted into an analog and a digital signal that can be translated into engineering units of measure such as gallons, liters etc.

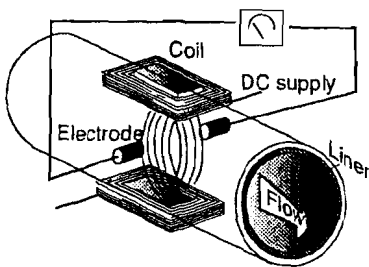


Figure 1-1.

UNPACKING AND INSPECTION

To avoid damage in transit, Badger meters are shipped to the customer in a special shipping container. Upon receipt of the meter, perform the following unpacking and inspection procedures. If damage to the shipping container is evident, be present when the meter is unpacked.

Carefully open the shipping container following any instructions that may be marked on the container. Remove all cushioning material surrounding the meter and carefully lift meter from container. Retain the container and all packing material for possible use in reshipment or storage.

B. Visually inspect the meter for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery. Then file a claim with the carrier. A claim for equipment damaged in transit is the responsibility of the customer.

STORAGE

If the meter is not to be installed right away, store it in its original container in a dry, sheltered location. Storage temperature: -4 to 158°F (-20 to +70°C)

2. INSTALLATION

INSTALLATION

The procedures covering the installation of a standard electromagnetic meter are essentially the same regardless of the meter model being installed or the configuration involved. Before attempting the installation, read the instructions given in the following paragraphs to become familiar with the requirements and procedures involved. Any special instructions required for the installation and/or electrical connection of accessory equipment such as indicators, pulse transmitters, remote batch controllers, etc., will be provided as a supplement to the manual.

A. PRELIMINARY CONSIDERATIONS. Factors to consider before proceeding with installation:

1. Avoid locating the meter in close quarters. The area in which the meter is to be installed should provide adequate space to permit cleaning and maintenance.
2. Verify that the operating temperature range of the meter is compatible with the temperature range of the fluid or fluids to be metered.

CAUTION: The meter must be operated within its rated temperature range (see technical brief) to obtain optimum accuracy and prevent damage to the meter.

3. Ensure that the flow range of the meter agrees with the flow rate or rates to be used in metering the fluid. Refer to the appropriate Technical Brief for the applicable meter flow range specification.

4. In metering applications involving abrasive materials, slurries, or liquids that may leave a residue or buildup of deposits on the electrodes, provisions should be made to inspect and clean the liner and electrodes periodically.



Badger Meter, Inc.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

INSTALLING THE METER

Location:

The following guidelines should be observed when selecting a mounting location for the meter:

- Avoid locations where the fluid is pulsating.
- Avoid locations near equipment producing electrical interference such as motors, transformers, radio transmitters or other equipment that causes electromagnetic or electrostatic interference.
- Avoid locations where there is extreme vibration in the pipe.
- Avoid places where there is direct sunlight, use a sun shade otherwise.
- Avoid places where there is not enough room or access to provide maintenance or comfortably observe the LCD display.
- Install the meter so that the detector is always filled with fluid. This may require special piping arrangements.
- Avoid places where the meter will be exposed to extreme humidity or corrosive environments.
- For corrosion safety, install any chemical injection downstream from the meter.

The three styles of electromagnetic meters: flanged, wafer and sanitary, are designed for in-line installation. However each style and size will require a different set of dimensions and clearances. After unpacking the meter, carefully measure all the dimensions to make sure to select an appropriate installation site. The most important dimension is the lay length of the meter.

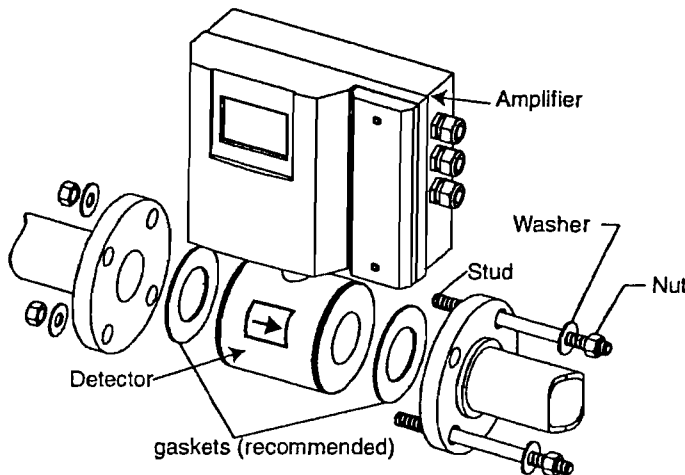


Figure 2-1.

NOTE: Even though the meter can be installed in any orientation, if the fluid contains solids that can deposit at the bottom or on the electrodes, it is strongly recommended to install the meter in a vertical position with the fluid moving upwards. When installing the meter horizontally make sure that the electrodes are oriented level horizontally.

After reviewing the applicable dimension requirements, perform the following procedures:

1. Install appropriate mating connectors in pipeline. Provide proper gap length for meter. On meters with flanged ends, allow for gaskets at both inlet and outlet of meter. The wafer style meter does not require gaskets between flanges since the liner will provide, in most cases, enough of a seal for proper operation. If however, this is not the case, install gaskets that are chemically compatible with the fluid to be measured. On wafer style meters, the detector is "sandwiched" between two flanges. Special flange through studs are provided for the installation. (See figure 2.1)

Note: For best operation and accuracy make sure to supply at least (3) diameters of straight pipe ahead of the meter and (2) diameters after, measured from the middle of the meter body.

Note: Both the flanged and the wafer meter when lined with PTFE, are shipped from the factory with wooden ends in order to prevent the liner from losing it's shape. Do not remove these ends until you are ready to position the meter between the mating flanges.

2. For larger meter and line sizes, consideration may be given to placing a support under the meter to relieve any strain on the facility piping caused by meter weight.

3. For flanged or sanitary style meters follow the standard mounting procedures of each type of meter. For wafer style meters, first insert the two lower mounting bolts through the holes in one of the end flanges. If necessary, install the flange gaskets and guide the lower bolts through the holes. Install the meter in between the flanges making sure that the flow arrow on the meter tag is in proper relation to the direction of flow of the liquid. Finish installing the rest of the bolts.

4. Thread nuts on both ends of the 4 or more mounting studs but only finger-tight, making sure that the meter is centered with the longitudinal axis of the pipe. Tighten the nuts with a wrench diagonally across in even increments. Do not overtighten or the meter liner could be damaged.

Very important !!!

5. Once the meter is securely installed make the grounding connections using the two 1/4" Faston terminals from the Primo housing or junction box (in remote Primo mounting) to one stud of each end flange. Use at least a 12 gauge (4mm² cross section) copper wire to ground the meter. **Failure to properly ground the detector will result in erratic readings and inaccurate measurements.**

Note: If your piping is non-metallic, the meter must have a grounding electrode. To confirm this, observe the inside of the meter to see if there is a third electrode installed. If not, contact the factory. Do not install the meter without the grounding electrode or grounding rings.

Check the following to ensure the meter is properly installed and operational.

A. Check all piping connections to the meter for proper mating and firm connection.

B. Apply fluid pressure to the meter and check connections for possible leaks. Retighten connections as required.

3. Wiring

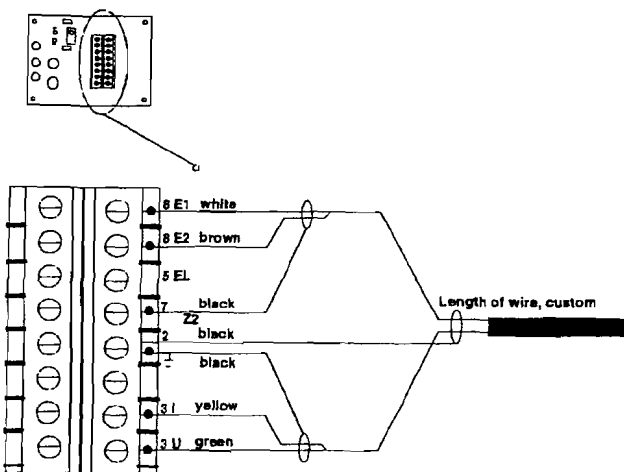
Wiring between the sensor and the Primo amplifier comes completed from the factory. However, if because of temperature or location constraints, the unit you have received has a remote configuration, that is, the Primo unit is not meter mounted, but is connected via a cable to a junction box atop the meter, and you must use conduit in your installation, then observe the following procedure.

WIRING TO A REMOTE PRIMO AMPLIFIER

1. Using a flat screwdriver, remove the four screws on the junction box lid. Carefully remove the wires that lead to the Primo amplifier from the terminal strip, making sure to remember or make note of each wire terminal.

2. Remove the wire nut at the bottom of the Primo housing and replace it with the appropriate conduit connector.

3. Install the wire through the conduit, and the new conduit connector at the junction box. Complete the conduit assembly and then rewire the cable into the terminal strip exactly as it was before step one.

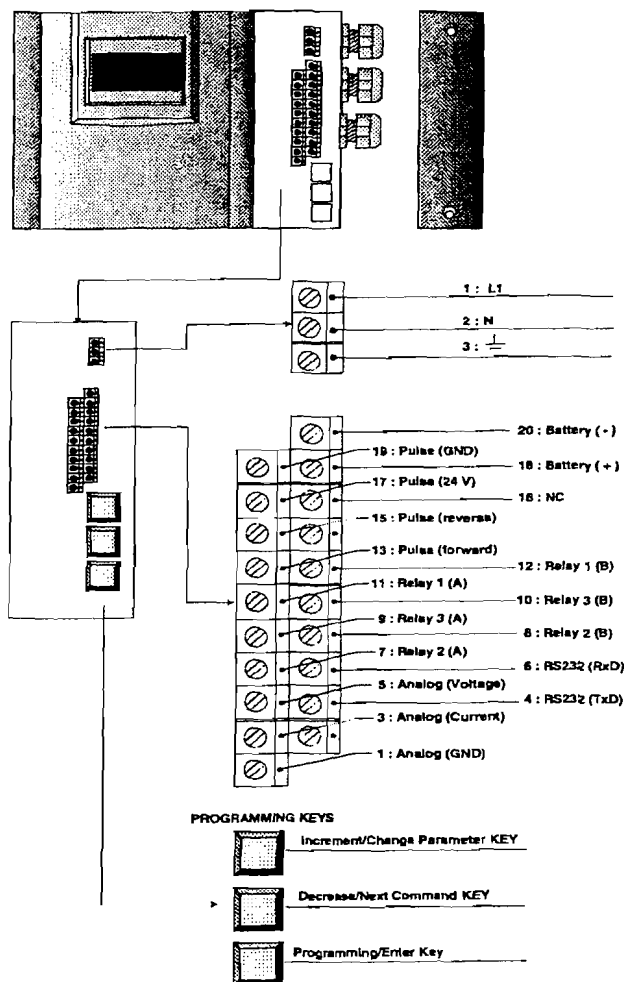


WIRING INPUTS AND OUTPUTS TO THE PRIMO AMPLIFIER

Once the wiring between the sensor and the amplifier is done proceed to wire the inputs and outputs to the Primo amplifier.

Note: For safety reasons leave AC power connections to the unit as the last step. Follow all the safety precautions and local code to prevent electrical shock and/or damaging of the electronic components.

1. Using a small flat screwdriver or a suitable 3 mm Allen wrench remove the two bolts off the red amplifier cover. Remove the cover and place it on a flat surface. Inside the amplifier you will see a terminal strip similar to the one depicted in the picture below.



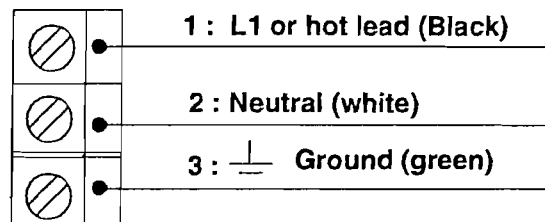
At installation, be sure to comply with the following requirements:

- Disconnect power to the unit before attempting any connection or service to the unit.
- Do not bundle or route signal lines with power lines.
- Keep all lines as short as possible.
- Use twisted pair shielded wire for all output wiring.
- Observe all applicable local electrical codes.

If you are going to use cable conduit, replace the cable-only port connectors with the appropriate conduit connectors. For the AC power connections use three wire sheathed cable. For signal output use 16 gauge shielded cable (cross-sectional area of 1.25mm² and overall diameter of 11 to 13mm).

How to connect the amplifier to the main AC power supply (Refer to label at the connection terminals)

120 or 240 AC volts connection



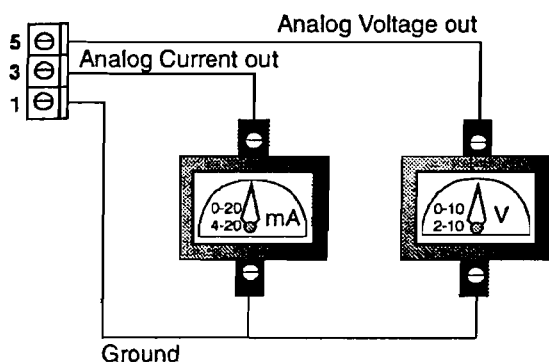
CAUTION: To prevent accidents, power connection should be made only after all other connections have been completed.

The PRIMO amplifier is a microprocessor based device. It is important that the power supply be as "clean" as possible. Avoid using power lines that feed heavy loads such as pumps, motors, etc. If dedicated lines are not available, a filtering or isolation system might be required.

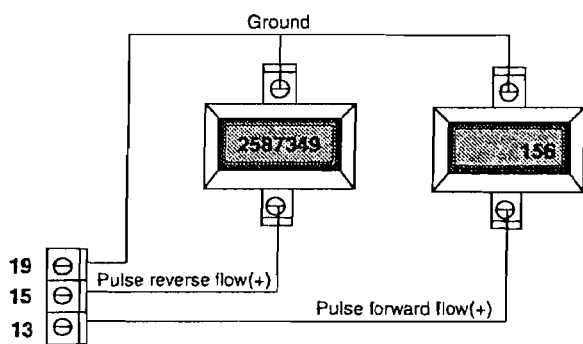
It is recommended that the internal fuse protection be maintained. Use a 2/10th amp slow blow fuse on 120 VAC and a 1/10th amp slow blow fuse on 240 VAC supply.

Typical US electrical code identifies the black wire as the hot or high lead, the white wire as the low or neutral lead, and the green wire as the chassis or ground lead.

How to connect the amplifier to remote analog indicators



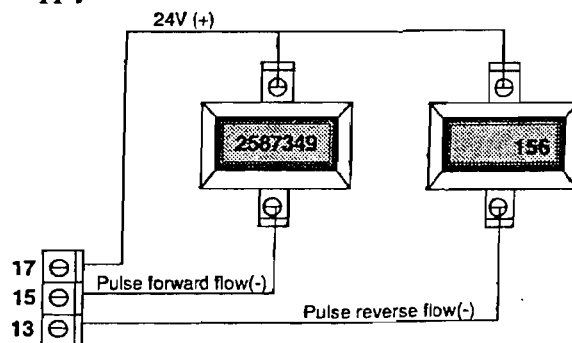
How to connect the amplifier to remote digital indicators/totalizers that do not require external power supply



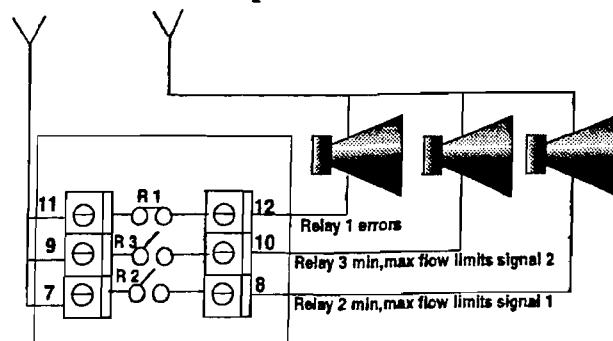
This connection is intended for use with indicators that do not require an external power supply such as the ER series indicators from Badger Meter. For the ER-6, ER-8 or ER-9, connect terminal 13 of the Amplifier to terminal 2 of the ER series for forward totalization, terminal 15 to terminal 2 of the ER series for reverse totalization and terminal 19 to ground or terminal 1 of the ER indicator.

For connection to the PC 100 Controller, connect terminal 13 of the amplifier to terminal 14 of the PC 100 and terminal 19 of the amplifier to terminal 12 of the PC 100.

How to connect the amplifier to remote digital indicators/totalizers that require external power supply



How to connect the amplifier to remote flow alarms



Relay 1 is used to signal any error conditions in the amplifier. Connect this output to an alarm to alert the operator of any malfunctioning of the meter. Note that for safety reasons this relay is normally closed and it will open on signal. You will need to adjust your alarm wiring accordingly.

Relay 2 can be used to turn on and audio/visual alarm when the flow rate exceeds or falls under a programmed percent of flow (refer to flow signal 1 in the programming procedures). This is a normally open relay.

Relay 3 can be used to turn on and audio/visual alarm when the flow rate exceeds or falls under a programmed percent of flow (refer to flow signal 2 in the programming procedures). This is a normally open relay.

Carefully consider all the connections to be made leaving the power supply connection for last. After all the connections are done, apply power to the amplifier and test operation in a manner that is suitable for each particular application. Please exercise extreme caution !! Please contact our technical support department or your local Badger Representative should you need additional support.

Programming

The Primo amplifier comes preprogrammed from the factory and in most instances will not require any additional manipulation. However, if you will be using the flow signal outputs or need to recalibrate the meter to suit your particular needs, it will be necessary to familiarize yourself with the programming procedures.

Programming of the Primo amplifier is very simple. This section gives step by step instruction on how to program each of the functions of the amplifier and an explanation of the choices that are available for each one.

First, using a small flat screwdriver or Allen wrench remove the red cover from the main amplifier housing. At the lower right corner of the unit you will see three square buttons. These buttons are used to perform all programming procedures.

Note:

The programming buttons have been placed inside the amplifier housing to prevent tampering or accidental reprogramming of the unit. After programming, be sure to replace the red cover on the amplifier housing.

The four line 16 digit LCD display of the Primo amplifier is used to guide you through each of the programming steps. The main screen of the unit, when in operation, will display the flow rate, the forward and reverse flow totalizers and the software date and issue number or one of several error messages:

```
rate> 350.00GPM
tot1 234567.73 G
tot2- 1234.00 G
v2.23us 28.04.98
```

To enter the programming mode press the Enter or E key (bottom key) and you will see the main SUBMENU screen:

```
>factors/totals
outputs
measurement
back      E=End
```

As you will see, there are three main submenus: Factors/totals, outputs and measurement. Each submenu gives access to the following appropriate functions:

factors/totals:

- 1) Amplifier factor
- 2) Detector factor (Scale or calibration factor)
- 3) Reset of both totalizers to zero

Outputs:

- 1) Analog outputs (voltage or current)
- 2) Scaled pulse output

- 3) Pulse width
- 4) High-low flow relay signal 1 output
- 5) High-low flow relay signal 2 output

Measurement:

- 1) Unit of measure
- 2) Maximum Flow rate
- 3) Low Flow Cutoff
- 4) Empty pipe detection
- 5) Flow direction (Forward or reverse)
- 6) Pipe diameter
- 7) Dampening filter

PROGRAMMING OF MEASUREMENT PARAMETERS

Once the programming screen has appeared, notice the right arrow on the far left side. In the previous screen the arrow is pointing to the Factors/totals submenu. Using the up ^ arrow key you can position the arrow in front of the submenu or command that you wish to interrogate. We recommend that you start with the measurement submenu followed by the outputs submenu and finally the factors/totals submenu.

```
factors/totals
outputs
>measurement
back      E=End
```

Use the ^ key to position the > arrow next to "measurement" and press the > key. The following screen will appear:

```
unit
> change
next parameter
back      E=End
```

This is where you will select the unit of measurement for the flow rate indication and the totalizers. Use the ^ key to place the > arrow next to "change" and press >. The first unit of measurement screen will appear:

```
unit
Gallon/min
> next
E Enter
```

With the arrow> on the "next" line keep pressing the > key until you reach the screen with the appropriate unit of measure, then press ENTER.

On US measure Primo units, the choices are:
Gallons/min, Ounces/min, Lbs/min and Millgallon/day.

On the metric version, Primo units of measure are:
Liters/minute, m3/hour, Liters/second Liters/hour

Once you have selected the correct unit of measure and press the E key the following screen will appear:

```

max. flowrate
  75 GPM
^ up > down
E Enter
  
```

If you changed the unit of measure the Maximum flow must also be changed to reflect the maximum flow rate with the new unit of measure. This is a very important parameter if you are using the flow limit signals 1 and 2. Input the new maximum flow based on your meter size and your applications requirements, making sure that it falls within the suggested flow range of the meter.

Once this is done, press E and the following screen will appear:

```

pulse output
 100 Pulse/G
^ up > down
E Enter
  
```

This is the pulse output parameter that is set in the outputs menu. This parameter must be programmed only if you are going to use the pulse output to drive a remote counter or controller. If that is the case and since you could have changed the maximum flow rate, this may cause the pulse output to go over 10Khz (the limit of the Primo unit) and needs to be reprogrammed. Refer to the section on OUTPUTS (page 9) to program the pulse output function.

Once you have programmed the pulse output and press the E key you will go back to the main parameter menu screen.

STEP A Press Enter until you reach the main parameter menu. Place the arrow next to the line "measurement" and press the > key. The following screen will appear:

```

unit
Gallon/min
> next
E Enter
  
```

Place the arrow text to the line "next" and press the > key until the next desired parameter is shown. (End of step A)

Press the > key until the following screen shows:

```

low flow cutoff
> change
next parameter
back E=End
  
```

This is the low flow cutoff function. It is used to assign a low flow rate at which measurement will stop, preventing measurement and thus totalization errors. This parameter can be programmed from 0 % up to 10% of maximum flow rate. Place the > arrow next to change and press >. The following screen will appear:

```

low flow cutoff
  0.0 %
^ up > down
E Enter
  
```

In general, programming this value at 0.2% or higher will prevent false readings during stop conditions due to fluid movement in the pipe caused by vibrations or piping arrangements.

Using the ^ and > keys select a value and then press ENTER.

Repeat step A until you see the following screen:

```

empty pipe det.
> change
next parameter
back E=End
  
```

The empty pipe parameter when programmed to be ON will deactivate Relay 1 and also show an empty pipe error message on the display. Position the arrow next to "change" and press the > key. The following screen will appear:

```

empty pipe det.
  on
^ on > off
E Enter
  
```

Use the ^ and > keys to turn the feature ON or OFF and press ENTER. Repeat step A until you see the following screen:

```

flow direction
> change
next parameter
back E=End
  
```

Place the arrow next to "change" and press the > key. The following screen will show:

```

flow direction
both directions
^ one > both
E Enter
  
```

The flow direction feature allows you to select if you are going to monitor and totalize in forward only or in forward and reverse direction. If you select "one" the meter will monitor and show both totalizers in the forward flow only. If you choose "both" one totalizer will show forward flow and the other will show reverse flow using a minus sign (-).

Your selection will also have an effect on the analog and pulse outputs. That is, you will be able to wire your outputs to indicators that will show both forward and reverse flow or only forward flow.

Using the ^ and > key select which flow direction you want and press ENTER.

Repeat step A until you see the following screen:

```

pipe diameter
> change
next parameter
back      E=End
  
```

Place the arrow next to "change" and press the > key. The following screen will show:

```

pipe diameter
      25 mm
^ up < down
E Enter
  
```

On this screen you can select the pipe diameter of your flow meter. By using the ^ and > keys you can change the number to match your meter size.

The selection is made in millimeters. Enter the equivalent size of your meter in millimeters (1 inch is 25mm, 2 inches is 50mm and so on). Please refer to the technical brief table for exact size specifications

Most of the time this parameter will come preprogrammed from the factory, but on occasion if you replace the software chip or the entire amplifier in the field you may need to reprogram this parameter.

Once you have selected the meter or pipe size, press E and follow step A until you see the following screen:

```

filter
> change
next parameter
back      E=End
  
```

This is the last parameter of the measurement submenu. This feature is used to increase the signal to noise ratio and stabilize the flow rate indication by increasing measurement integration time.

In general, the meter is programmed at 1 but if you notice too much back and forth oscillation of the flow rate indication, increase this value incrementally until the display is more stable. Your choices are 1,2,4,8,16,32,64,128 and 256. Only under extreme conditions will you need to use this feature. To change the filter value, place the arrow next to "change" and press the > key. The following screen will show:

```

filter
      2
^ up < down
E Enter
  
```

Using the ^ and > keys select the desired filter value and then press ENTER to return to the main submenu screen.

PROGRAMMING OF OUTPUTS

The next submenu deals with the amplifier's analog digital and signal outputs.

STEP B. From the main submenu screen, position the arrow next to the "outputs" submenu and press the right arrow key.

```

factors/totals
>outputs
measurement
back      E=End
  
```

The following screen will appear:

```

analog outputs
      change
>next parameter
back      E=End
  
```

This is the first of several output screens but they all have the same elements in them. If you want to change the specific output, position the arrow next to the "change" line and press the right arrow key. If you want to bypass the parameter, position the arrow in the "next parameter" line and press the right arrow until you see the desired parameter.

End of STEP B.

ANALOG OUTPUTS

Press the >key at the "change" line the following screen will appear:

```

analog outputs
+/-4..+/-20 mA
> next
E Enter
  
```

Press >"next" until you find the type of analog output that you desire among the following screens:

analog outputs
0...+/-10 mA
> next
E Enter

analog outputs
+/-2...+/-10 mA
> next
E Enter

analog outputs
0...+/-20 mA
> next
E Enter

Once you have found the right output, press the ENTER key to select that particular output. (See Primo Technical brief for voltage equivalent to mA outputs).

The next parameter to be selected is Pulse Output. Repeat Step B until the following screen appears:

pulse output
> change
next parameter
back E=End

The pulse output will determine how many pulses per gallon, litre, etc. will be sent out to remote counters and controllers and also how many decimal digits will be displayed on the totalizers. If, for example, you choose 100 pulses per gallon, then the display totalizers will have two digits after the decimal point. Move the > arrow next to "change", then press the > key and the following screen will appear:

pulse output
100 Pulse/G
^ up > down
E Enter

Use the ^ and > buttons to change the number to the desired pulse rate. The maximum pulse output for this unit is 10,000 pulses per second, thus, depending on the maximum flow selected you may be limited to a certain number of pulses per unit.

Press ENTER when you have programmed the right number.

The next parameter is pulse width, or the time duration that each pulse will be "ON". This can be programmed from zero, which means 50% on 50% off, to 1000 milliseconds in

increments of one millisecond. Program this parameter to match the required pulse width of the remote accessory that will use the pulse output. Repeat step B until you see this screen:

pulse width
change
next parameter
back E=End

Position the > arrow next to "change" and press the > key. The following screen will appear:

pulse width
0 ms
^ up >down
E Enter

Use the ^ and > buttons to set the right number. Once the correct number is selected press ENTER.

The next parameters to be programmed are the high and low flow signals. The amplifier has three relays. Relays two and three are used to signal an audio or visual alarm or other devices, when the flow rate is below a minimum flow or above a maximum flow. You can program one or both relays with similar or different values. The values are based on a percentage of the maximum flow programmed under the "measurement" submenu.

Repeat Step B until you can see the Flow signal 1 screen:

Flow signal 1
> change
next parameter
back E=End

Move the > arrow next to "change" and press the > key. The following screen will appear:

Min Flowsig 1
10 %
^ up >down
E Enter

Once you use the ^ and > keys to select the minimum flow percentage and press ENTER the following screen will appear:

Max Flowsig 1
90 %
^ up >down
E Enter

Again use the ^ and > arrows to change the maximum flow percentage and press ENTER to program the values. Repeat step B until you find the Signal 2 screen and use the same procedure as used with Signal 1 programming.

Note: On the signal output, the relays will remain energized until the flow rate returns to within the flow limits.

CALIBRATION & TOTALIZERS RESET

The third and last submenu "Factors/Totals" is used to calibrate the meter and to reset the totalizers back to zero.

STEP C: Press ENTER until you reach the main submenu screen. Position the arrow next to the "factors/totalizers" submenu and press the > key. The following menu will appear:

```

>amplifier fact.
detector factor
Reset Totals
back      E=End
  
```

Press the ^ key to position the arrow > next to the parameter you need to view or change, then press the > key to enter that particular menu.
END OF STEP C

The first choice is the amplifier factor. This is a factor reprogrammed into the amplifier at the time the meter is calibrated in the factory and should not be changed. Using the ^ button move the arrow to the "detector factor" line and press the right > button. The following screen will appear:

```

detector factor
      286.30
>change
back      E=End
  
```

The detector factor in this example is set at 286.3. It is with this factor that you can fine tune your calibration to meet your applications needs. For example, if you find that the meter is off by a certain percentage you can modify the detector factor to achieve the desired accuracy.

CALIBRATION CHECK AND ADJUSTMENTS

All meters are accuracy tested with water at the factory using calibrated test equipment. However, because of your specific installation and fluid parameters, it is sometimes necessary to recalibrate a meter under actual operating conditions with the liquid being metered.

The following instructions are provided to assist in performing an on-site calibration check and adjustment. This procedure may require either a test tank or vessel of known capacity or a second flow meter installed in the same line.

ACCURACY TEST

1. Place a test tank of calibrated volume at the output of the meter.

2. Operate meter until test tank is filled to the appropriate calibrated level. Since meter accuracy varies somewhat with flow rate, make test run at the same flow rate used in actual operation.

3. Record quantity indicated on amplifier display totalizer.

4. Repeat run three times and average recorded indications.

5. Perform the following calculation to determine the percent of accuracy of the meter.

$$\frac{\text{Qty. Delivered in vessel}}{\text{Qty. Indicated on Primo}} \times \frac{\text{Old Detector}}{\text{Factor}} = \frac{\text{New Detector}}{\text{Factor}}$$

Example 1.

$$\frac{100 \text{ Gallons}}{95 \text{ Gallons}} \times 286.3 = 301.3$$

In this example, the meter accuracy is low and must be increased by a calibration correction.

Example 2.

$$\frac{100 \text{ Gallons}}{104 \text{ Gallons}} \times 286.3 = 275.2$$

In this example, the meter accuracy is high by 4% and must be reduced by a calibration correction. To do this, multiply the detector factor programmed in the unit by 0.96 and enter the new number, 275.2, as follows:

With the arrow pointing to the word "change" press the right arrow key and the following screen will appear:

```

detector factor
      275.2
^ up > down
E Enter
  
```

Using the ^ and > buttons change the detector factor to the new number and then press ENTER.

The third and last parameter in this submenu is the Reset Totals. Press ENTER to see the following screen:

```

amplifier fact.
detector factor
>Reset Totals
back      E=End
  
```

Move the arrow to the "reset totals" line and press the right arrow key > The following screen will appear:

```

Reset forward
and reverse
> totalizers
back      E=End
  
```

By pressing the right arrow key you will reset both, forward and reverse totalizers back to zero. Finally press ENTER twice to return to the main display screen.

5. TROUBLESHOOTING

The Magnetoflow mag meter should give you many years of maintenance free operation. However, should it malfunction, there are certain things that we recommend you check before contacting our technical support department or your local Badger Representative.

On the detector side, there are no moving components, thus the only problems that can be encountered are with the liner or with the electrodes.

Note: If the fluid measured has a high concentration of conductive solids, they may accumulate as deposits on the internal liner walls and electrodes. These deposits will cause a reduction of the measuring output. Thus, it may be necessary to periodically take the meter off-line and inspect the liner and electrodes. If deposits are found, remove them with a soft brush. Do this periodically to insure the best accuracy possible.

If the flow rate or totalizers are not displayed, check for the following:

- Make sure the right power supply is being used and the wiring of power and Input/Output connections are correct.
- Is the recommended fuse protection active? If not, replace the fuse.
- Make sure that the maximum flow rate is set correctly.
- Make sure that the flow direction coincides with the arrow on the flow tag of the detector.

If the flow rate is shown but you know it is wrong, check for the following:

- Re-select the maximum flow rate.
- Make sure the electrodes and liner are free of deposits.
- Make sure the right pipe size was selected.

If the flow rate indication is not stable, check for the following:

- Make sure that power supply is clean.
- Make sure that cables between detector and amplifier are securely connected.
- Make sure that the flow meter is properly grounded to a good earth ground (100 ohms or less ground resistance).
- Make sure that the pipe is always full of fluid.
- Make sure that the fluid does not have air bubbles coming from a leaking connection in your piping.
- Make sure that the amplifier is not too close to sources of electrical interference.

Problems with accuracy can also be traced to faulty pumps, valves and other piping components. Make sure all your mechanical and electronic components are in proper working order.

Primo amplifier problems.

The amplifier is a processor based unit and it runs self diagnostics routines on a periodical basis. When it finds a component problem, it alerts you with the error messages described below. However, if the processor is damaged, diagnostics will not be possible and the unit will have to be sent back to the factory for inspection and repair if necessary.

If after checking all of the above recommendations, the meter still malfunctions, please contact our **technical support department at 1-800-876-3837**. Or contact your local Badger Representative.

1 Primo Amplifier Error - messages

Explanation of the error messages

Error message	Cause	Remedy
Detector error	- Detector is not connected or broken. - Detector resistor is too high. - Supply voltage is too low.	- Contact the Factory.
Detector-off err.	- A fixed gain is setting but the offset voltage is too high.	- Contact the Factory.
Slave-ack err.	- Connection error between master and slave processor	- Check the connection between the processor and the E-PROM.
Unknown error	- Error in the master processor. - Check all programmed parameters.	
error 1	- Error in the slave processor	- Contact the Factory.
error 2	- Pulse overflow - There are lost pulses at the output.	- Lower the pulse width or set the pulse width to zero.
error 4	- Transmit to slave error.	- Contact the Factory.
error 8	- Temperature over-ranges.	- Contact the Factory.



BadgerMeter, Inc.

P.O. Box 245036 Milwaukee, WI 53224-9536

Telephone: (414) 355-0400

Fax: (414) 355-7499

Due to continuous research, product improvements
and enhancements, Badger Meter reserves the right to
change product or system specifications without notice.

Copyright© Badger Meter, Inc. 2000

All rights reserved.

**Magnetoflow Primo**

01. Aug. 01

Serial number: 0107-056/17396296**Part number:** 9011019**Part code:** MID 2-100/150-A/St-HG-M/HC-St P0-1**Detector type:** Type 2**Nominal size:** 100 **Pressure rating:** 150 ASA**Connection:** Flanges acc. ANSI**Material:** C-Steel**Liner:** Hard Rubber**Max. temperature:** 80 °C**Electrode:** Measuring electrode**Electrode material:** Hastelloy C**Detector housing:** C-Steel painted**Protection class:** IP 65**Transformer:** Primo**Mounting:** Detector mounted**Cable length:** 0 m**Transformer housing:** Cast aluminium**Protection class:** IP 65**Power supply:** 115 VAC / 24 VDC**Flow range:** 3,7 bis 1230 GPM**Detector constant:** 97,54**Amplifier constant:** 2,50**Flow direction:** Uni-directional**Min/Max Alarm 1:** Min = 0 % Max = 100 %**Min/Max Alarm 2:** Min = 0 % Max = 100 %**Low flow cut off:** 0,2 %**Empty pipe detection active:** ☐**Pre selection counter:** ☐**Analog output:** +/- 4...20 mA**Full scale (20 mA):** 300 GPM**Pulse rate:** 1 pulse per Gallon**Pulse width:** 1:1 ms**Pulse output:** Transistor 24 VDC**Interface:** No**Software version:** V2.28 US**Coil adjustment:** 3x10 Ohm

BadgerMeter**Magnetoflow Primo**

01. Aug. 01

Serial number: 0107-056 / 17396296

Part number: 9011019

Part code: MID 2-100/150-A/St-HG-M/HC-St P0-1

Detector type: Type 2

Size DN: 100 Pressure rating: 150 ASA

Amplifier: Primo

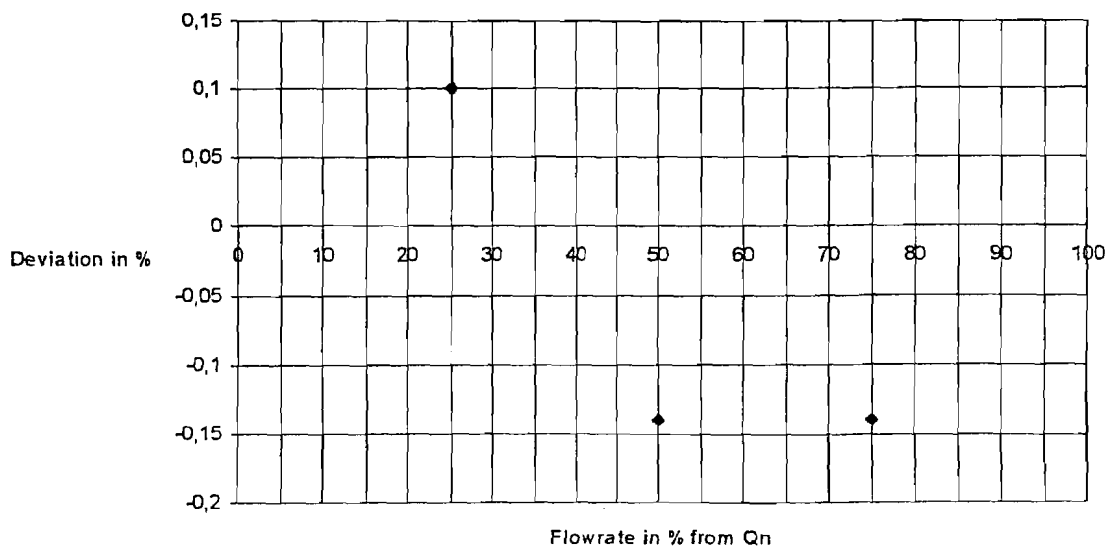
Mounting: Detector mounted Cable length: 0 m

Detector constant: 97,54

Amplifier constant: 2,50

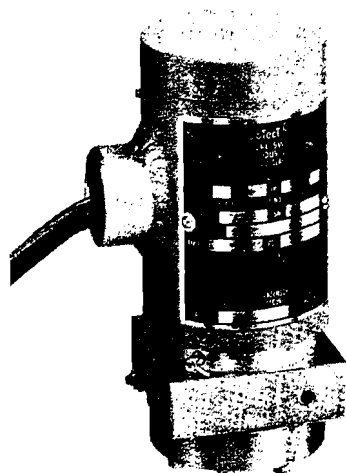
Full scale Qn: 300 GPM

	Flow rate in % f. Qn	Deviation in %
Measure point 1	25	0,1
Measure point 2	50	-0,14
Measure point 3	75	-0,14

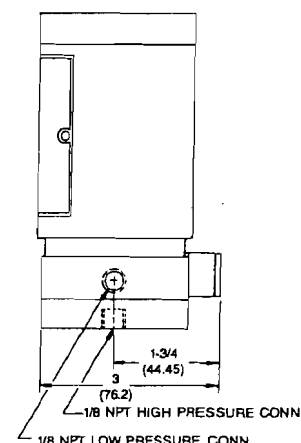
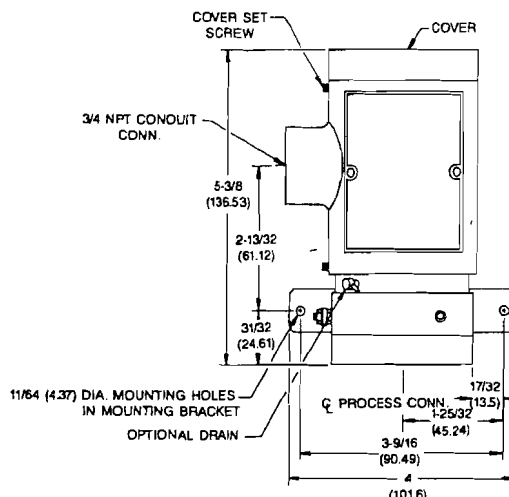
Calibration chart

SERIES H3 DIFFERENTIAL PRESSURE SWITCHES EXPLOSION-PROOF, WEATHERPROOF

Installation and Operating Instructions



Patent No. 4,827,095



Series H3 Differential Pressure Switches actuate one or two single pole, double throw (SPDT) snap switches in response to increasing or decreasing pressure of compatible gases or liquids. Four field adjustable operating ranges are available allowing set-points up to 200 PSID. All models are suitable for hazardous locations and also include weatherproof housings as detailed in the chart below. Read and understand instructions completely before proceeding with installation or operation.

MODEL NUMBER DEFINITIONS

H3 ① — ② ③ ④ — ⑤

① Wetted Materials

A — Aluminum/Nitrile
S — 316 SS/Viton

② Operating Range

1 — 10 - 180 In. W.C. (.025 - .46 Kg/cm²)
2 — .5 - 15 PSID (.035 - 1.05 Kg/cm²)
3 — 5 - 70 PSID (.35 - 4.92 Kg/cm²)
4 — 10 - 200 PSID (.70 - 14.06 Kg/cm²)

③ Circuit

S — SPDT
D — DPDT

④ Electrical Connections

C — Terminal block(s)
L — Wire leads

⑤ Options

MV — Gold contacts
DR — Drain/Breather

PHYSICAL DATA

Maximum Temperature: 220°F
Maximum Pressure: 1500 PSI
Pressure Connections: 1/8" FNPT
Electrical Rating: SPDT or optional DPDT contacts rated 5A @ 125/250 VAC, 5A res., 3A ind. @ 30 VDC. MV (gold contact) option for dry circuits rated 1A @ 125 VAC, 1A res. or 0.5A ind. @ 30 VDC
Wiring Connections: 18 AWG x 18" leads. Internal terminal blocks optional.
Conduit Connection: 3/4" NPT
Set Point Adjustment: Screw type, field adjustable.
Housing: Aluminum
Body: Aluminum or 316 SS
Diaphragm: Nitrile or Viton
Weight: 2 1/4 lbs.

HAZARDOUS LOCATION/WEATHERPROOF RATINGS

MODEL	UL	CSA	CENELEC
H3 _ _ _ C	Cl.I, Gr.B, C & D Cl.II, Gr.E, F & G NEMA 4X	Cl.I, Gr.B, C & D Cl.II, Gr.E, F & G NEMA 4	EExd IIc T6 IP 56
H3 _ _ _ L	Cl.I, Gr.B, C & D Cl.II, Gr.E, F & G NEMA 4X	Cl.I, Gr.B, C & D Cl.II, Gr.E, F & G NEMA 4	—
H3 _ _ _ C-DR	Cl.I, Gr.B, C & D Cl.II, Gr.E, F & G NEMA 3	—	EExd IIc T6 IP 54
H3 _ _ _ L-DR	Cl.I, Gr.B, C & D Cl.II, Gr.E, F & G NEMA 3	—	—

INSTALLATION

- LOCATION:** Select a location where the temperature limit of 220°F (104°C) will not be exceeded. Locate the switch as close as possible to the pressure source for best response. Longer lengths of tubing will not affect the accuracy of the actuation point but can increase response time slightly.
- MOUNTING:** Avoid mounting surfaces with excess vibration which could cause false actuation when pressure is near set-point. Attach switch with two 3/16" screws or bolts (not included) through mounting bracket. Normal position is with housing vertical.

- PRESSURE CONNECTION:** Connect source(s) of pressure, vacuum or differential pressure to the 1/8" NPT ports as follows:
 - Differential Pressures** — Connect higher pressure to High Pressure port (bottom) and lower pressure to Low Pressure port (side).
 - Pressure Only** — connect a single positive pressure to High Pressure port on bottom and leave Low Pressure port on side vented to atmosphere.
 - Vacuum Only** — Connect a single negative (vacuum) pressure to Low Pressure port on side and leave High Pressure port on bottom vented to atmosphere.

CONTINUED ON REVERSE

4. ELECTRICAL CONNECTIONS: Either one or two SPDT snap switches are provided with normally open contacts closing and normally closed contacts opening when pressure or vacuum increases beyond the set-point.

A. Wire in accordance with local electrical codes.

B. **Wire lead models** – Thread wires through conduit and connect to leads from snap switch(es).

Black = Common, Red = Normally closed, Blue = Normally open

C. **Terminal block models** – Loosen screws on terminal block(s), insert stripped and tinned wires in side openings and tighten screws. For Genelec approved installation, cable should enter enclosure housing through an approved Ex cable gland (not supplied).

Black = Common, Red = Normally closed, Blue = Normally open

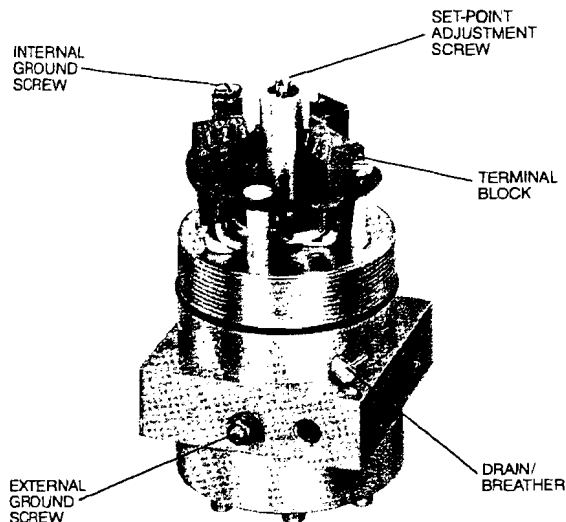
D. **Ground Screws** – Two grounding connections are furnished; one inside housing with green headed machine screw and one on exterior with threaded stud and nut. Use either one.

Replace cover after wiring connections are complete.

CAUTION: MAKE SURE CONDUIT OR CABLE ARE PROPERLY SEALED. ELECTRICAL COMPONENTS MUST BE KEPT FREE OF MOISTURE, INCLUDING CONDENSATION, AT ALL TIMES. TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERE, DISCONNECT THE DEVICE FROM THE SUPPLY CIRCUIT BEFORE OPENING. KEEP ASSEMBLY TIGHTLY CLOSED WHEN IN OPERATION.

ADJUSTMENT

1. To change the set-point, connect tubing or piping from the high pressure port on bottom to one leg of a tee. Connect the second leg to a pressure gage of known accuracy and in an appropriate range. The third leg should be connected to a controllable pressure source.
2. Connect a volt/ohm meter or other circuit tester to snap switch to indicate when switching occurs.
3. Slowly apply pressure to the system and note the pressure at which switching occurs. If adjustment is necessary, turn the adjustment screw (located internally at center next to snap switch) clockwise to raise or counterclockwise to lower the actuation point. When the required setting has been reached, exercise the switch through two or three additional cycles to verify consistent operation.



MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The set-point is the only user adjustment. On models with optional drain fitting, periodically rotate small captive screw from side to side several times to keep drain path clear. Units in need of repair should be returned to the factory prepaid.

Limited Warranty: The Seller warrants all Dwyer instruments and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's option provided the instruments have been returned, transportation prepaid, within one year from the date of purchase. All technical advice, recommendations and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory or the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.

THIS EXPRESS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER REPRESENTATIONS MADE BY ADVERTISEMENTS OR BY AGENTS AND ALL OTHER WARRANTIES, BOTH EXPRESS AND IMPLIED. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE FOR GOODS COVERED HEREUNDER.

Buyers Remedies: THE BUYER'S EXCLUSIVE AND SOLE REMEDY ON ACCOUNT OF OR IN RESPECT TO THE FURNISHING OF NONCONFORMING OR DEFECTIVE MATERIAL SHALL BE TO SECURE REPLACEMENT THEREOF AS AFORESAID. THE SELLER SHALL NOT IN ANY EVENT BE LIABLE FOR THE COST OF ANY LABOR EXPENDED ON ANY SUCH MATERIAL OR FOR ANY SPECIAL, DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES TO ANYONE BY REASON OF THE FACT THAT IT SHALL HAVE BEEN NON-CONFORMING OR DEFECTIVE.

W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC.

P.O. Box 358

Michigan City, IN 46360

Phone: 219/879-8000 Telex: 25916

Fax: 219/872-9057

© Copyright 1991 Dwyer Instruments, Inc.

LITHO IN USA 8/91

FR 81-440700-00



SERIES 1000 PRESSURE SWITCHES

INSTALLATION & OPERATING INSTRUCTIONS

This control is operated by a negative rate Bellville spring augmented diaphragm.

LOCATION AND MOUNTING

Select a location recommended by the equipment manufacturer. Use the four (4) lugs on the case to mount the control on a panel or smooth wall surface, or mount directly by the pressure connection.

The control is not position sensitive and may be mounted in any position. However, vertical is preferred when there is a possibility of sludge accumulation or condensed water freezing in the pressure chamber.

PRESSURE CONNECTION

The pressure connection is a standard female 1/4" N.P.T. taper pipe thread. Teflon tape or other good pipe joint material should be used to assure a pressure tight joint.

WIRING

A 3/4" conduit connection is provided for wiring.

Wire in accordance with local electrical codes or equipment manufacturers instructions. Use a short piece of BX between rigid conduit and control so that control will not be subject to the stress of conduit expansion and contraction.

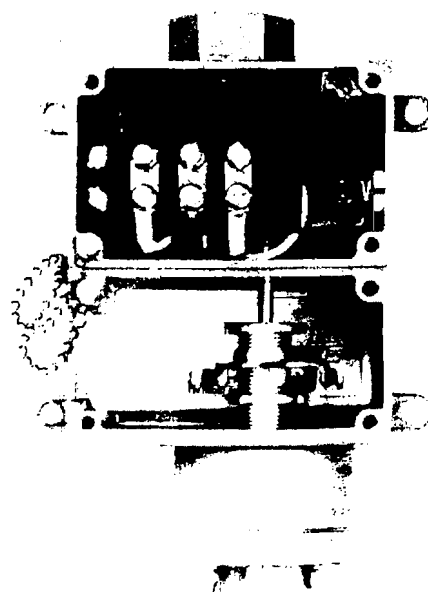
Electrical ratings are shown on the label.

DO NOT OVERLOAD.

SETTING OPERATING POINT

Remove the transparent cover over the adjusting wheel. Move the wheel by hand to the desired pressure on the vertical scale. If the adjusting wheel is difficult to move, a small screw driver inserted in the adjusting wheel arms will provide extra leverage. A stop is provided at the top and bottom of the scale to prevent setting beyond the control range. Dial markings are for the High operating point. Switch will reset at a lower pressure. Dial markings are a guide for setting. Actual setting should be checked with a good pressure gage.

Warning: A failure resulting in injury or damage may be caused by over-pressures, excessive vibration or pressure pulsation, excessive temperature, corrosion of pressure containing parts and movement assembly, electrical overload or other misuse.



SERIES 1000—
Covers removed to show
isolated terminals.

OPERATING RANGES/DIFFERENTIALS

Ranges (Specify One)		Approx. Fixed Differential*	System Max. Pressure Without Bursting
No.	PSIG		
3	5-40 psig	2 psig	600 psig
4	10-70 psig	4 psig	3000 psig
5	25-200 psig	8 psig	3000 psig
6	50-350 psig	15 psig	3000 psig
7	75-550 psig	30 psig	3000 psig
8	100-900 psig	50 psig	3000 psig
9	200-1400 psig	75 psig	3000 psig

* Differential 10% larger when using 316SS diaphragm, or Code F switch.

Note:

When used on steam, a pigtail syphon and Type 3 (teflon) diaphragm should be used.

Max. Case ambient temperature - 170°F.

ELECTRICAL RATING

Code	No. Switches, Action	AC Capacity			DC Capacity		Horse Power			
		125V	250V	480V	125V	250V	AC		DC	
							125V	250V	125V	250V
D	1-SPDT Snap	15A	15A				1/8	1/4	NA	NA
F	2-SPDT Snap ① (DPDT Action)	5A	5A	NA	①	①	NA	NA	NA	NA
J	1 - SPDT Snap	15A	15A	15A	0.5A①	0.25A①	1/8	1/4	NA	NA

① 5A @ 30V DC resistive

② Resistive

③ Operating Differentials Wider

MERCROID DIVISION

DWYER INSTRUMENTS, INC.

P.O. BOX 258

MICHIGAN CITY, IN 46360 (U.S.A.)

PHONE 219-879-8000

FAX 219-872-9057

TELETYPE 25016

©Copyright 1991 Dwyer Instruments, Inc.

Litho in U.S.A. 6/91

EPRO-111022-00



FLOTECT Vane Operated Flow Switch

FL 401

INSTALLATION AND OPERATING INSTRUCTIONS

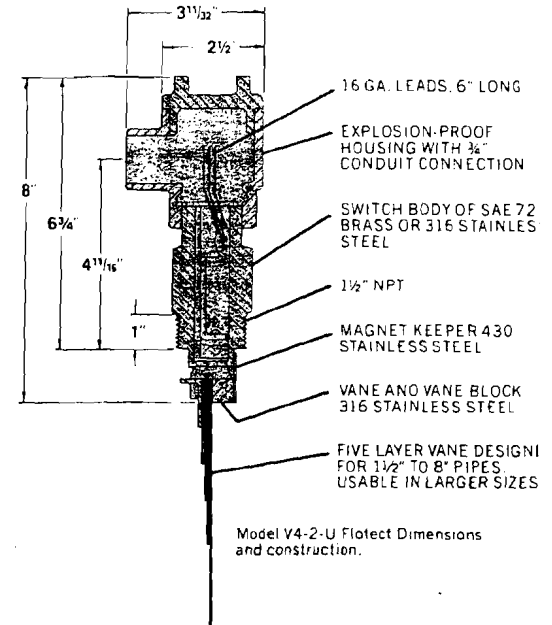
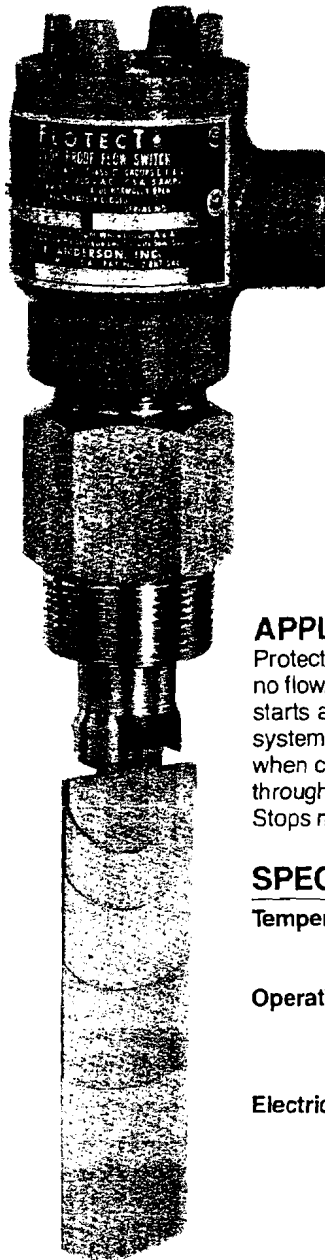
Explosion-Proof; U.L. and C.S.A. listed – Class I, Groups C, D; Class II, Groups E, F, G.
CENELEC: EExd 11B T6.

Dependable protection against flow variation or stopping in pipelines for fluids, gasses and flowing solids.

Supplied with custom or universal multi-layer vanes for field installation in pipes from 1½".

Compact and reliable, the Flotect V4 Flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. Installed in thousands of pipelines and processing plants around the world, this unique magnetically actuated switching design gives superior performance. Universal multi-layer vane accommodates pipe sizes from 1½" up. Custom vanes are available with factory calibration. There are no bellows, springs, or seals to fail. Instead, the free-swinging vane attracts a magnet within the solid metal switch body above, actuating a snap switch by means of a simple lever arm.

Features include: Simplicity of design and a leak-proof switch body, machined from bar stock for pressures to 2000 psig, (138 bar), it eliminates the possibility of process fluid entering the switch compartment. The threaded conduit enclosure cover permits easy inspection or replacement of electrical assembly without shutting down the process, or removing electrical conduit. Power must be disconnected. The unit fits directly into pipeline with tee, thredolet or flange for easy installation. Pendulum-like vane action responds accurately to fluid flow rate. The custom vane or multi-layer vane is sensitive to low velocity flows, yet it is rugged enough to withstand high flow surges. If desired, a delay timer can be wired into the installation. All units are explosion-proof and listed with U.L. and C.S.A. for Class I, Groups C and D, Class II, Groups E, F, and G or are flame-proof to CENELEC EExd IIB T6.

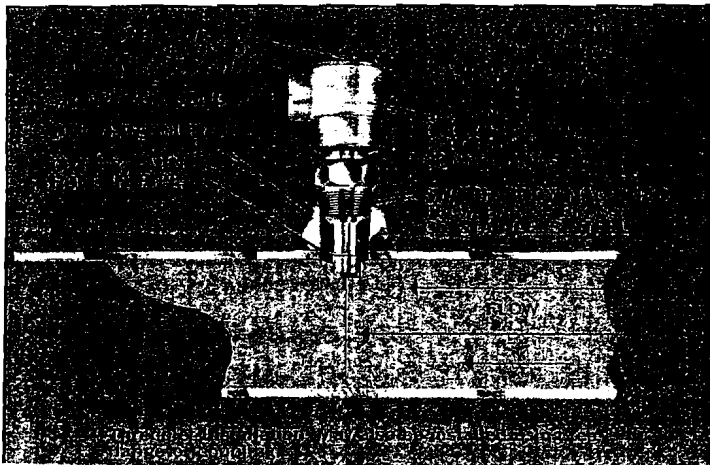


APPLICATIONS

Protects motors, pumps and other equipment against low flow or no flow. Controls sequential operation of pumps, etc. Automatic starts auxiliary pumps and engines or actuates alarm and sign systems. Stops water cooled engines, machines and processes when coolant flow is interrupted. Shuts down burner when air flow through heating coil fails. Controls dampers according to flow. Stops machines if cooling oil flow ceases.

SPECIFICATIONS

Temperature limits:	Standard 275°F (135°C). High temperature option (not U.L., C.S.A. or CENELEC), 400°F (205°C) max.
Operating Pressure:	Brass 1000psig (69bar) 316S.S. 2000psig(138bar) Ratings to 5000psig(345bar) available (SPDT only).
Electrical Rating:	U.L. and CENELEC: 10A@125/250 Vac C.S.A.: 5A@125/250 Vac, 5A resistive 3. inductive@30Vdc Optional ratings (not UL, CSA or CENELEC); MV option; Gold contacts, 1.0A@125 Vac MT option: 400°F (205°C) 5A@125/250Vac
Wiring:	U.L./C.S.A. unit; 16 gauge copper wire, 6" long, mechanically and solder bonded to switch. CENELEC unit: Terminal board.
Switch body:	One piece milled and bored Brass or 316 SS. Other materials on request.
Vane:	316 SS 1 1/16" (40mm) wide. Std. trim includes 430 SS and silver solder. Other materials on request.
Piping Connection:	1 1/2" NPT std for mounting in 1 1/2" thredolet. For other mounting see back page. Thredolet fittings available.
Installation:	Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipes) on request.
Weight:	4lb.-5oz. (1.96Kg)
Options:	All 316SS wetted parts. Teflon coated wetted parts. DPDT circuits. Cartridge heater to melt paraffin, etc. Time delay relay



10P J9

INSTALLATION

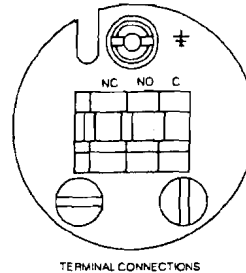
Remove packing material from switch body-cap and remove tape from magnet keeper. Adjust vane length if necessary on multi-layer vanes only. Install switch in thredolet previously welded to line. In some cases, it may be necessary to install the switch in a flange or tee. Note: extreme care must be exercised in welding the fitting to the line so that it is plumb and level.

- The arrow on the side of the switch must point in the direction of flow.
- U.L. and C.S.A. units only:** Thread connecting wires through conduit and connect.
Black – Common
Blue – N.O.
Red – N.C.

Note: Double pole, double throw switches have dual black, blue and red leads. These are connected in the same manner as single pole, double throw switches, as described above.

CENELEC units only: Wire in accordance with local electrical codes. Cable should enter enclosure housing through an approved Ex cable gland (not supplied). Stripped and tinned leads are simply pushed into wire entry of terminal block. Depress spring release with small screwdriver when inserting or removing fine stranded leads. Be sure strands do not bridge across terminal spacing. Double pole, double throw switches have dual terminal blocks.

Note: The switch is deactivated and contacts are in normal condition when there is no flow in the line.



- Make sure conduit or cable are properly sealed. Electrical components must be kept free of moisture, including condensation, at all times. **CAUTION:** To prevent ignition of hazardous atmosphere, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in operation.

Inspect and clean wetted parts at regular intervals.

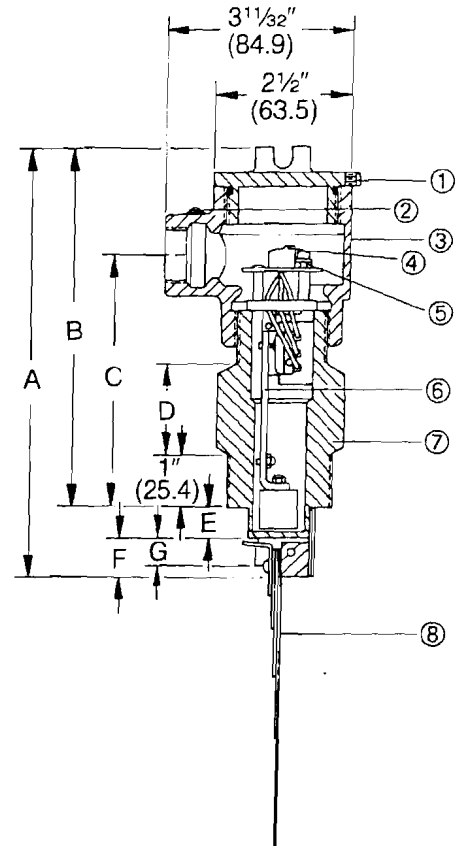
- CENELEC units only:** The "T" class is dependent upon the ambient temperature of the media. The approved ratings are: T6 at 75°C, T5 at 90°C; T4 at 125°C; T3 at 135°C.

- Custom vane units have been calibrated at factory to meet requirements. Do not change.

ADJUSTMENT OF MULTI-LAYER VANE

Remove only those layers which are too long. Leave the smaller layers to reinforce the vane. The longest vane fits 6" (150mm) or larger pipe, the second longest vane fits 4" (100mm) pipe, etc. Actuation-Deactuation rates are shown in the charts on the next page. To remove vane layers, proceed as follows:

- Remove the two screws and lockwashers holding the layers together. Do not lose these special corrosion resistant type 316 stainless steel screws and lockwashers.
- Remove the unwanted layers.
- Resecure the vane with the original two screws and lockwashers.
- With a hammer, lightly peen the ends of the screws so that they can't back out.
- If you lose the screws or lockwashers, don't replace with other parts which may corrode and break. That would void the warrantee and might cause severe damage to equipment located downstream of the switch.



CENELEC unit shown, for U.L./C.S.A. unit see first page.

DIM.	V4		V4-2	
	IN.	MM	IN.	MM
A	8 ³ / ₁₆	208	8	203
B	6	152	6 ³ / ₄	171
C	4 ¹ / ₁₆	119	3 ¹ / ₁₆	100
D	1	25.4	1 ³ / ₄	44
E	1 ⁵ / ₁₆	33	9 ¹ / ₁₆	14
F	7 ¹ / ₁₆	22	1 ¹ / ₁₆	17
G	1 ¹ / ₁₆	17	1/2	13

PARTS LIST

- Cover lock. (CENELEC unit only).
- External ground. (CENELEC unit only).
- Enclosure housing and cover.
- Terminal block. (CENELEC unit only, UL/CSA unit has 6" leads).
- Internal ground.
- Magnet arm and switch assembly.
- Switch body.
- Vane assembly.

*Approved replacement parts.

APPROXIMATE ACTUATION-DEACTUATION FLOW RATES FOR COLD WATER

UPPER FIGURES IN GPM. LOWER FIGURES IN M3/HR.

VANE LAYERS	1.5" PIPE	2" PIPE	3" PIPE	4" PIPE	6" PIPE	8" PIPE	10" PIPE	12" PIPE	14" PIPE	16" PIPE	18" PIPE	20" PIPE
1	7- 3 1.6-0.7	15- 8 3.4-1.8	45-22 10- 5	95-40 22- 9	210-120 48- 27	375-175 85- 40	600-300 136- 68	900-450 204-102	1200-600 273-136	1400-800 318-182	2000-1000 454- 227	2400-1200 545- 273
1&2		7- 4 1.6-0.9	23- 14 5.2-3.2	50- 35 11.4-7.9	130-90 30-20	230-150 52- 34	450-250 102- 57	650-350 148- 79	900-500 204-114	1200-650 273-148	1450-800 329-182	1800-1000 409- 227
1, 2&3			11- 7 2.5-1.6	27- 19 6.1-4.3	80-60 18-14	160-115 36- 26	300-180 68- 41	450-275 102- 62	600-350 136- 79	750-450 170-102	1000-600 227-136	1200-700 273-159
1, 2, 3&4				17- 12 3.9-2.7	60-45 14-10	120-90 27-20	230-150 52- 34	310-200 70- 45	430-280 98- 64	550-360 125- 82	700-450 159-102	850-550 193-125
1, 2, 3, 4&5					40- 30 9.1-6.8	80-65 18-15	135-100 31- 23	200-140 45- 32	290-200 66- 45	360-250 82- 57	460-325 104- 74	575-400 131- 91

Actuation rates are based on cold water at a specific gravity of 1.0. For fluids of different specific gravity, actuation rates may be approximated by dividing the rate shown by the square root of the specific gravity.

APPROXIMATE ACTUATION-DEACTUATION FLOW RATES FOR AIR

UPPER FIGURES IN SCFM. LOWER FIGURES IN NM3/S.

VANE LAYERS	1.5" PIPE	2" PIPE	3" PIPE	4" PIPE	6" PIPE	8" PIPE	10" PIPE	12" PIPE	14" PIPE	16" PIPE	18" PIPE	20" PIPE
1	32- 17 0.02-0.008	65- 32 0.03-0.02	210- 105 0.10-0.05	400- 200 0.19-0.09	950- 475 0.45-0.22	1550- 850 0.73-0.40	2400-1300 1.1- 0.6	3450-1900 1.6- 0.9	4700-2600 2.2- 1.2	6400-3500 3.0- 1.7	8000-4400 3.8- 2.1	10000-5500 4.7- 2.6
1&2		23- 13 0.01-0.006	120- 70 0.06-0.03	195- 140 0.09-0.07	550- 375 0.26-0.18	1100- 700 0.52-0.33	1850-1200 0.87- 0.57	2700-1750 1.3- 0.8	3400-2200 1.6- 1.0	4800-3100 2.3- 1.5	6000-3900 2.8- 1.8	7400-4800 3.5- 2.3
1, 2&3			60- 48 0.03-0.02	135- 100 0.06-0.05	375- 265 0.18-0.13	725- 500 0.34-0.24	1200- 850 0.57-0.40	1850-1300 0.87- 0.61	2600-1800 1.2- 0.8	3350-2350 1.6- 1.1	4300-3000 2.0- 1.4	5300-3700 2.5 1.7
1, 2, 3&4				65- 50 0.03-0.02	260- 200 0.12-0.09	500- 400 0.24-0.19	875- 700 0.41-0.33	1250-1000 0.59- 0.47	1900-1500 0.90- 0.71	2500-2000 1.2- 0.9	3100-2500 1.5- 1.2	3900-3100 1.8- 1.5
1, 2, 3, 4&5					130- 100 0.06-0.05	310- 250 0.15-0.12	650- 525 0.31-0.25	1000- 800 0.47-0.38	1600-1250 0.76- 0.59	2200-1750 1.04- 0.83	2800-2250 1.3- 1.1	3550-2850 1.7- 1.3

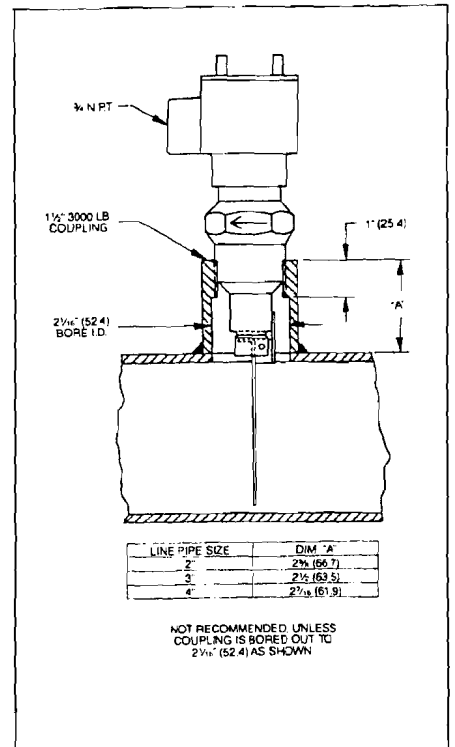
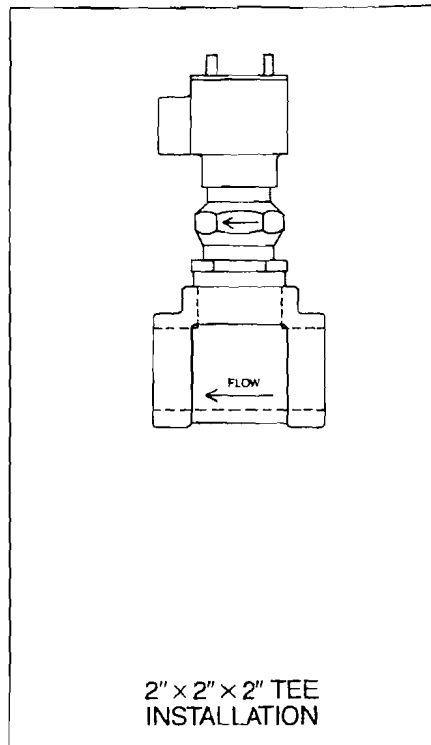
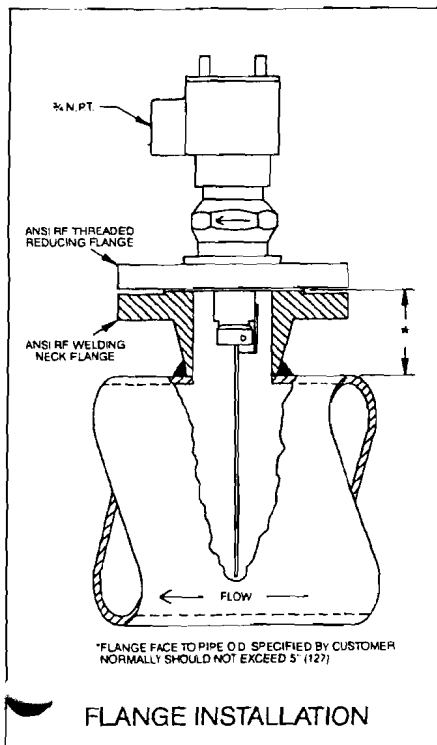
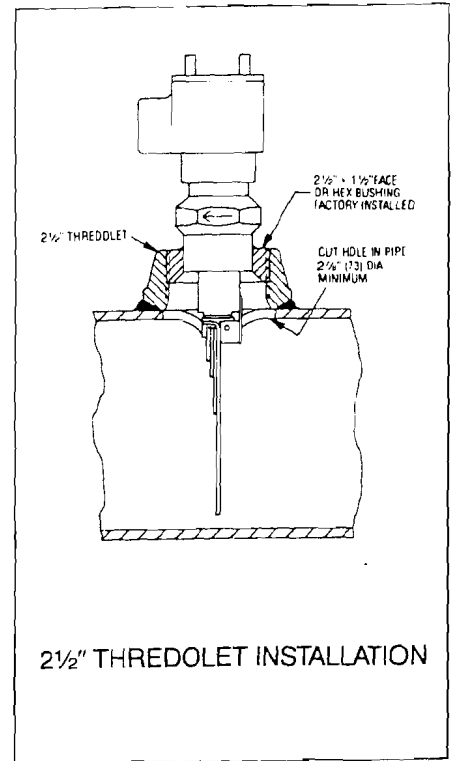
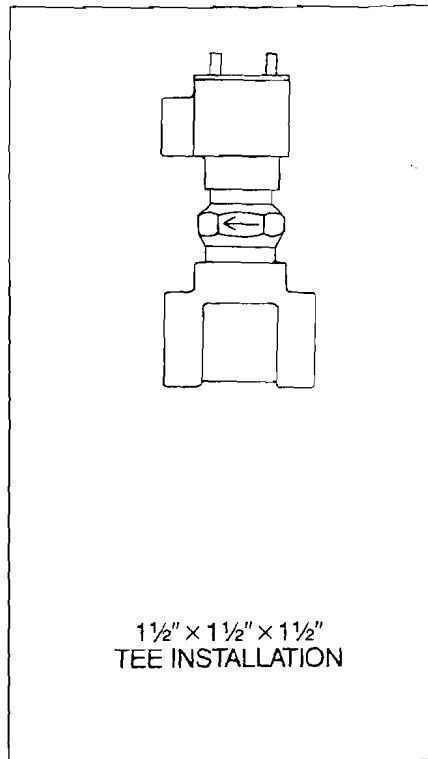
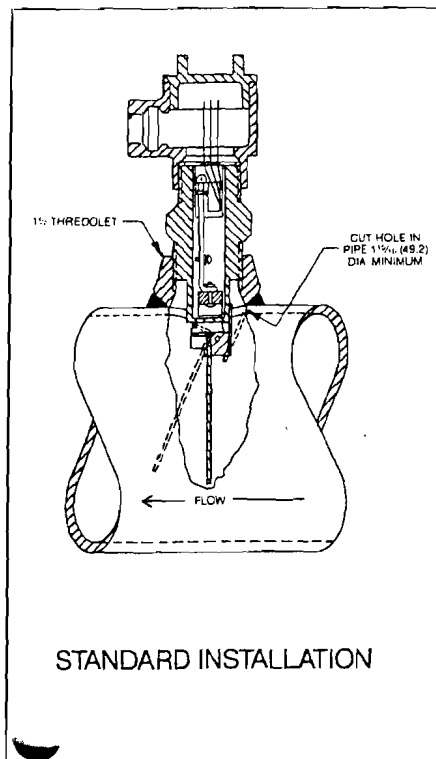
Values shown in both charts are nominal. If normal flows exceed actuation rates by less than 10%, custom vanes are recommended. Figures are based on standard vertical installation in a 1 1/2" threaded in a horizontal run of pipe.

Limited Warranty: The Seller warrants all Dwyer instruments and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's option provided the instruments have been returned, transportation prepaid, within one year from the date of purchase. All technical advice, recommendations and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory or the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.

THIS EXPRESS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER REPRESENTATIONS MADE BY ADVERTISEMENTS OR BY AGENTS AND ALL OTHER WARRANTIES, BOTH EXPRESS AND IMPLIED. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE FOR GOODS COVERED HEREUNDER.

Buyers Remedies: THE BUYER'S EXCLUSIVE AND SOLE REMEDY ON ACCOUNT OF OR IN RESPECT TO THE FURNISHING OF NONCONFORMING OR DEFECTIVE MATERIAL SHALL BE TO SECURE REPLACEMENT THEREOF AS AFORESAID. THE SELLER SHALL NOT IN ANY EVENT BE LIABLE FOR THE COST OF ANY LABOR EXPENDED ON ANY SUCH MATERIAL OR FOR ANY SPECIAL, DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES TO ANYONE BY REASON OF THE FACT THAT IT SHALL HAVE BEEN NON-CONFORMING OR DEFECTIVE.

APPLICATION DRAWINGS FOR FLOTECT® AUTOMATIC FLOW SWITCHES



15500-01-A
HEATING AND VENTILATION SYSTEM CALCULATIONS AND COMPONENTS

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

HVAC Equipment

- Exhaust Ventilators: Dayton Axial Belt Drive Downblast Exhaust fan with 20-inch blade diameter, capable of 3198 cfm @ 0.25" SP. 1/2-horsepower, 115/230 Volt, 1-Phase, 60 Hz motor. Grainger Catalogue No. 7A404
- Ventilator Curb: 29.5-inch square ID, 32.5-inch square OD, Supplied by Butler Building Co.
- Damper: Dayton Roof Mount Backdraft Damper, 27 x 27 inch, Grainger Catalogue No. 4HX68
- Speed Controller: Solid State Vari-Speed Speed Control, Grainger Catalogue No. 4YC46
- Selector Switch: Selector Switch, Toggle 20A-115V, SP-3 Position "Hand-Off-Auto"; Hubbell, Bryant, Arrow-Hart Thermostat: 22A-120V-SPDT, NEMA 4X, 40-100°F, Wall-mount 5' AFF, Chromalox No. WCRT-100.
- (2) Shutters/Louvers: 24-inch x 36-inch opening Shutter/Louver with insect screen as manufactured by Butler and provided with building. Rated for maximum air velocity intake of 500 fpm. Motor will be provided to operate louvers.
- (2) Heaters: Dayton Natural Gas Fired Unit Heaters, 30,000 BtuH Input, 80% Thermal Efficiency, 1/30-Hp 115 VAC Motor, 4.5 Full Load Amps, Grainger No. 4E454 or equivalent.
- (2) Thermostat: White-Rodgers Snap Action Thermostat Model No. 1C30-302, For Natural gas systems, Grainger No. 3TZ47
- (2) Redundant Gas Valves: White-Rodgers Redundant Gas Valve Model No. 36E93-304, 24 V, 60 Hz Coil Voltage, proven pilot with pressure switch, For Natural gas systems, Grainger No. 4E953.
- (2) Intermittent Pilot Gas Ignition Systems: Honeywell Intermittent Pilot Gas Ignition System, Model No. Y8610U3003, 24 V, 60 Hz Control Voltage, For Natural gas systems, Grainger No. 5E757.

**Heating Calculations
Active Industrial Uniform Site
Lindenhurst, New York
Law Project No. 22000-0-0019 Phase 300**

Assumptions: Building Insulation Schedule (R-values)
Doors: 5
Walls: 19
Roof: 38

HVAC Requirements per Specification 15500:

Outdoors: Current ASHRAE 99% winter and 1% summer criteria for Suffolk, NY

Indoors: Minimum 60°F
Maximum 10°F above outdoor ambient

HVAC: Ventilated at 1 cfm/square foot or 3 air changes/hour, whichever is higher

Inlet Air Velocity: 500 FPM (maximum)

Outlet Air Velocity: 700 FPM (maximum)

Building Size: 25 ft x 31 ft x 15 ft eave height
(internal) 2 ft height from eave to gable

Building Volume: 12,400 cubic feet
(internal)

Building Footage: 775 square feet

Heating Requirements:

Indoor Design Temp (t_i) : 60°F
Outdoor Design Temp (t_o) : 0°F

Heat Loss = Transmission Heat Loss (q) + Infiltration Heat Loss

Infiltration = $L \cdot W \cdot H \cdot C_p \cdot (t_i - t_o) \cdot \rho \cdot (\# \text{ air changes/hour})$

C_p = Specific heat of air = 0.24

ρ = density of standard air = 0.075

L, W, H = Building dimensions

t_i , t_o = as above

air changes = Assume 3 per hour

Heat Loss through Slab on Grade = $P \cdot F_2$

P = Exposed Perimeter, Ft

F_2 = Loss Coefficient, Btu/hr*ft

F_2 = 50 for unheated, uninsulated SOG
(ASHRAE, pg 378)

Heating Calculations
Active Industrial Uniform Site
Lindenhurst, New York
Law Project No. 22000-0-0019 Phase 300

Heat Loads

Component	U-Value (BTU/hr* ft^2 *°F)	Area (ft^2)	UA (BTU/hr*°F)	q=UA*(t_i-t_o) (BTU/hr)
Ceiling	0.026	785	21	1,239
Walls	0.053	1,680	88	5,305
Doors	0.2	121	24	1,452
Slab	= 112 * 50 BTU/hr* ft^2			5,600
Infiltration	= 12,400 ft^3 * 0.24 * (60-0) * 0.075 * 3			40,176
Total (BTU/hr)				53,773
Total (Kw)				16

Note: U-Value = 1 / (R-Value)

Heater Specifications:

(2) Heaters: Dayton Natural Gas Fired Unit Heaters
30,000 BtuH Input, 80% Thermal Efficiency
1/30-Hp 115 VAC Motor, 4.5 Full Load Amps
Grainger No. 4E454

(2) Thermostat: White-Rodgers Snap Action Thermostat Model No. 1C30-302
For Natural gas systems
Grainger No. 3TZ47

(2) Redundant Gas Valves: White-Rodgers Redundant Gas Valve Model No. 36E93-304
24 V, 60 Hz Coil Voltage, proven pilot with pressure switch
For Natural gas systems
Grainger No. 4E953

(2) Intermittent Pilot Gas Ignition

Systems: Honeywell Intermittent Pilot Gas Ignition System
Model No. Y8610U3003
24 V, 60 Hz Control Voltage
For Natural gas systems
Grainger No. 5E757

Prepared by:	AKG 6/10/01
Checked by:	DMS 6/11/01
Revised by:	AKG 8/3/01

**Ventilation Calculations
Active Industrial Uniform Site
Lindenhurst, New York
Law Project No. 22000-0-0019 Phase 300**

Assumptions: Building Insulation Schedule (R-values)
Doors: 5
Walls: 19
Roof: 38

HVAC Requirements per Specification 15500:

Outdoors: Current ASHRAE 99% winter and 1% summer criteria for Suffolk, NY

Indoors: Minimum 60°F
Maximum 10°F above outdoor ambient

HVAC: Ventilated at 1 cfm/square foot or 3 air changes/hour, whichever is higher

Inlet Air Velocity: 500 FPM (maximum)

Outlet Air Velocity: 700 FPM (maximum)

Ventilation Requirements:

$$Q = H / (C_p * \rho * 60 * (t_i - t_o)) = H / (1.08 * (t_i - t_o))$$

Q = Air removed, cfm

H = Heat removed, Btu/hr

C_p = Specific heat of air at constant pressure = 0.24

ρ = Density of standard air, 0.075 lbs/ft³

t_i-t_o = Desired indoor-outdoor temperature difference, °F

Reference: 1972 ASHRAE Handbook of Fundamentals, Eqn (5), pg. 343.

Equipment	Motor Size (horsepower)	Efficiency (%)	Usage Factor (%)	Heat Rejection (Btu/hr)
B-1 (Blower) ¹	10	92	100	27,663
P-1 (ST-1 Pump) ²	15	92	90	2,988
P-2 (ST-2 Pump) ²	15	92	90	2,988
P-3 (Acid Pump) ²	5	92	5	55
P-4 (KO Tank TP) ²	1	92	25	55
P-5 (Sump Pump) ²	0.5	85	5	11
P-6 (Drum TP) ²	0.25	85	5	6
Total	46.75			33,766

Note:

1) Heat Rejection = (((Horsepower * 2,545) / %efficiency)) * %Usage

2) Heat Rejection = (((Horsepower * 2,545 * (1 - %efficiency)) / %efficiency)) * %Usage

Source: Marks' Standard Handbook for Mechanical Engineers, 9th Edition.

Ventilation Calculations
Active Industrial Uniform Site
Lindenhurst, New York
Law Project No. 22000-0-0019 Phase 300

Temp. Diff. ($t_i - t_o$), °F	H Btu/hr	Q cfm	
10	33,766	3,126	(minimum for heat removal due to equipment heat reject

Building Size: 25 ft x 31 ft x 15 ft eave height
(internal) 2 ft height from eave to gable

Building Volume: 12,400 cubic feet 2,480 6200 4340
(internal)

Building Footage: 775 square feet

Ventilation at 1 cfm/square foot = 775 cfm (minimum)

Ventilation at 3 air changes/hour = 620 cfm (minimum)

∴ Ventilator(s) will be sized for an air flow of 3,126 cfm

Static Pressure of Fan:

Fan Static Pressure = Inlet loss + Friction Loss in piping + Loss through filters + Loss through Exhaust Stack

$$\text{Inlet Loss} = [(\text{Velocity} / 0.75) / 4005]^2 = [(500 / 0.75) / 4005]^2$$

Inlet Loss = 0.03 in. w.c.

Friction Loss = 0.20 in. w.c. (shutter)

Loss through Filters = 0.00 in. w.c. (no filters)

Loss through Exhaust Stack = 0.00 in. w.c. (no fan exhaust stack)

Fan Static Pressure = 0.23 in w.c.

**Ventilation Calculations
Active Industrial Uniform Site
Lindenhurst, New York
Law Project No. 22000-0-0019 Phase 300**

Ventilator Equipment Specifications:

Exhaust Ventilators: Dayton Axial Direct Drive Downblast Exhaust fan
20-inch blade diameter, capable of 3109 cfm @ 0.25" SP
1/2-horsepower, 115/230 Volt, 1-Phase, 60 Hz motor.
Grainger Catalogue No. 4YC52

Damper: Dayton Roof Mount Backdraft Damper, 27 x 27 inch
Grainger Catalogue No. 4HX68

Speed Controller: Solid State Vari-Speed Speed Control
Grainger Catalogue No. 4YC46

Selector Switch: Selector Switch, Toggle 20A-115V
SP-3 Position "Hand-Off_Auto"
Hubbell, Bryant, Arrow-Hart

Thermostat: 22A-120V-SPDT
NEMA 4X, 40-100°F, Wall-mount 5' AFF
Chromalox No. WCRT-100

Louver Sizing:

Air Flow Requirements = Max Ventilator Intake + Equipment Intake
= 3109 cfm + 0 cfm = 3109 cfm

Select (1) intake louver that allows 3109 cfm air flow, limiting the velocity to 500 fpm

Louver opening size requirement = $3109 \text{ cfm} / 500 \text{ fpm} = 6.22 \text{ sq feet}$

Louver size to be installed = $2 \text{ ft} \times 3 \text{ ft} = 6 \text{ sq. ft.}$
Inlet velocity = $3,109 \text{ cfm} / 6 \text{ sq ft} = 518.2 \text{ fpm}$

Louver Equipment Specifications:

Louver: 24-inch x 36-inch opening Louver with insect screen
Manufactured by Butler and provided with building.
Rated for maximum air velocity intake of _____ fpm.

Shutter: Heavy Duty, Single-panel, Gravity Operated, Aluminum frame
36-inch Wd. x 24-inch Ht. opening, Surface Mount with Flange
115-VAC Motor included
McMaster Carr No. 2047K339

Prepared by:	AKG 6/10/01
Checked by:	DMS 6/11/01
Revised by:	AKG 7/26/01

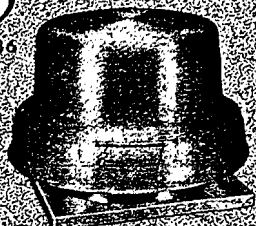
POWER ROOF VENTILATORS

BELT AND DIRECT DRIVE AXIAL EXHAUST VENTILATORS

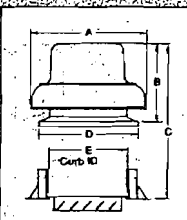
Dayton



ES3236



Dayton Electric Mfg. Co. certifies that the Models 5M149, 5M150, 5M151, and 5M152 ventilators shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.



Replacement Parts Available
1-800-323-0620



BELT-DRIVE EXHAUST

- The motor compartment is cooled by outside air
- Spun aluminum housing and galvanized steel base, stamped steel blade
- Motor and drive located outside discharge air stream
- Ball bearing motor and drives are packed separately when ordered with ventilators as 7-combo
- Permanently lubricated maintenance free bearings factory installed
- Maximum inlet temperature is 104°F
- All units are UL Listed Power Ventilators Subject 705
- Backdraft damper - sold separately

AXIAL ROOF VENTILATORS WITH MOTOR AND DRIVE PERFORMANCE AND ORDERING DATA

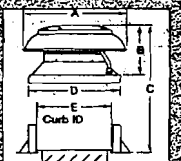
Propeller Dia. (in.)	CFM at RPM Shown					Fan RPM	Motor HP	Dimensions (inches)					Stock No.	Each	Shpg. Wt.	Single Phase Motor 115/230V, 60 Hz		3-Phase Motor 230/460V, 60 Hz		Mounting Curbs 8" High		Backdraft Dampers Stock No.
	0.0" SP	0.125" SP	0.250" SP	0.375" SP	0.500" SP			A	B	C	D	E				Stock No.	Each	Stock No.	Each	Stock No.	Stock No.	
16	2023	1837	1562	1299	915	905	1/6	32	23 1/4	31 1/4	26	21 1/4	5M149	\$332.60	63.0	7A396	\$417.72	7A415	\$448.27	4HX40	4HX48	4HX66
	2258	2093	1871	1632	1359	1010	1/4									7A399	430.30	7A416	431.84			
	2638	2500	2350	2124	1924	1180	1/3									7A400	445.27	7A417	442.99			
	2906	2784	2648	2424	2206	1300	1/2									7A401	445.37					
24	3400	2863	2116	1323	—	635	1/4	40	25 1/4	33 1/4	34	29 1/4	5M151	469.08	85.0	7A402	554.29	7A418	578.40	4HX42	4HX50	4HX68
	3667	3162	2475	1785	1123	685	1/3									7A403	582.06	7A419	568.62			
	4203	3749	3198	2645	2002	785	1/2									7A404	578.99	7A420	575.61			
	4818	4425	4061	3454	3007	800	3/4									7A405	586.27	7A421	589.68			
	5461	5116	4774	4367	3857	1020	1									7A406	616.69	7A422	609.54			
30	5609	4872	3826	2947	2035	620	1/2	48	31 1/4	39 1/4	42	37 1/4	5M152	652.61	138.0	7A407	773.30	7A423	770.92	4HX43	4HX51	4HX69
	6514	5906	5112	4221	3459	720	3/4									7A408	774.31	7A424	777.73			
	7012	6464	5754	4872	4185	775	1									7A409	838.56	7A425	831.41			
	8052	7604	7029	6358	5568	890	1 1/4									7A410	865.80	7A426	841.18			
	8912	8497	8013	7456	6813	985	2									7A411	876.25	7A427	887.00			
36	8787	7784	6450	4966	3798	550	3/4	57	33	41	46	41 1/4	5M150	802.60	243.0	7A412	925.00	7A428	928.42	4HX44	4HX52	4HX70
	9745	8877	7777	6340	5206	610	1									7A413	954.16	7A429	954.51			
	10705	9915	8973	7817	6451	670	1 1/4									7A414	1013.61	7A430	989.00			

(1) Add 4" when using 12" high curb.

Dayton



Dayton Electric Mfg. Co. certifies that the direct drive wall or roof ventilators shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.



ES3236



Replacement Parts Available
1-800-323-0620

DIRECT DRIVE EXHAUST

- Roof mount
- Low silhouette units provide economical ventilation of industrial and commercial buildings
- Aluminum construction with built-in bird screen.
- Backdraft damper - sold separately.
- Includes safety disconnect switch
- Maximum inlet temperature: 120°F

Fan blade driven by 115V, 60 Hz, totally enclosed, shaded pole or PSC motor. No. 2X605. Two-Speed Fan Switch. Shpg. wt. 0.2 lbs. List \$18.40. Each \$8.90.

Propeller Dia. (in.)	Ventilator Dimensions (in.)					CFM @ Static Pressure Shown					Nominal RPM	HP	Max. Watts	Stock No.	Each	Fixed Roof Curbs 8" High		Backdraft Dampers
	A	B	C	D	E	0.0" SP	0.125" SP	0.250" SP	0.375" SP	0.500" SP						8" High	12" High	
10	21	2 1/4	15 1/4	16 1/4	11 1/4	511	375	260	166	—	1630	1/30	102	2C912	\$155.98	3T253	—	3T250
12	21	10 1/4	18 1/4	19 1/4	14 1/4	917	740	593	475	347	1675	1/10	188	4C097	201.06	4HX38	4HX46	4HX64
14	28	12 1/4	20 1/4	22	17 1/4	1584	1329	931	648	413	1115	1/6	176	2C913	287.97	4HX39	4HX47	4HX65
14	28	12 1/4	20 1/4	22	17 1/4	1543	1316	948	717	498	1118	1/6	181	4C204*	297.60	4HX39	4HX47	4HX65
						819	427	118	—	—	695		112					
18	33 1/4	13 1/4	21 1/4	26	21 1/4	2641	2369	2016	1531	1198	1098	1/3	433	2C960	355.45	4HX40	4HX48	4HX66
18	33 1/4	13 1/4	21 1/4	26	21 1/4	2641	2369	2016	1531	1198	1098	1/3	433	4C205*	365.30	4HX40	4HX48	4HX66
						2083	1802	1043	646	—	827		307					
20	37 1/4	13 1/4	21 1/4	26	21 1/4	2967	2641	2241	1680	1221	1162	1/2	344	6C991	418.99	4HX40	4HX48	4HX66

(*) Requires 2 speed switch: 2X605. (†) Height with 8" high curbs. (**) Not available - Fabricate locally.

3622 GRAINGER

Exhaust it, filter it, exchange it — we have the ventilators to get it done.

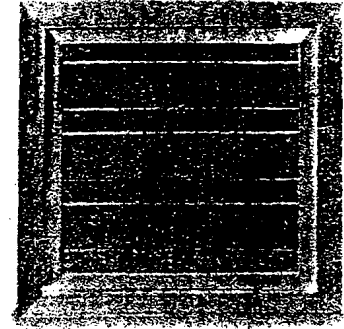
BACKDRAFT DAMPERS

For direct or belt-drive centrifugal roof and wall ventilators. Roof mount units have 19 gauge galvanized steel frame, 2" deep with 1" flange. Aluminum blades have felted edges for quiet operation. Pre-punched conduit hole knock-out. Wall mount units have 16 gauge extruded aluminum frame, 1½" deep with 1½" flange. Wall mount blades are aluminum with felted edges.

WARNING! NOT FOR USE WITH ANY KITCHEN EXHAUST APPLICATION.



No. 4HX72
Wall Damper



ROOF MOUNT BACKDRAFT DAMPERS

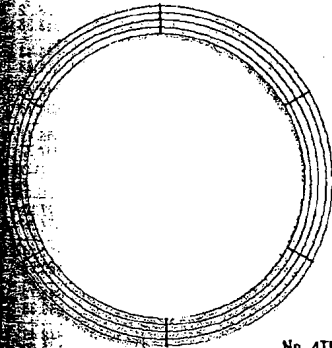
WALL MOUNT BACKDRAFT DAMPERS

Damper Size (in.)	Outside Flange (in.)	For Use With Dayton Ventilators (UL 705 Only)	Stock No.	List	Each	Shpg. Wt.	Damper Size (in.)	Outside Flange (in.)	For Use With Dayton Ventilators (UL 705 Only)	Stock No.	List	Each	Shpg. Wt.
8 x 8	11½ x 11½	2C912, 4WN57	3TZ50	\$32.50	\$20.13	2.5	8 x 8	10¼ x 10¼	4HZ34, 4HZ35	4HX72	\$25.57	\$15.85	4.5
12 x 12	14 x 14	4HX80, 4HX91, 4HZ32, 4HZ33, 4HZ36, 4HZ37, 4YC64-67, 4YC86	4HX64	29.92	18.55	4.5	10 x 10	12¾ x 12¾	4HZ38, 4HZ39	4HX73	36.88	22.85	5.0
15 x 15	17 x 17	4HX81, 4HX82, 4HX92, 4HX93, 4HZ40, 4HZ41, 4HZ44, 4HZ45, 4YC66-71, 4YC88, 4YC87, 4YC89, 4YC90	4HX65	36.75	22.77	6.0	11 x 11	13¾ x 13¾	4HZ42, 4HZ43	4HX33	40.46	25.08	6.0
19 x 19	21 x 21	4HX83, 4HX84, 4HX94, 4HX95, 4HZ48, 4HZ49, 4HZ52, 4HZ53, 4YC48, 4YC49, 4YC72-75	4HX66	43.55	27.01	7.5	12 x 12	14¾ x 14¾	4HZ46, 4HZ47	4HX74	44.49	27.58	6.5
23 x 23	25 x 25	4HX85, 4HX86, 4HX96, 4HX97, 4HZ56, 4HZ57, 4YC50, 4YC51, 4YC76-77	4HX67	56.23	34.88	9.0	13 x 13	15¾ x 15¾	4HZ50, 4HZ51	4HX75	48.34	29.96	7.0
27 x 27	29 x 29	4HX87, 4HX98, 4YC52, 4YC53, 4YC54, 4YC55	4HX68	65.74	40.78	13.0	14 x 14	16¾ x 16¾	4HZ54, 4HZ55	4HX76	50.89	31.57	7.5
35 x 35	37 x 37	4HX88, 4HX99	4HX69	92.71	57.48	20.0	15 x 15	17¾ x 17¾	4HZ58, 4HZ59	4HX77	56.23	34.88	8.0
41 x 41	43 x 43	4HX90, 4HZ01	4HX70	120.09	74.47	26.0							
52 x 52		4HX90	4HX71	158.11	98.01	34.0							

BIRDSCREENS

- Nickel-chrome plated for durability
- Successfully passed twenty-four hour salt spray test
- Concentric ring birdscreen precisely sized to eliminate any rattling

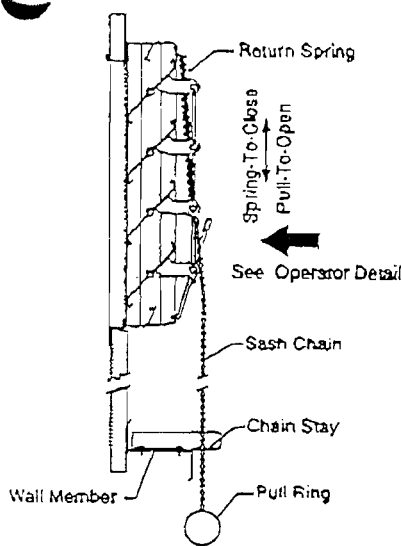
Wheel Dia. (in.)	For Use With Dayton Ventilators	Stock No.	List	Each	Shpg. Wt.
10¼	4HX91, 4HZ36, 4HZ37, 4HZ38, 4HZ39	4TM21	\$20.97	\$13.00	2.5
12¾	4HX92, 4HZ40, 4HZ41, 4HZ42, 4HZ43	4TM22	21.40	13.27	2.5
13¾	4HX93, 4HZ44, 4HZ45, 4HZ46, 4HZ47	4TM23	23.25	14.41	2.5
15	4HX94, 4HZ48, 4HZ49, 4HZ50, 4HZ51	4TM24	26.45	16.39	3.0
16½	4HX95, 4HZ52, 4HZ53, 4HZ54, 4HZ55	4TM25	32.90	20.39	3.5
18½	4HX96, 4HZ56, 4HZ57, 4HZ58, 4HZ59	4TM26	39.48	24.47	3.5
20	4HX97	4TM27	46.38	28.77	5.0
24½	4HX98	4TM28	54.23	33.64	5.0
30	4HX99	4TM29	66.19	41.04	6.0
36½	4HZ01	4TM30	108.20	67.07	13.0



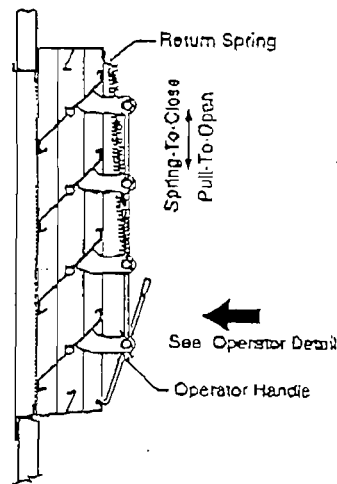
No. 4TM22

ADJUSTABLE LOUVER-PREMIER SERIES

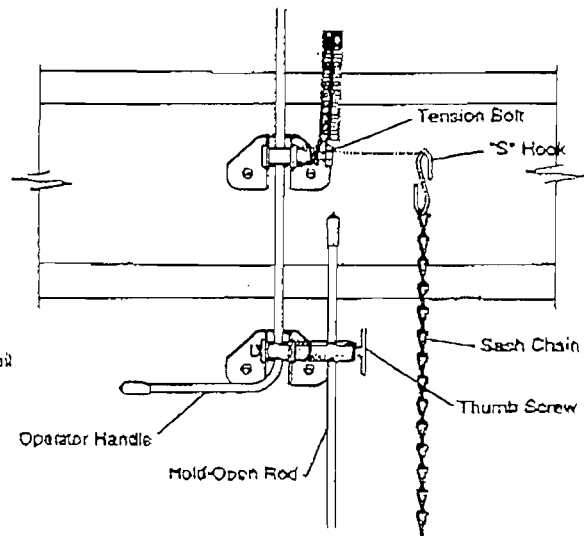
Model AL-CPS



LOUVER SECTION
Optional Chain Operator



LOUVER SECTION
Manual Thumb screw Operator

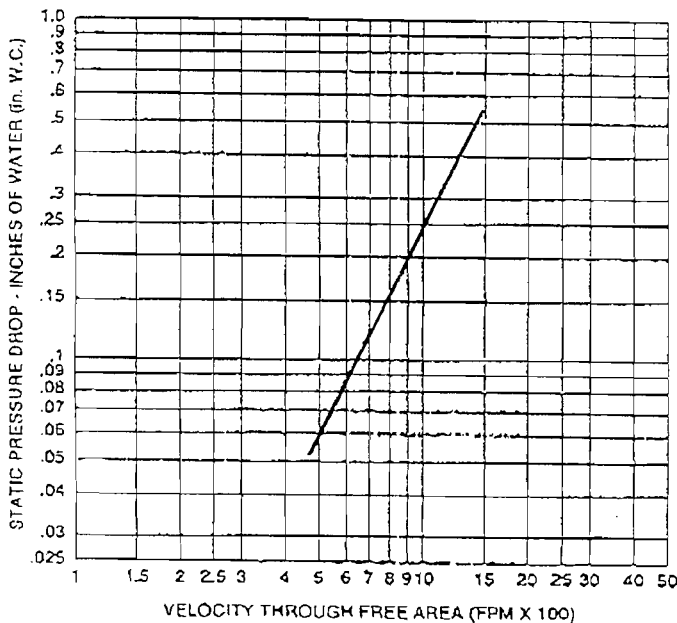


OPERATOR DETAIL

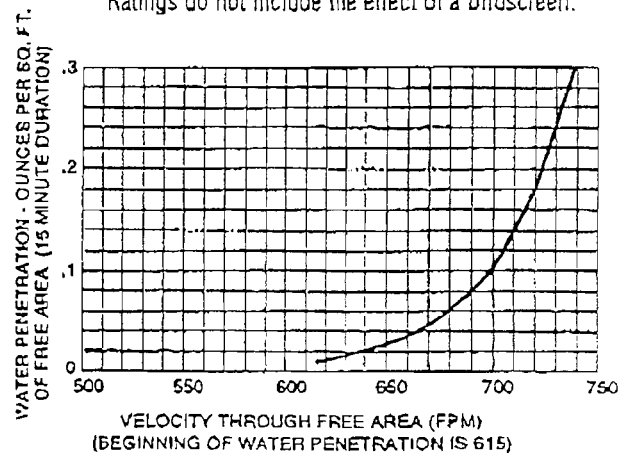


TRIMCO, Inc. certifies that the Model AL-CPS Louver shown herein is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings and water penetration ratings.

Test results below based on a 48" x 48" louver size. Ratings do not include the effect of a birdscreen.



AIR PERFORMANCE (INTAKE)



WATER PENETRATION

Height (inches)	Width (inches)						
	24	30	36	42	48	54	60
24	1.42	1.50	2.18	2.56	2.93	3.21	3.70
30	1.82	2.30	2.79	3.27	3.75	4.24	4.72
36	2.14	2.71	3.26	3.85	4.42	5.00	5.57
42	2.75	3.49	4.22	4.96	5.69	6.43	7.16
48	3.25	4.12	5.00	5.86	6.73	7.59	8.46
54	3.65	4.63	5.60	6.57	7.55	8.52	9.50
60	4.01	5.08	6.14	7.21	8.28	9.35	10.42

FREE AREA IN SQUARE FEET

TRIMCO
Manufacturers of Metal Building Products

1256 Brittonmoore
Houston, Texas 77043
<http://www.trimco.com>
email: louvers@trimco.com

(713) 455-8368
(800) 231-5809
Fax (713) 455-1653



© 1999, TRIMCO, Inc.
Rev. B
Date: 06/01/99

CPAL-2

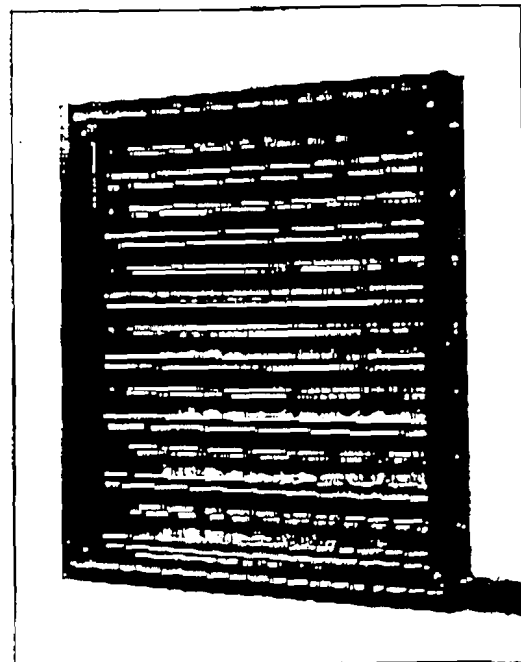
Model AL-CPS

ADJUSTABLE LOUVER-PREMIER SERIES**STANDARD FEATURES:**

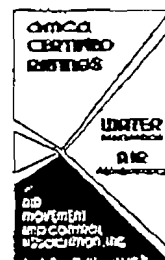
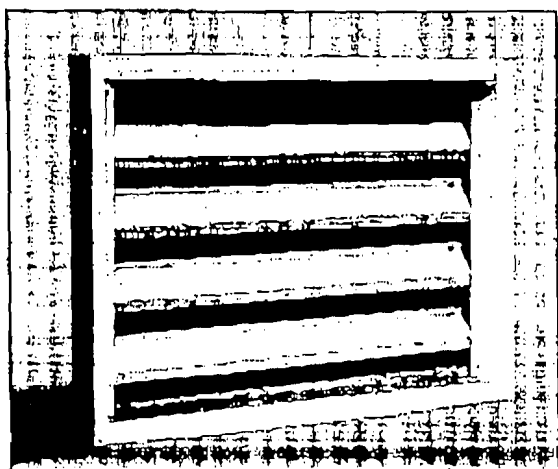
- Constructed of AZ-55 galvalume
- 18 gauge x 4-1/2 inch deep welded steel frame (see options for available frame types)
- 18 gauge steel adjustable center pivot blades on 1/2 inch plated steel axles. Nylon bushings provide self-lubrication for blade rotation
- Blade linkage assembly located on rear of louver consists of 1/4 inch plated steel tie rod secured to brass barrels with set screws and attached to steel blade clips providing synchronized blade operation
- Manual thumb screw operator lock blades at desired angle. Blade angle variable from fully closed to fully open at 45 degrees (blades are spring loaded to close)
- Extruded vinyl blade edge seals provide a continuous seal at mating blade surfaces
- Flexible stainless steel jamb seals provide seal at blade pivot ends
- Fiberglass insect screen mounted in a removable/rewirable aluminum frame, secured to exterior face of louver with swivel clips
- Licensed to bear the AMCA seal

OPTIONS:

- Aluminum (.080) or 18 gauge G-90 galvanized steel frame and blades
- Flange, Channel or Self-flashing frame
- Mullion strips
- Sill Extensions
- Chain and stay, Hand crank, Electric or Pneumatic operation available
- Birdscreen (2 mesh) mounted on interior side of louver
- Powdercoated finish. Louvers receive a high temperature chemical pre-treatment, clear rinse, electrostatically applied powdercoating and oven cure
- Kynar finish



#443 —



TRIMCO, Inc. certified that the Model AL-CPS Louver shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings and water penetration ratings.

TRIMCO
Manufacturers of Metal Building Products

1256 Brittonmoore
Houston, Texas 77043
<http://www.trimco.com>
email: louvers@trimco.com

(713) 465-8368
(800) 231-5809
Fax (713) 465-1653



© 1999, TRIMCO, Inc.
Rev. A
Date: 05/01/99

CPAL-1

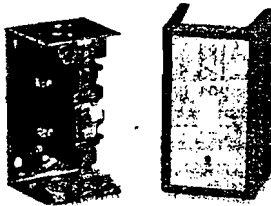
Power Roof Ventilators Accessories

Order today! phone | fax | visit | www.grainger.com

SQUARE D
Schneider Electric



E78360



No. 1H400

NFPA NEMA MANUAL SWITCHES

Non-reversing manual switches provide manual "On-Off" control of single or three phase AC motors where overload protection is not required or is provided separately. Applications include small machine tools, pumps, fans, conveyors and electrical machinery. Can also be used on non-

- motor loads such as resistance heaters.
- NEMA Type 1 surface mounting enclosures are sheet metal with a thermoplastic wrap-around cover
- Accessories available, order on page 515

NFPA NEMA MANUAL SWITCHES

Description	Amps	115V	Max. HP VAC 230V	460-575V	Stock No.	List	Each	Shpg. Wt.
Nema Type 1	30	2	2	3	1H400	\$37.09	\$31.15	0.8
Nema Type 1	30	2	7.5	10	1H401	82.98	69.48	0.8

SINGLE PHASE SWITCHES

Single	15	1/2	2	—	6A699	12.72	18.54	0.2
Single	20	1	2	—	6A700	20.72	17.17	0.2
Single	30	2	2	—	5Z809	28.49	23.59	0.3



SPECIAL COVERS FOR SWITCHES

Protect switches from water, rain, dirt, etc.

- No. 3D012 for use with FS/FD and standard type boxes
- No. 3D013 has 120V pilot light to indicate when load is on
- No. 3D014 used with all standard length toggle switches and PresSwitches
- No. 3D014 has clear silicone bubble so switch

handle position is visible on Lighted and Pilot Light switches

- No. 3D298 fits over standard metal switch plate and has a keyed lock. Key is provided with locking cover
- No. 4D095 is identical to No. 3D298, except it has a locking receptacle cover
- All Locks Keyed Alike



No. 3D012

No. 3D013

No. 3D298

Description	Fits	Color	Hubbell Model	Stock No.	List	Each	Shpg. Wt.
Silicone Bubble Plate	All Standard Toggle & PresSwitches	Clear	HBL1795	3D014	\$33.94	\$28.15	0.3
Weatherproof Plate	PresSwitches	Gray	HBL1750	3D012	42.21	34.95	0.3
Weatherproof Plate with 120V Pilot Light	PresSwitches	Gray	HBL1785	3D013	55.01	45.55	0.4
Locking Switch Cover	All Switches	Brushed Brass	HBL96061	3D298	146.94	121.78	0.4
Locking Receptacle Cover	Single 15 & 20A Receptacles	Brass	HBL96067	4D095	174.53	144.55	0.1



No. 1H408

NON-FUSIBLE SERVICE DISCONNECT SWITCHES

- NEMA Class 1 - Interior Applications
- NEMA Class 3R - Weatherproof Applications
- NEMA Class 4 - Watertight Applications

Note: Consult local Electrical Inspector regarding requirements

NEMA Class	Phase	Poles	Voltage AC	Max. HP	Max. Amps	Stock No.	Details See Page
1	Single	1	120-277	1	20	1XC19	740
1	Single	2	120-277	1	20	1X971	741
1	Three	3	208-220/480	7 1/2	30	1H373	459
3R	Single	2	120/240	3	30	1H259	457
3R	Three	3	208-220/480	20	30	1H375	459
4	Single	2	115/230	2	30	1H408	500
4	Three	3	230/460	10	30	1H409	500,3701

(*) For installation in NEMA 1 junction box (separate). (†) Requires Grounding bar kit. Stock No. 5B717, see page 442.

SPEED CONTROLS

Variable speed controls permit adjustment between 50 and 100% air performance and are rated 120V, 60Hz. Can be used to operate multiple fans, if total amp draw does not exceed control's amp rating. Controls

are suitable and intended only for use with specified ventilators as listed. UL Listed when used in combination with fan as listed. Do not use speed controls in NFPA96 installations.

SPEED CONTROL ORDERING DATA

Max. Amps	Use with Dayton Ventilator Nos.		Stock No.	List	Each	Shpg Wt.
	Centrifugal Roof Ventilators	Axial Roof Ventilators				
3	4YC64-68, 4YC70, 4HZ32-40, 4HZ42, 4YC72, 4HZ44, 4HZ46, 4HZ48, 4HZ50	4YC86-89, 4YC48, 4YC91-93	4YC44	\$29.29	\$18.37	1.0
10	4YC71, 4YC75, 4YC77, 4HZ45, 4HZ47, 4HZ53, 4HZ55, 4HZ57, 4HZ59, 4YC69, 4YC73-74, 4YC76	4YC54, 4YC58-60	4YC45	71.65	44.97	1.0
6	4HZ41, 4HZ43, 4HZ49, 4HZ51-52, 4HZ54, 4HZ56, 4HZ58	4YC49-50, 4YC52, 4YC56, 4YC57, 4YC62, 4YC90, 4YC94	4YC46	45.82	28.77	0.5



No. 4YC44

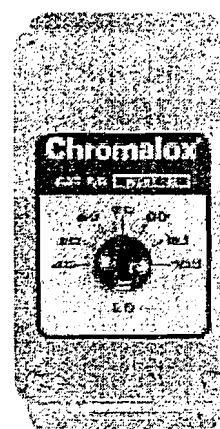
Controls

WCRT

Corrosion Resistant Wall Mounted Industrial Room Thermostat



- 25-Amps, 120 - 240 Vac
22 - Amps, 277 Vac
- Positive Snap-Action Switch
- Heating or Cooling Control, SPDT Contacts
- NEMA 4X Weatherproof Enclosure
- 40 - 100°F Temperature Range
- 2.5°F Differential



Description

The WCRT Room Thermostat is designed to directly control an individual heater. Using an external contactor, it can control several heaters. The WCRT provides high level accuracy and sensitivity with 2.5°F differential. The control has a SPDT output and can be used for heating or cooling.

WARNING: Hazard of Fire. The WCRT thermostat is designed for temperature control service only. Because it is not fail-safe, it should not be used for temperature limiting duty.

Applications

- Can be used to control room temperature in harsh environments regardless of whether heating or cooling is required.
- Tolerates continuous spraying with water, high humidity, airborne contamination and moderately corrosive conditions.

Ratings for Other Electrical Applications

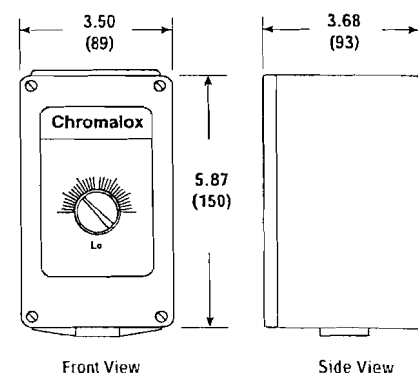
Type of Service	Maximum Rating (Amps AC)		
	120V	240V	277V
Locked Rotor	80	60	50
Inductive	16	12	10
Pilot Duty	125VA	125VA	125VA

Suitable for 24 Vac Operation @ 100 mA Minimum

Features

- Shielded sensing bulb is nickel-plated and attached directly to bottom of enclosure where it is shielded from damage and accumulation of insulating particles.
- Sealed Noryl case with neoprene gasket to seal out dust and moisture. Knob opening is closed with lubricated "O" ring.
- Adjustable Knob setting is accurate to $\pm 2.5^\circ\text{F}$ with large easily-read numerical dial.
- Positive OFF for heating is provided by setting unit to LO position. (At LO Position, heat circuit is open and cool circuit is closed at any temperature.)

Dimensions



All Dimensions in Inches (mm)

Specifications and Ordering Information

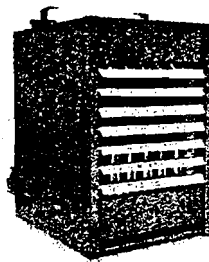
Model	Type	Temp. Range (°F)	Voltage/Current, Resistive			Voltage/Current, Inductive			Stock	PCN	Wt. (Lbs.)
			120V	240V	277V	120V	240V	277V			
WCRT-100	SPDT	40-100	22A	22A	18A	16A	12A	10A	S	223589	1

Stock Status: S = stock AS = assembly stock NS = non-stock

UNIT HEATER

Dayton Unit Heaters are the only Dayton heaters that use a system thermocouple. The heat is called for by a thermocouple that generates a spark at pilot. A sensor proves that the heater is on and main gas valves are de-energized. The gas supply to the main pilot burner until the gas is CSA Certified. Dayton

Dayton



No. 4E455

DAYTON LIMITED WARRANTY

10 years on heat exchanger, flue collector and burners. 1-year on other components. This warranty does not cover loss due to corrosion from chemicals precipitated in the air, such as chlorinated or halogenated hydrocarbon vapors. Text of warranty available upon request. See "Manufacturers' Warranties" on page opposite inside back cover.



Repair
Parts Available
1-800-323-0620



Air Switch provides safe venting before gas valve opens

Power Venter reduces installation costs

DAYTON LIMITED WARRANTY

10 years on heat exchanger, flue collector and burners. 1-year on other components. This warranty does not cover loss due to corrosion from chemicals precipitated in the air, such as chlorinated or halogenated hydrocarbon vapors. Text of warranty available upon request. See "Manufacturers' Warranties" on page opposite inside back cover.

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

For correct sizing by altitude call 1-800-323-0620

Thermal efficiency

vented

able in LP or Natural Gas operation

for sidewall venting equivalent to 50 ft.

applications in altitudes about 2000 ft., the burner orifices need to be

For correct sizing by altitude call 1-800-323-0620

cannot be converted to alternative fuel source

24V thermostat, not included (see pages 3383, 3384 and 3385)

CFM	Air Temp. Rise (°F)	Fan Diameter	Motor HP	Full Load Amps @ 115 VAC	Gas Inlet	Flue*	O.C. Mig. Dim.	Overall Dimensions (In.)			Stock No. ②	List	Each	Shpg. Wt.
								H	W	D				
NATURAL GAS FIRED DAYTON UNIT HEATERS														
750	30	12	1/30	4.5	1/2	4	11	27 1/2	14	30 1/2	4E454	\$899.00	\$686.00	79.0
1050	42	14	1/30	4.5	1/2	4	16 1/2	27 1/2	17 1/2	30 1/2	4E455	991.00	759.50	109.0
1100	50	14	1/30	4.5	1/2	4	16 1/2	27 1/2	17 1/2	30 1/2	4E456	1063.00	812.00	119.0
1480	50	14	1/20	5.8	1/2	4	14 1/2	34 1/2	17 1/2	37 1/2	4E457	1177.00	880.50	174.0
2200	50	16	1/4	7.2	1/2	4	17 1/2	39 1/2	20 1/2	37 1/2	4E458	1347.00	982.00	253.0
2640	56	18	1/3	8.2	1/2	5	22 1/2	39 1/2	26 1/2	37 1/2	4E459	1533.00	1125.00	249.0
3100	60	18	1/3	8.2	3/4	5	28 1/2	39 1/2	31 1/2	37 1/2	4E460	1784.00	1311.00	305.0
4400	50	(2) 16	(2) 1/4	11.2	3/4	6	33 1/2	39 1/2	37 1/2	37 1/2	4E461	2112.00	1545.00	350.0
5300	56	(2) 18	(2) 1/3	13.2	3/4	6	44 1/2	39 1/2	48 1/2	37 1/2	4E462	2567.00	1880.00	461.0

PROPANE FIRED DAYTON UNIT HEATERS																	
750	30	12	1/30	4.5	1/2	4	11	27 1/2	14	30 1/2	4E463	899.00	733.00	79.00			
1050	42	14	1/30	4.5	1/2	4	16 1/2	27 1/2	17 1/2	30 1/2	4E464	991.00	806.50	109.00			
1100	50	14	1/30	4.5	1/2	4	16 1/2	27 1/2	17 1/2	30 1/2	4E465	1063.00	859.00	119.00			
1480	50	14	1/20	5.8	1/2	4	14 1/2	34 1/2	17 1/2	37 1/2	4E466	1177.00	959.00	174.00			
2200	50	16	1/4	7.2	1/2	4	17 1/2	39 1/2	20 1/2	37 1/2	4E467	1347.00	1042.00	219.00			
2640	56	18	1/3	8.2	1/2	5	22 1/2	39 1/2	26 1/2	37 1/2	4E468	1533.00	1170.00	249.00			
3100	60	18	1/3	8.2	1/2 or 3/4	5	28 1/2	39 1/2	31 1/2	37 1/2	4E469	1784.00	1358.00	305.00			
4400	50	(2) 16	(2) 1/4	11.2	1/2 or 3/4	6	33 1/2	39 1/2	37 1/2	37 1/2	4E470	2113.00	1591.00	350.00			
5300	56	(2) 18	(2) 1/3	13.2	1/2 or 3/4	6	44 1/2	39 1/2	48 1/2	37 1/2	4E471	2565.00	1925.00	461.00			

round and shipped in vertical position. Venter can be repositioned in field for horizontal discharge. Units are covered by California Proposition 65. California purchases or shipments, see first page of Grainger Branch Listing or call any California branch. This energy efficient product. (†) Limited availability, see page 3474 for alternate heaters.

MANUFACTURERS' CROSS-REFERENCE† FOR DAYTON UNIT HEATERS LISTED ABOVE

Dayton	Empire	Old Sterling	Sterling	Modine	Jackson & Church	Grinnell	Reznor	Trane
H-30	—	CFEP-30	OFEP-30	PV-30	UFEP-30	EP-PTO-30	—	GHND-003
H-50	—	CFEP-60	OFEP-60	PV-55	UFEP-60	EP-PTO-60	FE-50	GHND-006
H-100	UH-1050	CFEP-75	OFEP-75	PV-75	UFEP-75	EP-PTO-75	FE-75	GHND-007
H-150	—	CFEP-100	OFEP-100	PV-110	UFEP-100	EP-PTO-100A	FE-100	GHND-010
H-200	—	CFEP-150	OFEP-150	PV-150	UFEP-150	EP-PTO-150A	—	GHND-015
H-250	UH-1075	CFEP-200	OFEP-200	PV-180	UFEP-200	EP-PTO-200A	FE-200	GHND-020
H-300	—	CFEP-250	OFEP-250	PV-240	UFEP-250	EP-PTO-250A	FE-250	GHND-025
H-350	UH-1100	CFEP-300	OFEP-300	PV-300	UFEP-300	EP-PTO-300A	FE-300	GHND-030
H-400	—	CFEP-400	OFEP-400	—	UFEP-400	EP-PTO-400A	FE-400	GHND-040

† Model numbers shown in this chart are base models only. Determine fuel type (natural gas or propane) and ignition type (pilot or spark) before cross-referencing to equivalent Dayton Stock No. See Cross Reference Information on page opposite inside back cover.

SIDE WALL VENTING KIT

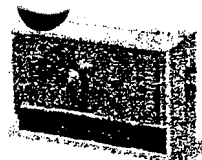
4" Side Wall Venting Kit. Includes a 4" side wall vent cap, 4" wall thimble, 18" "B" vent, and "B" to "C" adapter. Required for side-wall venting individual 100-175,000 BtuH heaters on this page.

No. 2C448
No. 2C448. Shpg. wt. 6.0 lbs. List\$78.75
Each\$67.33

VENT CAPS FOR UNITS ABOVE

No. 3T772. 4" Vent Cap. Shpg. wt. 3.3 lbs. List\$51.40
Each\$39.30
No. 3T773. 5" Vent Cap. Shpg. wt. 3.5 lbs. List\$56.12
Each\$43.05
No. 3T774. 6" Vent Cap. Shpg. wt. 4.8 lbs. List\$80.05
Each\$61.55

SNAP-ACTION THERMOSTATS



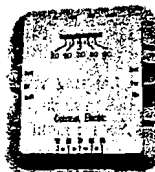
No. 2E397



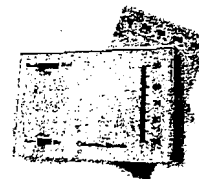
No. 2E830



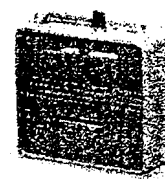
No. 2E156



No. 5E267

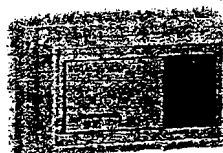


No. 2E514



No. 3T244

List	Each	Shpg. Wt.
45.04	\$94.20	0.7
35.20	149.60	0.7



No. 1D280

	Stock No.
ion heater.	3XK54
	3XK95
	4E879
	2E096
te included.	4E087
minial	4E244
nL	2E515
ount.	1D280

List	Each	Shpg. Wt.
49.14	\$31.40	0.3
39.52	25.20	0.3
59.11	24.71	0.3
46.50	23.68	0.3
46.59	25.85	0.4
59.38	33.10	0.5
51.19	27.80	0.3
37.37	25.05	0.3

alifornia branch.

List	Each	Shpg. Wt.
\$23.17	\$15.09	0.2
23.66	15.08	0.1
24.16	16.92	0.1
23.14	15.17	0.2
24.52	16.04	0.1
16.56	9.00	0.1



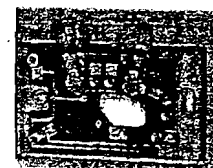
No. 2E632



No. 3T246



No. 3T247



No. 2E634

Columbus Electric

Honeywell



SNAP-ACTION THERMOSTAT SPECIFICATIONS

Type	Fan Switch	Application	Stock No.	Subbase	Control Range (°F)	Switch Action	Anticipation
Heat only	None	Gas, oil	2E830	Not Required	45-85	SPST	Heat: Adj. 0.18 to 0.8A
Heat only*	None	Gas, oil	2E156	Not Required	50-90	SPST	Heat: Adj. 0.3 to 1.2
Heat-Cool	Auto-On	Gas, oil	5E267	Not Required	50-90	SPST	Heat: Mv to 1.0A; Cool: Fixed
Cool only*	Auto-On	24VAC	2E278	Not Required	50-90	SPST	Cool: fixed
Heat only	None	Gas, oil	3T244	Not Required	50-90	SPST	Heat: Adj. 0.18 to 1.0A
Cool only	None	24 VAC	3T245	Not Required	50-90	SPST	Cool: Fixed
Heat-Cool*	Auto-On	Gas, oil, electric	2E514	Not Required	50-90	SPDT	Heat: Mv to 1.0A; Cool: Fixed
Heat only Cool only† Heat-Cool†	None None Auto-On	Gas, oil	2E632	Not Required 2E634	50-90	SPDT	Heat: Adj. 0.1 to 1.0A
Heat-Cool	Auto-On	Gas, oil, 24 VAC	3T246	Not Required	50-90	SPDT	Heat: Adj. 0.18 to 1.0A; Cool: Fixed
Heat-Cool	Auto-On	Gas, oil, electric 24V systems and single stage heat pumps	1N173	Not Required	50-90	SPDT	Heat: Adj. 0.15 to 1.2A Cool: Fixed
Heat only	None	Gas, oil	3T247	Not Required	50-90	SPST	Heat: Adj. 0.15 to 1.0A

SNAP-ACTION THERMOSTAT ORDERING DATA

Type	Color	H	Dimensions (in.) W D	Mfr.	Mfr's Model	Stock No.	List	Each	Shpg. Wt.
Heat only	Beige	2 1/4	4 1/4 1 1/4	Honeywell	T810D1003	2E830	\$35.13	\$15.04	0.2
Heat only*	White	2 1/4	4 1/4 1 1/4	Columbus Electric	RSV120LAW	2E156	35.04	15.27	0.3
Heat-Cool	White	3 1/4	3 1 1/4	Columbus Electric	RK420GAA	5E267	39.97	17.52	0.2
Cool only*	White	2 1/4	4 1/4 1 1/4	Columbus Electric	RSV310LAW	2E278	34.38	15.72	0.3
Heat-Cool*	White	2 1/4	4 1/4 1 1/4	Columbus Electric	RSV420GAW	2E514	45.25	17.66	0.2
Heat only	Light Gray	4 1/4	4 1/4 1 3/4	White-Rodgers	1C20-1	3T244	25.26	12.55	0.3
Cool only	Light Gray	4 1/4	4 1/4 1 3/4	White-Rodgers	1C21-1	3T245	25.82	13.80	0.2
Heat only Cool only† Heat-Cool†	Beige	2 1/4	4 1/4 1 1/4	White-Rodgers	1D36-316	2E632	59.93	24.60	0.4
Heat-Cool	Light Gray	4 1/4	4 1/4 1 1/4	White-Rodgers	1C26-1	3T246	35.54	17.40	0.4
Heat-Cool	Beige	3 1/4	4 1/4 1 1/4	White-Rodgers	1D56-347	1N173	86.23	26.80	0.4
Heat only	Beige	4 1/4	2 1/4 1 1/4	White-Rodgers	1C30-302	3T247	51.08	23.79	0.4

(†) Requires additional subbase, sold separately below. (*) Vertical or horizontal mount.

SUBBASES FOR SELECTED THERMOSTATS ABOVE

Use with Thermostat	Type	Fan Switch	White-Rodgers Model	Stock No.	List	Each	Shpg. Wt.
2E632	Heat-Cool	On-Auto	S21-3	2E634	\$47.62	\$22.44	0.2

For direct replacement in existing controls. Do not use this control except as specified for the specific listed at left.

ITEM SPECIFICATIONS

Pressure Regulator Setting in In.-WC	Type of Opening
3.5	Standard
Each	Shpg. Wt.
\$9.74	\$112.45
70.95	46.75
	0.2

to operate dampers and
ded to match the height of

Timing (Seconds)	Stroke (Degrees)
30 to 60	90 to 160
30 to 60	90 to 160
30 to 60	90 to 160

Each	Shpg. Wt.
\$353.25	8.0
387.75	8.0
440.25	10.0

Package for internal or motor crank arm, and Honeywell brand

.....\$195.67.
.....\$85.05
odutrol IV motors and 1 1/2" bonnet diameter. lbs. Honeywell brand

.....\$253.42.
.....\$104.70
odutrol IV motors and 1 1/2" bonnet diameter. lbs. Honeywell brand

.....\$253.42.
.....\$104.70

UNIVERSAL ELECTRONIC IGNITION GAS VALVE

Honeywell

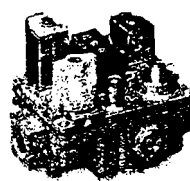


- Replaces more than 100 standard-opening IP, HSI or DSI valves
- 415,000 BtuH max. reg., N.G.
- Uses 2 simple adapters to convert between IP and HSI/DSI applications

Universal electronic ignition combination gas control for use with direct spark ignition, hot surface ignition or intermittent

pilot ignition in 24VAC, gas-fired appliances, with capacities from 30 to 415 cfm. Includes manual valve, two automatic operators, pressure regulator, pilot adjustment, pilot plug, and ignition adapter. For use with natural or manufactured gas or LP gas. Includes conversion kit to adapt from natural to LP gas. All adjustments and wiring connections accessible from top of control. Honeywell brand.

Coil Voltage	Inlet-Outlet Size (in.)	A.G.A. Cert. Capacity cfm	A.G.A. Std. Gas	Gas Type	Pressure Regulator	Includes	Honeywell Model	Stock No.	List	Each	Shpg. Wt.
24V	3/4 x 3/4	300	8.5	Nat.	Standard	(2) 3/4 x 1/2-IN. NPT bushings and (1) 1/2 x 3/8-IN. NPT bushings	VR8345M4302	4CZ56	\$120.41	\$99.45	1.8



No. 4E950

REDUNDANT GAS VALVES

Compact multifunction valves are designed to meet requirements for use with all types of intermittent ignition systems. All valve adjustments and features are located on top surface of control for easy accessibility. Valves may be mounted horizontal, vertical, and 90° from horizontal. Include pilot filter, adjustable pilot pressure, and manual shut-off valve. AGA

and CGA Design Certified. White-Rodgers brand.

ELECTRICAL RATING: 0.3 amps
REGULATOR SETTING: Natural gas, 3.5" W.C.; L.P. gas, 10.0" W.C.
MAXIMUM PRESSURE RATING: 1/2 PSI (14.0" W.C.)
AMBIENT OPERATING RANGE: -40 to +175°F (-40 to +79°C)

Coil Voltage	Inlet-Outlet Size (in.)	Capacity A.G.A. Std. Gas	System Usage	Slow/Step Opening	Gas Type	Side Taps	White-Rodgers Model	Stock No.	List	Each	Shpg. Wt.
24V, 60 Hz	1/2 x 3/4	140,000	Proven Pilot, HSI, DSI	—	Nat	Yes	36E36-304	4E950*	\$151.58	\$85.50	2.8
24V, 60 Hz	1/2 x 3/4	140,000	Proven Pilot, HSI, DSI	1.2" W.C.	LP	Yes	36E38-301	4E951*	152.92	91.05	3.4
24V, 60 Hz	1/2 x 3/4	140,000	Proven Pilot, HSI, DSI	2.5" W.C.	LP	Yes	36E38-302	4E952*	152.93	91.05	3.0
24V, 60 Hz	1/2 x 3/4	140,000	Proven Pilot, HSI, DSI	Slow	Nat	No	36E98-304	4DG52	147.84	87.30	2.4
24V, 60 Hz	1/2 x 3/4	140,000	Proven Pilot w/pressure switch	—	Nat	No	36E93-304	4E953	277.37	97.60	3.0

* Pilot fittings included with valves.

REDUNDANT GAS VALVE CROSS-REFERENCE

No. 4E950 Replaces these OEM Control Nos.	No. 4E951 Replaces these OEM Control Nos.	No. 4E952 Replaces these OEM Control Nos.	No. 4DG52 Replaces these OEM Control Nos.	No. 4E953 Replaces these Carrier Control Nos.
36E01-103 36E01-105 36E01-106 36E01-201 36E01-204 36E01-205 36E01-206 36E01-221 36E01-223	36E01-225 36E01-226 36E01-227 36E01-233 36E01-238 36E01-240 36E01-241 36E01-243 36E01-244	36E01-245 36E01-248 36E01-305 36E01-307 36E01-308 36E01-310 36E36-1 36E36-2 36E36-105	36E36-106 36E36-201 36E36-210 36E36-216 36E36-220 36E36-227 36E36-230 36E36-232 36E36-235	36E36-237 36E36-238 36E36-244 36E36-245 36E36-254 36E36-255 36E36-303 36E36-304 36E36-305
			36E03-205 36E03-209 36E03-211 36E03-224 36E38-301	36E03-206 36E03-215 36E03-217 36E03-301 36E38-302
				36E98-201 36E98-202 36E98-203 36E98-204 36E98-205 36E98-206
				BOP5 346-AX 4346-AY 646AP361-1501 EF32CW183

Honeywell

No. 10286
Ignitor SensorNo. 10287
Pilot Burner

IGNITOR SENSORS AND PILOT BURNERS

Ignitor Sensors. Nonprimary-aerated combination pilot burner and ignitor. Used with ignition modules in intermittent pilot systems on page 3407. Natural gas only. Honeywell brand.

Pilot Burners. Nonprimary-aerated, insert orifice-type pilot burner for main burner ignition. Provide main burner ignition for natural and LP gas-fired equipment. Used

with Honeywell Q340A (30 mv) thermocouple to provide automatic pilot safety control or with Honeywell Q313A (750 mv) thermopile in a self-powered system.

Each pilot burner is shipped with .018" orifice for natural gas; also contains .010" orifice (unassembled) for LP gas. Honeywell brand.


IGNITOR SENSORS

Orifice (in.)	Bracket	Tip	Fitting (in.)	Honeywell Model	Stock No.	List	Each	Shpg. Wt.
.018	B	F	1/4	Q345A1305	10286	\$27.00	\$19.35	0.2
.018	B	L	1/4	Q345A1313	10285	27.47	19.56	0.2
.018	B	K	1/4	Q345A1321	10284	26.98	19.34	0.2

PILOT BURNERS

Orifice (in.)	Bracket	Tip	Fitting (in.)	Honeywell Model	Stock No.	List	Each	Shpg. Wt.
.018/.010	B	F	1/4	Q314A4586	10289	19.67	16.80	0.2
.018/.010	B	L	1/4	Q314A6094	10288	19.67	16.80	0.2
.018/.010	B	K	1/4	Q314A6102	10287	19.67	16.80	0.2

VALVES

from  ant position
regulator, gas pilot
all on top of control for

ES
rmostat call for heat,
if regulator; closes if gas

nd 4E770, 0-175°F

ished

	Each	Shpg. Wt.
82	\$103.00	3.0
20	111.05	3.0
81	74.65	2.7
18	87.00	3.0
95	82.00	3.2
92	190.50	3.1
71	55.30	2.3
79	70.25	2.0
07	82.90	1.9
35	61.50	3.0
30	68.65	2.6
17	73.60	2.3
15	77.70	2.4
23	80.55	1.9
19	4.99	0.2

VALVES

atic pilot safety valve,
id pressure regulator
orporating 2 automatic

ide down

hed

List	Each	Shpg. Wt.
14.66	\$54.90	2.3
26.85	62.10	2.3
71.69	64.80	2.3
28.75	87.00	2.3
73.21	72.10	2.3
74.97	79.60	2.3
43.70	47.20	2.5
44.01	49.85	2.5
50.70	54.40	2.5

Honeywell



No. 5E757



No. 5E758

HONEYWELL INTERMITTENT PILOT GAS IGNITION SYSTEM

- For converting conventional standing pilot systems to intermittent pilot systems
- Each kit includes: intermittent pilot module, dual combination valve, ignition cable, wiring harness, and misc. installation hardware

REGULATOR SETTING: Natural gas, 3.5" WC; LP gas, 11" WC

AMBIENT OPERATING RANGE: 32-175°F

MAXIMUM PRESSURE RANGE: 1/2 psi

PILOT GAS CONNECTION: 1/4"

PRESSURE TAP: 1/8" NPT

REGULATOR ADJUSTMENT RANGE: Natural, 3.0 to 5.0" WC; LP, 8.0 to 12" WC

MAX LOCKOUT TIME: 90 seconds

SHUTOFF: 100%

Control Voltage	Inlet/Outlet Size (In.)	BluH Capacity	Gas Type	Reducer Bushing Kit (In.)	Side Taps	Honeywell Model	Stock No.	List	Each	Shpg. Wt.
120 V, 60 Hz	1/2 x 3/4	270,000	Nat. or LP	(2) 3/4 x 1/2	No	YB610U3003	5E757	\$273.80	\$204.75	3.6

REPLACEMENT MODULES ORDERING DATA

Description	Honeywell Model	Stock No.	List	Each	Shpg. Wt.
Control Module for Natural Gas System	S8610F1008	5E761	\$130.15	\$90.10	1.0
Control Module for Natural or LP Gas System	S8610U1003	5E758	140.84	95.20	0.9



No. 2E563

PILOT GAS IGNITION SYSTEM

- Natural gas only
- For converting conventional standing pilot systems to intermittent pilot systems
- Each kit includes: intermittent pilot module, dual combination valve, igniter-sensor assembly, ignition cable, and misc. installation hardware

REGULATOR SETTING: Natural gas, 3.5" WC

AMBIENT OPERATING RANGE: -20 to 150°F

MAXIMUM PRESSURE RANGE: 1/2 psi

PILOT GAS CONNECTION: 1/4"

PRESSURE TAP: 1/8" NPT

REGULATOR ADJUSTMENT: 2.5-5.0" WC

SHUTOFF: Non 100%

Control Voltage	Inlet/Outlet Size (In.)	BluH Capacity	Gas Type	Reducer Bushing Kit (In.)	Side Taps	White-Rodgers Model	Stock No.	List	Each	Shpg. Wt.
120 V, 60 Hz	3/4 x 3/4	280,000	Natural	(2) 3/4 x 1/2 1/2 x 3/8	No	21D18-3	2E563	\$379.66	\$190.50	4.0

PLUG-IN REPLACEMENT MERCURY SENSOR ORDERING DATA

Plug-In Bulb Style	Length (In.)	White-Rodgers Model	Stock No.	List	Each	Shpg. Wt.
#19	48	3098-134	1N180	\$114.35	\$77.50	0.3
#20	48	3098-156	1N187	114.35	77.50	0.3

*Replacement for many OEM type mercury sensors.

ROBERTSHAW INTERMITTENT PILOT GAS IGNITION SYSTEM

Robertshaw.



No. 4E396

- For converting conventional standing pilot systems to intermittent pilot systems
- Each kit includes: intermittent pilot module, dual combination valve, igniter-sensor assembly, ignition cable, and wiring harness

REGULATOR SETTING: Natural gas, 3.5" WC; LP gas, 11" WC

AMBIENT OPERATING RANGE: -40-175°F

MAXIMUM PRESSURE RANGE: 1/2 psi

PILOT GAS CONNECTION: 1/4"

PRESSURE TAP: 1/8" NPT

REGULATOR ADJUSTMENT: 3-7" WC

No. 4E396:

MAXIMUM LOCKOUT TIME: None. Continuous trial for ignition

SHUTOFF: Non-100%

No. 4E397:

MAXIMUM LOCKOUT TIME: 60 seconds

SHUTOFF: 100% after 3 trials for ignition

Control Voltage	Inlet/Outlet Size (In.)	BluH Capacity	Gas Type	Reducer Bushing Kit (In.)	Side Taps	Robertshaw Model	Stock No.	List	Each	Shpg. Wt.
24V, 60 Hz	1/2 x 3/4	200,000	Nat.	3/4 x 1/2	No	712-017	4E396	\$282.76	\$146.80	3.5
24V, 60 Hz	1/2 x 3/4	200,000	Nat. or LP	3/4 x 1/2	No	712-008	4E397	424.70	180.50	3.7

REPLACEMENT MODULES ORDERING DATA

Description	Robertshaw Model	Stock No.	List	Each	Shpg. Wt.
Control Module for Natural Gas System	780-001	4E958	\$198.76	\$105.30	1.3
Control Module for LP Gas System	780-002	4E959	210.19	112.75	1.7

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Roof and Wall Backdraft Dampers

Description

ROOF DAMPER

Dayton roof backdraft dampers are for use with centrifugal/axial roof ventilators (not supplied). Frame is constructed with 19 ga. galvanized steel axial roof, is 2" deep with a 1" flange. Blades are 26 ga. aluminum with felted edges for quiet operation.

WALL DAMPER

Dayton wall backdraft dampers are for use with wall mount ventilators (not supplied). Frame is constructed with 16 ga. extruded aluminum, is 1 3/4" deep with a 1 1/2" mounting flange. Blades are 26 ga. aluminum with felted edges for quiet operation.

Installation

ROOF MOUNTING

CAUTION Do not force damper in opening!

NOTE: We recommend that the minimum distance between the installed damper and ventilator be at least equivalent to 1/3 the overall diameter of the fan propeller blade.

WARNING Do not put your hand or arm through the damper blades when installing damper in opening.

1. Blades must operate freely when installed.
2. Mount damper in level position, avoid twisting damper frame.
3. In case of uneven mounting surface or binding of blades, leave mounting screws slightly loose.

WALL MOUNTING

NOTE: Arrow direction on side of damper. Always mount damper with arrow pointing in the up direction.

1. Mount damper squarely in the wall opening, avoid twisting damper frame.

WARNING Do not put your hand or arm through the damper blades when installing damper in opening.

2. Blades must open and close freely when installed.

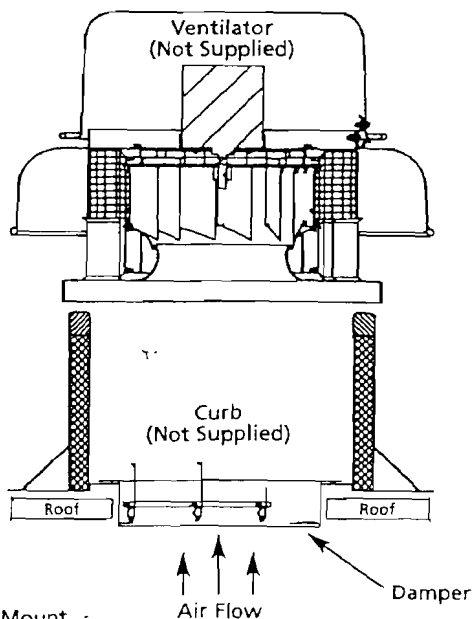
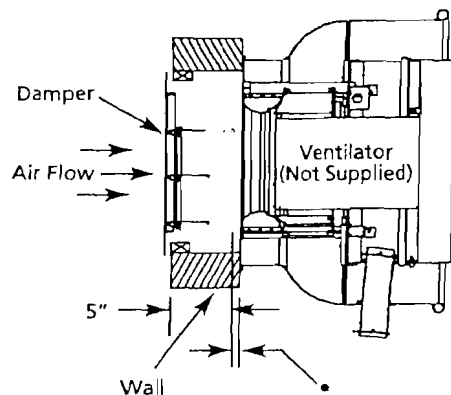


Figure 1 - Roof Mount



(*) Note: 2 Inches Minimum

Figure 2 - Wall Mount

Dayton® Roof and Wall Backdraft Dampers

E
N
G
L
I
S
H

Specifications

Model	Damper Size	Outside Dimensions	Shipping Wt. (lbs.)	Use With These Axial Roof Ventilators and Ventilator Models (UL 705 Only)
ROOF				
3TZ50	9½ X 9½"	11½ X 11½"	3	2C912, 4WN57
4HX64	12 X 12	14 X 14	5	4C097, 4HX80, 4HX91, 4HZ18, 4HZ19, 4HZ20, 4HZ21, 4HZ32, 4HZ33, 4HZ36, 4HZ37, 4WN58
4HX65	15 X 15	17 X 17	6	2C913, 4C204, 4HX81, 4HX82, 4HX92, 4HX93, 4HZ22, 4HZ23, 4HZ24, 4HZ25, 4HZ40, 4HZ41, 4HZ44, 4HZ45, 4WN59, 4WN60
4HX66	19 X 19	21 X 21	8	2C960, 4C205, 4HX83, 4HX84, 4HX94, 4HX95, 4HZ26, 4HZ27, 4HZ28, 4HZ29, 4HZ48, 4HZ49, 4HZ52, 4HZ53, 4WN61, 4WN62, 4WN63, 4WN64, 6C991
4HX67	23 X 23	25 X 25	9	4HX85, 4HX86, 4HX96, 4HX97, 4HZ30, 4HZ31, 4HZ56, 4HZ57
4HX68	27 X 27	29 X 29	13	4HX87, 4HX98, 4WN65
4HX69	35 X 35	37 X 37	20	4HX88, 4HX99, 4WN66
4HX70	39 X 39	41 X 41	26	4HX89, 4HZ01, 4WN67
4HX71	50 X 50	52 X 52	34	4HX90
WALL				
4HX72	8 X 8"	10¾ X 10¾"	5	4HZ34, 4HZ35
4HX73	10 X 10	12¾ X 12¾	5	4HZ38, 4HZ39
4HX33	11 X 11	13¾ X 13¾	6	4HZ42, 4HZ43
4HX74	12 X 12	14¾ X 14¾	6	4HZ46, 4HZ47
4HX75	13 X 13	15¾ X 15¾	7	4HZ50, 4HZ51
4HX76	14 X 14	16¾ X 16¾	7	4HZ54, 4HZ55
4HX77	15 X 15	17¾ X 17¾	8	4HZ58, 4HZ59

Limited Warranty

Dayton One-Year Limited Warranty. Roof and Wall Backdraft Dampers, Models covered in this manual, are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see PROMPT DISPOSITION below. This limited warranty gives purchasers specific legal rights which vary from jurisdiction to jurisdiction.

Limitation of Liability. To the extent allowable under applicable law, Dayton's liability for consequential and incidental damages is expressly disclaimed. Dayton's liability in all events is limited to and shall not exceed the purchase price paid.

Warranty Disclaimer. Dayton has made a diligent effort to provide product information and illustrate the products in this literature accurately; however, such information and illustrations are for the sole purpose of identification, and do not express or imply a warranty that the products are MERCHANTABLE, OR FIT FOR A PARTICULAR PURPOSE, or that the products will necessarily conform to the illustrations or descriptions.

Except as provided below, no warranty or affirmation of fact, expressed or implied, other than as stated in the "LIMITED WARRANTY" above is made or authorized by Dayton.

Product Suitability. Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Dayton attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714 U.S.A.

Manufactured for Dayton Electric Mfg. Co.
Niles, Illinois 60714 U.S.A.

Dayton®



OPERATING INSTRUCTIONS & PARTS MANUAL

GAS UNIT HEATERS WITH ELECTRONIC IGNITIONS

MODELS 3E366C THRU 3E368C, 3E369B THRU 3E375B,
3E379C THRU 3E381C, 3E382B THRU 3E386B,
3E406B & 3E407B

FORM 5S2486

08262
0993/267/1.5M

READ CAREFULLY BEFORE ATTEMPTING TO ASSEMBLE, INSTALL, OPERATE OR MAINTAIN THE PRODUCT DESCRIBED. PROTECT YOURSELF AND OTHERS BY OBSERVING ALL SAFETY INFORMATION. FAILURE TO COMPLY WITH INSTRUCTIONS COULD RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE!

RETAIN INSTRUCTIONS FOR FUTURE REFERENCE.

Description

Dayton gas unit heaters are factory assembled, low static pressure type, propeller fan heaters designed to be suspended within the space to be heated. THESE HEATERS ARE NOT TO BE CONNECTED TO DUCT-WORK. These units are certified by AGA/CGA. All models provide a minimum of 80% thermal efficiency. DO NOT MODIFY THESE GAS UNIT HEATERS IN ANY WAY!

NOTE: This equipment has been test fired and inspected. It has been shipped free from defects from our factory. However, during shipment and installation, problems such as loose wires, leaks or loose fasteners may occur. It is the installer's responsibility to inspect and correct any problem that may be found.

Unpacking

Inspect shipment immediately when received to determine if any damage has occurred to the unit during shipment. After the unit has been uncrated, check for any visible damage to the unit. If any damage is found, the consignee should sign the bill of lading indicating such damage and immediately file claim for damage with the transportation company.

General Safety Information

The following terms are used throughout this manual, in addition to AGA/CGA requirements, to bring attention to the presence of potential hazards or to important information concerning the product:

▲ DANGER

INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH, SERIOUS INJURY OR SUBSTANTIAL PROPERTY DAMAGE.

▲ WARNING ▲

INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH, SERIOUS INJURY OR SUBSTANTIAL PROPERTY DAMAGE.

▲ CAUTION

Indicates an imminent hazardous situation which, if not avoided, may result in minor injury or property damage.

Copyright 1993 WW Grainger, Inc.

NOTE: Used to notify of special instructions on installation, operation or maintenance which are important to equipment but not related to personal injury hazards.

▲ WARNING ▲

INSTALL, OPERATE AND MAINTAIN UNIT IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS TO AVOID EXPOSURE TO FUEL SUBSTANCES OR SUBSTANCES FROM INCOMPLETE COMBUSTION WHICH CAN CAUSE DEATH OR SERIOUS ILLNESS. THE STATE OF CALIFORNIA HAS DETERMINED THAT THESE SUBSTANCES MAY CAUSE CANCER, BIRTH DEFECTS, OR OTHER REPRODUCTIVE HARM.

FOR YOUR SAFETY

IF YOU SMELL GAS:

- 1. OPEN WINDOWS.**
- 2. DO NOT TOUCH ELECTRICAL SWITCHES.**
- 3. EXTINGUISH ANY OPEN FLAME.**
- 4. IMMEDIATELY CALL YOUR GAS SUPPLIER.**

FOR YOUR SAFETY

THE USE AND STORAGE OF GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN OPEN CONTAINERS IN THE VICINITY OF THIS APPLIANCE IS HAZARDOUS.

▲ WARNING ▲

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, INJURY OR DEATH. READ THE INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS THOROUGHLY BEFORE INSTALLING OR SERVICING THIS EQUIPMENT.

Specifications & Performance Chart No. 1

NATURAL GAS		PROPANE GAS		NATURAL AND PROPANE GAS									
MODEL NO.	GAS INLET	MODEL NO.	GAS INLET	BTU/HR INPUT	FAN CFM	FAN DIA.	MOTOR HP	FLUE	HT.	OVERALL WIDTH	DEPTH	APPROX. SHP WT.	HANGER C* DIM. A
3E366C	1/2"	3E379C	1/2"	30,000	700	12"	1/30	4"R, V	25 ³ / ₄ "	14"	19 ³ / ₈ "	72 lbs.	8 ⁵ / ₈ "
3E367C	1/2	3E380C	1/2	45,000	800	12	1/30	4R, V	25 ³ / ₄	14	19 ³ / ₈	82	8 ⁵ / ₈
3E406B	1/2	3E407B	1/2	60,000	1050	14	1/30	5R, V	25 ³ / ₄	17 ¹ / ₂	19 ³ / ₈	98	14 ¹ / ₈
3E368C	1/2	3E381C	1/2	75,000	1100	14	1/30	5R, V	25 ³ / ₄	17 ¹ / ₂	19 ³ / ₈	104	14 ¹ / ₈
3E369B	1/2	3E382B	1/2	100,000	1480	14	1/20	6R, V	31 ¹ / ₄	17 ⁷ / ₈	26 ³ / ₄	178	14 ³ / ₈
3E370B	1/2	3E383B	1/2	125,000	1650	16	1/10	6R, V	31 ¹ / ₄	20 ⁵ / ₈	26 ³ / ₄	200	17 ¹ / ₂
3E371B	1/2	3E384B	1/2	150,000	2200	16	1/4	7R, H	36 ¹ / ₄	20 ⁵ / ₈	26 ³ / ₄	209	17 ¹ / ₂
3E372B	1/2			175,000	2530	18	1/3	7R, H	36 ¹ / ₄	23 ³ / ₈	26 ³ / ₄	232	20 ¹ / ₄
3E373B	1/2	3E385B	1/2	200,000	2640	18	1/3	8R, H	36 ¹ / ₄	26 ¹ / ₈	26 ³ / ₄	242	23
3E374B	3/4			225,000	2700	18	1/3	8R, H	36 ¹ / ₄	28 ⁷ / ₈	30 ³ / ₄	279	25 ¹ / ₂
3E375B	3/4	3E386B	1/2 or 3/4	250,000	3100	18	1/3	8R, H	36 ¹ / ₄	31 ¹ / ₈	30 ³ / ₄	301	28 ¹ / ₄

R = Round V = Vertical H = Horizontal

(*) See Figure 4.

Gas Pipe Sizing Chart No. 2

MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR FOR GAS PRESSURES OF 0.5 PSIG OR LESS AND A PRESSURE DROP OF 0.3 INCH WATER COLUMN (BASED ON A 0.60 SPECIFIC GRAVITY GAS)														
NOMINAL IRON PIPE SIZE (INCHES)	LENGTH IN FEET													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	132	92	73	63	56	50	46	43	40	38	34	31	28	26
3/4	278	190	152	130	115	105	96	90	84	79	72	64	59	55
1	520	350	285	245	215	195	180	170	160	150	130	120	110	100
1 ¹ / ₄	1050	730	590	500	440	400	370	350	320	305	275	250	225	210
1 ¹ / ₂	1600	1100	890	760	670	610	560	530	490	460	410	380	350	320
2	3050	2100	1650	1450	1270	1150	1050	990	930	870	780	710	650	610
2 ¹ / ₂	4800	3300	2700	2300	2000	1850	1700	1600	1500	1400	1250	1130	1050	980
3	8500	5900	4700	4100	3600	3250	3000	2800	2600	2500	2200	2000	1850	1700
4	17500	12000	9700	8300	7400	6800	6200	5800	5400	5100	4500	4100	3800	3500

NOTE:

- Determine required CU.FT/HR by dividing BTU/HR input from rating plate by 1,000.
- For Natural Gas: Select pipe size directly from chart.
- For Propane Gas: Multiply CU.FT/HR from Step #1 by 0.633 before entering chart.

General Safety Information

- This heater is intended **ONLY** for permanent installation in accordance with the National Electrical Code (NEC), ANSI Standard Z223.1-1992 (NFPA No. 54: "National Fuel Gas Code"), all applicable local codes and ordinances, and all sections of this manual. Standards referred to herein are those that were applicable at the time the design of the heater was certified. ANSI Standards are available from the American Gas Association, 1515 Wilson Blvd., Arlington VA 22209. NFPA Standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

be done and checked by a qualified electrician, using copper wire only. All gas connections should be made and leak-tested by a suitably qualified individual, per instructions in this manual.

- Use only the fuel for which the heater is designed (see nameplate). Using LP gas in a heater that requires natural gas, or vice versa, will create the risk of gas leaks, carbon monoxide poisoning and explosion.

⚠ WARNING ⚠

DO NOT ATTEMPT TO CONVERT THE HEATER FOR USE WITH A FUEL OTHER THAN THE ONE INTENDED. SUCH CONVERSION IS DANGEROUS, AS IT WILL CREATE THE RISKS LISTED ABOVE.

NOTE: This heater is suitable for use in airplane hangars when installed in accordance with ANSI/NFPA No. 409 and in public garages when installed in accordance with NFPA No. 88A and NFPA No. 88B.

- Follow installation instructions **CAREFULLY** to avoid creating unsafe conditions. All wiring should

- Make certain that the power source conforms to the electrical requirements of the heater.

General Safety Information (Continued)**⚠ WARNING ⚠**

DISCONNECT POWER BEFORE INSTALLING OR SERVICING THE HEATER. IF THE POWER DISCONNECT IS OUT OF SIGHT, LOCK IT IN THE OPEN POSITION AND TAG IT TO PREVENT UNEXPECTED APPLICATION OF POWER. FAILURE TO DO SO COULD RESULT IN FATAL ELECTRIC SHOCK.

⚠ WARNING ⚠

DO NOT DEPEND UPON A THERMOSTAT OR OTHER SWITCH AS SOLE MEANS OF DISCONNECTING POWER WHEN INSTALLING OR SERVICING HEATER. ALWAYS DISCONNECT POWER AT MAIN CIRCUIT BREAKER AS DESCRIBED ABOVE. FAILURE TO DO SO COULD RESULT IN FATAL ELECTRIC SHOCK.

5. Special attention must be given to any grounding information pertaining to this heater. To prevent the risk of electrocution, the heater must be securely and adequately grounded. This should be accomplished by connecting a grounded conductor between the service panel and the grounding screw provided in the conduit box of the heater. To ensure a proper ground, the grounding means must be tested by a qualified electrician.
6. Do not insert fingers or foreign objects into the heater or its air moving device. Do not block or tamper with the heater in any manner while in operation or just after it has been turned off, as some parts may be hot enough to cause injury.
7. This heater is intended for general heating applications **ONLY**. It must **NOT** be used in potentially dangerous locations such as flammable, explosive, chemical-laden or wet atmospheres.
8. Do not attach ductwork to this product or use it as a makeup air heater. Such usage voids the warranty and will create unsafe operation.
9. In cases in which property damage may result from malfunction of the heater, a backup system or a temperature sensitive alarm should be used.
10. The venting system shall be in accordance with the heater manufacturer's installation instructions.

Installation**LOCATING HEATING**

Location of unit heaters is related directly to the selection of sizes. Basic rules to follow:

1. Mounting height: As a general rule, unit heaters must be installed 8 feet above the floor. Less efficient air distribution results at higher levels. Of course, there are exceptions to this principle. Occasionally unit heaters must be mounted at 12 to 16 feet above the floor to clear obstacles. In this case, it is advisable to use centrifugal blower heaters. One exception to the minimum mounting height would be in a school classroom or other structures where ceiling heights are 10 feet or less if permitted by local codes.
2. Unit heaters should be installed in airplane hangars and public garages as follows: In airplane hangars,

units must be at least 10 feet above the upper surface of wings or engine enclosures of the highest aircraft to be stored in the hangar and 8 feet above the floor in shops, offices, and other sections of the hangar where aircraft are not stored or housed. Refer to ANSI/NFPA No. 409.

3. In public garages, unit heaters must be at least 8 feet above the floor. Refer to NFPA No. 88A Parking Structures and NFPA No. 88B Repair Garages.
4. Air distribution: Direct air towards areas of maximum heat loss. When multiple heaters are involved, circulation of air around the perimeter is recommended (where heated air flows along exposed walls). Satisfactory results can also be obtained where multiple heaters are located toward the center of the area with heated air directed toward the outside walls. Be careful to avoid obstacles and obstructions which could impede cool air distribution patterns. Heat throw distances as well as examples of heater location are presented (see chart below).

LOCATIONS TO AVOID

Unit heaters should not be installed within corrosive or flammable atmospheres. Do not locate any gas fired heater where air for combustion contains chlorinated vapors or acid fumes. Avoid locations where extreme drafts can affect burner operation.

⚠ CAUTION ⚠

Presence of these air impurities can cause premature failure of the heat exchanger and void the warranty. (See Limited Warranty on page 11.)

Unit heaters should not be installed to maintain low temperatures and/or freeze protection of buildings. A minimum of 50°F thermostat setting must be maintained.

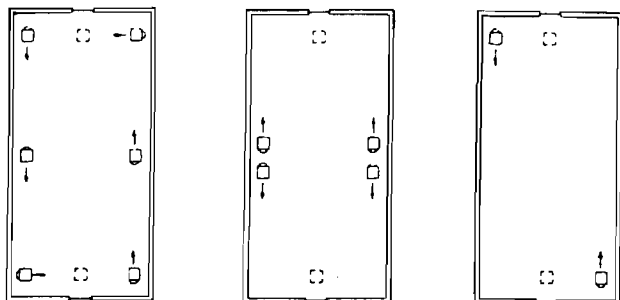
If unit heaters are operated to maintain lower than 50°F, hot flue gases are cooled inside heat exchanger to point where water vapor (a flue gas by-product) condenses onto the heat exchanger walls. The result is a mildly corrosive acid that prematurely corrodes the aluminized heat exchanger and can actually drip water down from the unit heater onto floor surface. Additional unit heaters should be installed if a minimum 50°F thermostat setting cannot be maintained.

The unit heater **MUST** be installed such that the gas ignition control system is not directly exposed to water spray, rain, or dripping water.

Chart No. 3

APPROXIMATE DISTANCE OF HEAT THROW (FEET)											
HT.	Size Unit — BTU Input (Multiply by 1000)										
	25	30/45	60	75	100	125	150	175	200	225	250
8'	15	33	33	40	60	65	70	75	80	85	90
10'	NR	28	28	35	54	56	60	64	68	72	78
12'	NR	NR	NR	NR	44	46	49	57	61	65	68
15'	NR	NR	NR	NR	NR	NR	45	49	52	56	60
20'	NR	NR	NR	NR	NR	NR	NR	NR	46	50	54

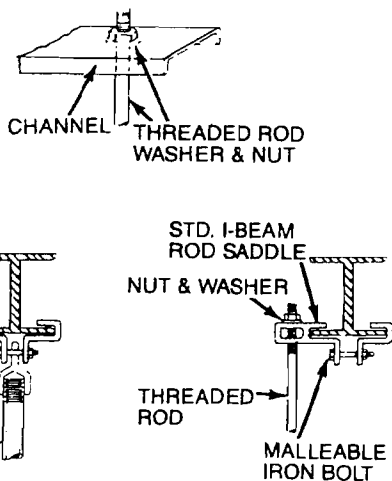
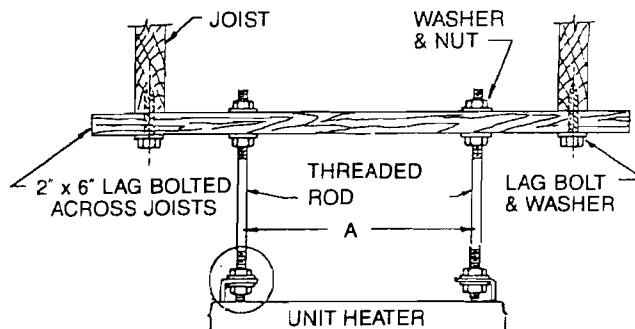
NR = Not recommended.

Installation (Continued)**Figure 1 — Locating the Heaters**

NOTE: Unit heater sizing should be based upon heat loss calculations where unit heater output equals or exceeds heat loss. Heater output is approximately 80% of input BTU/HR rating.

CLEARANCES

1. Every gas appliance shall be located with respect to building construction and other equipment so as to permit access to the appliance. Clearance between the vertical walls and the vertical sides of the appliance shall be no less than 18". Minimum clearance between the top of the appliance and the ceiling is 6".
2. Minimum clearance from combustibles to the bottom of the unit is 12"; however, this bottom clearance should be maintained at 2" for access to the burners. The minimum clearance from combustibles to the flue collector is 6". Adequate clearance must be maintained around air openings into the combustion chamber.

**HEATER MOUNTING
STEEL CONSTRUCTION*****Figure 2****WOOD CONSTRUCTION JOISTS***

▲SEE CHART NO. 1 FOR "A" DIMENSION

*ALL HANGING HARDWARE & WOOD NOT INCLUDED.

Figure 3 — Mounting Heaters**AIR FOR COMBUSTION**

Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting, and the maintenance of ambient temperature at safe limits under normal conditions of use. Appliances shall be located in such a manner as not to interfere with proper circulation of air within the confined space. When buildings are so tight that normal infiltration does not meet air requirements, outside air shall be introduced per Sections 1.3.4.2 and 1.3.4.3. of ANSI Z223.1 for combustion requirements. A permanent opening or openings having a total free area of not less than one square inch per 5,000 BTU/HR of total input rating of all appliances within the space shall be provided.

AFTER SUSPENSION IS COMPLETED

(See Figures 2 & 3)

Proceed as follows: After unit heater is hung — level from side to side and front to back (from the two balanced suspension points):

▲ WARNING ▲

MAKE CERTAIN THAT THE STRUCTURE TO WHICH THE HEATER IS TO BE MOUNTED IS CAPABLE OF SAFELY SUPPORTING ITS WEIGHT. UNDER NO CIRCUMSTANCES MUST THE GAS LINES OR THE ELECTRICAL CONDUIT BE USED TO SUPPORT THE HEATER. FAILURE TO HEED THESE WARNINGS MAY RESULT IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

GAS CONNECTIONS:

(See Figures 4, 5 and Chart No. 2)

Unit heater must be connected to a gas supply source capable of supplying its full rated BTU capacity at a pressure not less than 5" WC nor greater than 14" WC for natural gas. For propane gas service, the manifold pressure must be 10" WC. A regulator (not supplied) must be field installed at LP tank to assure pressure is not greater than 14" WC. The connecting pipe should be sized in accordance with the ANSI Standard Z223.1

Installation (Continued)

National Fuel Gas Code. See gas pipe sizing chart for proper size of gas supply piping. The gas piping supplied by the unit heater manufacturer has been tested for leaks. A ground joint union and a manual gas valve should be installed ahead of the unit heater controls to permit servicing. It is recommended that pipe compound which is resistant to the action of liquified petroleum gases be used. **Do not overtighten the inlet gas piping into the valve. This may cause stresses that would crack the valve.** The gas supply piping and all factory unit piping should be checked for gas leaks with a soapy water solution or some other approved method **but never with matches or any other source of ignition.**

⚠ WARNING ⚠

THE APPLIANCE AND ITS INDIVIDUAL SHUTOFF VALVE MUST BE DISCONNECTED FROM THE GAS SUPPLY PIPING SYSTEM DURING ANY PRESSURE TESTING OF THAT SYSTEM AT TEST PRESSURES IN EXCESS OF 1/2 PSI (3.5 KPA). THE APPLIANCE MUST BE ISOLATED FROM THE GAS SUPPLY PIPING SYSTEM BY CLOSING ITS INDIVIDUAL MANUAL SHUTOFF VALVE DURING ANY PRESSURE TESTING OF THE GAS SUPPLY PIPING SYSTEM AT TEST PRESSURES EQUAL TO OR LESS THAN 1/2 PSI (3.5 KPA). A DRIP LEG MUST BE INSTALLED AHEAD OF THE UNIT. A 1/8" NPT PLUGGED TAPPING ACCESSIBLE FOR TEST GAUGE CONNECTION, MUST BE INSTALLED IMMEDIATELY UPSTREAM OF THE GAS SUPPLY CONNECTION TO THE APPLIANCE.

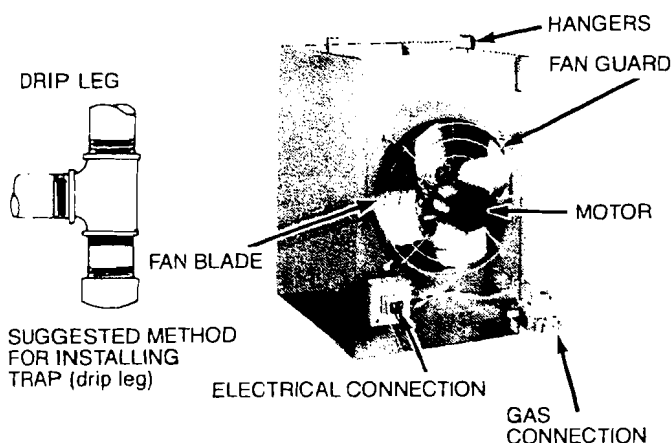


Figure 4 — Installing Drip Leg

IMPORTANT: HEATER INSTALLATION FOR USE WITH PROPANE (BOTTLED) GAS MUST BE MADE BY A QUALIFIED L.P. GAS DEALER OR INSTALLER. HE WILL ENSURE THAT PROPER JOINT COMPOUNDS ARE USED FOR MAKING PIPE CONNECTIONS; THAT AIR IS PURGED FROM LINES; THAT A THOROUGH TEST IS MADE FOR LEAKS BEFORE OPERATING HEATER; AND THAT IT IS PROPERLY CONNECTED TO THE PROPANE GAS SUPPLY SYSTEM.

ELECTRICAL CONNECTIONS: (See Figures 5, 6, 7 & 8) Standard units are shipped for use on 115 volt, 60 hertz single phase electric power. Check the motor nameplate and electrical rating on the transformer before energizing the unit heater electrical system. The wiring of the unit heater conforms to the standard as set forth in ANSI Standard Z83.8. The external wiring must conform to the National Electrical Code and applicable local codes. It is recommended that the electrical power supply to the unit heater be provided from a fused, separate, and permanently live electrical circuit. This unit must be electrically grounded according to the National Electrical Code ANSI/NFPA-70-1993. See thermostat connections.

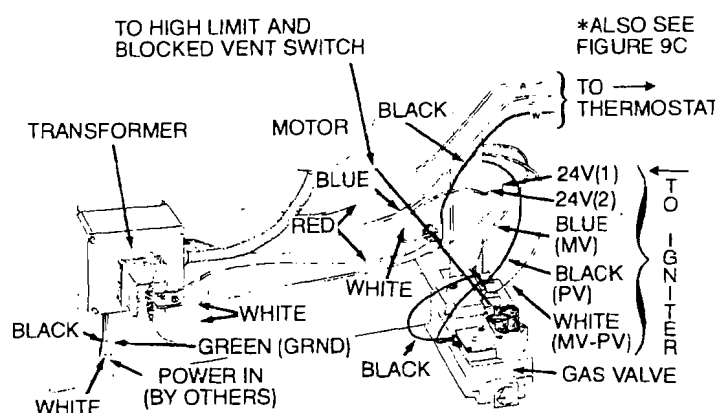


Figure 5 — Valve Transformer & Thermostat Connections

The transformer supplied with this unit heater is internally fused. Any overload or short circuit will ruin the transformer. **DO NOT USE A SCREWDRIVER ACROSS THE TERMINALS TO CHECK FOR POWER.** Use a voltmeter.

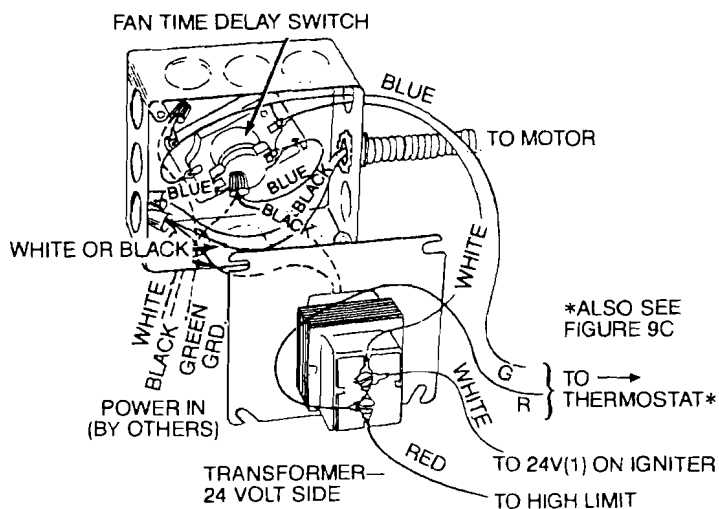
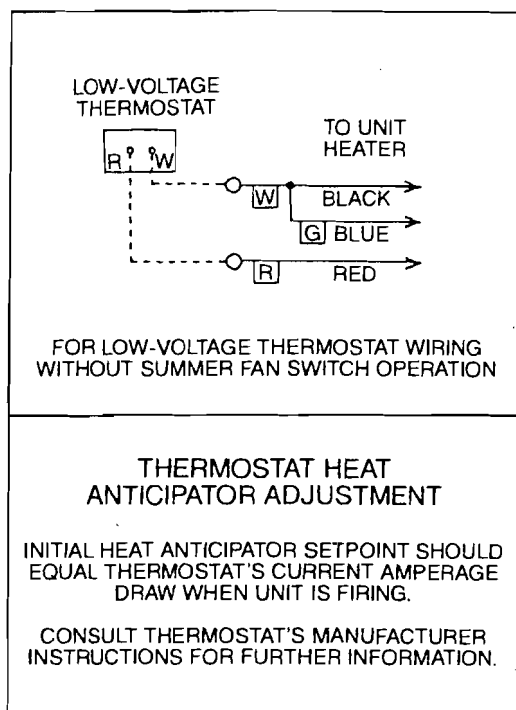


Figure 6 — Junction Box Wiring

Installation (Continued)

5/14/93

C1267G

Figure 9C — For Low-Voltage Thermostat Wiring w/o Summer Fan Operation and Anticipator Adjustments

intervals of four feet to prevent sagging. The venting should comply with Part 7, Venting of Equipment of the National Fuel Gas Code, ANSI Z223.1-1992 or applicable provisions of local building codes. The venting system should be checked to determine whether or not there is adequate draft to assure proper venting of the appliance.

Other considerations to which governing codes should be applied are: vent clearances from combustible materials, vent termination above the roof, dilution air for venting, and combined vents.

In buildings where negative pressures are created by exhaust fans or other causes, the negative pressure will cause downdraft conditions in a gravity vent. Here "Make-up Air Heaters" should be specified. Do not try to use Powered Vents to overcome a negative pressure problem.

Vent connectors serving Category I heaters shall not be connected into any portions of mechanical draft systems operating under positive pressure.

Diameter for vent pipe from unit heater to stack should never be less than that of vent outlet in unit. When a common vent is used for more than one unit, refer to NFPA No. 54 for venting design.* **Length of vent pipe from unit heater to stack should be kept at a minimum and should not exceed 75 percent of the height of the vertical flue section.** Vent pipe should be at least 6" from combustible material and should be properly insulated when passing through combustible partitions. Where vent goes directly from unit through roof, the vertical stack should be at least 5 feet and an approved type weather cap should be used. Top of vertical stack should be at least 2 feet above the highest point of roof. Responsibility of providing adequate vent rests with the installer of this equipment.

VENTING: See Figure 5.

CAUTION

This unit heater is equipped with a blocked vent (spill) shutoff switch.

If the venting system becomes blocked or there is continuous spillage the vent shutoff switch will shut off the unit heater. Before resetting the switch check to see if the vent system is blocked. Remove any blockage.

To reset the switch (which is located in the upper right side of the draft diverter), push the reset button after the unit heater has cooled down.

NOTE: The switch will not reset hot.

All unit heaters must be vented. They should be vented with a UL listed Type B vent, a factory built chimney, or a lined brick and mortar chimney that has been constructed in accordance with the National Building Code. The horizontal section of the vent connector should slope upward from the heater at the rate of 1/4" per foot of length. Horizontal portions of the venting system shall be supported at maximum

FOR 30,000 THRU 125,000
MODELS ONLY.

FOR 150,000 THRU
250,000 MODELS

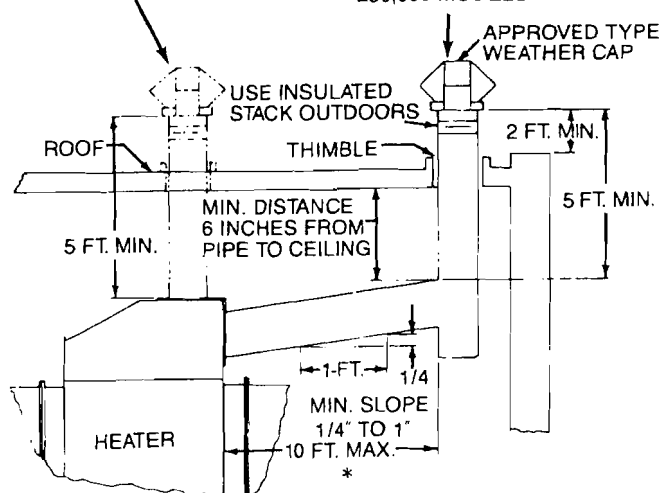


Figure 9 — Venting

Operation

EXPLANATION OF CONTROLS

1. The unit heater is equipped with a dual automatic gas valve and electric ignition device (separate from the gas valve on some models) which provide the following functions:
 - a. Pilot solenoid valve is energized and pilot is electrically ignited when thermostat calls for heat.
 - b. Electronic circuitry proves that pilot flame is established, then energizes main gas solenoid valve.
 - c. When thermostat is satisfied, main gas solenoid valve and pilot solenoid valve are de-energized, stopping all flow of gas.
 - d. Pilot solenoid valve also functions as a main gas valve to provide redundancy.
 - e. Pressure regulator provides proper and steady gas pressure to the main burners.
 - f. Manual shutoff valve for service and long term shut-down. (Separate from the automatic valve on some models.)
2. The limit switch interrupts the flow of electric current to the main gas valve in case the heater becomes overheated.
3. The fan switch delays the operation of the fan until the heater is warmed, then keeps the fan running after the gas has been turned off until the useful heat has been removed. The startup fan delay must not exceed 90 seconds from a cold start.
4. The wall thermostat is a temperature sensitive switch which turns the main gas valve ON or OFF to control the temperature of the space being heated. It must be mounted on vibration-free, vertical surface away from air currents, in accordance with the instructions furnished with the thermostat.

INITIAL LIGHTING INSTRUCTIONS

IMPORTANT: NEVER OVERFIRE THIS UNIT HEATER, AS UNSATISFACTORY OPERATION OR SHORT LIFE MAY RESULT.

1. Open the manual gas valve supplying gas to the unit heater and, with the union connection loose, purge air from gas line. Tighten union and check for gas leaks, using a soapy water solution only.
2. Open manual valve on unit heater.
3. Turn ON electrical power.
4. Unit should be under control of thermostat. Turn thermostat to highest point and determine that pilot and main burners ignite. Turn thermostat to lowest point and determine that pilot and main burners are extinguished.
5. If pilot adjustment is required, remove pilot adjustment seal cap and adjust pilot screw to obtain proper flame. Clockwise rotation decreases pilot flame size. Replace cap.
6. Turn thermostat to desired position.

TO CHECK GAS INPUT RATE

1. Turn OFF all gas appliances that use gas through the same meter as the unit heater.
2. Turn gas ON to the unit heater.

3. Clock the time in seconds required to burn one cubic foot of gas by checking the gas meter.
4. Insert the time required to burn one cubic foot of gas in the following formula and compute the input rate.

$$\frac{3600 (\text{Sec. Per Hr.}) \times \text{Btu./Cu. Ft.}}{\text{Time (Sec.)}} = \text{INPUT RATE}$$

EXAMPLE: Assume the Btu content of 1 cubic foot of gas equalled 1000 and that it takes 18 seconds to burn one cubic foot of gas.

$$\frac{3600 \times 1000}{18} = 200,000 \text{ BTU/HR}$$

NOTE: If computation exceeds or is less than 95% of gas BTU/HR input rating (see Specifications), adjust gas pressure.

GAS PRESSURE ADJUSTMENT

1. **NATURAL GAS:** Best results are obtained when the unit heater is operating at its full input rating with the manifold pressure of 3.5" WC. Adjustment of the Pressure Regulator is not normally necessary since it is preset at the factory. However, field adjustment may be accomplished as follows:
 - a. Attach manometer at pressure tap plug below control outlet.
 - b. Remove regulator adjustment screw cap located on combination gas valve.
 - c. With small screwdriver, rotate adjustment screw counterclockwise to decrease or clockwise to increase pressure.

CAUTION

Do not force beyond stop limits!

- d. Replace regulator adjustment screw cap.
2. **PROPANE GAS:** An exact manifold pressure of 10.0" WC must be maintained for proper operation of the unit heater. If the unit is equipped with a pressure regulator on the combination gas valve, follow steps (a) through (d) above. If the unit is not equipped, the propane gas supply system pressure must be regulated to attain this manifold operating pressure.
3. Ratings of gas appliances are based on sea level operation and need not be changed for operation at elevations up to 2,000 feet. For operation at elevations above 2,000 feet, input ratings should be reduced at the rate of 4 percent for each 1,000 feet above sea level. (Also see Canadian Installations).

CAUTION

Do not attempt to de-rate the heater by installing blank (undrilled) orifices. This may cause hot spots on the heat exchanger and significantly shorten its life. Holes in the heat exchanger may allow harmful combustion products to enter the space being heated.

Operation (Continued)

4. After the unit heater has been operating for at least 15 minutes, adjust the primary air flow to the burners as follows; turn friction locked manually rotated air shutters clockwise to close; counterclockwise to open. (See Figure 11.)
5. For correct air adjustment, close air shutter until yellow tips in flame appear. Then open air shutter to the point just beyond the position where yellow tipping disappears. On some propane units air shutter may be completely closed for correct adjustment.

⚠ CAUTION

There may be momentary and spasmodic orange flashes in the flame. This is caused by the burning of airborne dust particles, and is not to be confused with the yellow tipping, which is a stable or permanent situation, when there is insufficient primary air.

6. If thermostat employed has an adjustable heat anticipator, adjust the heat anticipator to match the thermostat amperage draw while unit is firing. For further information, consult the thermostat manufacturer's literature.

Maintenance**⚠ WARNING ⚠**

DISCONNECT ALL POWER SOURCES RELATED TO THE INSTALLATION BEFORE SERVICING ANY COMPONENT.

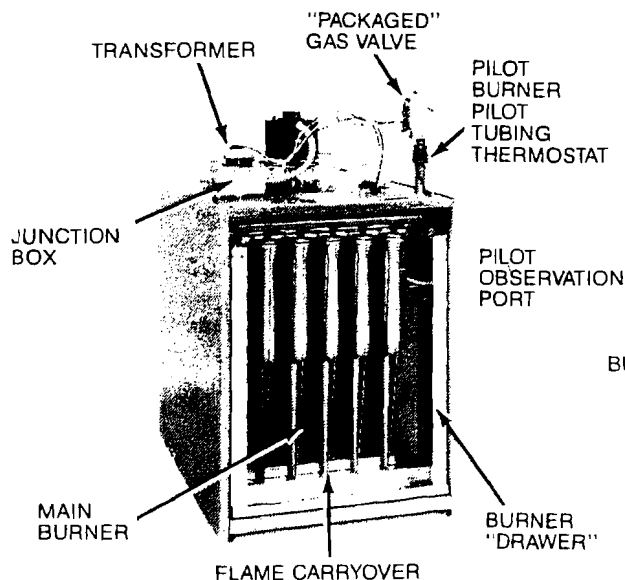


Figure 10

1. Inspect fan blade and guard for accumulation of lint or other foreign material. Clean as appropriate to maintain efficient air flow.
2. Check lubrication instructions on motor. If oiling is required, add 3 to 4 drops of electric motor oil to the motor as follows, depending on service.
 - a. Light Duty — After 3 years or 25,000 hours of operation.
 - b. Average Duty — Annually after 3 years or 8,000 hours of operation.
 - c. Heavy Duty — Annually after 1 year or at least every 1500 hours of operation.

⚠ CAUTION**Do not over oil!**

3. To clean or replace the main burners, turn OFF both electric power supply and gas supply to the unit heater and proceed as follows:
 - a. Remove bottom panel.
 - b. Compress spring by moving burner toward manifold; slide opposite end of burner downward from locating slot while retaining spring is still compressed.
 - c. Pull burner away from heater.
 - d. To clean burners, remove any dust, dirt, or other foreign matter using a bristle brush and/or compressed air. Ensure that all ports are unobstructed. Inspect and clean pilot burner if necessary.
4. Replace all parts in reverse order.

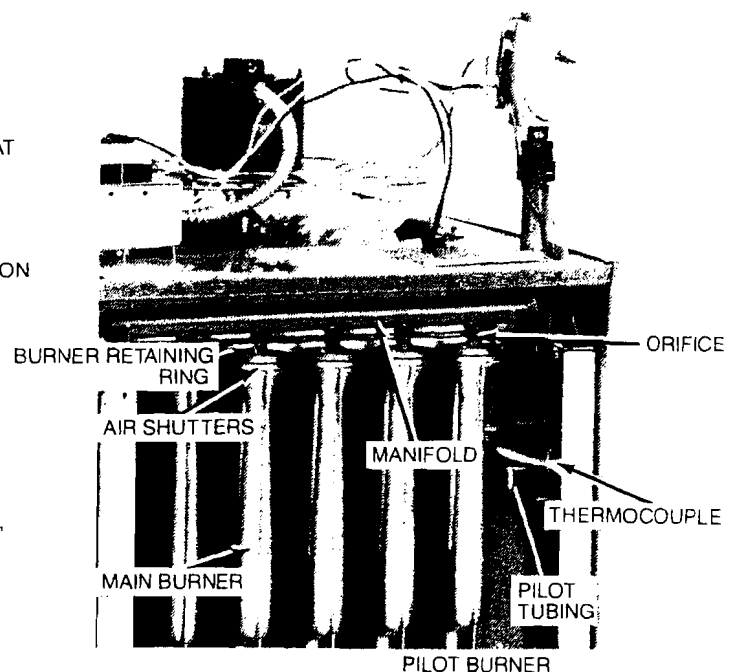


Figure 11 — Pilot Burner

For Canadian Installations Only

The following instructions apply to Canadian installations in addition to installation and operating instructions:

1. Installation must conform with local building codes, or in absence of local codes, with current CAN/CGA B149.1, Installation Codes for Natural Gas Burning Appliances and Equipment, or CAN/CGA B149.2, Installation Codes for Propane Gas Burning Appliances and Equipment.
2. Any references to U.S. standards or codes in these instructions are to be ignored and the applicable Canadian standards or codes applied.
3. Any references to deration at altitudes in excess of 2000 feet are to be ignored. When installed in heaters must be orificed to 90% of the normal altitude rating, and be so marked in accordance with the C.G.A. certification.
4. Unit heaters are designed and certified to comply with CAN/CGA 2.6.
5. In Canada, installation in airplane hangars when acceptable to the enforcing authorities, and in public garages when installed in accordance with current CAN/CGA B149 Installation Codes for Gas Burning Appliances and Equipment.
6. All electrical connections must be in accordance with the Canadian Electrical Code, Part 1, CSA Standard C22.1.

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. Gas unit heaters, Models 3E366C thru 3E368C, 3E369B thru 3E375B, 3E379C thru 3E381C, 3E382B thru 3E386B, 3E406B & 3E407B, are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined by Dayton to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see **PROMPT DISPOSITION** below. This limited warranty gives purchasers specific legal rights which vary from state to state.

LIMITATION OF LIABILITY. To the extent allowable under applicable law, Dayton's liability for consequential and incidental damages is expressly disclaimed. Dayton's liability in all events is limited to, and shall not exceed, the purchase price paid.

WARRANTY DISCLAIMER. Dayton has made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit a particular purpose, or that the products will necessarily conform to the illustrations or descriptions.

Except as provided below, no warranty or affirmation of fact, expressed or implied, other than as stated in "LIMITED WARRANTY" above is made or authorized by Dayton.

PRODUCT SUITABILITY. Many states and localities have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Dayton attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, please review the product application, and national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some states do not allow limitations on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

PROMPT DISPOSITION. Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, IL 60714

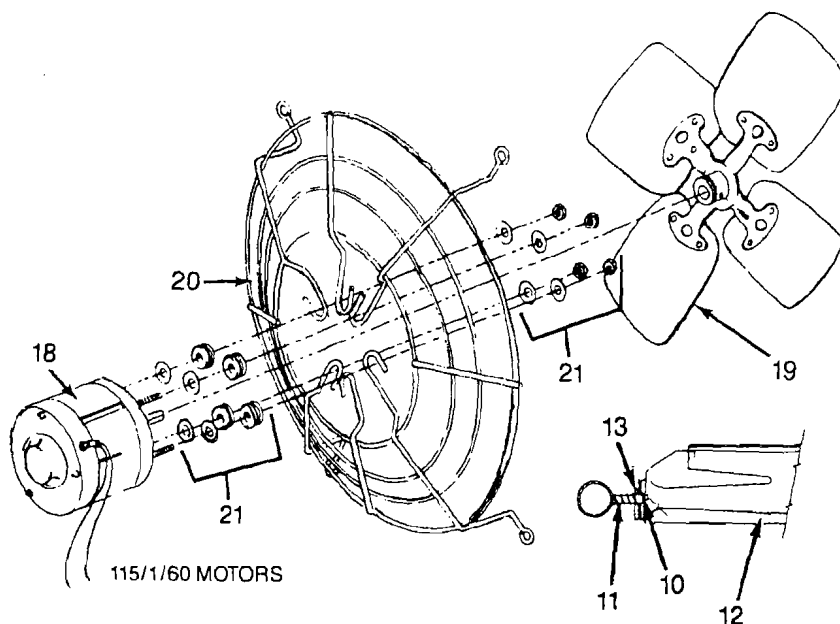


Figure 12 — Heat Exchanger & Components
Replacement Parts Illustration

**ORDER REPLACEMENT PARTS
BY CALLING TOLL FREE
1-800-323-0620**

Please provide following information:

- Model Number
- Serial Number (if any)
- Part Description and Number as shown in Parts List.

Address parts correspondence to:

Parts Company of America
1657 Shermer Road
Northbrook, IL 60062-5362



Replacement Parts List for Figures 12-14 Chart No. 4

REF. NO.	DESCRIPTION	FOR SIZES Nat. L.P.	30	45	60	75	100	125	150	175	200	225	250
			3E366C	3E367C	3E406B	3E368C	3E369B	3E370B	3E371B	3E372B	3E373B	3E374B	3E375B
			3E379C	3E380C	3E407B	3E381C	3E382B	3E383B	3E384B	—	3E385B	—	3E386B
1	Heat exchanger (only)		20030	20045	20060	20075	20004	20005	20006	20007	20008	20009	20010
2	Draft diverter		20330	20345	20360	20375	20304	20305	20306	20307	20308	20309	20310
3	Burner drawer (only)		(Part of Heat Exchanger Assembly)				20504	20505	20506	20507	20508	20509	20510
†4	Main gas valve	Nat. L.P.	21500 21505A	21500 21505A	21500 21505A	21500 21505A	21501 21504	21501 21504	21501 21504	21501 —	21501 21504	21502 —	21502 21504
5	G67 Sensor lead		21511	21511	21511	21511	NA	NA	NA	NA	NA	NA	NA
6	G67 Sensor probe		21510	21510	21510	21510	NA	NA	NA	NA	NA	NA	NA
†8	Igniter	Nat. L.P.	(Included with Main Gas Valve)				21522 21524	21522 21524	21522 21524	21522 —	21522 21524	21522 —	21522 21524
†9	Pilot burner assy.	Nat. L.P.	21508 21509	21508 21509	21508 21509	21508 21509	21512 21513	21512 21513	21512 21513	21512 —	21512 21513	21512 —	21512 21513
10	Burner orifice set	Nat. L.P.	21048 21065	21049 21066	21050 21067	21051 21068	21052 21069	21053 21070	21054 21071	21055 —	21056 21073	21057 —	21058 21075
11	Burner spring set		21079	21080	21081	21082	21081A	21082A	21083	21084	21085	21086	21087
12	Main burner set (Alum.)		21014	21015	21016	21017	21018	21019	21020	21021	21022	21023	21024
13	Air shutter set		21091	21092	21093	21094	21093A	21094A	21095	21096	21097	21098	21099
14	Burner manifold		21106	21107	21108	21109	21110	21111	21112	21113	21114	21115	21116
15	Pilot tubing		21515	21515	21515	21515	21515	21515	21515	21515	21515	21515	21515
16	Transformer 115/24, 40 VAC		4X746	4X746	4X746	4X746	4X746	4X746	4X746	4X746	4X746	4X746	4X746
17	Mounting plate		4X748	4X748	4X748	4X748	4X748	4X748	4X748	4X748	4X748	4X748	4X748
18	Motor		23301	23301A	23301B	23301C	23302	23303	23304	23305	23305A	23305B	23305C
19	Fan blade		23307	23307A	23308	23308A	23308B	23309	23309A	23310	23310A	23310B	23310C
20	Fan guard		23312	23312A	23313	23313A	23313B	23313C	23313D	23314	23314A	23314B	23314C
21	Hardware kit		23315	23315	23315	23315	23315	23315	23315	23315	23315	23315	23315
†22	Electrode sensor/lead		NA	NA	NA	NA	21514	21514	21514	21514	21514	21514	21514
23	Blocked vent (spill) switch		21125	21125	21125	21127	21126	21126	21126	21126	21126	21126	21126
△	High limit switch		21120B	21120B	21120B	21120B	21120	21120	21120	21120	21120	21120	21120
△	Fan time delay*		21121	21121	21121	21121	21121	21121	21121	21121	21121	21121	21121
△	Louver spring set		22030	22045	22060	22075	25004	25005	25006	25007	25008	25009	25010
△	Louver horizontal set		22130	22145	22160	22175	25104	25105	25106	25107	25108	25109	25110
△	Right side panel		22230R	22245R	22260R	22275R	25204R	25205R	25206R	25207R	25208R	25209R	25210R
△	Left side panel		22230L	22245L	22260L	22275L	25204L	25205L	25206L	25207L	25208L	25209L	25210L
△	Bottom panel		22330	22345	22360	22375	25304	25305	25306	25307	25308	25309	25310
△	Venturi panel		NA	NA	NA	NA	25704	25705	25706	25707	25708	NA	NA
△	Venturi extension assy.		NA	NA	NA	NA	NA	NA	NA	NA	NA	25709	25710
△	Bottom rear extension assy.		NA	NA	NA	NA	NA	NA	NA	NA	NA	25809	25810

(*) Fan Time Delay is located inside Junction Box.

(△) Not shown.

(†) 30 thru 75 models may also be equipped with the following alternate controls:

Main Gas Valve: 21501 (Nat.), 21504 (L.P.); Ignitor: 21522 (Nat.), 21524 (L.P.); Pilot Burner Assy.: 21512 (Nat.), 21513 (L.P.); Electrode Sensor Lead: 21514

Main Burner Orifice Schedule* Chart No. 5

* INPUT IN 1000 BTU	TYPE OF GAS	NATURAL	PROPANE	NO. OF BURNER ORIFICES	* INPUT IN 1000 BTU	TYPE OF GAS	NATURAL	PROPANE	NO. OF BURNER ORIFICES
	BTU VALUE	1075	2500			BTU VALUE	1075	2500	
	MANIFOLD PRESSURE IN INCHES WATER	3.5	10			MANIFOLD PRESSURE IN INCHES WATER	3.5	10	
30	Ft³/Hr Orifice Drill	28 49	12 57	2	175	Ft³/Hr Orifice Drill	163 41	70 54	7
45	Ft³/Hr Orifice Drill	42 49	18 57	3	200	Ft³/Hr Orifice Drill	186 41	80 54	8
60	Ft³/Hr Orifice Drill	56 49	24 57	4	225	Ft³/Hr Orifice Drill	210 41	90 54	9
75	Ft³/Hr Orifice Drill	70 49	30 57	5	250	Ft³/Hr Orifice Drill	233 41	100 54	10
100	Ft³/Hr Orifice Drill	96 41	40 54	4	300	Ft³/Hr Orifice Drill	280 41	120 54	12
125	Ft³/Hr Orifice Drill	120 41	50 54	5	350	Ft³/Hr Orifice Drill	326 41	140 54	14
150	Ft³/Hr Orifice Drill	140 41	60 54	6	400	Ft³/Hr Orifice Drill	372 41	160 54	16

(*) This schedule is for units operating at normal altitudes of 2000 ft. or less. When installed in Canada, any references to deration at altitudes in excess of 2000 feet are to be ignored. When installed in Canada at altitudes of 2000 to 4500 feet, the unit heaters must be orificed to 90% of the normal altitude rating, and be so marked in accordance with the C.G.A. certification.

Troubleshooting Chart No. 6 (Continued)

LIMIT — FAN SWITCH — AUTOMATIC PILOT — AUTOMATIC VALVE — FAN OPERATION (Continued)

SYMPTOM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Pilot will not light or will not stay lit (Continued)	9. Extremely high or low gas pressure 10. Bent or kinked pilot tubing 11. Drafts around unit 12. Pilot valve not opening (faulty wiring)	9. Refer to Operation 10. Replace pilot tubing 11. Eliminate drafts. Refer to Installation 12. Inspect and correct all wiring

LIMIT-FAN SWITCH

Fan will not run	1. Loose wiring 2. Defective motor overload protector or defective motor 3. Defective fan switch	1. Check and tighten all wiring connections per diagrams 2. Replace motor 3. Check for 24V across terminals 1 and 3 on fan time delay switch. If 24V is present, jumper terminal numbers 2 and 4. If motor runs, replace fan time delay switch. If 24V is not present, check wiring per diagrams
Fan motor turns ON and OFF while burner is operating	1. Fan switch heater element improperly wired 2. Defective fan switch 3. Motor overload protector cycling ON and OFF 4. Motor not properly oiled	1. Be sure fan switch heater terminals are connected to gas valve per diagrams 2. Replace fan switch 3. Check motor amps against motor name plate rating, check voltage, replace fan motor if defective 4. Refer to label on motor
Fan motor will not stop	1. Improperly wired fan control 2. Pilot not lit while thermostat calls for heat 3. Defective fan switch	1. Check all wiring 2. Light pilot (see previous symptoms) 3. Replace fan switch

POOR HEATING RESULTS

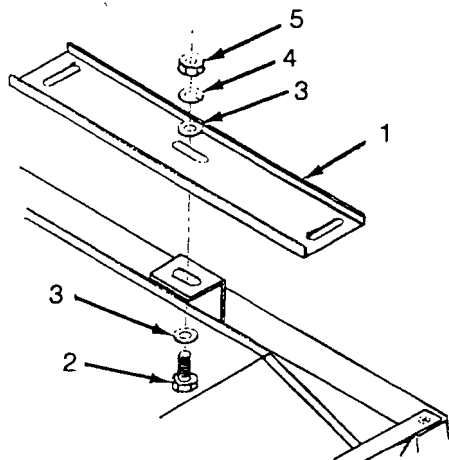
Not enough heat	1. Incorrect gas input 2. Heater undersized 3. Thermostat malfunction 4. Heater cycling on limit control	1. Refer to Operation 2. This is especially true when the heated space is enlarged. Have the heat loss calculated and compare to the heater output (80% of input). Your gas supplier or installer can furnish this information. If heater is undersized, add additional heaters 3. Replace thermostat 4. There should be no ducts attached to the front of this heater. Check air movement through heat exchanger. Check voltage to fan motor, clean fan blade and heat exchanger, and oil fan motor
Too much heat	1. Thermostat malfunction 2. Heater runs continuously <ul style="list-style-type: none"> a. Improper thermostat or transformer wiring at gas valve b. Short circuit c. Defective or sticking gas valve d. Excessive gas supply pressure 	1. Replace thermostat 2. <ul style="list-style-type: none"> a. Check wiring per diagrams b. Check operation at valve. Look for short and correct, such as staples piercing thermostat wiring c. Replace gas valve d. Refer to Operation
Cold air is delivered on start up	Fan switch heater element improperly wired	Be sure fan switch heater terminals are connected to gas valve per diagrams (page 5)
Cold air is delivered during heater operation	1. Incorrect manifold pressure or input 2. Voltage to unit too high 3. Air throughput too high	1. Refer to Operation 2. Check motor voltage with fan running. Should be 115 volts AC 3. Refer to Operation

Optional Accessories**FOUR-TO-TWO SUSPENSION KIT****Part No.: 27370****INSTALLATION INSTRUCTIONS & PARTS LIST
FOUR TO TWO-POINT SUSPENSION KIT**

Allows easy installation of current two-point mounting unit heaters in locations where four mounting points exist. This retrofit situation typically involves units with inputs of 125,000 BTU/HR and larger.

KIT CONTENTS

1. (2) Brackets, 12 ga, C.R.S.
2. (2) Bolts, 1/2-13 UNC x 3" lg.
3. (4) Washers, plain
4. (2) Washers, lock
5. (2) Nuts, 1/2-13 UNC

**Figure 15****PRIOR TO INSTALLATION**

Prior to adapting to any existing four-point suspension, determine that it is secure by inspecting the existing heater mounting, wood joists, I-beams, bolts, washers & clamps.

DRAFTOR KIT

Each kit contains drafter, adaptor and relay.

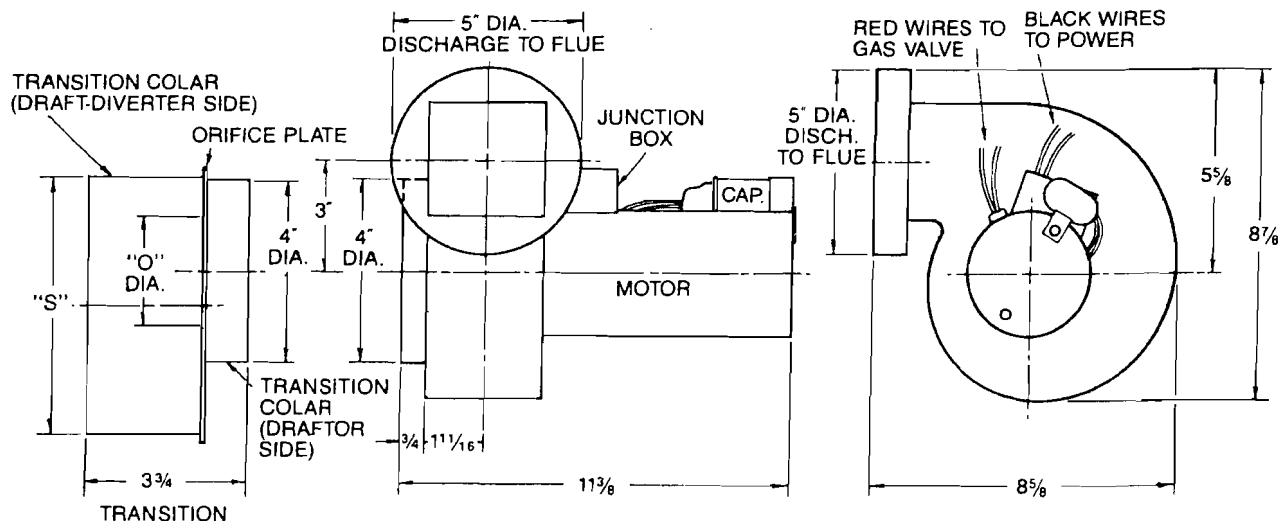
MODELS	KIT PART NO.
3E366C, 3E379C 3E367C, 3E380C 3E406B, 3E407B 3E368C, 3E381C	OSDR 115L/30 OSDR 115L/40 OSDR 115L/60 OSDR 115L/75
3E369B, 3E382B 3E370B, 3E383B 3E371B, 3E384B 3E372B	OSDR 115L/100 OSDR 115L/125 OSDR 115L/150 OSDR 115L/175
3E373B, 3E385B 3E374B 3E375B, 3E386B	OSDR 115L/200 OSDR 115L/225 OSDR 115L/250

DRAFTOR

A drafter may be used in lieu of, or in conjunction with, a chimney. Where chimneys of sufficient height are impractical, or where distances of heaters to chimney are so great that sufficient draft cannot be created, a mechanical drafter will get rid of the products of combustion from the heater. Plants with minor negative pressure should use mechanical drafters.

The induced drafter is a rugged, well designed air handling exhaust fan. Combined with the proper inlet orifice size for each unit, it provides correct venting and allows use of minimum diameter vent flue. Normally it is started and stopped by the room thermostat and provides pre-purge and post-purge of the products of combustion. A centrifugal switch in the drafter motor operates the electric gas valve. When used on a dual furnace the drafter can operate the electric gas valve and also control the system fan motor usually through a magnetic starter.

Only one size drafter is required for units up to 400,000 BTU input.

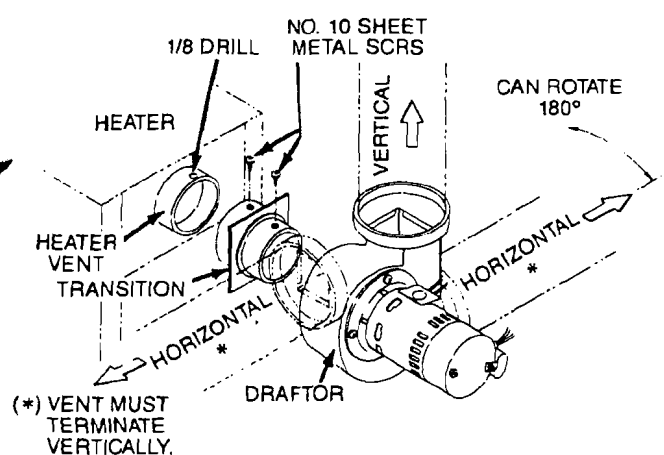
**Figure 16 — Drafter**

NOTE: NOT AGA/CGA CERTIFIED

Optional Accessories (Continued)**INSTALLATION AND OPERATION OF DRAFTOR****DIMENSION DATA**

FOR SIZES MBTU/HR	30	45	60	75	100	125	150	175	200	225	250
NAT	3E366C	3E367C	3E406B	3E368C	3E369B	3E370B	3E371B	3E372B	3E373B	3E374B	3E375B
	3E379C	3E380C	3E407B	3E381C	3E382B	3E383B	3E384B	—	3E385B	—	3E386B
HEATER INPUT (Btu/hr)	30,000	45,000	60,000	75,000	100,000	125,000	150,000	175,000	200,000	225,000	250,000
DRAFTOR ORIFICE SIZE "O" DIAMETER	1¼"	1½"	1¾"	1¾"	2⅛"	2⅝"	2½"	3"	3¼"	3½"	3¾"
NORMAL HEATER FLUE SIZE "S" (OV = OVAL)	4" R	4" R	5" R	5" R	6" R	6" R	7" R	7" R	8" R	8" R	8" R
RECOMMENDED FLUE PIPE DIAMETER	4"	4"	4"	4"	4"	4"	4"	4"	5"	5"	5"
MAXIMUM LENGTH OF RUN — FEET	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'

NOTE: Runs should be reduced as follows for listed accessories: Each 90° elbow — 10'; Each 45° elbow — 5'; Briedert cap or equivalent — 10'.



Typical assembly of power vent unit showing method of installing draftor assembly to flue outlet collar.

Figure 17

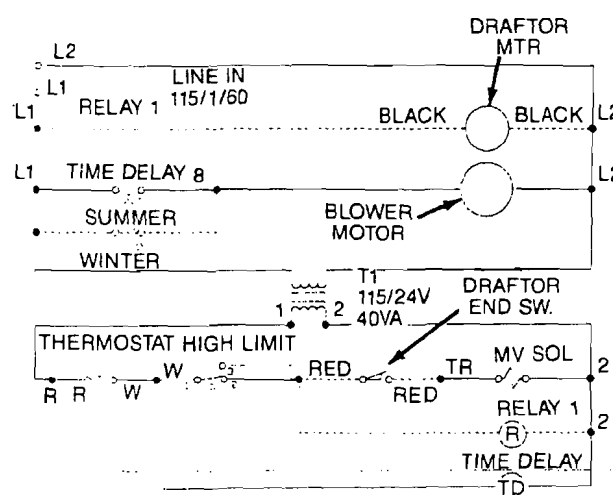


Figure 18 — Schematic Wiring for Induced Draftor

INSTALLATION

1. Check Electrical Specifications of both the Draftor motor and the controlling thermostat.
2. Install Heater in position.
3. Install Draftor Adaptor. Drill holes with 1/8" drill and secure Adaptor with #10 sheet metal screws.
4. Orientate inducer outlet in proper direction and fasten with sheet metal screws.
5. Determine flue pipe diameter. The Draftor outlet is 5" diameter and a transition must be used when either a 4" or 6" pipe is used.
6. Fasten flue pipe to Draftor outlet with sheet metal screws.
7. A weather cap should be used at the termination of the flue pipe outdoors.
8. Type B vent pipe can be used on gas appliances with this Draftor.
9. Study electrical from factory and wire accordingly.

10. Orientate motor so that oil holes will be at an angle permitting oil to enter bearings.

OPERATION

1. Room thermostat controls relay which controls Draftor motor.
2. The centrifugal switch in motor controls gas valve. When Draftor motor comes up to speed it closes contact in switch, energizing gas valve. Gas should never be burning if Draftor is not running.

When unit is firing and Draftor is in operation make following check to determine proper system function. Place match in draft diverter opening. If flame is pulled inward, system operation is proper. If flame is blown outward and excessive heat is felt, venting is not proper. A check should be made to determine reason for malfunction.

08262

Service Record

DATE	MAINTENANCE PERFORMED	COMPONENTS REQUIRED

FORM 5S2486

MODELS 3E366C THRU 3E368C, 3E369B THRU 3E375B,
3E379C THRU 3E381C, 3E382B THRU 3E386B, 3E406B & 3E407B

08262

Notes

Please read and save this Replacement Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Belt-Drive Axial Power Roof Ventilators

Refer to Form 8S811 for General Operating and Safety Instructions and applicable Warranty

For Replacement Parts call 1-800-323-0620

24 hours a day - 365 days a year

Please provide the following information:

-Model Number

-Serial number (if any)

-Part description and number as shown in parts list

Address parts correspondence to:

Grainger Parts

P.O. Box 3074

1657 Shermar Road

Northbrook, IL 60065-3074 U.S.A.

Drive Requirements *

Model	HP	RPM	Motor Selection		Fan Sheave		Motor Sheave		Belt		Bushing	
			Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase
4WN61	1/6	905	3K613	—	3X815	—	3X858	—	4L220	—	—	—
	1/4	1010	6K731	2N101	3X815	3X815	3X957	3X957	4L230	4L230	3X884	3X572
	1/3	1180	5K115	3N040	3X815	3X815	3X774	3X774	4L240	4L240	—	—
	1/2	1300	5K116	3N041	3X815	3X815	3X887	3X887	4L240	4L240	—	—
4WN65	1/4	635	6K731	2N101	6L063	6L063	3X858	3X859	3X697	3X697	—	—
	1/3	685	5K115	3N040	6L063	6L063	3X770	3X770	3X697	3X697	—	—
	1/2	785	5K116	3N041	6L062	6L062	3X770	3X770	4L250	4L250	—	—
	3/4	900	3K617	3N042	3X815	3X815	3X859	3X859	4L250	4L250	—	—
4WN66	1	1020	6K148	3N043	6L062	6L062	3X837	3X837	4L270	4L270	—	—
	1/2	620	5K116	3N041	6L065	6L065	3X868	3X868	5X995	5X995	—	—
	3/4	720	3K617	3N042	6L064	6L064	3X868	3X868	3X654	3X654	—	—
	1	775	6K148	3N043	3X565	3X565	3X408	3X408	(2)6A141	(2)6A141	3X574	3X574
4WN67	1 1/2	890	6K305	3N013	3X565	3X565	3X553	3X553	(2)6A141	(2)6A141	3X572, 3X574	3X572, 3X574
	2	985	6K393	3K1W31	3X564	3X564	3X553	3X553	(2)6A139	(2)6A139	3X574	3X574
	3/4	550	3K617	3N042	6L067	6L067	3X774	3X774	6A146	6A146	—	—
	1	610	6K148	3N043	6L066	6L066	3X774	3X774	6A145	6A145	—	—
4WN67	1 1/2	890	6K305	3N013	3X565	3X565	3X550	3X550	(2)1A095	(2)1A095	3X572, 3X574	3X572, 3X574

(*) Drive requirements show minimum motor HP required. Other drives may be used, provided they meet the fan RPM stated above and have adequate load-carrying capacity.

(**) Manufactured to tolerances set by the RMA (Rubber Manufacturers' Association).

E
N
G
L
I
S
H

E
S
P
A
Ñ
O
L

F
R
A
N
Ç
A
I
S

Replacement Parts List

4WN61, 4WN65 thru 4WN67

For Replacement Parts, call 1-800-323-0620

24 hours per day - 365 days per year

Please provide the following information:

- Model number
- Serial number (if any)
- Part description and number as shown in parts list

Address parts correspondence to:

Grainger Parts
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074 U.S.A.

ENGLISH

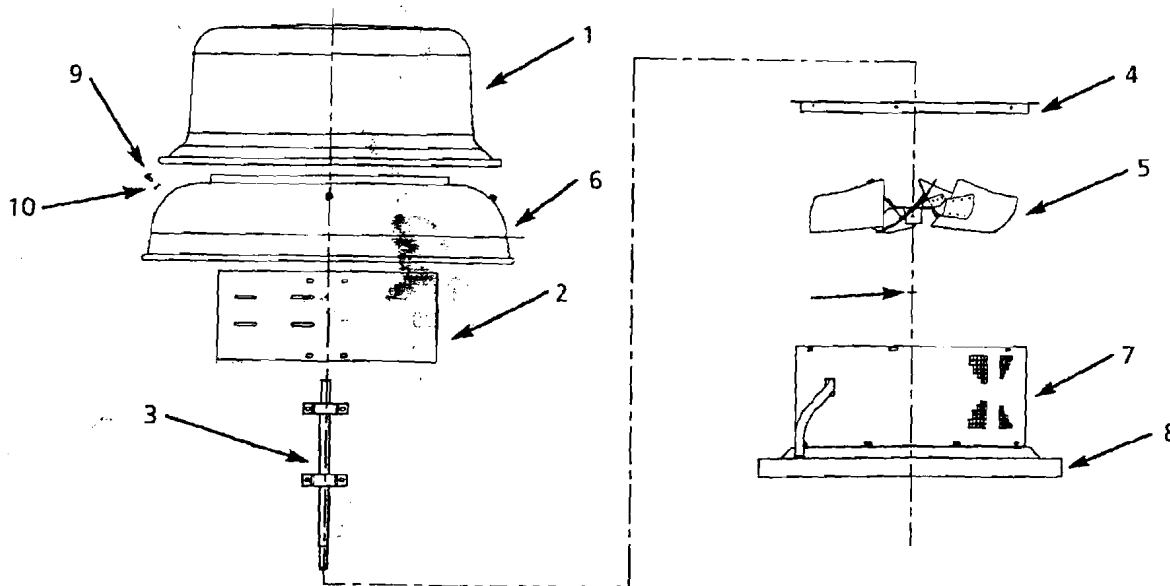


Figure 1 — Replacement Parts Illustration

Replacement Parts List

Ref. No.	Description	Part Number For Models:				Qty.
		4WN61	4WN65	4WN66	4WN67	
1	Cover dome	90313001	90314001	90315001	90316001	1
2	Motor mounting base	09063001	09065001	09068001	09068001	1
3	Shaft/bearing assembly	27378001	27378001	27379001	27380001	1
4	Deflector (top plate)	90975001	90976001	90977001	90978001	1
5	Propeller	03195001	03063001	03064001	03065001	1
6	Exhaust bell	09964001	09965001	09966001	09967001	1
7	Bird screen	91641001	91642001	91643001	91644001	1
8	Venturi panel	91108001	91105001	91106001	91107001	1

Standard hardware item No.'s 10 thru 12 available locally:

9) 1/4-20 x 3/4" Screw 10) 5/16 x 3/4 Washer w/rubber 11) 0.810" Snap ring

Notes

11-11-11

Notes

E
N
C
L
O
S
E

Improvements to the Dayton® Line of Belt-Drive Axial Roof Ventilators

Significantly stiffer and much simplified mounting method by eliminating back brace (except 30") and utilizing galvanized metal

Simplification of bearing access and replacement by elimination of deflector cone

Noticeable cooler running motor resulting from improved motor compartment airflow made elimination of breather hole and motor fin possible

Significantly stronger, stiffer and more durable bird screen through use of galvanized metal

Significantly stronger, stiffer and more durable base through use of galvanized metal venturi

Utilization of CRV accessories now possible through increased venturi footprint

Dampers have now been accessorized. See listing below.

Belt-Drive Axial Power Roof Ventilators

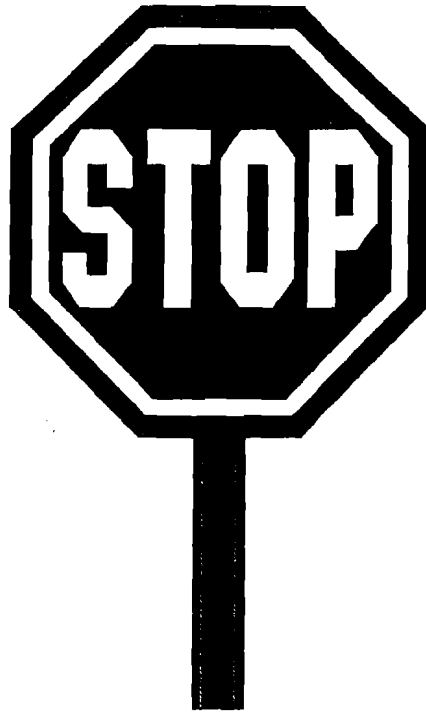
Old Model No.	New Model No.	Wheel Dia.	Old Curb Cap Sq. Dimensions	New Curb Cap Sq. Dimensions	Recommended Roof Curb 8"	Recommended Roof Curb 12"	Recommended Damper
5M149	4WN61	18"	26"	26"	4HX40	4HX48	4HX66
5M151	4WN65	24	32	34	4HX42	4HX50	4HX68
5M152	4WN66	30	40	42	4HX43	4HX51	4HX69
5M150	4WN67	36	44 1/2	46	4HX44	4HX52	4HX70

Manufactured for Dayton Electric Mfg. Co.
Dayton, Illinois 60714 U.S.A.

11564001

Dayton®

F.M.E.A.



**IN CASE OF DIFFICULTY
PLEASE READ THIS BEFORE
CONTACTING
THE FACTORY**


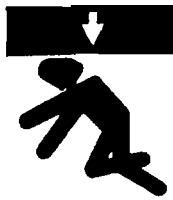

Rolling Steel Technical Assistance ----- 1-800-929-2553
Operator Technical Assistance ----- 1-800-275-6187

IMPORTANT WHEN STARTING A ROLLING STEEL DOOR INSTALLATION

The most important thing before starting the door installation is to READ THE INSTALLATION INSTRUCTIONS. Below is a list of items that must be done for a proper installation.

1. Make sure the opening is the correct size, this is very critical for between jamb doors.
2. The guides must be installed plumb and level, the use of a water level will aid in the installation. Verify the guides are set to the correct "S" reference.
3. When installing the barrel and headplates make sure the barrel is centered and all set collars are tightened down. This will keep the barrel from shifting.
4. Make sure the proper drive assembly is used, all chains are aligned and all sprocket set screws are tightened down.
5. When the curtain is installed make sure that you center it between the headplates.

If all these steps are followed and you have problems follow the attached TROUBLE SHOOTING GUIDE. If you can not resolve the problem, fill out the attached TROUBLE SHOOTING CHECKLIST before calling the factory. This information will help to eliminate additional calls.

 WARNING		
Overhead doors are large, heavy objects that move with the help of springs under high tension. Since moving objects and springs under tension can cause injuries, your safety and the safety of others depend on you reading the information in this manual.		
POTENTIAL HAZARD	EFFECT	PREVENTION
 MOVING DOOR	Can Cause Serious Injury or Death	Keep people clear of opening while door is moving. Get help or use support when lifting new door into place.
 HIGH SPRING TENSION	Can Cause Serious Injury or Death	Installation, repairs and adjustments must be made by a trained service person using proper tools and instructions. Before winding torsion spring, open door and make sure curtain is wrapped on barrel. Use 1/2" steel rods, 2 feet long for winding counterbalance assembly. Do Not use pipe, conduit, screwdrivers, etc. as winding bars.

ROLLING STEEL TROUBLE SHOOTING GUIDE

SYMPTOMS	CAUSE	POSSIBLE SOLUTION
Curtain Hanging up or Rubbing in Guides.	Incorrect guide gap.	See Computer Data Sheet in Door Installation Instructions..
	"S" Reference incorrect.	Same as above.
	Cope at top of guides.	May need to be flared more.
	Incorrect guide gap.	Verify gap with instructions.
	Wrong Endlocks or windlocks.	Consult Factory.
	Guides may be toed in.	Reset Guides.
	Endlocks or windlocks broken.	Replace before using.
Curtain Not Balancing Correct..	Incorrect sprocket alignment or Wrong size drive.	Align all drive chains. Make sure correct sprockets are used. Verify drive from installation instructions.
	Spring tension	Back off tension and reapply.
	Broken spring or springs.	Call Factory.
	Ring size.	Verify correct ring size Contact the Factory. Flange of ring for curtain attachment always points to the left side of the door.
	Incorrect "S" Ref. Setting.	Set to proper "S" Ref. setting.
FIRE DOORS Drop test did not function properly.	Improper installed sash chain.	Check direction of sash chain and reroute if necessary.
	Has sash chain been painted.	Replace sash chain.
	Inadequate spring tension.	Increase or decrease the spring tension.
	Curtain hung-up.	Make sure curtain is free to move within the guides.
	Operator drive chain too tight.	Adjust drive chain.
	Improperly aligned sprockets.	Align the sprockets.
	Improperly adjusted clutch clearances.	Adjust stationary dentil arm located at the governor. See installation instructions.
	Drop weight not fully disengaging.	Check the clearance at the drop weight, also that the sash chain is free for weight to pull.
	Spreader bar is to tight or loose on #5 drive headplates..	Properly install spreader bar, it should be adjusted so that the spreader assembly is snug against the drive shaft and the stub shaft. DO NOT OVER TIGHTEN THE ASSEMBLY.

ROLLING STEEL DOOR TROUBLESHOOTING CHECKLIST

The information listed below needs to be filled out before you call the factory for assistance. 1-800-929-2553

FACTORY ORDER NO: _____ ITEM NO. _____

(1) CURTAIN:

Curtain not fitting in guide or jamming.

- A. "S" Reference: _____
- B. Guide gap: _____
- C. Slat cut length: _____
- D. Dim. over endlocks: _____
- E. Dim. over windlocks: _____
- F. Are guides plumb: _____
- G. Are guides bent: _____
- H. Is barrel level: _____

(2) PIPE:

Not balancing.

- A. Ring size: _____
 - B. Initial turns: _____
 - C. Gauge of curtain: _____
 - D. Verify drive pin locations from tension end of pipe.
 - E. Describe operation at open, close and middle, Curtain positions: _____
- _____
- _____
- _____

- F. Verify drive # of chain hoist operated doors. _____
See Installation Instructions.

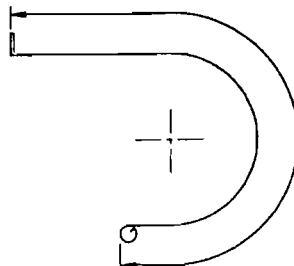
(3) BRACKET:

Incorrect or not working.

- A. Bracket size (Width): _____
- B. Operation type: _____
- C. Hand of operation: _____
- D. Bracket bearing size: _____

(4) HOOD:

Not fitting.



- A. Verify circumference: _____
(See sketch at left.)
- B. Bracket size (Width): _____
- C. Cut length of hood: _____

IMPORTANT WHEN STARTING AN OPERATOR INSTALLATION

The most important item before starting an operator installation is to READ THE INSTALLATION INSTRUCTIONS and the accompanying WIRING DIAGRAM.

Below is a list of items which MUST be correct for a proper operator installation.

1. Make sure the WIRING DIAGRAMS are correct for the given job site and that all installed wiring matches the WIRING DIAGRAMS. Wiring Diagrams must be correct in terms of the following items:
 - a. Operator voltage and phase.
 - b. Type of operator wiring, type C or type D.
 - c. The presence of all specified auxiliary devices.
2. Make sure operator is correct for given job site. Correct in terms of the following items:
 - a. Operator model.
 - b. Operator voltage and phase.
3. Make sure that operator is mounted with its output drive shaft parallel with the door shaft.
4. Operator and door output shaft sprockets must be correctly aligned and all sprocket set screws properly tightened. Drive chain must be properly tensioned.
5. Make sure all limit switches (open, close, auxiliary open) are correctly adjusted. Note that the auxiliary open limit must be adjusted such that it activates before the open limit switch activates.

If all of these items are correct and all problems have not been corrected, see the attached TROUBLESHOOTING GUIDE. If you cannot resolve the problem, fill out the attached TROUBLESHOOTING CHECKLIST before calling the operator division at 1-800-275-6187. The information contained in the checklist will help to eliminate additional calls.

OPERATOR TROUBLESHOOTING GUIDE

(+ Wired Operators Only)

SYMPTOM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Operator will not run from pushbutton station.	Stop pushbutton wiring.	Check wiring diagram.
	Hoist interlock switch.	Adjust or replace switch.
	Tripped circuit breaker.	Reset circuit breaker.
	Defective transformer.	Replace transformer.
Operator will only run in one direction from pushbutton station.	Open/close pushbutton wiring.	Check wiring diagram.
	Malfunctioning limit switch.	Verify wiring/replace defective switch.
	Malfunctioning contactor coil.	Replace defective contactor.
Operator runs in wrong direction from pushbutton station.	Improper wiring type selected.	Verify type 'D' versus type 'C' wiring.
	Improper line voltage connections on 3-phase power.	Switch any 2 line voltage connections at electric box input power terminals.
Operator pushbutton(s) operate in constant contact mode.	Momentary contact jumper(s) not installed.	Install jumpers as shown in <i>External Wiring Diagram</i> located in installation manual.
	Defective 3 phase sensing relay.	Replace defective relay.
Operator will not close from radio control, but will open.	Improper auxiliary open limit switch adjustment.	Adjust auxiliary open limit switch per installation instructions.
Sensing edge will not reverse door.	Improper sensing edge wiring.	Check <i>External Wiring Diagram</i> .
	Malfunctioning SR relay.	Replace defective relay.
	Malfunctioning safety cut-out limit switch(es).	Verify wiring/replace defective switch(es).
Sensing edge will stop, but not reverse, the door.	Open circuit configured for constant contact operation.	Install momentary contact jumper as shown in <i>External Wiring Diagram</i> .
	Malfunctioning SR relay.	Replace defective relay.

OPERATOR TROUBLESHOOTING CHECKLIST

Fill in the information below before calling the Operator Division for assistance at 1-800-275-6187.

FACTORY ORDER NO: _____ ITEM NO: _____

WIRING DIAGRAM PART NO: _____

FROM THE ELECTRIC BOX COVER LABEL, FILL IN THE FOLLOWING:

MODEL: _____ PART NO. _____

HP: _____ PULL: _____

PHASE: _____ AMPS: _____

Hz: _____ VOLTS: _____

DATE CODE: _____

(1) MOTOR:

Motor will not run.

From motor nameplate, fill in the following:

A. Motor (10 digit) part number: _____

B. Motor voltage rating: _____

C. Motor horsepower rating: _____

(2) BRAKE SOLENOID:

Brake does not disengage.

From brake solenoid label, fill in the following:

A. Solenoid part number: _____

B. Solenoid voltage rating: _____

(3) TRANSFORMER:

Motor will not run/contactors will not pull-in.

From transformer label, fill in the following:

A. Transformer part number: _____

B. Primary voltage rating: _____

C. Primary Hz. (frequency) rating: _____

(4) ACCESSORIES:

Please place a check by all auxiliary devices utilized for this specific installation.

A. Sensing edge: _____ D. Radio control: _____

B. Photocells: _____ E. Loop detector: _____

C. Single button control: _____ F. Other (please list): _____

NOTES:

INSTALLATION INSTRUCTIONS



ROLLING SERVICE DOOR **SERIES 610 / 620 / 625**

**READ COMPLETE INSTRUCTIONS
BEFORE INSTALLING DOOR**



CAUTION

**USE PROPER LIFTING EQUIPMENT AND CORRECT
LIFTING PROCEDURES TO AVOID INJURY.**

Order No. _____ Job Name _____

Distributor: Overhead Door _____ Date: _____

DOOR SPECIFICATIONS

Door	Series	Opening Width	Opening Height	Guide Type *	"S" Dim.	Hand	Operation	Initial Turns	Drive No.	Guide Gap

* This Designates "E" or "Z" or Between Jamb Guide Assembly, Plus Angle Or Rolled Guides, and Inside or Outside Mount.

NOTE

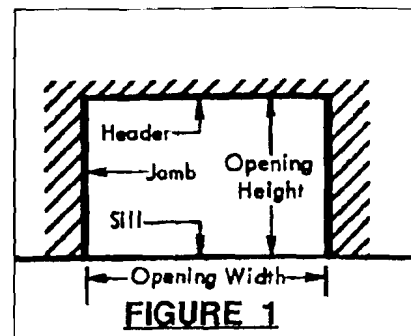
In This Instruction Manual, We Illustrate A Right Hand Door. Take Care to Orient A Left Hand Door Opposite To This, As Described In The Text.

STEP 1 READ ALL OF INSTALLATION INSTRUCTIONS before you start.

STEP 2 CHECK TO SEE that Wall Opening matches Opening Width and Height shown on Cover Sheet 1 and Figure 1.

STEP 3 ARE GUIDES YOU RECEIVED SUITABLE FOR THE JAMBS? Compare the guides type shown on Sheet 1 with Figure 2.

STEP 4 CHECK to see that **SILL** is level. If Sill is out of level, mark high Sill level location on low Side Jamb.

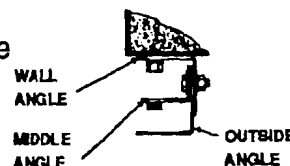


STEP 5 VERIFY THAT GUIDES CAN BE INSTALLED PLUMB.

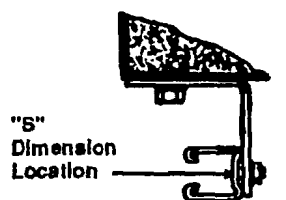
STEP 6 VERIFY THAT DOOR INSTALLATION CAN BE MADE BEFORE PROCEEDING.

NOTE

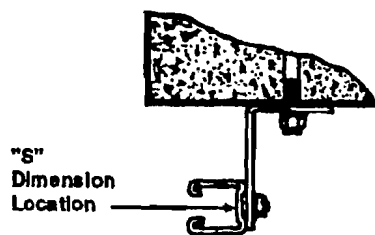
If outside Guide Angle is Flared, then unbolt it and the Middle Angle from the Wall Angle. They should be bolted to the Wall Angle after the curtain is rolled onto the counterbalance pipe in Step 17.



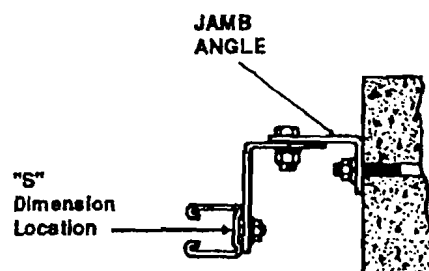
ROLLED GUIDES



"E" GUIDE, E/R

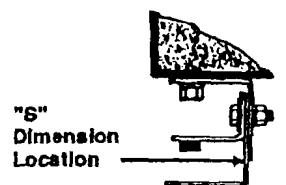


"Z" GUIDE, Z/R

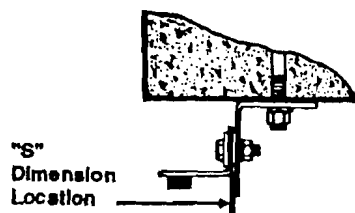


BETWEEN JAMB, B/R

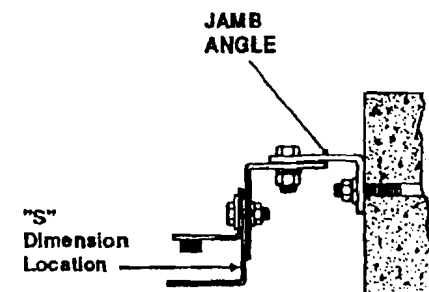
ANGLE GUIDES



"E" GUIDE, E/A



"Z" GUIDE, Z/A



BETWEEN JAMB, B/A

FIGURE 2

STEP 16 CONT. (CHAIN HOIST ASSEMBLY)

FOR DRIVE #5 - REFER TO FIGURE 16, PAGE 8

- STEP A:** Slide spacer **A** onto support shaft # 3.
- STEP B:** Slide 12T x 48T reducer sprocket **B** onto support shaft # 3 with the 12T sprocket facing toward the headplate.
- STEP C:** Slide spacer **C** onto shaft # 3. Press set collar toward headplate until a snug fit between **A**, **B**, and **C** is obtained. Tighten set screw in set collar.
- STEP D:** Slide 29T sprocket **E** and key **D** onto main shaft with hub facing away from headplate.
- STEP E:** Alignment of sprockets: Refer to **Figure 17**. Press edge of straight edge to side of sprocket **E**. Slide **E** until straight edge touches outside face of small sprocket on sprocket **B**. Tighten set screw of sprocket **E**.
- STEP F:** Wrap # 50 roller chain **F** (45 links) around small 12T sprocket **B** and 29T sprocket **E** and connect with master link **G**.
- STEP G:** Slide spacer **H** onto support shaft # 2.
- STEP H:** Slide 14T x 48T reducer sprocket **I** onto shaft # 2 with 14T sprocket facing away from headplate.
- STEP I:** Slide set collar **J** onto support shaft # 2. Press set collar toward headplate until a snug fit between **H**, **I**, and **J** is obtained. Tighten set screw in set collar **J**.
- STEP J:** Slide spacer **K** onto support shaft # 1.
- STEP K:** Slide 14T dentil sprocket **L** onto support shaft # 1 with dentil projections facing away from the headplate.
- STEP L:** Wrap # 41 roller chain **M** (63 links) around 14T dentil sprocket **L** and 48T sprocket **I** and connect with master link **N**.
- STEP M:** Wrap # 41 roller chain **O** (63 links) around 48T sprocket **B** and 14T sprocket **I** and connect with master link **P**.
- STEP N:** Slip pocket wheel **Q** onto support shaft # 1 with dentil recesses facing headplate. Rotate until recesses are fully engaged with projections on 14T dentil sprocket **L**.
- STEP O:** Slip chain guide **R** onto support shaft # 1 with chain guide holes toward headplate.
- STEP P:** Slip set collar **S** onto support shaft # 1. Press set collar toward headplate until a snug fit between **K**, **L**, **Q**, **R**, and **S** is obtained. Tighten set screw in set collar **S**.
- STEP Q:** Thread hand chain **U** over pocket wheel **Q** and through chain guide **R**. Connect hand chain together as shown in Figure 18. Chain must not be twisted.
- STEP R:** Slip brace assembly **T** onto shaft # 3 and main drive shaft, with bearing on main drive shaft.
- STEP S:** Turn adjustment nut until snug against cast bearing housing.
- STEP T:** Tighten set screw in set collar of brace assembly. Make sure that brace assembly does not interfere with door operation by operating door. Brace assembly must be adjusted to keep slack in roller chain **F** through a full rotation of 29T sprocket **E**.
- STEP U:** Tighten brace assembly jam lock nut against adjustment nut to lock nut in place.
- NOTE:** A visual check should be made to verify: (1) All sprockets are in alignment, (2) Slack in chain is not excessive, (3) All set screws are tight, (4) All master links have keepers installed properly, (5) Key located properly, (6) That brace assembly is installed properly (Drive # 5 must have this item installed to operate properly).

STEP 16 CONT. (CHAIN HOIST ASSEMBLY)

For Drive #5 - Refer to Figure 16

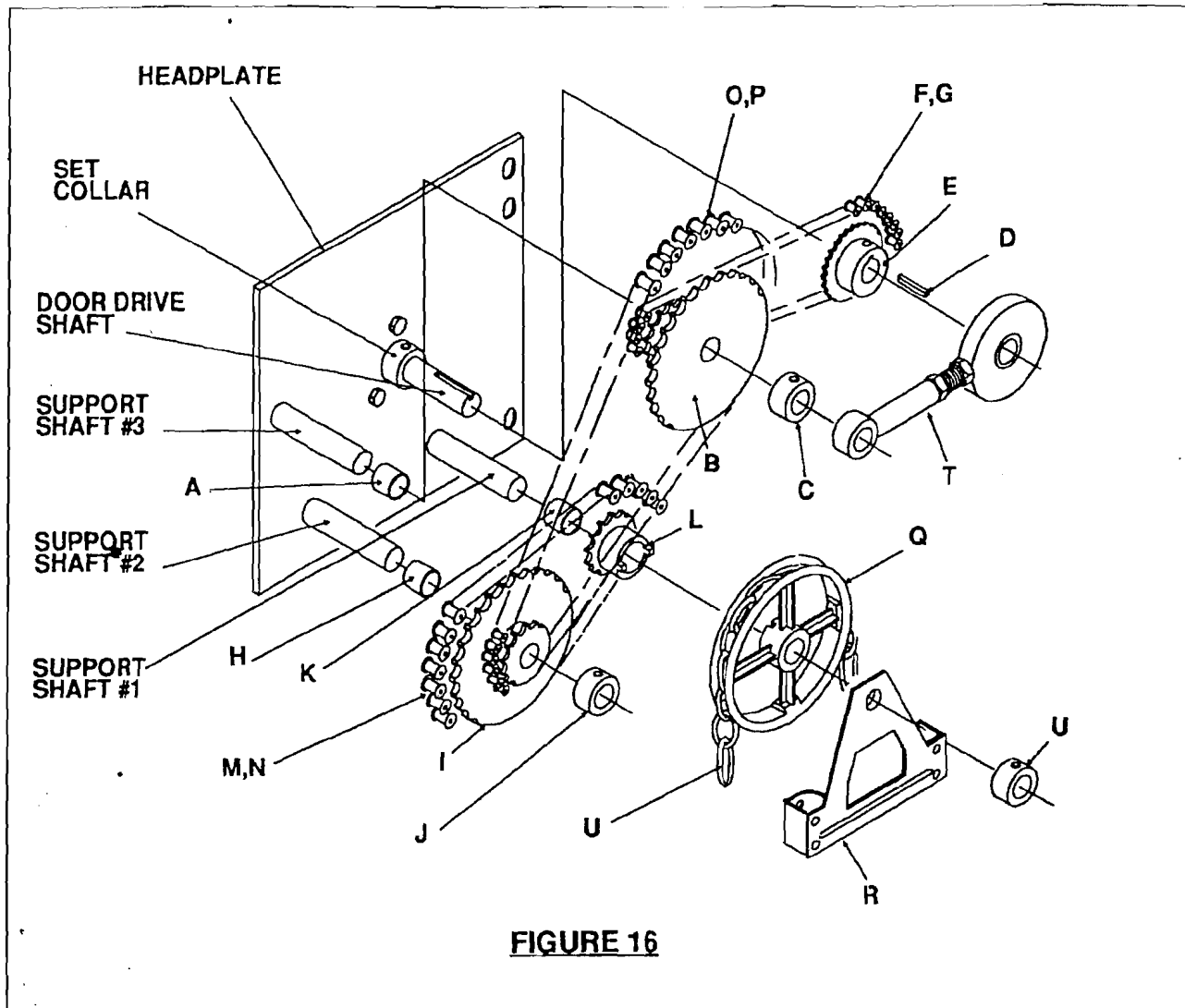


FIGURE 16

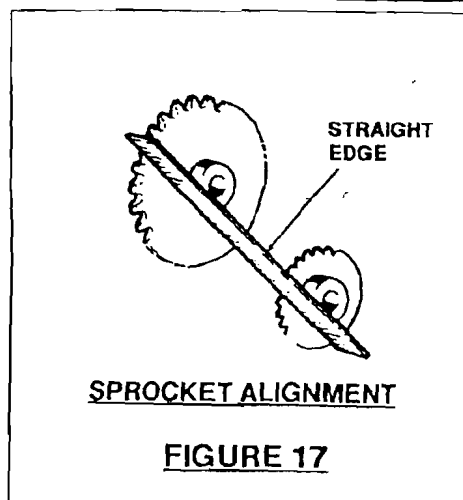


FIGURE 17

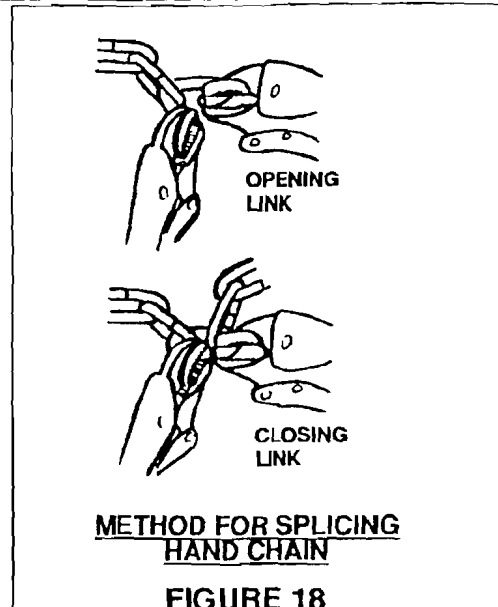


FIGURE 18



CAUTION

USE PROPER LIFTING EQUIPMENT AND CORRECT LIFTING PROCEDURE TO AVOID INJURY.

STEP 17 INSTALLATION OF CURTAIN (SLING METHOD)

Hang the Curtain on two or more Slings or Heavy Ropes capable of suspending the curtain weight. Ropes/Slings **MUST** be able to suspend the Curtain weight. Fasten the Top Slat to the Slings or Ropes with wire. Rotate the Barrel to bring the Top Slat in place. Center the Curtain between the Headplate Brackets. See Figure 19.

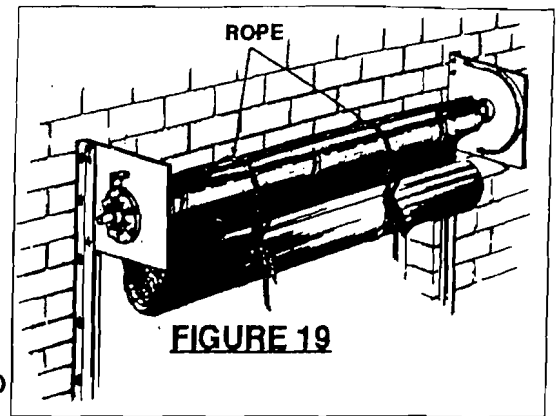


FIGURE 19

- If the Barrel Assembly has Rings, pull the curtain up and hold the Top Slat against the Rings making sure Curtain is evenly centered on Barrel. Make holes in Top Slat to match holes in the Rings. Attach Top Slat to Rings with 3/8" Round Head Torx Screws and Washers provided. **DO NOT** strip Screw Threads.
- If Barrel Assembly has Studs, the Top Slat will have slots to attach to Barrel. Hook Curtain over Studs and fasten with 5/16" Round Head Screws and Washers provided.
- If Slat Segments are provided at the Top of the Curtain, fasten them to Rings or Studs after Curtain is centered. Then crimp the Slat Curl adjacent to each Slat Segment.
- The Sling Method causes less damage than rolling the Curtain onto the Counterbalance while it is on the floor.

STEP 18 COMPLETE CURTAIN INSTALLATION

- Coil Curtain completely onto Barrel.
- If Guides are Flared, then install the Middle Angle and Outside Guide Angles according to Steps 10 & 11.
- Place locking pliers on the Guides as shown.
- Lower Curtain into Guides.
- Lock the Drive to prevent the Curtain from falling.
- If the Guides are not flared, install Curtain Stop-Bellmouth on Guides. A Stud is attached to the Guides to hold the Bellmouth. Be certain the back of the Bellmouth is flush against Headplate. See Figure 20.
- If Guides are Flared, slide Stop Bar into Channel Holder welded to Guide, and install 3/8" Cap Screw. See Figure 21.

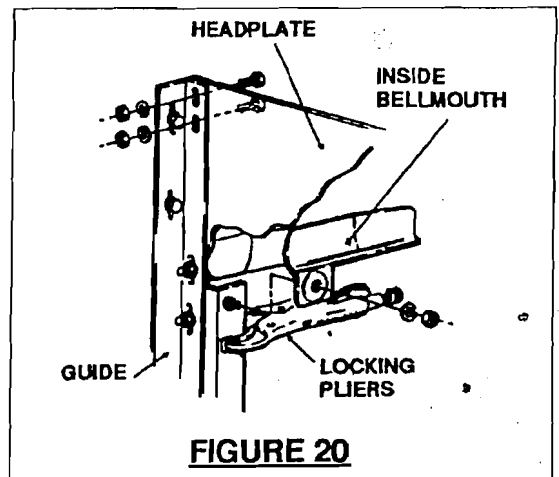


FIGURE 20

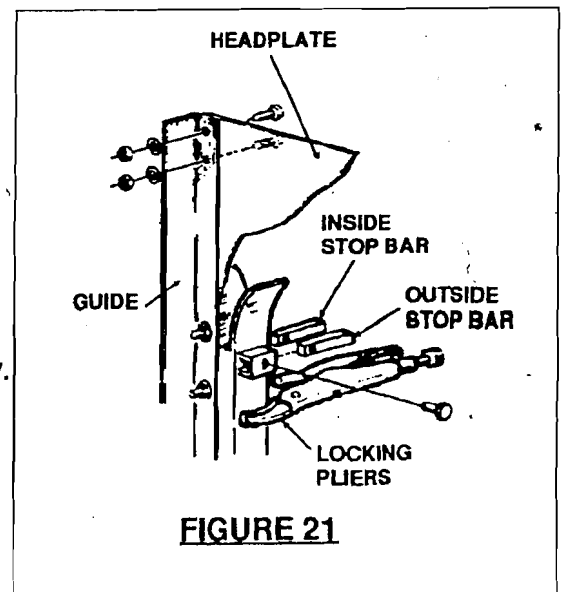


FIGURE 21

STEP 19 APPLY INITIAL TENSION



WARNING

Tension Wheel can spin rapidly if released.
Wheel is under **EXTREME TENSION**.
Use of Improper tools can cause **SERIOUS INJURY**.
Door **MUST** be **FULLY OPEN** and Curtain wrapped on the Barrel.
Winding bars **MUST** be 1/2" to 5/8" diameter steel rods, 2 to 3 feet long.
DO NOT use pipe, conduit, screwdrivers, etc., as winding bars.

Wind Tension Wheel in the direction shown in Figure 22. Apply the number of Initial Turns indicated in the Table on Page 1.

After proper tension is applied, install Tension Pin into Tension Wheel hole and allow Wheel to rotate against Tension Stop. See Figure 22. If Reduced Tension Wheel is required, the Factory will provide the Installation Instruction sheet.

Open and close door Five (5) times and evaluate Tension Adjustment.

A rolling door should snap into the head and barely tend to rise off the floor. It will also fall through the middle of its height.

Larger doors may require a 35 pound pull to raise with hand chain. A chain pull of up to 35 lbs. is permissible. **DO NOT ALLOW UNCONTROLLED FREE FALL CLOSING OF DOOR. INSTRUCT CUSTOMERS TO USE BOTH HANDS TO CONTROL BOTH HAND CHAINS DURING THE CLOSING OPERATION.**

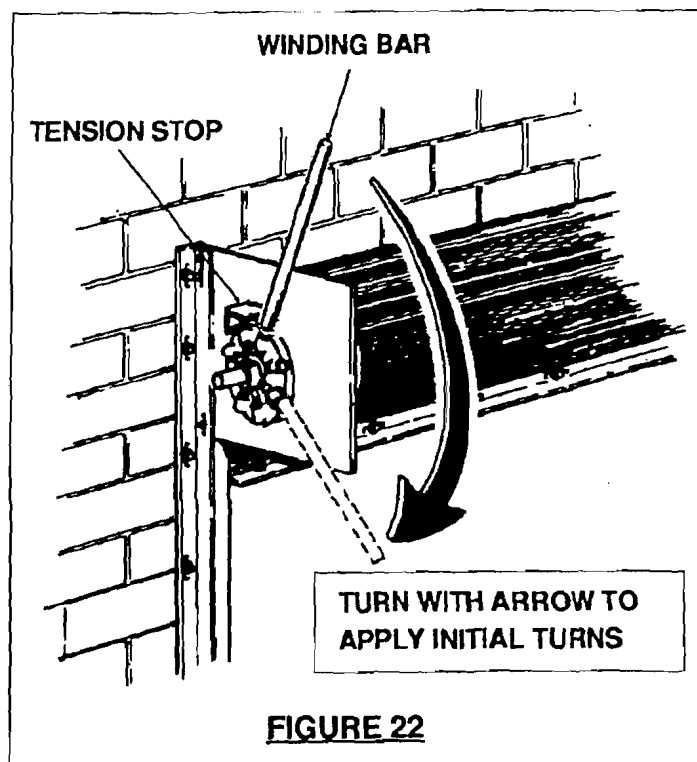


FIGURE 22

STEP 20 ADJUST TENSION WITH DOOR IN FULLY OPEN POSITION.

ADJUST TENSION ONE NOTCH AT A TIME TO INCREASE OR DECREASE TORQUE AS REQUIRED.

STEP 7 LOCATING GUIDE ASSEMBLIES

Locate guide assemblies such that "S" Dimension exists between guides as shown in Figure 3.

"S" Dimension is given on Cover Sheet 1.

Bottom of guides **MUST** be on a level line and Guides **MUST** be plumb. "S" Dimension **MUST** be held within 1/8" over entire height of guides.

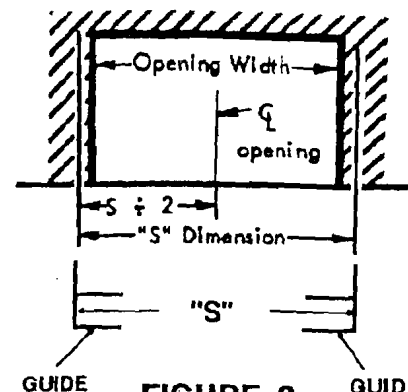


FIGURE 3

STEP 8 MASONRY JAMBS

Hold "Z" guide, or wall angle, or jamb angle against wall and drill mounting holes thru the slots using drill size shown below. Install wall fasteners.

STEP 9 STEEL JAMBS - Screw Attachment Option

Hold "E" guide against steel jamb and mark the spot to be drilled, or hold wall angle or jamb angle against steel jamb and drill holes thru the slots using drill size shown below. Install jamb fasteners.

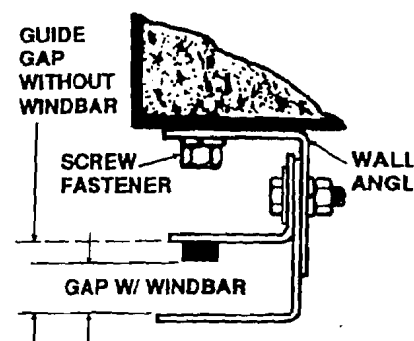


FIGURE 4

STEP 10 STEEL JAMBS - Weld Attachment Option

Hold "E" guide against steel jamb and tack weld wall angle (jamb angle) in place. Recheck "S" distance before proceeding. Weld as shown in Figure 5 using E7014 welding electrode. All welds must be good quality 3/16" fillet welds. Weld the angle to the steel jamb along the top of the angle. Figure 5 shown without the middle angle and outside angle for illustration.

IMPORTANT:

When steel jamb does not extend above the opening, use three thru-bolts to fasten each wall angle above the opening.

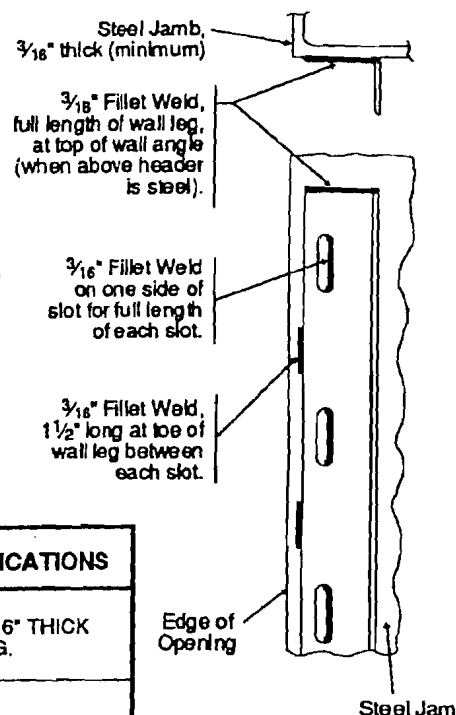


FIGURE 5

STEP 11 The Guide Gap **MUST** be set to the "Guide Gap" dimension shown on Page 1. See Figure 4.

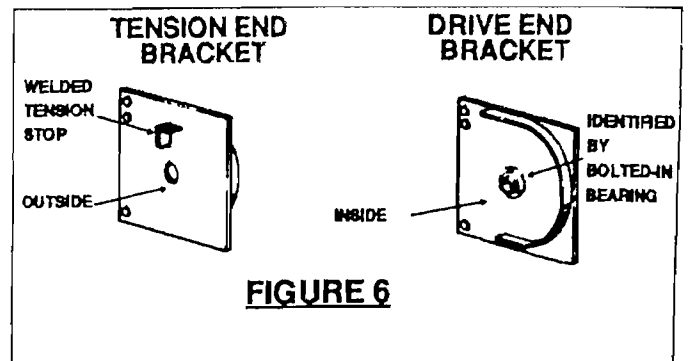
JAMB	FASTENER	DRILL SIZE	JAMB FASTENER SPECIFICATIONS
STEEL	3/8" SELF-TAP SCREW 1/2" SELF-TAP SCREW	11/32" Dia. 27/64" Dia.	STEEL JAMBS MUST BE 3/16" THICK FOR 20 PSF RATING.
CONCRETE	3/8" EXPANSION BOLT 1/2" EXPANSION BOLT	3/8" Dia. 1/2" Dia.	DRILL HOLE AT LEAST 4" FROM JAMB CORNER PER OHD INSTRUCTION 304725-0001.
FILLED BLOCK	3/8" EXPANSION BOLT 1/2" EXPANSION BOLT	3/8" Dia. 1/2" Dia.	
WOOD	3/8" LAG SCREW	1/4" Dia.	DRILL HOLE 3" DEEP.
UNFILLED BLOCK	3/8" THRU BOLT 1/2" THRU BOLT	7/16" Dia. 9/16" Dia.	INSTALL 3" O.D. STEEL WASHER ON OPPOSITE SIDE OF WALL.

STEP 12 IDENTIFY HEADPLATE BRACKET

Right Hand Drive shown; Left Hand Drive is opposite. See Figure 6.

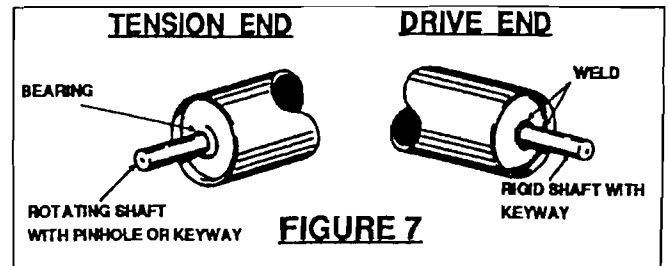
STEP 13 IDENTIFY BARREL ASSEMBLY DRIVE END

Right Hand Drive shown in Figure 7. Left Hand Drive opposite. Look for an "R" or an "L" stamped on the Drive End of Shaft.



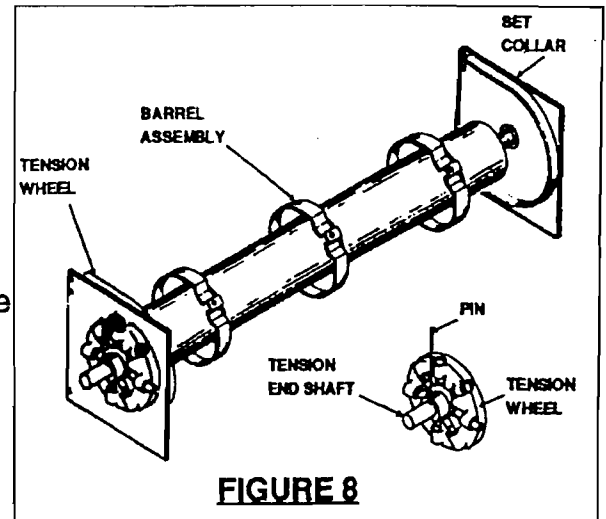
WARNING

Use a Right Hand Drive Bracket with a Right Hand Drive Barrel to prevent Torsion Spring failure in barrel, which can allow Curtain to free fall causing **DEATH OR SERIOUS INJURY**. Left Hand Drive Bracket and Left Hand Drive Barrels **MUST** match also.



STEP 14 ORIENT BARREL AND HEADPLATE BRACKETS

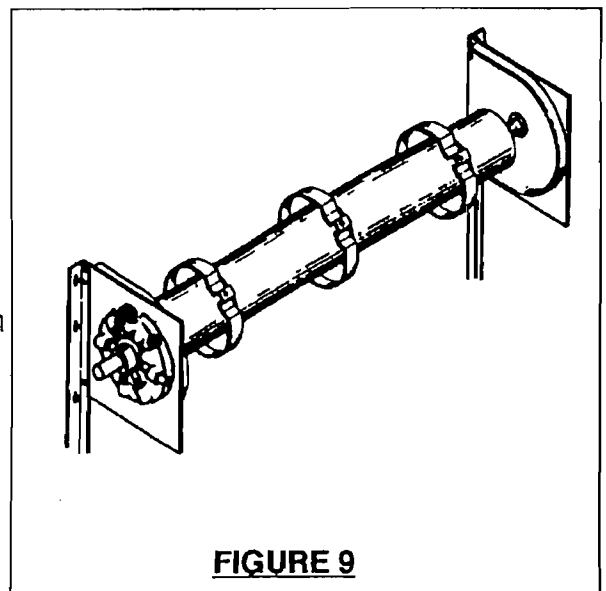
Slide Drive End of Barrel Assembly through Drive Bracket Bearing and Tension End through Tension Bracket. Install Set Collars on Shafts on outside of Headplate Brackets. (No Set Collar is used with Pin in Tension Shaft because Tension Wheel rests against Headplate Bracket). Secure Tension Wheel to Shaft using Pin or Key. See Figure 8. The distance between the Headplate Brackets should be the "S" dimension shown on Page 1.



STEP 15 LIFT BRACKETS AND BARREL AND BOLT TO GUIDE WALL ANGLES

USE PROPER LIFTING EQUIPMENT AND CORRECT LIFTING PROCEDURE TO AVOID INJURY.

Use Hex Bolts to fasten Headplate Brackets to inside of Guide Wall Angles. Bolt heads are to be on inside of Brackets. Brackets are to be square to Wall and parallel. Center Barrel between brackets and secure with Set Collars on Outside of Brackets to prevent Barrel from moving sideways. Two Set Collars are required for Drive Headplate with Cast Flange Bearing. Use a level to make sure Barrel Assembly is level. See Figure 9.



STEP 16 CHAIN HOIST ASSEMBLY

For Drives #1 & #2 - Refer To Figure 10

STEP A: Slide spacer A onto support shaft.

STEP B: Slide 14 tooth dentil sprocket B onto shaft with the dentil projections facing away from headplate.

STEP C: Slide sprocket D and key C onto main shaft with hub facing away from headplate.

STEP D: Alignment of sprockets; Refer to Figure 11. Press edge of straightedge to side of sprocket D. Slide D until straight edge touches side of dentil sprocket B. Tighten set screw of sprocket D.

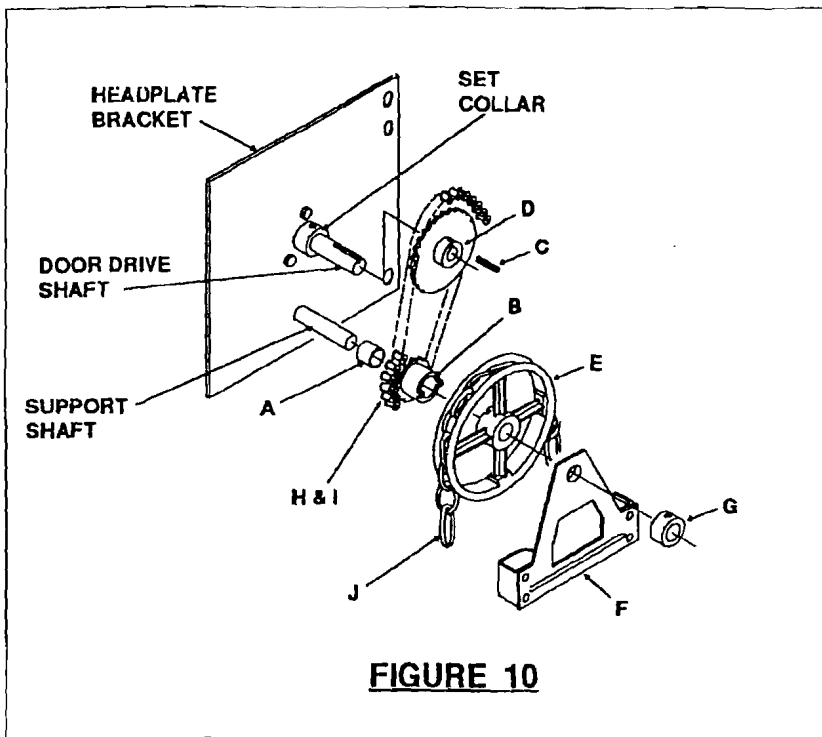
STEP E: Wrap # 41 roller chain H around dentil sprocket B and sprocket D, connect chain with master link I.

STEP F: Slide pocket wheel E onto support shaft with dentil recess facing headplate. Rotate until recesses are fully engaged with projections on dentil sprocket B.

STEP G: Slide chain guide F onto support shaft with chain guide holes toward headplate.

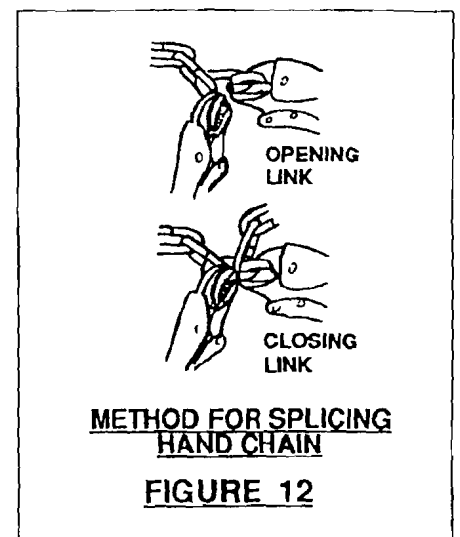
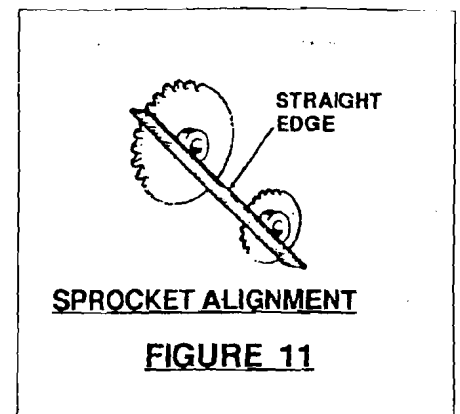
STEP H: Slide set collar G onto support shaft. Press set collar toward headplate until a snug fit between A, B, E, F, and G is obtained, tighten set screw in set collar.

STEP I: Thread hand chain J over pocket wheel E and through chain guide F. Connect hand chain together as shown in Figure 12. Chain **MUST NOT** be twisted.



NOTE: A VISUAL CHECK SHOULD BE MADE TO VERIFY:

- (1) That sprockets are in alignment.
- (2) All set screws are tight.
- (3) All master links have keepers installed properly.



STEP 16 CONT. (CHAIN HOIST ASSEMBLY)

FOR DRIVES #3 & #4 - REFER TO FIGURE 13

- STEP A :** Slide spacer **A** onto support shaft # 1.
- STEP B :** Slide 14T dentil sprocket **B** onto shaft # 1 with the dentil projections facing away from the headplate.
- STEP C :** Slide spacer **C** onto support shaft # 2 .
- STEP D :** Slide 14T x 48T reducer sprocket **D** onto support shaft # 2 with 14T sprocket facing away from headplate.
- STEP E :** Slide set collar **E** onto support shaft # 2. Press set collar toward headplate until a snug fit with **C**, **D** , and **E**, is obtained. Tighten set screw in set collar **E**.
- STEP F :** Slide sprocket **G** and key **F** onto main shaft with hub facing away from headplate.
- STEP G :** Alignment of sprockets: Refer to **Figure 14**. Press edge of straight edge to side of sprocket **G** (38 tooth for drive # 3, 48 tooth for drive # 4). Slide **G** until straight edge touches outside face of 14T sprocket on reducer sprocket **D**. Tighten set screw of sprocket **G**.
- STEP H :** Wrap # 41 roller chain **H** (63 links) around dentil sprocket **B** and reducer sprocket **D**, connect chain with master link **I**.
- STEP I :** Wrap # 41 roller chain **J** (57 links for drive # 3, 63 links for drive # 4) around reducer sprocket **D** and sprocket **G**. Connect with master link **K**.
- STEP J :** Slide pocket wheel **L** onto support shaft # 1 with dentil recesses facing headplate. Rotate until recesses are fully engaged with projections on dentil sprocket **B**.
- STEP K :** Slide chain guide **M** onto support shaft # 1 with chain guide holes toward headplate.
- STEP L :** Slide set collar **N** onto support shaft # 1. Press set collar toward headplate until a snug fit between **A**, **B**, **L**, **M**, and **N** is obtained. Tighten set screw in set collar **N**.
- STEP M :** Thread hand chain **O** over pocket wheel **L** and through chain guide **M**. Connect hand chain together as shown in **Figure 16**. Chain **MUST NOT** be twisted.

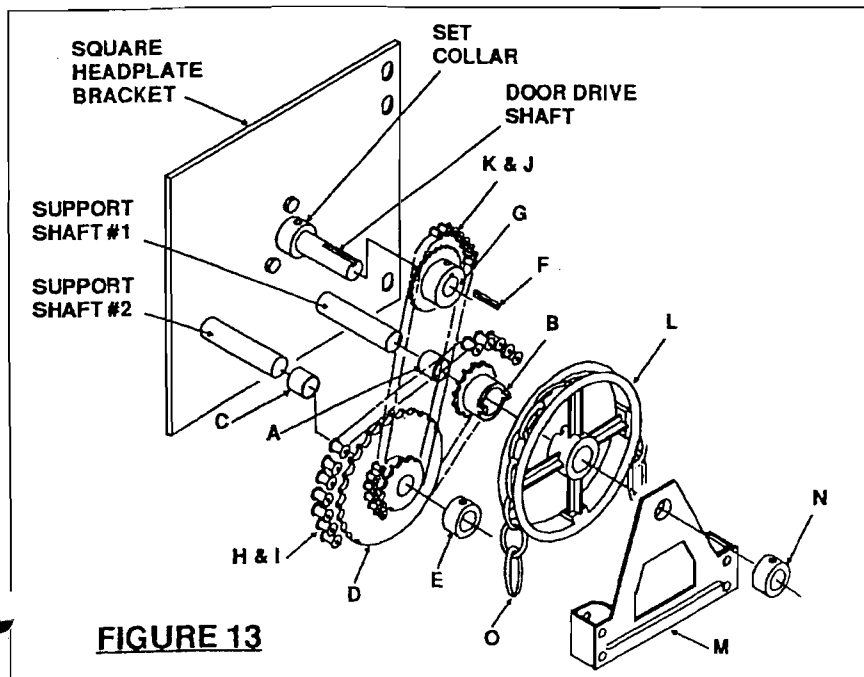
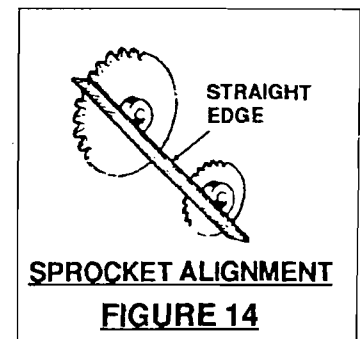


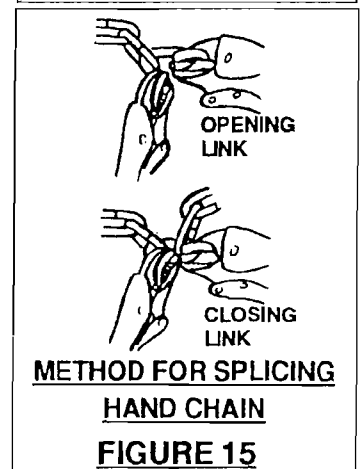
FIGURE 13

NOTE: A VISUAL CHECK SHOULD BE MADE TO VERIFY:

- (1) That sprockets are in alignment.
- (2) All set screws are tight.
- (3) All master links have keepers installed properly.



SPROCKET ALIGNMENT
FIGURE 14



METHOD FOR SPLICING
HAND CHAIN
FIGURE 15

STEP 21 FINAL CHECKOUT

(TO BE COMPLETED BEFORE INSTALLING HOOD)

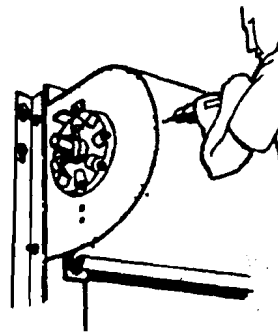
1. The Guides may be lubricated with a Paste Wax or Silicone Spray.
2. Verify thru entire travel of the door that the Endlocks or Windlocks on the end of the Curtain are not rubbing the Headplate Brackets. Operate door several times to check for problems.
3. Check that Bottom Bar is level in full down and full up position and that Curtain is not binding against back of Guide.
4. If Curtain is level at bottom and not level at top, put Shims between Curtain and Counterbalance on the low side.

STEP 22 HOOD INSTALLATION


If Hood Supports are provided, snap a line across top of Headplate Brackets on the Wall. Measure length of Hood Sections and locate Hood Support so that Hood Splice will fall on center of Support.


Attach Hood to Hood Bands on Bracket Plates (and to Supports if provided) by drilling a 7/32" hole through Hood and Band. Then secure with 1/4" dia. x 3/8" long Self-tapping Screws (four per Bracket and four per Support).

NOTES :



DECALS SHOWN BELOW MUST BE ATTACHED TO THE GUIDES ON THE COIL SIDE


WARNING




Moving Door can cause serious injury or death.

Do Not start door downward unless doorway is clear.


SAFETY INSTRUCTIONS


- Unlock door before opening.
- Operate door only when doorway is in sight and free of people and obstructions.
- **DO NOT** permit children to play in door area or operate door.
- **DO NOT** stand in doorway at anytime or walk through doorway while door is moving.
- If control is by a 3 - button station and there is not a reversing edge, locate station so that the door is in sight of user.
- Door is under high spring tension. If door will not open or close, or needs repair, contact local distributor.



DO NOT remove, cover, or paint over this label.
Place label on Rolling Door guide on the drive side.

301603-0001


WARNING




Door May Fail to Close during fire and cause serious injury or death.

Do Not prop or wedge door open.

Do Not substitute or modify parts.

SAFETY INSTRUCTIONS

- Qualified personnel should perform fire door drop test and reset at least annually. See Instructions inside tension headplate cover.
- Fire door must be open when fire door automatic closing mechanism is released. **DAMAGE MAY OCCUR** if fire door is closed when automatic mechanism is released.
- Damage to hood or guide may prevent door closing during fire. Inspect hood, guide, and bottom bar monthly; call for professional repair immediately.



Do Not remove, cover, or paint over this label.
Place label on Rolling Door guide on the drive side.

307600-0001

03-A

11319-01-C

EXTRACTION WELL SEALS

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134



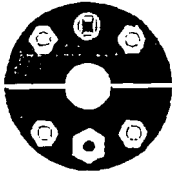
Campbell

Cast Iron Well Seals

SPLIT WELL SEAL

(submersible)

continued from K1



part	casing i.d.	drop pipe	vent tapping	cable hole
SUB6-1/8x2	6-1/8	2	1/2	3/4
SUB6-1/8x2-1/2	6-1/8	2-1/2	1/2	3/4
SUB6-1/4x3/4	6-1/4	3/4	1/2	3/4
SUB6-1/4x1	6-1/4	1	1/2	3/4
SUB6-1/4x1-1/4	6-1/4	1-1/4	1/2	3/4
SUB6-1/4x1-1/2	6-1/4	1-1/2	1/2	3/4
SUB6-1/4x2	6-1/4	2	1/2	3/4
SUB6-1/4x2-1/2	6-1/4	2-1/2	1/2	3/4
SUB6-1/4x3	6-1/4	3	1/2	3/4
SUB6-3/8x3/4	6-3/8	3/4	1/2	3/4
SUB6-3/8x1	6-3/8	1	1/2	3/4
SUB6-3/8x1-1/4	6-3/8	1-1/4	1/2	3/4
SUB6-3/8x1-1/2	6-3/8	1-1/2	1/2	3/4
SUB6-3/8x2	6-3/8	2	1/2	3/4
SUB6-3/8x2-1/2	6-3/8	2-1/2	1/2	3/4
SUB6-3/8x3	6-3/8	3	1/2	3/4
SUB6-1/2x3/4	6-1/2	3/4	1/2	3/4
SUB6-1/2x1	6-1/2	1	1/2	3/4
SUB6-1/2x1-1/4	6-1/2	1-1/4	1/2	3/4
SUB6-1/2x1-1/2	6-1/2	1-1/2	1/2	3/4
SUB6-1/2x2	6-1/2	2	1/2	3/4
SUB6-1/2x2-1/2	6-1/2	2-1/2	1/2	3/4
SUB6-1/2x3	6-1/2	3	1/2	3/4
SUB6-5/8x3/4	6-5/8	3/4	1/2	3/4
SUB6-5/8x1	6-5/8	1	1/2	3/4
SUB6-5/8x1-1/4	6-5/8	1-1/4	1/2	3/4
SUB6-5/8x1-1/2	6-5/8	1-1/2	1/2	3/4
SUB6-5/8x2	6-5/8	2	1/2	3/4
SUB6-5/8x2-1/2	6-5/8	2-1/2	1/2	3/4
SUB6-5/8x3	6-5/8	3	1/2	3/4
SUB8x3/4	8	3/4	1/2	1
SUB8x1	8	1	1/2	1
SUB8x1-1/4	8	1-1/4	1/2	1
SUB8x1-1/2	8	1-1/2	1/2	1
SUB8x2	8	2	1/2	1
SUB8x2-1/2	8	2-1/2	1/2	1
SUB8x3	8	3	1/2	1
SUB8x4	8	4	1/2	1
SUB8-1/4x3/4	8-1/4	3/4	1/2	1-3/8*
SUB8-1/4x1	8-1/4	1	1/2	1-3/8*
SUB8-1/4x1-1/4	8-1/4	1-1/4	1/2	1-3/8*
SUB8-1/4x1-1/2	8-1/4	1-1/2	1/2	1-3/8*
SUB8-1/4x2	8-1/4	2	1/2	1-3/8*
SUB8-1/4x2-1/2	8-1/4	2-1/2	1/2	1-3/8*
SUB8-1/4x3	8-1/4	3	1/2	1-3/8*
SUB10x3/4	10	3/4	1/2	1-3/8*
SUB10x1	10	1	1/2	1-3/8*
SUB10x1-1/4	10	1-1/4	1/2	1-3/8*
SUB10x1-1/2	10	1-1/2	1/2	1-3/8*
SUB10x2	10	2	1/2	1-3/8*
SUB10x2-1/2	10	2-1/2	1/2	1-3/8*
SUB10x3	10	3	1/2	1-3/8*
SUB10x4	10	4	1/2	1-3/8*
SUB10x5	10	5	1/2	1-3/8*
SUB10x6	10	6	1/2	1-1/8**
SUB12x3/4	12	3/4	1/2	1-3/8*
SUB12x1	12	1	1/2	1-3/8*
SUB12x1-1/4	12	1-1/4	1/2	1-3/8*
SUB12x1-1/2	12	1-1/2	1/2	1-3/8*
SUB12x2	12	2	1/2	1-3/8*
SUB12x2-1/2	12	2-1/2	1/2	1-3/8*
SUB12x3	12	3	1/2	1-3/8*
SUB12x4	12	4	1/2	1-3/8*
SUB12x5	12	5	1/2	1-3/8*
SUB12x6	12	6	1/2	1-3/8*
SUB12x8	12	8	1/2	1-1/8**

*

SUB12x6

SUB10x2

SUB8x3

SUB6-1/4x1-1/4

Campbell

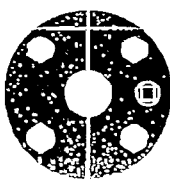
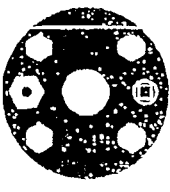
Cast Iron Well Seals



SUB5-5/8x1

JET WELL SEAL*

part	casing	drop	vent	cable
JET2x1	i.d.	pipe	tapping	hole
2	1	-	-	-

SOLID WELL SEAL
(submersible)

SUB4x1S	4	1	1/2	3/4
SUB4x1-1/4S	4	1-1/4	1/2	3/4
SUB4x1-1/2S	4	1-1/2	1/2	3/4
SUB4x2S	4	2	1/2	3/4
SUB6x1S	6	1	1/2	3/4
SUB6x1-1/4S	6	1-1/4	1/2	3/4
SUB6x1-1/2S	6	1-1/2	1/2	3/4
SUB6x2S	6	2	1/2	3/4

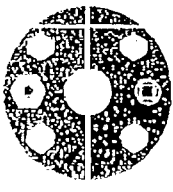
SUB6x1-1/2S

SUB4x2S

SUB5x1

SUB4x1

JET2x1

SPLIT WELL SEAL
(submersible)

SUB3x3/4	3	3/4	1/8	7/16**
SUB3x1	3	1	1/8	7/16**
SUB3x1-1/4	3	1-1/4	1/2	7/16**
SUB4x3/4	4	3/4	1/2	1/2
SUB4x1*	4	1	1/2	3/4
SUB4x1-1/4*	4	1-1/4	1/2	3/4
SUB4-1/4x3/4	4-1/4	3/4	1/2	1/2
SUB4-1/4x1	4-1/4	1	1/2	1/2
SUB4-1/4x1-1/4	4-1/4	1-1/4	1/2	1/2
SUB4-1/4x1-1/2	4-1/4	1-1/2	1/2	1/2
SUB4-1/4x2	4-1/4	2	1/2	1/2
SUB4-1/2x3/4	4-1/2	3/4	1/2	1/2
SUB4-1/2x1	4-1/2	1	1/2	1/2
SUB4-1/2x1-1/4	4-1/2	1-1/4	1/2	1/2
SUB4-1/2x1-1/2	4-1/2	1-1/2	1/2	1/2
SUB4-1/2x2	4-1/2	2	1/2	1/2
SUB5x3/4	5	3/4	1/2	3/4
SUB5x1	5	1	1/2	3/4
SUB5x1-1/4	5	1-1/4	1/2	3/4
SUB5x1-1/2	5	1-1/2	1/2	3/4
SUB5x2	5	2	1/2	3/4
SUB5x2-1/2	5	2-1/2	1/2	1/2
SUB5-3/16x3/4	5-3/16	3/4	1/2	3/4
SUB5-3/16x1	5-3/16	1	1/2	3/4
SUB5-3/16x1-1/4	5-3/16	1-1/4	1/2	3/4
SUB5-3/16x1-1/2	5-3/16	1-1/2	1/2	3/4
SUB5-3/16x2	5-3/16	2	1/2	3/4
SUB5-5/8x3/4	5-5/8	3/4	1/2	3/4
SUB5-5/8x1	5-5/8	1	1/2	3/4
SUB5-5/8x1-1/4	5-5/8	1-1/4	1/2	3/4
SUB5-5/8x1-1/2	5-5/8	1-1/2	1/2	3/4
SUB5-5/8x2	5-5/8	2	1/2	3/4
SUB5-5/8x2-1/2	5-5/8	2-1/2	1/2	3/4
SUB6x3/4	6	3/4	1/2	3/4
SUB6x1	6	1	1/2	1
SUB6x1-1/4	6	1-1/4	1/2	1
SUB6x1-1/2	6	1-1/2	1/2	1
SUB6x2	6	2	1/2	1
SUB6x2-1/2	6	2-1/2	1/2	1
SUB6x3	6	3	1/2	3/4
SUB6-1/8x3/4	6-1/8	3/4	1/2	3/4
SUB6-1/8x1	6-1/8	1	1/2	3/4
SUB6-1/8x1-1/4	6-1/8	1-1/4	1/2	3/4
SUB6-1/8x1-1/2	6-1/8	1-1/2	1/2	3/4

continued on K2

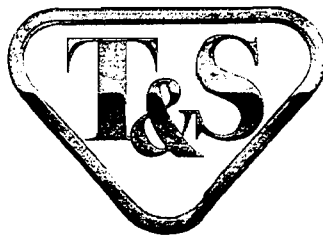
*All Submersible Well Seals can be converted to Jet Well Seals by plugging conduit tap with a Malesole Square Head Plug (p&c C5).

**Cable hole is not tapped.

†S-split type (see photo).

Other sizes and styles available upon request. All seals individually packaged.

Campbell Manufacturing, Inc.
Spring & Railroad Streets
Bechtelsville, PA 19505
800-623-0224, Fax 610-369-3580



Limited One Year Warranty

T&S warrants to the original purchaser (other than for purposes of resale) that such product is free from defects in material and workmanship for a period of one (1) year from the date of purchase. During this one-year warranty period, if the product is found to be defective, T&S shall, at its option, repair and/or replace it. To obtain warranty service, products must be returned to...

*T&S Brass and Bronze Works, Inc.
Attn: Warranty Repair Department
2 Saddleback Cove
Travelers Rest, SC 29690*

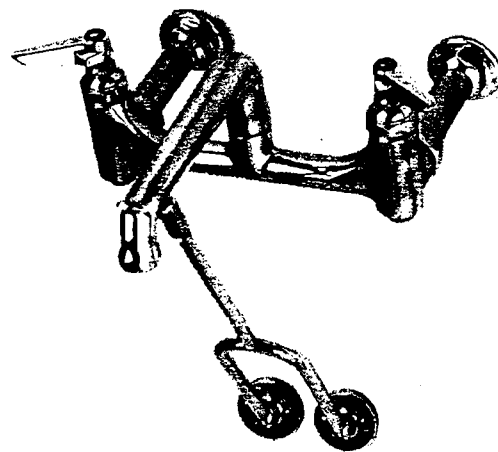
Shipping, freight, insurance, and other transportation charges of the product to T&S and the return of repaired or replaced product to the purchaser are the responsibility of the purchaser. Repair and/or replacement shall be made within a reasonable time after receipt by T&S of the returned product. This warranty does not cover items which have received secondary finishing or have been altered or modified after purchase, or for defects caused by physical abuse to or misuse of the product, or shipment of the products.

Any express warranty not provided herein, and any remedy for Breach of Contract which might arise, is hereby excluded and disclaimed. Any implied warranties of merchantability or fitness for a particular purpose are limited to one year in duration. Under no circumstances shall T&S be liable for loss of use or any special consequential costs, expenses or damages.

Some states do not allow limitations on how long and implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. Specific rights under this warranty and other rights vary from state to state.

P/N: 098-003117-45 Rev.1
Date: 980402
Drawn: CW
Checked: MW 6-10-98
Approved: MAB 6-10-98

Installation and Maintenance Instructions



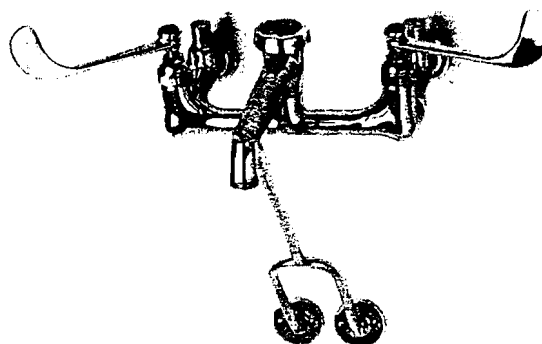
Service Sink Faucet B-0650 Series

Deutsch: Installations- und
Wartungsanleitungen

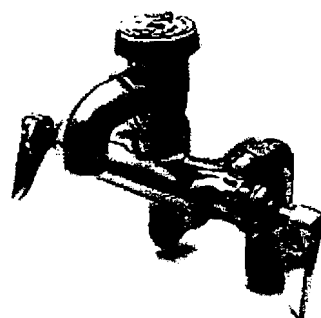
Español: la Instalación y las
Instrucciones de
Mantenimiento

Français: les Instructions
d'Installation et
d'Entretien

RELATED T&S BRASS PRODUCT LINE



B-0657
Service Sink Faucet



B-0669
Service Sink Faucet

T&S BRASS AND BRONZE WORKS, INC.

A firm commitment to application-engineered plumbing products

2 Saddleback Cove, P.O. Box 1088,

Travelers Rest, SC 29690

Phone: (864) 834-4102

Fax: (864) 834-3518

E-mail: tsbrass@tsbrass.com

T & S Brass-Europe

'De Veenhoeve'

Oude Nieuwveenseweg 84

2441 CW Nieuwveen

The Netherlands

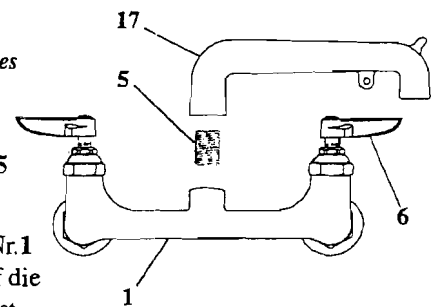


Allgemeine Anleitungen

Schwenkhahninstallation:

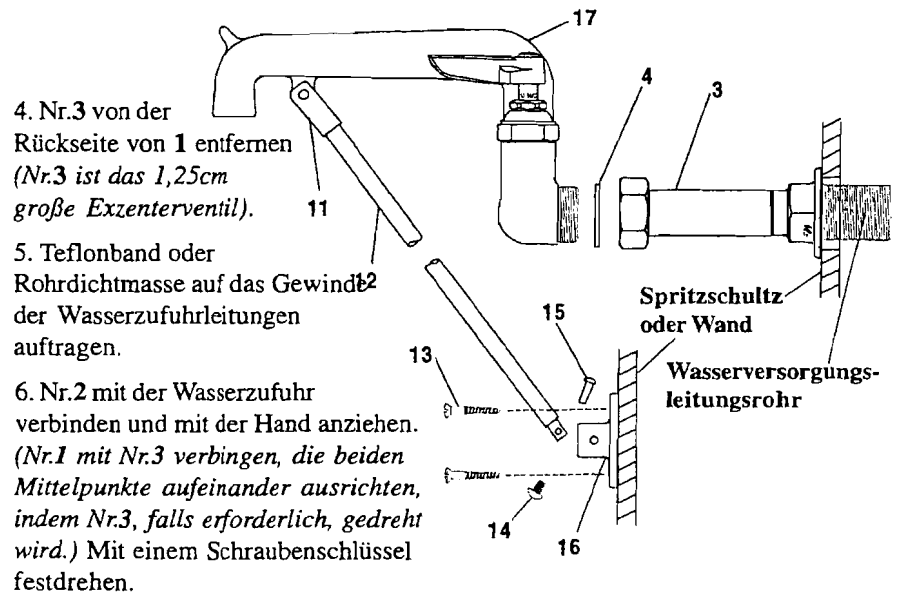
Anmerkung: Die Schwenkhähne sind als erstes zu installieren. Nr.6 von beiden Seiten des Schwenkhahns entfernen.

1. Loctite Nr. 680 auf das Gewinde von Nr.5 auftragen.
2. Nr.5 durch Nr.17 führen, dann Nr.17 in Nr.1 drehen, bis Nr.17 fest sitzt, wobei Nr.17 auf die Vorderseite des Spültisches auszurichten ist



Armatureneninstallation:

3. Wasserzufuhr abstellen und Leitungen entleeren. Zwei (2) 2,25cm große Löcher mit einem Durchmesser von ungefähr 3cm in die Wand oder den Spritzschutz bohren mit einer Mitte von 20cm, in die Nr.1 installiert wird.



4. Nr.3 von der Rückseite von 1 entfernen (Nr.3 ist das 1,25cm große Exzenterventil).

5. Teflonband oder Rohrdichtmasse auf das Gewinde der Wasserzufuhrleitungen auftragen.

6. Nr.2 mit der Wasserzufuhr verbinden und mit der Hand anziehen. (Nr.1 mit Nr.3 verbinden, die beiden Mittelpunkte aufeinander ausrichten, indem Nr.3, falls erforderlich, gedreht wird.) Mit einem Schraubenschlüssel festdrehen.

7. Auf der Unterseite von 17 Nr.12 in Nr.11 einschrauben. Nr.12 auf Nr.16 anbringen, indem Nr.15 durch Nr.16 und Nr.12 gesteckt wird und dann Nr.14 in Nr.15 eingeschraubt und festgezogen wird.

8. Wo Nr.12 und Nr.16 auf der Wand aufliegen, vier (4) 0,5cm Löcher in die Wand oder den Spritzschutz bohren. Nr.16 befestigen, indem Nr.13 durch Nr.16 in die Wand oder den Spritzschutz geschraubt wird.

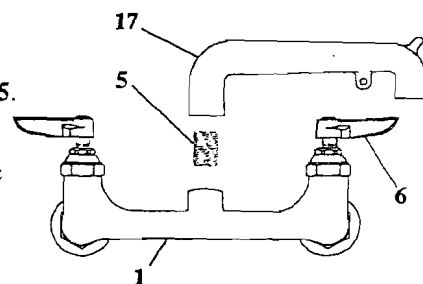
9. Wasserzufuhr andrehen und auf Lecks prüfen.

Instructions Générales

L'Installation De L'Ajutage:

Noter: Les ajutages doivent être installés au début. Enlever N°6 de chaque côté du robinet.

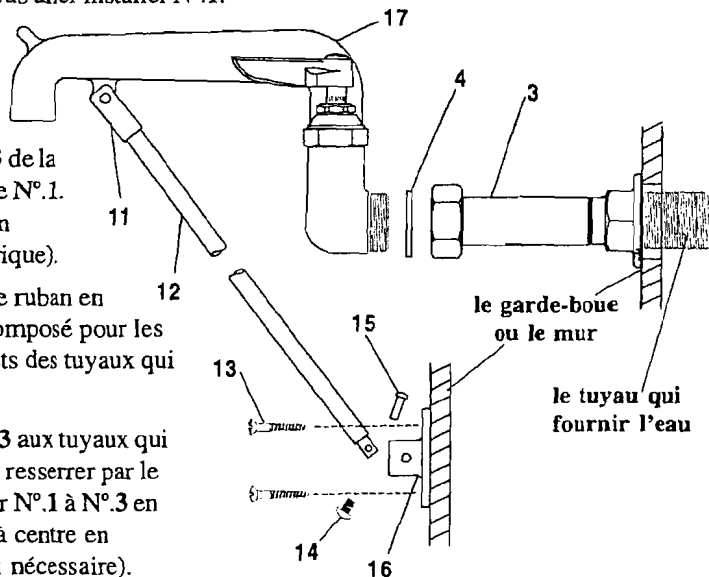
1. Appliquer "loctite #680" aux filets de N°5.
2. Mettre N°5 à travers N°17, puis tourner N°17 dans N°1 jusqu'à ce qu'il soit bien serré avec N°17 vers la face de l'évier.



L'Installation Du Robinet:

3. Fermer la réserve de l'eau et égoutter la tuyauterie. Percer (2) deux trous 2cm, avec un diamètre de 3cm dans le mur ou le garde-boue de l'évier avec les centres de 20cm, où vous allez installer N°1.

4. Enlever N°3 de la partie arrière de N°1. (N°3 est 1.5cm femelle excentrique).
5. Appliquer le ruban en Téflon ou le composé pour les tuyaux aux filets des tuyaux qui fournir l'eau.
6. Attacher N°3 aux tuyaux qui fournir l'eau et resserrer par le main. (Attacher N°1 à N°3 en réglant centre à centre en tournant N°3 si nécessaire). Resserrer avec une clef.



7. Visser N°12 dans N°11 sur le côté arrière de N°17. Attacher N°12 à N°16 en plaçant N°15 à travers N°16 et N°12. Puis visser N°14 dans N°15 et resserrer.
8. Percer (4) quatre trous 9cm dans le mur ou le garde-boue de l'évier où N°12 et N°16 resteront contre le mur. Attacher N°16 en vissant N°13 à travers N°16 dans le mur ou le garde-boue.
9. Recommencer l'eau et vérifier s'il y a des fuites.

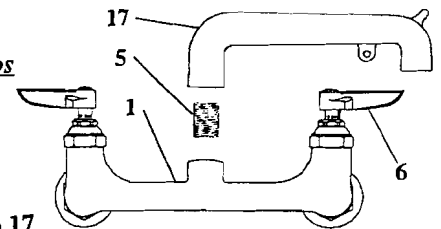
Instrucciones Generales

Instalación:

Nota: Las boquillas deben ser instaladas primero. Remueva la parte No.6 de ambos lados de la canilla.

1. Aplique Loctite No. 680 a la rosca de la parte No.5.

2. Enrosque la parte No.5 entre la parte No.17, luego gire la parte No.17 entre la parte No.1 hasta que este apretada, con la parte No.17 orientada hacia el frente de el lavatorio.



Instalación De La Canilla:

3. Cierre la fuente principal de agua y desagüe las tuberías. Perfore (2) dos huecos de 2cm de diámetro en la pared o en el espaldar del lavatorio con centros de 20cm, donde la parte No.1 será instalada.

4. Remuéva la parte No.3 de la parte posterior de la parte No.1 (No.3 es rosca femenina de 1.25cm excéntrica)

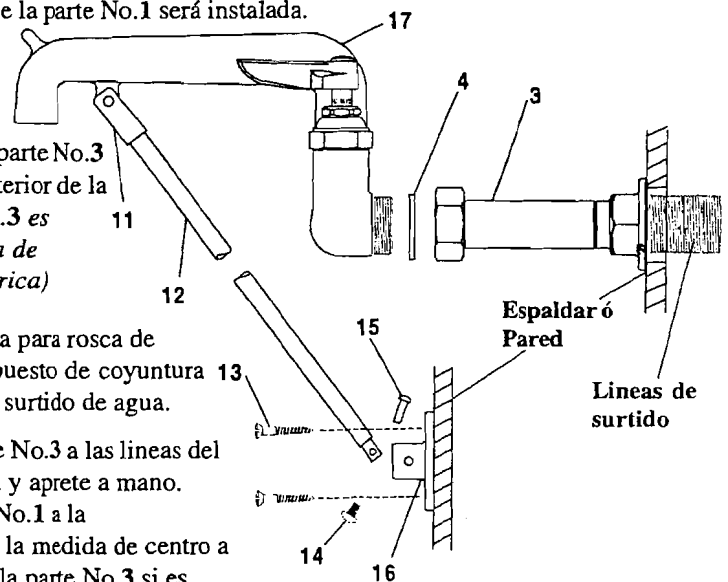
5. Aplique cinta para rosca de tubería o compuesto de coyuntura 13 a las líneas del surtido de agua.

6. Junte la parte No.3 a las líneas del surtido de agua y aprete a mano. (Junte la parte No.1 a la No.3,ajustando la medida de centro a centro girando la parte No.3 si es necesario.) Apreté con una llave.

7. Atornille la parte No.12 entre la No.11 en el lado de abajo de la parte No.17. Junte la parte No.12 a la parte No.16 colocando la parte No.15 a través de las partes No.16 y No.12 luego atornillando la parte No.14 en la No.15 y apretela.

8. Perfore (4) cuatro huecos de .5cm en la pared o el aspalдар donde las partes No.12 y 16 hagan contacto. Asegure la parte No.16 atornillando la parte No.13 a través de la parte No.16 dentro de la pared o el espaldar.

9. Abra la fuente de agua e inspeccione por filtraciones.

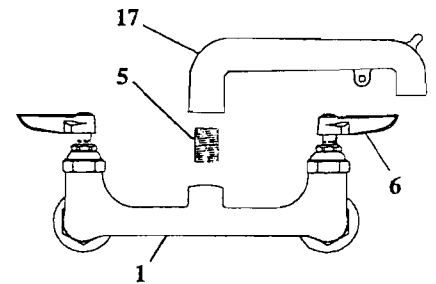


General Instructions

Nozzle Installation:

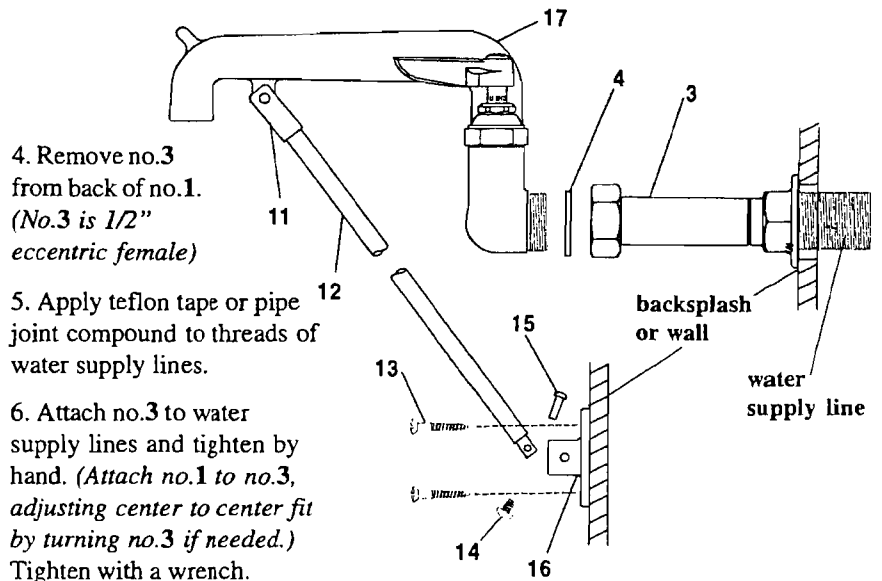
*Note: Nozzles should be installed first.
Remove no.6 from both sides of faucet.*

1. Apply Loctite #680 to threads of no.5.
2. Thread no.5 into no.17, then rotate no.17 into no.1 until tight with no.17 facing front of sink.



Faucet Installation:

3. Shut off water supply and drain lines. Drill (2) two 7/8" holes in wall or backsplash of sink with 8" centers, where you are installing no.1.



4. Remove no.3 from back of no.1. (No.3 is 1/2" eccentric female)

5. Apply teflon tape or pipe joint compound to threads of water supply lines.

6. Attach no.3 to water supply lines and tighten by hand. (Attach no.1 to no.3, adjusting center to center fit by turning no.3 if needed.) Tighten with a wrench.

7. Screw no.12 into no.11 on bottom side of no.17. Attach no.12 to no.16 by placing no.15 through no.16 and no.12 then screwing no.14 into no.15 and tightening.

8. Drill (4) four 3/16" hole into wall or backsplash where no.12 and no.16 rest against wall. Secure no.16 by screwing no.13 thru no.16 and into wall or backsplash.

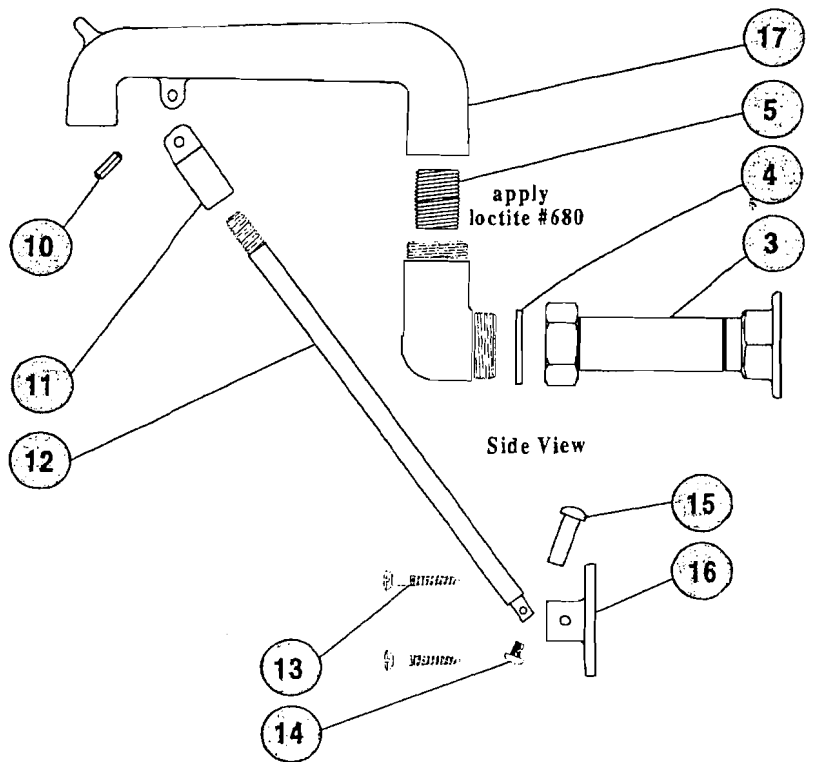
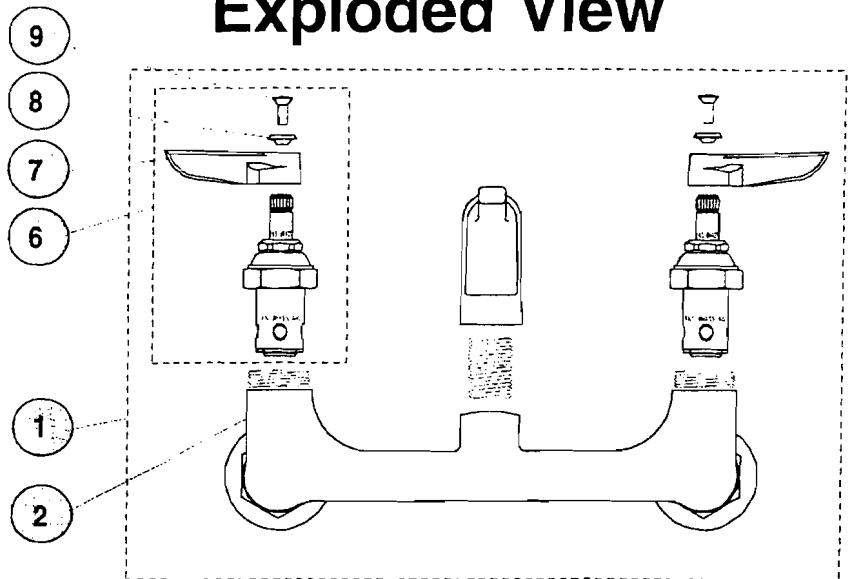
9. Turn on water supply and check for leaks.

Part Number Guide

Faucet Body Assemblies

1	Asm. Base Faucet	00650201
2	Body Faucet	
3	Asm. Inlet Extension	000101
4	Washer Coupling Flange	00100105
5	Washer Gasket (2 HWT)	00250000
6	Asm. Stem LH Spindle	00271000
7	Asm. Stem RH Spindle	00271000
8	Handle Lever (Cold)	00180005
9	Handle Lever Hot	00180705
10	Index Button (Red Hot)	00180105
11	Index Button (Blue Cold)	00180005
12	Spring Handle	00000000
13	Cap Gasket (2 HWT)	00100105
14	Cap Gasket	00100105
15	Support Rod	00100105
16	Screw (Wash Plug)	00100105
17	Screw (Wash Plug)	00100105
18	Washer	00100105
19	Washer	00100105

Exploded View



* Some items are listed for instructional purposes and may not be sold as separate parts.

GUARDIAN EQUIPMENT

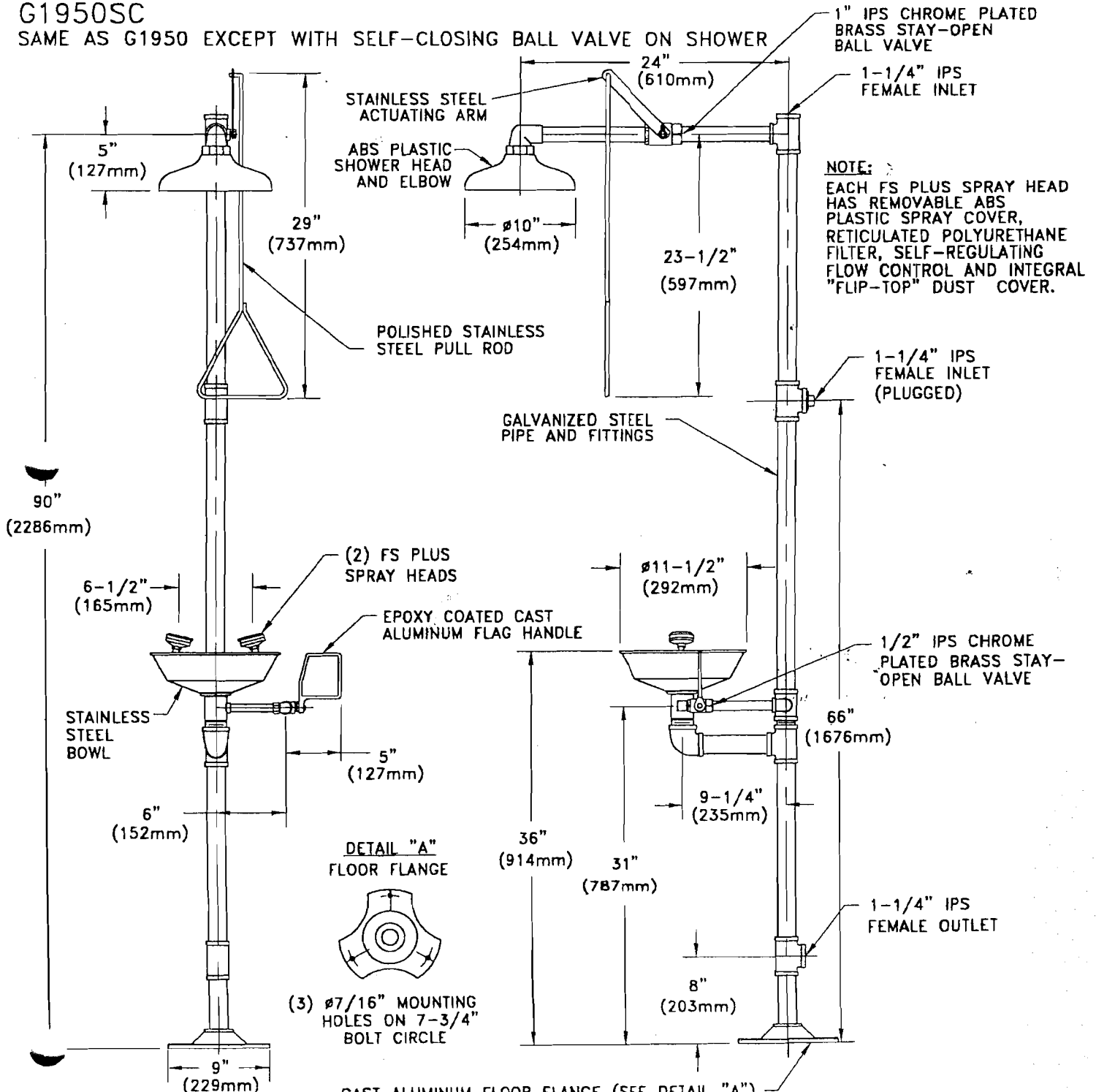
860 North Union Street
Chicago, IL 60610
Phone: 312/733-2626
Fax: 312/733-4684

G1950

SAFETY STATION WITH STAY-OPEN SHOWER VALVE AND EYE/FACE WASH WITH STAINLESS STEEL BOWL AND STAY-OPEN BALL VALVE

G1950SC

SAME AS G1950 EXCEPT WITH SELF-CLOSING BALL VALVE ON SHOWER



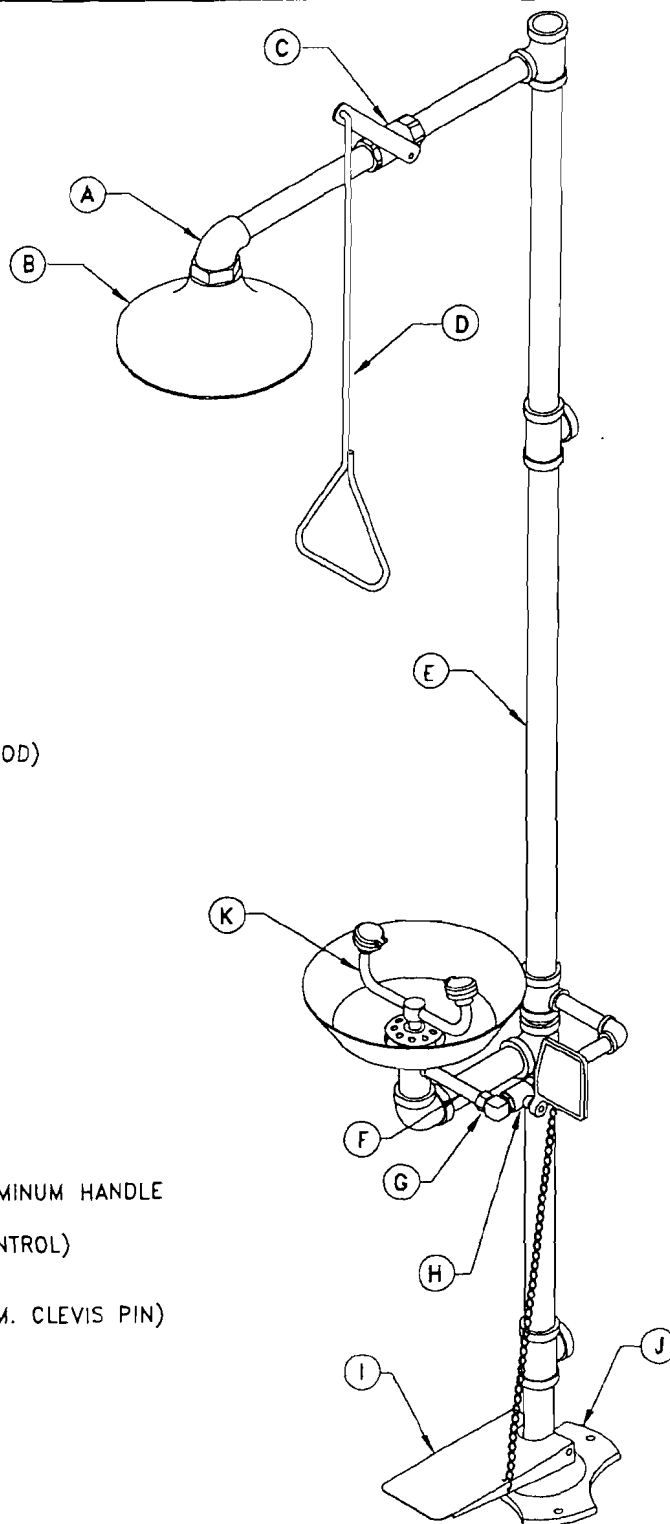
UNITS (EXCEPT THOSE WITH SELF-CLOSING VALVES) COMPLY WITH THE REQUIREMENTS OF ANSI Z358.1. TEST ALL EMERGENCY EQUIPMENT AT LEAST WEEKLY. MEASUREMENTS MAY VARY ±1/4".

Drawing Number: **G402-500**

Revision Number: **061197-WK**

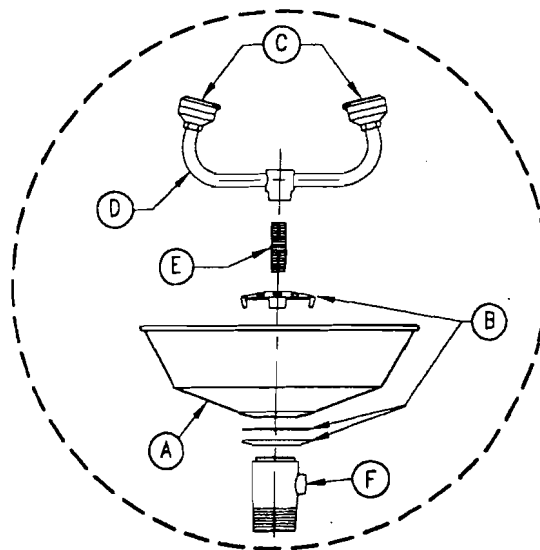
PARTS LISTING SAFETY STATIONS

- (A) SHOWER HEAD ELBOWS
 - PLASTIC
 - 330-12-08RSE-OR (ORANGE)
 - 330-12-08RSE-GR (GREEN)
 - 330-12-08RSE-YE (YELLOW)
 - GALVANIZED
 - 300-08SE
- (B) SHOWER HEADS
 - PLASTIC
 - AP450-032ORG (ORANGE)
 - AP450-032GRN (GREEN)
 - AP450-032YEL (YELLOW)
 - STAINLESS STEEL
 - AP450-048 (10" DIA.)
 - CHROME PLATED BRASS
 - AP450-016 (8" DIA.)
- (C) SHOWER VALVE/ACTUATING ARM ASSEMBLIES
 - CHROME PLATED BRASS VALVE/STAINLESS STEEL ARM
 - AP600-345H (SELF-CLOSING)
 - AP600-335H (STAY-OPEN, SINGLE ACTIVATION)
 - AP600-215 (SLOW, SELF-CLOSING)
 - RK600-300 (REPAIR KIT FOR AP600-215)
- (D) SHOWER ACTUATING COMPONENTS
 - AP050-079 (29" STAINLESS STEEL PULL ROD)
 - AP050-080 (43" STAINLESS STEEL PULL ROD)
 - AP050-081 (EXTENDED LENGTH STAINLESS STEEL PULL ROD)
 - AP050-078 (48" SASH CHAIN W/PIPE CLAMP)
- (E) PIPE PACK (INCLUDES ALL MAJOR PIPE LENGTHS REQUIRED)
 - GALVANIZED
 - AP500-100 (FOR UNITS WITH BOWL)
 - AP500-110 (FOR UNITS W/O BOWL)
- (F) FLARED NIPPLE
 - 3/8" IPS X 4" LONG CHROME PLATED BRASS
 - 510-03-04FX
- (G) COUPLING NUT/GASKET
 - 1/2" IPS CHROME PLATED BRASS NUT AND FIBER WASHER
 - 810-04CN (NUT)
 - 730-006A (GASKET)
- (H) BALL VALVE ASSEMBLY
 - CHROME PLATED BRASS WITH EPOXY POWDER COATED ALUMINUM HANDLE
 - AP600-101H
 - AP600-101H-HFC (FOR UNITS WITH HAND AND FOOT CONTROL)
- (I) HAND AND FOOT CONTROL ASSEMBLIES
 - AP050-010 (STN. FOOT TREADLE/RETURN SPRING W/ALUM. CLEVIS PIN)
 - AP050-011-028 (28" LONG SASH CHAIN)
- (J) FLOOR FLANGE
 - CAST ALUMINUM
 - 150-030-1 (1-1/4" IPS THREAD)
- (K) EYE WASH AND EYE/FACE WASH (SEE PAGE 2)

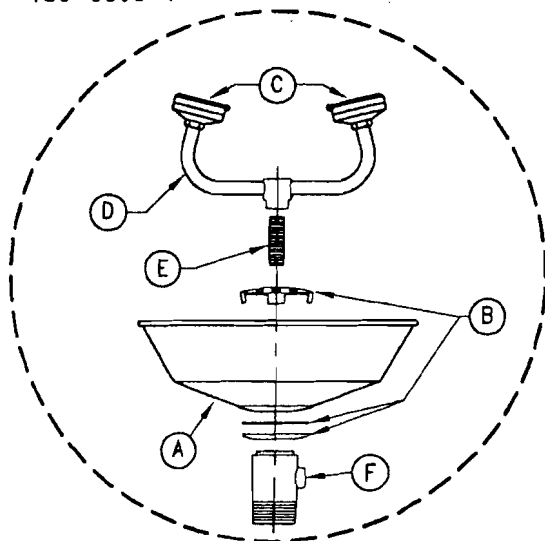


PARTS LISTING SAFETY STATIONS (EYE AND EYE/FACE WASHES)

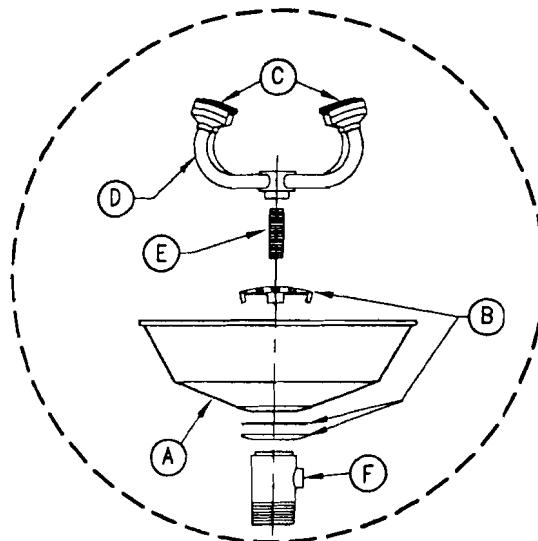
- (A) BOWLS
 - PLASTIC
 - 100-009ORG-R (ORANGE)
 - 100-009GRN-R (GREEN)
 - 100-009YEL-R (YELLOW)
 - STAINLESS STEEL
 - 100-008R
- (B) DRAIN PLATE ASSEMBLIES
 - DRAIN PLATE, CUPPED WASHER, AND GASKET
 - AP150-012A (FOR PLASTIC BOWLS)
 - AP150-012B (FOR STAINLESS BOWLS)
- (C) DUST COVER ASSEMBLIES
 - PLASTIC
 - AP470-002R (FOR GS PLUS SPRAY HEADS)
 - AP470-022R (FOR FS PLUS SPRAY HEADS)
 - STAINLESS STEEL HINGED
 - AP470-040 (FOR GS PLUS SPRAY HEADS)
 - AP470-045 (FOR FS PLUS SPRAY HEADS)
- (D) SPRAY HEAD ASSEMBLIES
 - PLASTIC HEADS W/CHROME PLATED BRASS FITTINGS
 - AP470-100R (2 GS PLUS SPRAY HEADS)
 - AP470-110R (2 FS PLUS SPRAY HEADS)
 - AP470-120R (4 GS PLUS SPRAY HEADS)
- (E) EYEWASH SHANK
 - 3/8" IPS X 2-1/4" BRASS SHANK
 - BI136-02-04
- (F) WASTE RECEPTOR
 - 1-1/2" IPS MALE OUTLET
 - 150-066C-1



ASSEMBLY DETAIL
EYE WASH
(2 GS PLUS SPRAY HEADS)



ASSEMBLY DETAIL
EYE/FACE WASH
(2 FS PLUS SPRAY HEADS)

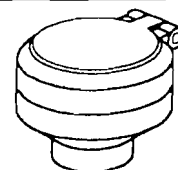


ASSEMBLY DETAIL
EYE/FACE WASH
(4 GS PLUS SPRAY HEADS)

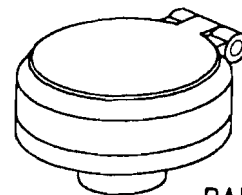
SPRAY HEAD ASSEMBLY INSTRUCTIONS GS PLUS AND FS PLUS SPRAY HEAD

EACH GS PLUS AND FS PLUS SPRAY HEAD FEATURES:

- TOUGH POLYPROPYLENE PLASTIC CONSTRUCTION
- HIGHLY VISIBLE INTEGRATED NYLON DUST COVER
- EASILY ACCESSIBLE 1.8 GPM(GS) OR 3.2 GPM(FS) FLOW CONTROL
- DENSE (60 PORE PER INCH) POLYURETHANE FILTER
- UNIQUE DESIGN PROVIDES A CONSISTENTLY SOFT, FULL SPRAY ACROSS A RANGE OF WORKING PRESSURES FROM 30 TO 100 PSI.



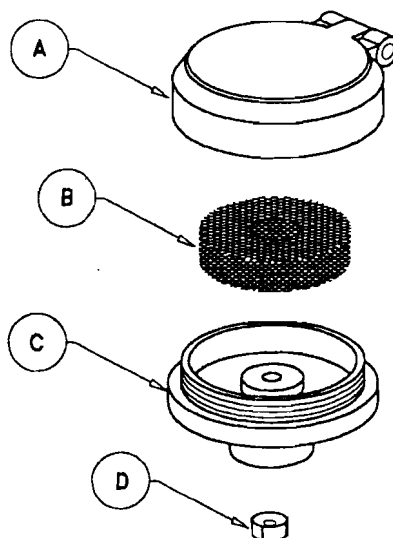
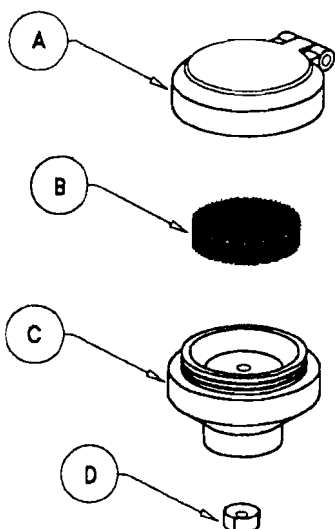
PART NUMBER:
AP470-001



PART NUMBER:
AP470-021

GS PLUS SPRAY HEAD

FS PLUS SPRAY HEAD



ITEM:	GS PLUS:	FS PLUS:	DESCRIPTION:
A	AP470-002R	AP470-022R	DUST COVER AND CAP ASSEMBLY
B	470-004R	470-024R	60 PPI POLYURETHANE FILTER
C	470-001R	470-021R	PLASTIC BODY
D	470-005R	470-025R	1.8/3.2 GPM FLOW CONTROL

IMPORTANT:

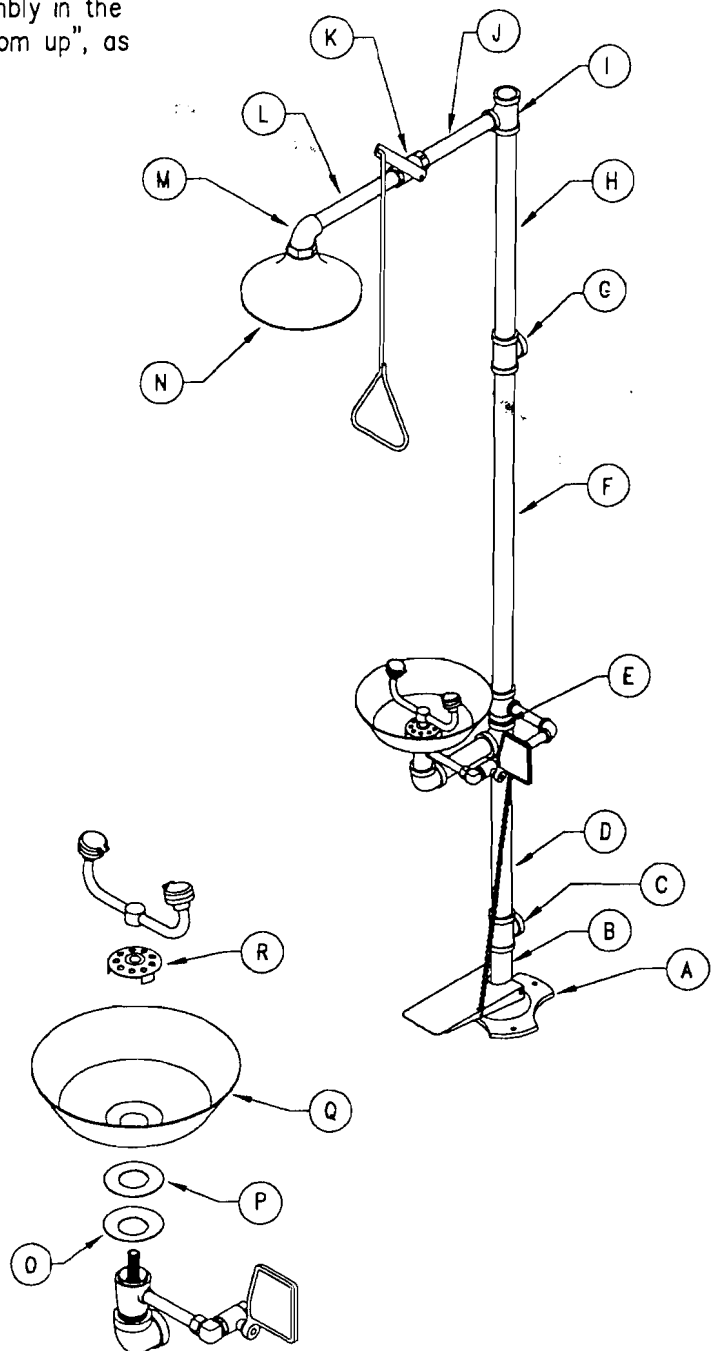
IN ORDER TO OPERATE PROPERLY, THE FLOW CONTROL
MUST BE INSERTED INTO THE BODY CONCAVE END FIRST

ALL EMERGENCY EQUIPMENT SHOULD BE TESTED AT LEAST WEEKLY TO ASSURE PROPER OPERATION.

ASSEMBLY INSTRUCTIONS SAFETY STATION

Guardian safety stations are designed for easy assembly in the field. Essentially, these units are assembled from the "bottom up", as described below:

1. Assemble floor flange (A), 1-1/4" IPS x 5-3/4" nipple or plug (B), and outlet tee (C). If unit has a foot treadle, the floor flange, plug and treadle are pre-assembled. Position foot treadle for proper access by users, and tee for connection to drain.
2. Assemble 1-1/4" IPS x 17-3/4" nipple (D) and frame assembly (E). Position frame assembly for proper access by users.
3. Assemble 1-1/4" IPS x 32" nipple (F) and inlet tee (G). Position tee for connection to supply. If the top vertical inlet will be employed, plug tee with supplied 1-1/4" IPS square head plug. Assemble 1-1/4" IPS x 22" nipple (H) and 1-1/4" x 1" IPS reducing inlet tee (I). Position tee forward for proper location of shower. If the back horizontal inlet will be employed, plug tee with supplied 1-1/4" IPS square head plug.
5. Assemble 1" IPS x 8-7/8" nipple (J), emergency shower valve (K), 1" IPS x 10-1/2" nipple (L), elbow (M), and shower head (N). If shower valve is slow, self-closing type, attach chain to riser.
6. Place cupped, stainless steel washer (O), rubber gasket (P), and bowl (Q) onto waste receptor. Center components to assure a watertight seal.
7. Thread drain plate (R) down onto mounting shank as far as possible. If necessary, rotate bowl clockwise to draw drain plate down onto mounting shank.
8. Thread eye or eye/face wash spray head assembly onto mounting shank. Position outlet heads for proper access by user.
9. Secure entire unit to floor and/or wall for stability.
10. If unit has foot treadle, connect foot treadle chain to valve/handle assembly.



NOTES:

1. All threads are tapered pipe and require pipe joint compound or Teflon tape to assure watertight connection.
2. If unit is furnished with corrosion-resistant epoxy coating, care must be taken to avoid damaging finish during assembly. For best results, a strap wrench should be used.
3. Test the entire unit for proper operation.

11246-01-B
ACID RECIRCULATION TANK RE-SUBMITTAL

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

CAMERON GREAT LAKES, INC.

ACTIVATED CARBON & FILTRATION MEDIA - WATER & GAS TREATMENT EQUIPMENT & SYSTEMS

Corporate Office: 2335 NW 29th Ave., Portland, OR 97210 Tel: 800-777-4044 (Fax 503-225-0137)
Eastern Regional Office: 166 Sandybrooke Dr., Langhorne, PA 19047 Tel: 215-752-2246 (Fax 2247)

June 27, 2001

Ref. No. 10620-LAW-BWE
Via Fed Ex – Page 1 of 2

TO: Angie Gershman, Project Engineer
Law Engineering & Env'tal Svcs (LAW)
One Summit Square – Suite 402
Route 413 & Doublewoods Road
Langhorne, PA 19047
Tel. 215-860-1963 (fax 5360)

CC: Mark Soliman, Project Engineer.
Blue Water Environmental (BWE)
1610 New Highway
Farmingdale, NY 11735
Tel: 631-752-2145
Fax: (3008)

Re: **Blue Water Env'tal PO No. 02370-107 - CGL Sales Order No. 77977**
LAW No. 22000-0-0019 Phase 300 - Active Industrial Uniform Site, Lindenhurst, NY

Dear Angie & Mark:

Please find attached a *revised* submittal drawing for the acid tank and additional data per ERM Submittal Review Comments dated 6/26/01, Page 2 of 2, Item 5. Details as follows:

A. Details of Construction:

- (1) Wall Thickness – Attached is a print out provided by the tank vendor, PolyProcessing, showing the Thickness Requirements for this tank design (with SG = 1.9).
- (2) Chemical Compatibility with 10% HCL – Attached is a copy of a table provided by PolyProcessing showing HCL as acceptable for the HDXLPE tank to be provided.
- (3) The tank weight is approx. 950 pounds as shown on the attached Wall Thickness print out.
- (4) This letter confirms PolyProcessing's statement to me this date that the tank will be fabricated per the specification.
- (5) Handling & Installation Instructions will be issued in the next 7 to 10 days as part of the Final Drawings & Documentation to be provided by the tank vendor now that the tank has been released into production.

B. Guarantee – See attachment for details on the three (3) year Limited Warranty provided by the Poly Processing Company for this tank when used for HCL at $\leq 37\%$ concentration.

C. Fittings – ERM requested that the tank drawing be modified to show the location of the top fitting for the “level control elements.” The three (3) float type level switches to be provided are to be attached in the field (per a detail sketch to follow) to a length of 1-1/2” PVC pipe extended vertically down into the tank. The pipe will be connected to a bulkhead fitting (provided by CGL) mounted in the top of the tank on the flat section next to the manway (but not blocking or hanging over the manway). The drawing has been modified to show this fitting & location (a revised copy is attached).

Also, ***please note*** the following additional changes on the Acid Tank drawing:

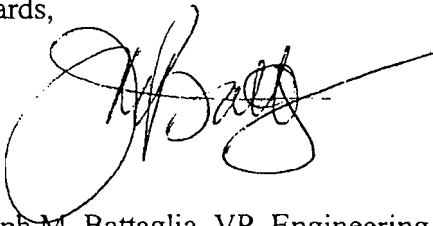
- The manway cover is a solid 24” dia. fume-tight manway ***without*** a separate center-mounted 10” threaded access lid per BWE fax to CGL dated 06-27-01.
- The three (3) x 2” NPT fittings at the top have been changed to read ***self-aligning*** bulkhead fittings to simplify field piping to these fittings.

Per previous discussion with Mark, one (1) copy of the submittal will be sent to LAW and four (4) copies sent to BWE. BWE will make the formal submittal to ERM for their review and approval.

The acid tank has been released effective today’s date into production per the attached revised drawing to meet the required delivery date of no later than the morning of July 18, 2001.

Additional equipment submittals by CGL to follow. Please call if you have any questions.

Regards,



Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - Eastern Regional Office

Attachments – Four (4) pages follow as noted above

Copy (letter only) to: CGL, Portland, OR

Tank: 5000 Gallon Upright Tank
 Date: 06/27/01

OD = 85 in
 SL = 126 in
 SD = 600 psi

Top Head Design Thickness, t TH (inches)

SG:	1.35	1.65	1.90
Design Thickness	0.28	0.28	0.28
Lower Limit	0.23	0.23	0.23
Upper Limit	0.28	0.28	0.28

Cylindrical Shell Design Thickness, t CS (inches)

SG:	1.35	1.65	1.90
Design Thickness	0.28	0.28	0.28
Lower Limit	0.23	0.23	0.23
Upper Limit	0.28	0.28	0.28

III. Lower Knuddie Design Thickness, t LK (inches)

SG:	1.35	1.65	1.90
Design Thickness	0.44	0.53	0.61
Lower Limit	0.35	0.43	0.49
Upper Limit	0.44	0.53	0.61

IV. Bottom Plate Design Thickness, t BP (inches)

SG:	1.35	1.65	1.90
Design Thickness	0.41	0.49	0.56
Lower Limit	0.30	0.34	0.38
Upper Limit	0.41	0.49	0.56

V. Powder Weight

PW 1: model powder weight, lb
 PW 2: powder weight at uniform thickness = t LK, lb

SG:	1.35	1.65	1.90
PW 1 =	489 lb	538 lb	583 lb
PW 2 =	675 lb	825 lb	950 lb

SUBMITTAL NO. 11246-01-A

DETAILS OF CONSTRUCTION

Para. 103A WALL THICKNESS

± TANK WEIGHT

950 LBS

ACID RESIST TANK

CHEMICAL COMPATIBILITY

WITH 10% HCL

Table I

The following chemicals do not attack or permeate high density crosslinkable polyethylene resins up to 100° F. Each application should be considered individually. All concentrations apply except where noted.

Acetic Acid	Ethyl Alcohol	Mercury	Stannous Salts
Aluminum Salts	Ethylene Glycol	Methyl Alcohol	Starch Solutions
Alum	Ferric Salts	Methylsulfuric Acid	Stearic Acid
Ammonium Hydroxide	Ferrous Salts	Michel Salts	¹ Sulfuric Acid <80%
Ammonium Salts	Fluoboric Acid	Nicotinic Acid	Sulfurous Acid
Amyl Alcohol	Fluosilicic Acid	Nitric Acid<50%	Sugar Solution
Antimony Salts	Formic Acid	Oxalic Acid	Glucose
Arsenic Acid	Gallic Acid	Perchloric Acid	Lactose
Barium Hydroxide	Gluconic Acid	Phenol<10%	Sucrose, etc.
Benzene Sulfonic Acid	Hexanol	Potassium Hydroxide	Tannic Acid
Bismuth Salts	Hydrazone<35%	Potassium Salts	Tanning Extracts
Boric Acid	Hydrozine Hydrochloride	Phosphoric Acid	Tartaric Acid
Bromic Acid	Hydriodic Acid	Photographic Solutions	Titinium Acid
Butanediol	Hydrobromic Acid	Propyl Alcohol	Toluene Sulfonic Acid
Butyl Alcohol	<u>Hydrochloric Acid</u>	Propylene Glycol	Triethanolamine
Calcium Hydroxide	Hydrofluoric Acid	Sea Water	Urea
Calcium Salts	Hydrofluorosilicic Acid	Selenic Acid	Vinegar
Chromic Acid<50%	Hydrogen Peroxide<52%	Sewage	Wetting Agents
Citric Acid	Hydrogen Phosphide	Silicic Acid	Zinc Salts
Copper Salts	Hydroquinone	Silver Salts	
Detergents	Hypochorous Acid	Soap Solutions	
Diazo Salts	Iodine Solutions	Sodium Ferricyanide	
Diethyl Carbonate	Lactic Acid	Sodium Ferrocyanide	
Diethanol Amine	Latex	Sodium Hydroxide	
Diethylene Glycol	Lead Acetate	¹ Sodium Hypochlorite<9%	
Diglycolic Acid	Magnesium Salts	Sodium Salts	
Dimethylamine	Mercuric Salts	Sodium Sulfonates	
Dimethyl Formamide	Mercurous Salts	Stanic Salts	

¹ Concentrations above stated percentage require special considerations, contact factory for guidelines concerning these applications.

Table II

The following oils and organic chemicals do not attack HDXLPE resins. They will be absorbed into the wall of the tank; however, there should be no loss of chemical. Because of this absorption, no chemical other than the original should be stored in the tank as long as contamination may result as the absorbed oil is leached out. Storage at temperatures up to 100° F are possible provided the effects of the absorption on the properties of the tank are not prohibitive.

Fatty Acids	Mineral Oils	Animal Fats	Vegetable Oil
Butyric	Lube	Lard	Corn
Lauric	Transformer	Fish Oil	Coconut
Linoleic	Hydraulic	Musk Oil	Cottonseed
Oleic		Whale Oil	Olive
Palmitic			Peanut
Stearic			

Table III

The following organic chemicals do not attack high density crosslinkable polyethylene resins. They will be absorbed into the wall of tank and a permeation loss will occur. Because of this permeation and the effect it has on the physical properties of the tank, it is generally not recommended that these chemicals be storage at room temperatures above 100° F.

However, their use largely depends on such factors as size of tank, its location, toxicity of the chemical, and applicable codes such as NFPA, OSHA, etc.

Aniline	Ethyl Butyrate	Nitrobenzene
Benzene	Ethylene Chlorohydrin	Octyl Cresol
Carbon Tetrachloride	Fuel Oil	Propylene Dichloride
Chlorobenzene	Furfural	Toluene
Cyclohexanol	Aliphatic Hydrocarbons	Xylene
Cyclohexenone	(hexane, octane, hexene, octene, etc.)	
Dibutylphthalate	Jet Fuel	
Diesel Fuel	Gasoline	
Dimethylamine		

ACID RECIRC TANK
SECTION 11246
PARA. 1.07

LIMITED WARRANTY
Poly Processing Company

Poly Processing Company, a Division of Abell Corporation, warrants its manufactured products against defects in material and workmanship, subject to the limitations set forth below.

Poly Processing Company Product	100% Replacement Warranty Period	Pro-rata Replacement Warranty Period	Total Warranty Period
Crosslinked Polyethylene Tanks	2 yrs	4 yrs	6 yrs
Linear Polyethylene Tanks	2 yrs	2 yrs	4 yrs
UL Listed or Classified Tanks	2 yrs	6 yrs	8 yrs
Tanks storing SODIUM HYPOCHLORITE 9 - 15% (see note below) XLPE w/ OR 1000 liner, 1.9 spg rating With IMFO outlet (Premium Warranty)	5 yrs	—	5 yrs
Tanks storing SODIUM HYPOCHLORITE 9 - 15% (see note below) 1000 - 6650 gal. max. XLPE w/ OR 1000 liner, 1.9 spg rating Less than 1000 gallons XLPE 1.9 spg rating	3 yrs	—	3 yrs
Tanks storing SODIUM HYPOCHLORITE 9 - 15% (see note below) Linear polyethylene, 1.9 spg rating 6650 gallons maximum	1 yr	—	1 yr
Tanks storing SULFURIC ACID ≥ 80% CONCENTRATION (see note below) 1000 - 6650 gal. max. XLPE w/ OR 1000 liner, 2.2 spg rating Less than 1000 gallons XLPE 1.9 spg rating	3 yrs	—	3 yrs
Tanks storing HYDROCHLORIC ACID ≤ 37% CONCENTRATION (see note below) XLPE or XLPE w/ OR 1000 liner 1.9 spg rating	3 yrs	—	3 yrs

Note: PPC Position Statements specify tank, fitting, and vent requirements for these applications and are available upon request.

Warranty begins with date of shipment from Poly Processing Company's factory. When replacement is necessary during the 100% replacement period, warranty continues from date of shipment of original product. When replacement is necessary during the pro-rata replacement period, current pricing is used to calculate credit available and new warranty begins with shipment of replacement product. Credit is not provided for fittings and ancillary items.

LIMITATIONS OF LIABILITY

Under this warranty, Poly Processing Company's liability is limited to either repair or replacement of defective product. In order to determine if the product is defective, Poly Processing Company may conduct an investigation into the matter. Buyer (owner and/or user) may be requested to provide a cleaned section of the product in question for evaluation. Product disposal in accordance with all applicable laws and regulations is the Buyer's responsibility.

This warranty may not be honored if:

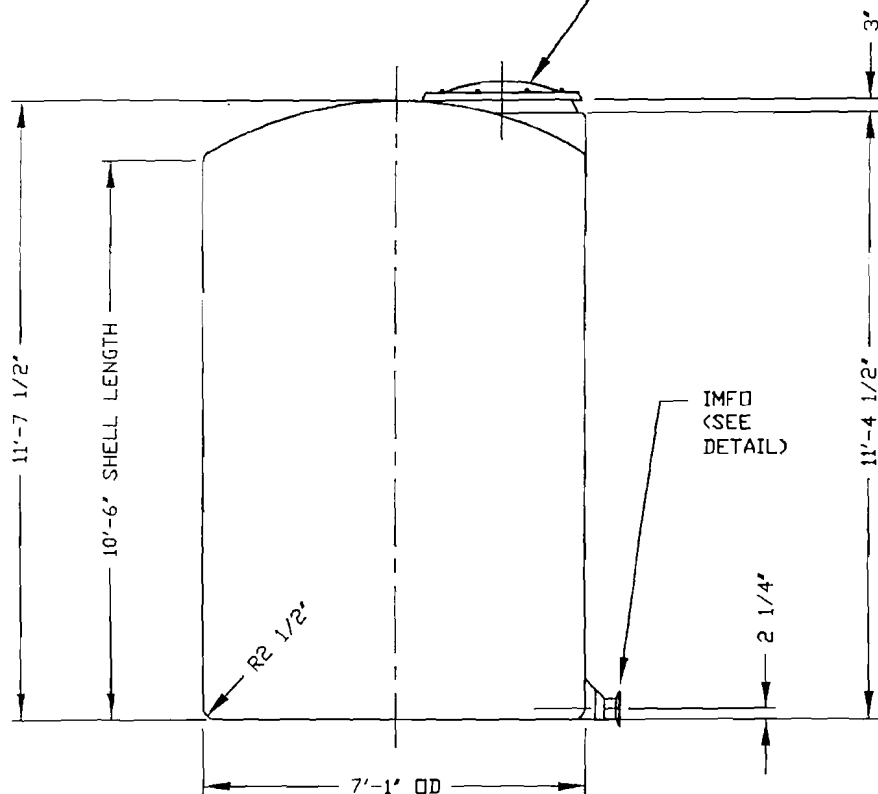
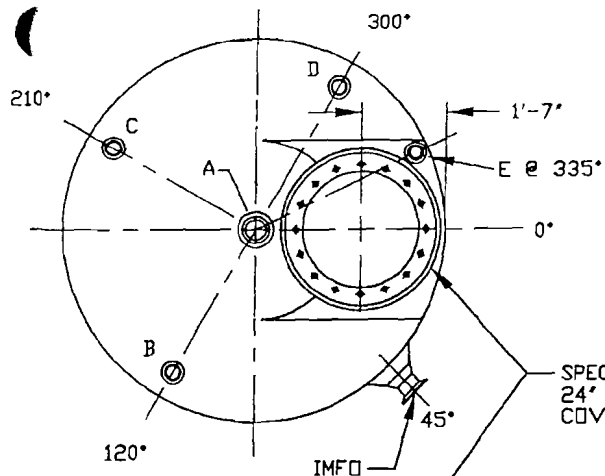
1. Product has been used in manner other than its originally declared purpose.
2. Poly Processing Company recommendations for the particular material being stored have not been followed.
3. Product has not been installed, used, and maintained in accordance with a) all federal, state, and local laws and regulations; b) generally accepted best practices within the applicable industry; c) guidelines set forth in the PPC User Manual and/or in PPC Position Statements.
4. Product has been altered or repaired by unauthorized personnel.
5. Product has been subjected to misuse, negligence, fire, accident, act of war, or act of God.
6. Notification of the defect has not been made in writing within the warranty period.
7. Invoice for product has not been paid.

By accepting delivery of the product, Buyer (owner and/or user) waives any claim against Poly Processing Company for incidental or consequential damages arising from any product failure including, but not limited to, damages for lost profits, lost sales, damage caused by leaking products, or injury to persons or property. Poly Processing Company's liability is limited to either repair or replacement of its product.

By accepting delivery of the product, Buyer (owner and/or user) accepts full responsibility for secondary containment appropriate and adequate for the material being stored. Buyer accepts full responsibility for any damage to secondary containment and for any consequential damage however caused.

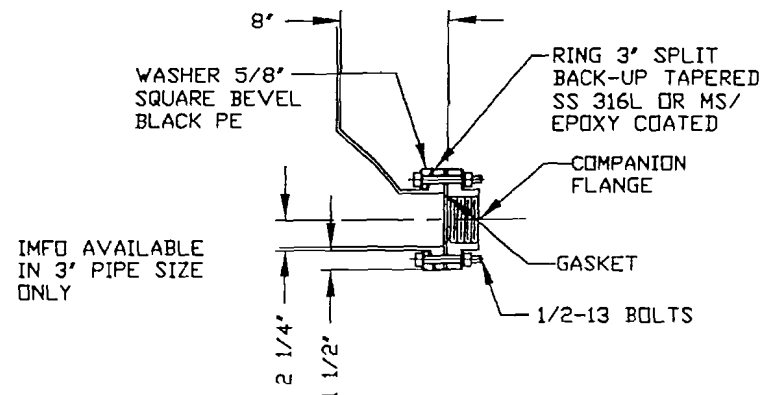
The limited warranty described herein is Poly Processing Company's sole warranty and the complete, final and exclusive statement of the terms of the warranty. Buyer may not rely on any oral statement or representations. This warranty is neither assignable nor transferable.

THIS WRITTEN WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. BY ACCEPTING DELIVERY OF THE



NOZZLE SCHEDULE & ACCESSORIES					
SERVICE	MK	STOCK NO.	SIZE	FITTING	FTG ELEV
RETURN	A	2659	4"	PVC BULKHEAD, SxT, EPDM	TOP
ACID IN	B	2785	2"	PVC S-A B/H*, SxT, EPDM	11'-0"
WATER IN	C	2785	2"	PVC S-A B/H*, SxT, EPDM	210 11'-0"
VENT	D	2785	2"	PVC S-A B/H*, SxT, EPDM	300 11'-0"
PUMP IN	-		3"	IMFO	45 BOT.
LEVEL					
SWITCHES	E	2656	1.5"	PVC BULKHEAD, SxT, EPDM	335 11'-0"
				NOTE - INSTALL FITTING "E" ON FLAT PART OF TANK NEXT TO MANWAY CASTLE	

* S-A B/H = SELF-ALIGNING BULKHEAD FITTING



IMFO NOZZLE DETAIL
 (INTEGRALLY MOLDED FLANGED OUTLET)
 SCALE: 1 1/2"=1'-0"

NOTES

1. THIS IS A COMPUTER GENERATED DWG. DO NOT REVISE BY HAND.
2. DIMENSIONS WILL VARY ±3% DUE TO VARIATIONS IN MULTIPLE MOLDS & CONDITIONS PREVALENT DURING MANUFACTURE & USAGE.
3. MOLDED IN GALLONAGE MARKERS @ APPROX 60° IN 200 GAL INCREMENTS UP TO 2800 GAL.

CALCULATED CAPACITIES/ VOLUME IN U.S. GALLONS		
DESIGN CAP	DOME VOL	TOTAL VOL
3031	142	3173

CONFIDENTIAL PROPERTY OF
 POLY PROCESSING COMPANY
 NOT FOR REPRINT OR USE
 WITHOUT PERMISSION

Dwg. Revised 06-27-01 by J.M.Battaglia of
 Cameron Great Lakes, Inc. for CGL
 PO # 20563 to CRECO / PolyProcessing

DWG TITLE			
3000 GALLON IMFO TANK (Revised by CGL)			
SCALE: 3/8"=1'-0"	POLY PROCESSING Company	Central Region P.O. Box 4000 5000 N. Highway 100 Hawthorne, CA 92343 Tel: 951-261-7700 Fax: 951-261-7700	DR: MB WILKERSON
ORIG. DATE: 11/9/99		CK: D. RECTOR	
HCL STOR./RECIRC. TANK		SHEET	REV
CGL Rev. 1 Date: 06-27-01		1 OF 1	1103000 -

11246-01-C
ACID RECIRCULATION TANK INSTALLATION MANUAL

Site No. 1-52-125
Active Industrial Uniform Site
Lindenhurst, New York
NYSDEC Contract No. D004134

Dear Valued Customer:

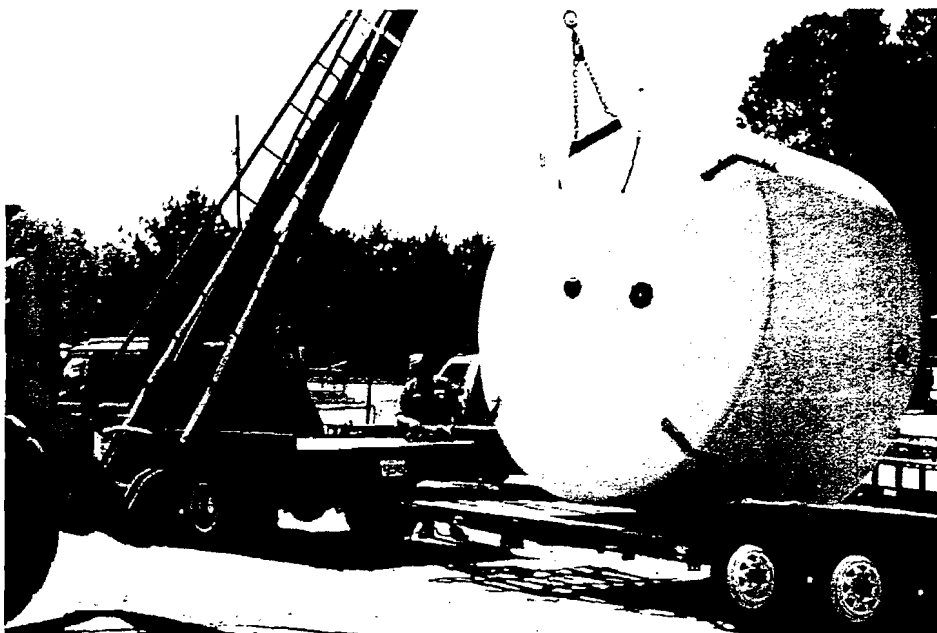
Thank you for making us your chosen tank supplier!

After being in the tank business for over 30 years, we are convinced that proper installation is the key to long term, trouble free tank service.

Please study and use the information contained in this booklet. It will make a tremendous difference in the useful life of your tank.

The Employees of Poly Processing

Installation Manual



Tank Serial #: _____

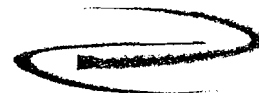
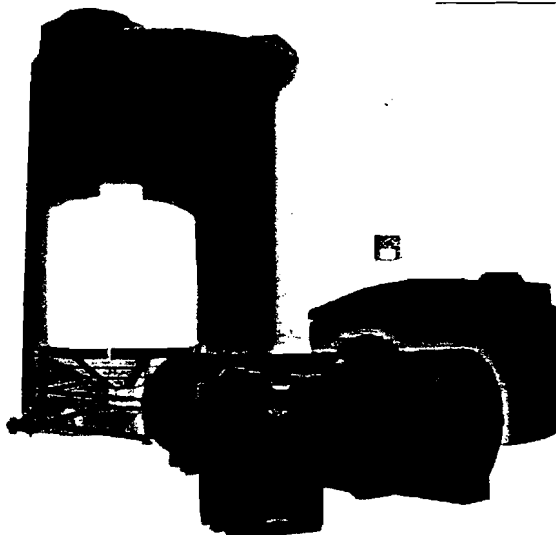
Date of Installation: _____

Cameron Great Lakes SO # 77977

Blue Water Env'tal PO # 02370-109

Law Project # 22000-0-0019 Ph. 300

Active Industrial Site - NYSDEC



POLYPROCESSING

Providing Solutions Through Innovation

1-866-590-6845

www.polyprocessing.com

Checklist for SAFETY

- **Check chemical compatibility** of chemicals being stored with that of the polyethylene tank and fittings.
- **Adequately vent tanks** to maintain atmospheric pressure only.
- **Do not allow the purging of tanker truck fill lines to over-pressurize polyethylene tanks.**
- **Prevent excessive heat near or inside the tank.**
Polyethylene tanks are designed for a maximum continuous temperature of 100°F. Tanks must be designed for continuous use above 100°F.
- **Have and use Material Safety Data Sheets (MSDS)** for the product being stored.
- **Regard tanks as confined spaces.** Followed proper entry procedures.
- **Make sure ladders are properly secured,** top and bottom. Allow only one person on a ladder at a time.
- **Avoid standing and working on tank domes.** The surface is flexible and slippery. There is no weight or load rating for the dome.
- **Never move a tank holding liquid and never allow personnel under a tank when it is being lifted!**

Instructions for Unloading

By Forklift:

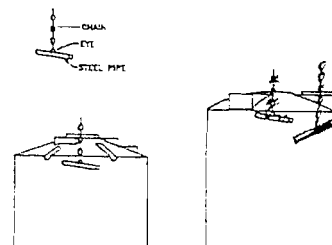
Make sure the forklift tines are **smooth and free from burrs.**

Use **extended tines** if handling a large tank.

Tie the tank to the forklift mast if there is a possibility of rolling or sliding.

By Crane:

Use the usual method of rigging and lifting a tank with slings or **use a pipe and chain** in the manway of the tank as shown here and in the picture on the front of this manual.



Field Installation of Fittings

Be extremely careful to consider the fitting contact inside the tank before cutting and drilling the tank. The fitting must not rest against any portion of the tank that will not allow a complete seal. (i.e. Fitting must be installed clear of any knuckled radius.)

Use hole saws and drill bits only *slightly* larger than the fitting and bolts to cut holes in the tank. Oversized holes make gasket sealing difficult. Keep the hole saw or drill bit “square” with the tank wall in all directions.

Slightly bevel the edges of all fitting and bolt holes to relieve stress on the plastic caused by the cutout.

Use sand paper to create a sealing surface for gaskets installed on the interior of thicker tanks. Sand the surface in a circular motion concentric with the fitting hole cutout. Make sure tank wall thickness is uniform around the entire circumference of the sealing surface.

Do not over tighten fittings and bolts on plastic tanks.

Plastic nuts on bulk head fittings:.....1/4 turn beyond hand tight

Metal nuts on 5/16" metal studs:..... 12 ft lbs torque

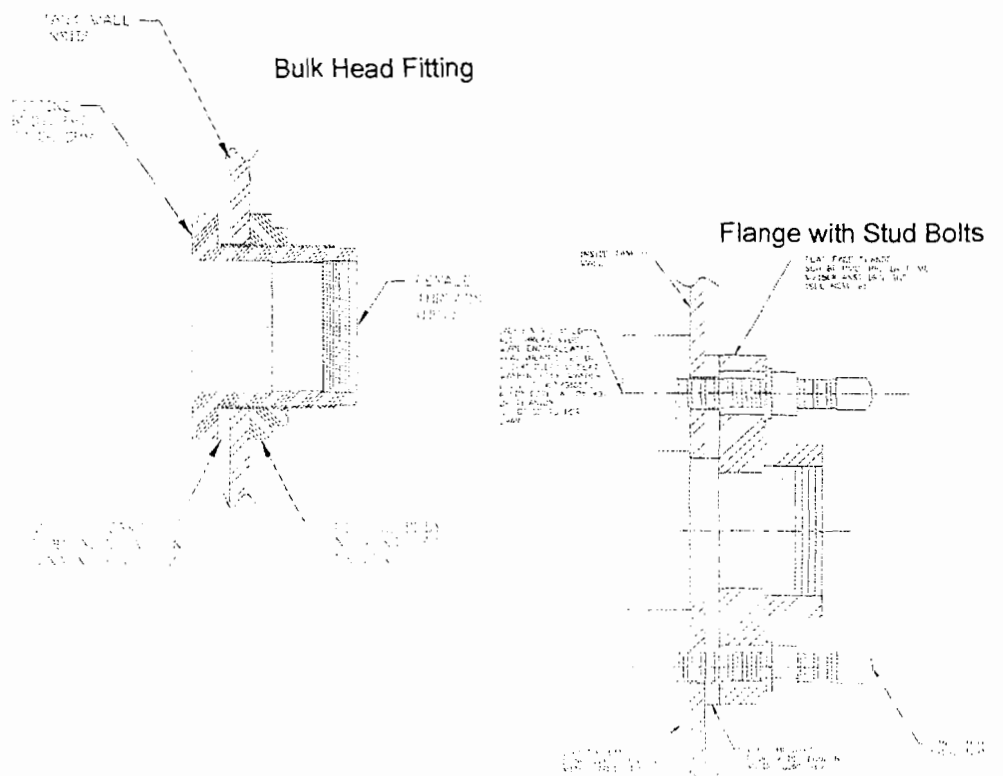
Metal nuts on 1/2" metal studs:.....30 ft lbs torque

Metal nuts on plastic-headed metal stud bolts:.....20 ft lbs torque

Use lubricants on metal studs and stud bolts to prevent siezing.

Use flexible connections to allow the tank to expand and contract and to protect the tank from pump and piping vibration. **DO NOT CONNECT DIRECTLY TO RIGID PIPING.**

Fill the tank with water and hydrotest after installation to ensure tank and fitting integrity.



Sight Glass Style

-

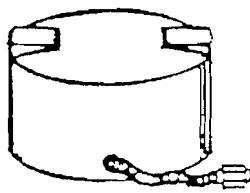
- Make sure gauge rope is seated on the pulleys and working freely in both directions.
- Connect threaded pipe or nipple on the end of the gauge into the dome fitting. In order to facilitate later maintenance, DO NOT GLUE the connection.
- Attach the exterior portion of the gauge to the pipe support bracket on the side wall of the tank.



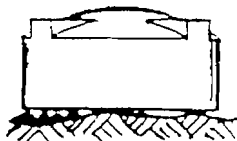
PROMO TANK PIPE SUPPORT
REQ'D FOR PIPING INSIDE
SAFE-TANK ASSEMBLIES
MAY BE USED ON ANY TANK
AS REQ'D BY CUSTOMER

Checklist for Installation

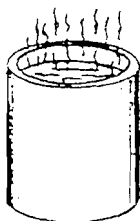
- **Retrieve and check the uninstalled parts** usually shipped inside the tank.
- **Place the tank wisely**, making servicing easy and inexpensive.
- **Place the tank wisely**, protecting personnel from chemical danger and protecting the tank from traffic damage and excessive heat.
- **Utilize adequate secondary containment** according to particular chemical danger and governmental and industry requirements.
- **Use teflon tape, paste, or both** on all threads. Do not over tighten.
- **Use flexible connections** to allow the tank to expand and contract and to protect the tank from pump and piping vibration. **DO NOT CONNECT DIRECTLY TO RIGID PIPING.**
- **Fully support the entire bottom of the tank** on a clean, smooth foundation or in factory approved metalwork.
- **Fill the tank with water and hydrotest for 24 hours** after installation to ensure tank and fitting integrity.
- **Install needed labels for chemical warning and response** according to industry best practice and governmental requirements.
- **Make sure there is a Poly Processing warning label** on the tank.



A flexible hose connection must be used to allow for expansion & contraction; solid piping may contribute to premature failure of the tank and fitting.



Do not set tank on sharp objects, rocks or uneven contour; sand, fine soil or smooth concrete are ideal bases.



EXTREME CAUTION:

Consult factory on any applications where continuous use is above 100°F.

Periodic Tank Inspection

Tanks should be inspected on a routine, scheduled basis and the findings of the inspections recorded. As a very minimum, follow these guidelines:

- Clean the exterior and interior of the tank. You cannot properly inspect a dirty tank.
- Inspect the exterior and the interior of the tank for cracking, crazing, and brittle appearance.
 - Pay particular attention to areas around fittings and where different planes of the tank radius into one another.
 - A bright light source should be used to inspect the interior from the manway opening to avoid a confined space entry.
- Inspect fittings and exterior gaskets for leaks and signs of general corrosion and deterioration.
- Confirm that secondary containment is appropriate for chemical stored, adequate in size, and in good repair.

Installation & Inspection Record

Date _____

Comments

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

**ACTIVE INDUSTRIAL UNIFORM
REMEDATION PROJECT**

NYS Site # 1 – 52 – 125

Lindenhurst, New York

Ex-Situ Groundwater Treatment System

APPENDIX E

System Monitoring & Maintenance Log (Book 2)

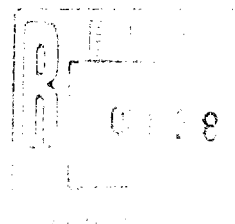
February 2002

Prepared For:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7013

Prepared By:

Phoenix Environmental Technology, Inc.
57 Mall Drive
Commack, NY



Appendix E
System Monitoring and Maintenance Log
(Book 2)

Page _____

Active Industrial Uniform Site, Lindenhurst, New York



Active Industrial Uniform, Lindenhurst, NY NYSDEC Site Number 1-52-125

Active Industrial Uniform, Lindenhurst, NY NYSDEC Site Number 1-52-125

[illegible]

Active Industrial Uniform, Lindenhurst, NY NYSDEC Site Number 1-52-125

Active Industrial Uniform, Lindenhurst, NY NYSDEC Site Number 1-52-125

[illegible]

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform
NYSDEC Site #: 1-52-125
Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform
NYSDEC Site #: 1-52-125
Lindenhurst, New York

Air Stripping Blower and GAC Units

	Air Stripper Blower	Vapor Phase Granular Activated Carbon Vessel #1	Vapor Phase Granular Activated Carbon Vessel #2
Air Flow (SCFM)			
Pressure (psi)			
Temperature (degrees F)			
Alarm Conditions:			
Comments:			

Acid Storage/ Recirculation System

Is acid cleaning of towers needed?		Acid disposed of, saved for reuse, or diluted and discharged?	
Was acid cleaning performed?		pH Readings	
Approximate volume of acid transferred to towers?		Towers during recirc.	
		Discharge after cleaning	
Duration of acid recirculation?		Holding tank after cleaning	

Samples:

Water	Yes/No	Air	Yes/No
RW-1		GAC-1 influent	
RW-2		GAC-2 influent	
ST-1 influent		Air effluent (required monthly)	
ST-2 influent			
System effluent (required monthly)			

Additional Comments:

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform
NYSDEC Site #: 1-52-125
Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform
NYSDEC Site #: 1-52-125
Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform
NYSDEC Site #: 1-52-125
Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			

EX-SITU GROUNDWATER SYSTEM CHECKLIST AND MONITORING REPORT

Active Industrial Uniform

NYSDEC Site #: 1-52-125

Lindenhurst, New York

Date: _____ Time: _____ Technician: _____

GENERAL/SAFETY:

	OK	Needs repair/missing	Comment
Property Fencing/Gate			
24-Hour Emergency Contact Notice to Public			
No Smoking Signs			
Hard Hat, Hearing Protection, and Eye Protection Signs			
Equipment Safety Signs (Pinch Points, Moving Parts, Hot Surfaces)			
System Noise Levels			
Fire Extinguishers			
Eye Wash and First Aid			
Additional General Observations and Comments			

EX-SITU GROUNDWATER TREATMENT SYSTEM:

Recovery Wells

	RW-1	RW-2	TOTAL
Pump running (Y/N)			
Pressure (psi)			
Water Flow (gpm)			
Pump Alarm Conditions:			
Comments:			

Air Stripping Towers

	ST-1	ST-2	Effluent
Pressure Differential (psi)			
Water Flow (gpm)			
Total Flow (gallons)			
Pervious Total Flow (on what date)	Date:		
Alarm Conditions:			
Tower Configuration (series, parallel)			
Comments:			